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Preface

International Science & Education Researcher Association (ISER) puts her focus on studying and exchanging academic achievements of international teaching and scientific research, and she also promotes education reform in the world. In addition, she serves herself on academic discussion and communication too, which is beneficial for education and scientific research. Thus it will stimulate the research interests of all researchers to stir up academic resonance.

CSISE 2011 is an integrated conference concentrating its focus upon Computer Science, Intelligent System and Environment. In the proceeding, you can learn much more knowledge about Computer Science, Intelligent System and Environment of researchers all around the world. The main role of the proceeding is to be used as an exchange pillar for researchers who are working in the mentioned field. In order to meet high standard of Springer, Advances in Intelligent and Soft Computing, the organization committee has made their efforts to do the following things. Firstly, poor quality paper has been refused after reviewing course by anonymous referee experts. Secondly, periodically review meetings have been held around the reviewers about five times for exchanging reviewing suggestions. Finally, the conference organization had several preliminary sessions before the conference. Through efforts of different people and departments, the conference will be successful and fruitful.

CSISE 2011 is co-sponsored by International Science & Education Researcher Association, Beijing Gireida Education Co. Ltd and Wuchang University of Technology, China. The goal of the conference is to provide researchers from Computer Science, Intelligent System and Environment based on modern information technology with a free exchanging forum to share the new ideas, new innovation and solutions with each other. In addition, the conference organizer will invite some famous keynote speaker to deliver their speech in the conference. All participants will have chance to discuss with the speakers face to face, which is very helpful for participants.

During the organization course, we have got help from different people, different departments, different institutions. Here, we would like to show our first sincere thanks to publishers of Springer, Advances in Intelligent and Soft Computing for their kind and enthusiastic help and best support for our conference. Secondly, the authors should be thanked too for their enthusiastic writing attitudes toward their papers. Thirdly, all members of program chairs, reviewers and program committees should also be appreciated for their hard work.

In a word, it is the different team efforts that they make our conference be successful on September 24–25, Guangzhou. We hope that all of participants can give us good suggestions to improve our working efficiency and service in the future. And we also hope to get your supporting all the way. Next year, In 2012, we look forward to seeing all of you at CSISE 2012.

July 2011

Helen Zhang
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Contents

Study of University Physics Teaching Based on Information Technology with Education Practice

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Abstract. Today's university physics teaching is facing some difficulties such as short teaching hours and richer contents. This article firstly analyses the present situation of university physics. Then it points out that the way out of the university physics teaching reform is the organic integration of information technology and university physics teaching. The additional role of information technology would be gave full play and then the teaching methods can be optimized. According to teaching practice, some suggestions about integrated approach are proposed in this article.

Keywords: information technology, university physics, integration.

1 Introduction

Nowadays, with the rapid development of information technology, higher requests are put for higher education. Info-tech can arouse student's interest in study, induce the conscious of creation, and practice divergent thinking and convergent thinking. The application of information technology in university physics teaching should be reinforced. It would play an important role for training rigorous and high quality innovative talents who are necessary for the development of society and economy.

University physics is a required and basic course to all students majoring in science and engineering in university. It is the foundation of the courses succeeding after it. University physics is very important for developing students' scientific abilities and improve student's scientific qualities. The university physics teaching reform is one of the focuses of educational reform. It can give full play to the advantages of modern information technology and enable the teaching to the maximum excellence.

At the present time there still is much difficulty in the conformation between information technologies with university physics teaching though some successful achievements have been obtained. This paper tries to begin from the questions in university physics teaching and treats information technologies as the assistant tools. It is also discussed in the point of view university physics teaching reform with information technology how to train students' abilities of scientific thinking method, scientific research and innovation effectively. [1]

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2 First, the Present Situation of University Physics Teaching

Though university physics is one of the most important lectures for training students' abilities of scientific thinking method, scientific research and innovation effectively. But currently, the university physics teaching is facing with a very delicate situation indeed. There are three conflicts that urgent need resolves in the teaching process.

2.1 The Fewer Granted Period Can't Satisfy the Relatively More Contents' Need

With development of science and technology, science, technology and knowledge become more and more rich that are in connection with physics. The university physics which is used to disseminate scientific knowledge to the students also need to add new the forefront of knowledge. Then university physics teaching will need further more class hours.

But the students' majors become more and more systematize which also need more and more periods. Because the students' total class hours can't break through the limit of Ministry of Education, therefore the majors have to occupy the periods of foundation courses such as university physics. So the conflict between teaching hours and teaching contents is the first issue to tackle.

2.2 The Traditional Teaching Methods Can't Stimulate the Students' Initiative

According to the people's cognitive habit, one will be very easy to accept a thing and may be make a deep impression only when he acknowledges it in the aspects of hearing, vision and touch and so on. While the traditional university physics class teaching modes are monotonous and rigid since teachers mainly use chalk and oral. Even if they use the multimedia, they simply think of it as the blackboard which can be written in advance. [2]

The students who simply rely on hearing can't understand the physical phenomena well. They also can't very well experience of natural phenomena, much less the forefront of knowledge. Over time, they will not have the interest to learn physics.

2.3 The Limited Class Time Can't Meet the Needs of Students Study

The current college class is usually two lessons as one, each takes 50 minutes. Because of the less lesson time and more content, so in order to finish the content, the teacher has to talk full time all by himself. And all students can do is listening the lecture. After two lessons, the teacher and students leave the classroom each with their books. There only are ten minutes which the teacher and students can used to communicate each other. Some students who like to study physics have a lot of puzzles that needed the teacher to explain. But the time is so short that they can't communicate with the teacher.

Even though it is encouraged the teachers answer questions after class. But since the free time of the teachers and students is limited, the results of actual operation are not obvious.

3 Second, the Approach to Integrate University Physics Teaching with Information Technology

In view of the all sorts of problems that presently appear in the process of university physics teaching, the only way out is that the information technology is stepped up an in the teaching application. Teachers to vigorously carry out research projects, in-depth study of current teaching methods, scientific research as a guide, deepen the educational reform and improve education quality. The ideas are changed and the teaching contents and teaching methods are reformed. Then the students' active learning interest can be stimulated and the teaching effect also would be improved remarkably. The teaching reform can be started from three approaches.

3.1 The Teaching Content Should Be Reformed and the Relation with High School Physics Also Should Be Considered

Although physics is one of the oldest subjects which has a long history. But in the past few centuries it full of exuberant vitality and enter a vigorous development period. The new knowledge needs to be added in the physics. The university physics which is used to disseminate scientific knowledge to the students also need to constantly add new the forefront of knowledge. And the substances what the teacher need to say also subsequently grow in quantity.

While the total class time is limit, so the course contents about the university physics should be choose. The teacher should have a detailed course outline for this course before he begins to teach the students. The part contents that the students have studied can be simply talked, while the other part that is new for students should be explained in detail. So it is possible that a lot of physics knowledge can be told in the provided time.

3.2 Adjust the Teaching Methods and Give Full Play to the Information Technology in the Teaching in Class Advantage

The traditional teaching methods are drab and inflexible and cannot display the beauty of physics. So the feel of the students only is boring. Now each subject has penetrated the information technology into the teaching in class. The multimedia teaching coursewares of the university physics are used increasingly become an important means of teaching. But in the process of that Multimedia Courseware are used, there are two extreme phenomenon. One treats the courseware as a blackboard written in advance. The courseware is full of text and formulas .After watching the courseware the students become dizzy. Another kind is that multimedia course ware can be used very skilled. There are a lot of audio, video and cartoons in the courseware. But these are so many that the students’ attentions are arrested by the audio, video and cartoons. Then the students can’t understand the physics knowledge transitived in the courseware very well.

Teachers should bear in mind that multimedia courseware is a kind of auxiliary teaching tools and must serve for the physics teaching. Rational use of multimedia courseware can stimulate students and arouse students' various senses, will the teaching content and visualized vividly demonstrated in front of the student, make the student scene, lets the student as the lively, cheerful atmosphere, thus the most the learning interest of the students learn physics. Therefore, while teachers make

courseware, two points should be paid attention.One is that large chunks of text can't appear in the courseware. The pictures and videos can be inserted at proper places and they are able to back up the contents.So the students can understand much better and more quickly. But the courseware must not be too loud so as not to dominate. The second part is that all derivations of formulas can't be given at once for the physics knowledge has very strong logicality.[3] They should be made using a combination of animation and gradually showed. That is in order to cultivate students' logical reasoning ability.

3.3 Making Complete Use of the Internet and Stretch the Classroom Instruction

The development of current world and society already entered informatization period, and the process of informatization is being accelerated increasingly. With the development of information technology and network technology, the educational field has changed enormously too. Vocational teachers must meet the needs of informational society , and adopt advanced teaching facilities and means to promote teaching reforms and catch up with the trends of informational era In order to solve the problem that the class hours are insufficient, the network technology can be made full use of. Teachers can rely on the school campus network and build links in staff room. These can be put on the Internet such as teaching plans, the syllabus, the courseware and the answers to questions that can be used to study for students after class.

If possible, an interactive platform may be further established. Then teachers and students may form an interactive by the platform. Even through it is advocated that students answer each others questions in a computer massage. This gives students a sense of achievement and has further to arouse the enthusiasm of students' study and make students pay more attention in university physics. All in all, the application of network technology can foster independent learning farthest. So it corresponds to that the university physics teaching is extended from in class to after class. This can remit the pressure of few class hours.

3.4 Adopt New Teaching Model and Strengthen Students' Ability Training

The physicist Laue said that it is important not attaining knowledge but developing thinking ability and education is nothing but what remained after forgetting all what have been learned.[4] Strengthening of cultivating the ability of teaching theory and methods are now education scientific research has become one of the important topics, high scores low-ability phenomenon! More widespread existence indicated that this study has important realistic significance. If the teacher in the classroom didn't give students' autonomous learning opportunities, also has failed to provide them with exploring channel, innovation ability also can't talk about. Because the cultivation of students' creative thinking and innovation ability the enhancement, not through teacher's explanation or completely depend on the book of the indirect experience, more is reached by its own inquiry and experience concludes.

Physical problem solving teaching is a kind of very effective teaching strategy. Based on the information technology of physical problems in physics teaching methodology, is the guidance and information technology learning environment, under the support of the initiative, prompting students found, active exploration and practice experience, solve problems, in order to deeply understand and use physical

basic knowledge and rules to solve practical problems, social development request, promoting students' overall development of a kind of teaching mode. Under the information technology environment will physical methodology with specific physical knowledge combine the teaching content, namely to thinking method to the analysis of the specific physical knowledge teaching driven, give full play to the information technology cognitive tools, learning tools and cooperative tool, should be under the information technology environment physical problem solving teaching basic strategy.[5]

4 Conclusion

In short, the teaching reform is a long-term continuous exploring process. The integration of information technology and physical education is a development trend of modern physics education. The organic integration between the university physics course with modern information technology which take computer as the core would help to overcome the integration of traditional university physics teaching mode. The integration may optimize the university teaching course and training of students' abilities of scientific thinking method, scientific research and innovation. It is response to the demand of quality education and information society.

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Study of the Non-planarity of the Desargues Graph

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Abstract. In this paper, we give the definition and construction of the Desargues graph, and illustrate some of its properties like symmetry, hamiltonicity, etc. We put forward and analyze three different methods which are both traditional and innovative to prove the non-planarity of the Desargues graph.

Keywords: Desargues Graph, Tensor Product of Graphs, Planar Graph, Hamilton Graph, Isomorphic Graph.

1 Introduction

Gérard Desargues (February 21 1591, and baptized March 2, 1591–October 1661) was a French mathematician and engineer, who is considered one of the founders of projective geometry. Desargues' theorem, the Desargues graph, and the crater Desargues on the Moon are named in his honor. The famous Desargues graph is shown as Fig. 2 [1].

The Desargues graph is a distance-transitive cubic graph with 20 vertices and 30 edges [2]. It is named after Gérard Desargues, having a high level of symmetry, and has been applied in chemical databases.

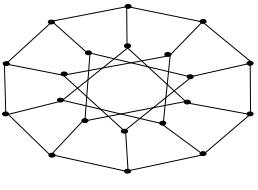

Fig. 1. The Desargues graph

Reference [1] gives some properties of the Desargues graph, but does not give the proof of these properties and characteristics, and we can not find the proof of these properties in other papers. In this article, we give the construction method of the Desargues graph, reveal and prove the non-planarity and other important properties of it.

This article discusses the simple connected graph only.

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2 The Basics

The following knowledge can be in [3] ~ [8] found.

Definition 1. A graph G is a planar graph, if it has a plane figure P(G), called the plane embedding of G, where the lines(or continuous curves) corresponding to the edges do not intersect each other except at their ends.

The example of planar graph is shown as Fig. 2.

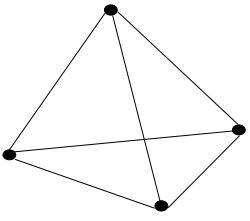

Fig. 2. The K_4 is a planar graph

A non-planar is a graph that is not a planar graph.

Theorem 2. (Euler Identity) Let G=(V, E) be a connected planar graph, and let P(G) be any of its plane embeddings. Then

$$V\text{-}E+F=2,$$

in which F is the number of faces of P(G).

Definition 3. Two graphs G and H are isomorphic, denoted by $G \overset{\alpha}{\cong} H$, if there exists a bijection α: $V(G) \rightarrow V(H)$ such that

$xy \in E(G)$ if and only if $\alpha(x)\ \alpha(y) \in E(H)$ for all $x, y \in G$.

Theorem 4. If graph G has the same vertex label as graph H, and to maintain the adjacency relations between vertices, then the two graphs are isomorphic.

Theorem 5. Both $K_{3,3}$ and K_5 are non-planar.

Theorem 6. Let G is planar. If we use $l(F_i)$ to represent the length of face F_i of G, then $2E(G)=\sum l(F_i)$[3].

Theorem 7. The Petersen graph is not a planar graph [9].

3 The Construction of the Desargues Graph

Definition 8. The tensor product $G \bigcirc\!\!\!\!\times H$ of graphs G and H is a graph such that

(1) The vertex set of $G \bigcirc\!\!\!\!\times H$ is the Cartesian product $V(G) \bigcirc\!\!\!\!\times V(H)$; and

(2) Any two vertices (u, v) and (x, y) are adjacent in $G \bigcirc\!\!\!\!\times H$ if and only if v is adjacent with y and u is adjacent with x.

The tensor product of C_4 and P_3 is shown as Fig. 3(b).

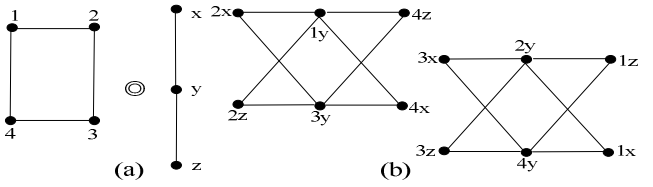

Fig. 3. The tensor product of C_4 and P_3

Definition 9. The bipartite double cover of an undirected graph G is a bipartite covering graph of G, with twice as many vertices as G. It can be constructed as the tensor product of graphs $G \bigcirc\!\!\!\!\times K_2$. It is also called the Kronecker double cover, canonical double cover or simply the bipartite double of G.

The tensor product of the Petersen graph and K_2, is shown as Fig. 4.

Obviously, the bipartite double cover is a special example of the tensor product. The bipartite double cover of a graph is a bipartite graph.

Theorem 10. The tensor product of the Petersen graph and the K_2 is the Desargues graph.

Proof. One of the label graph of the Desargues graph is shown as Fig. 5. It is isomorphic to the graph as shown as 4(b), by theorem 2.4.

Corollary 11. The Desargues graph is a bipartite graph.

Theorem 12. The Desargues graph is a Hamilton graph.

Proof. The graph is a Hamilton graph, shown as Fig. 6. It is isomorphic to the graph, shown as Fig. 5, by theorem2.4. Hence the Desargues graph is a Hamilton graph.

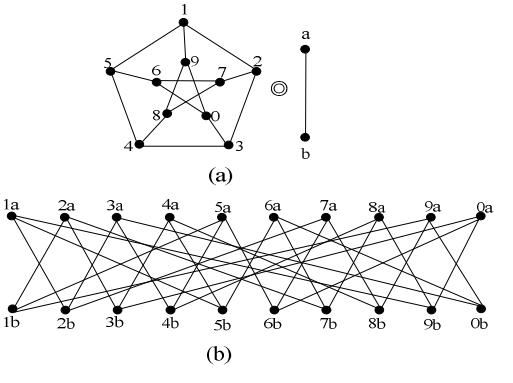

Fig. 4. The tensor product of the Peterson graph and K_2

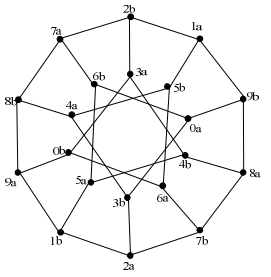

Fig. 5. The vetex label of the Desargues graph

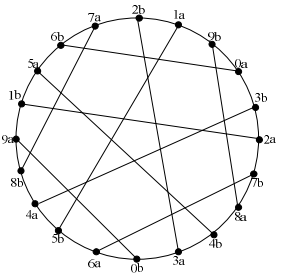

Fig. 6. The hamiltonicity of the Desargues graph

4 The Non-planarity of the Desargues Graph

Evidently, the Desargues Graph is cubic. The BC graph is a graph if and only if it is both a cubic and a bipartite graph [10].

Theorem 13. The girth of the planarity BC graph is 4[10].

Theorem 14. The girth of the Desargues Graph is 6[1].

Theorem 15. The Desargues Graph is non-planar.

Proof 1(by girth). If the Desargues graph is planar, then, by theorem 4.1, its girth is 4, but its girth is 6, by theorem4.2, that is ridiculous.

Proof 2(by Euler Identity). Suppose the Desargues graph is planar. We get a contradiction that the Desargues graph is non-planar. Because the girth of the Desargues graph is 6, therefore, by theorem 2.6, $2E=\sum l(F_i) \geq 6F$ By Euler identity: V - E + F=2 i.e. 3V – 3E + 3F =6, we can get 3V-2E≥6, now V=20, E=30(in fact, for any cubic graph, we have 3V=2E, by handshake theorem), thus 0≥6, that is ridiculous.

Proof 3(by contraction of graph)

Definition 16. A graph G is called an MX, if X can be obtained from G by a series of edge contractions, i.e. if and only if there are graphs $G_0,\ldots,G_n$ and edges $e_i \in G_i$ such that $G_0=G$, $G_n \cong X$, and $G_{i+1}=G_i/e_i$ for all i <n.

Definition 17. If G=MX is a sub-graph of another graph Y, we call X a minor of Y.

Theorem 18 If the graph G is a subdivision of H, then H is a minor of G.

Theorem 19. (Wagner's theorem) A graph G is planar if and only if G contains neither K_5 nor $K_{3,3}$ as a minor[4].

Before contraction of the Desargues graph, is shown as Fig. 7. After contraction of the Desargues graph, is shown as Fig. 8. After contraction, contains K_5 as a minor, is shown as Fig. 9.

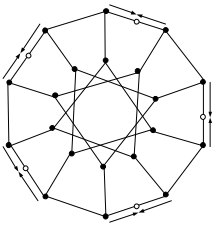

Fig. 7. Before contraction

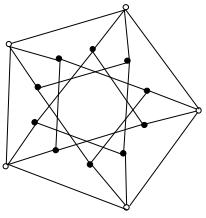

Fig. 8. After contraction

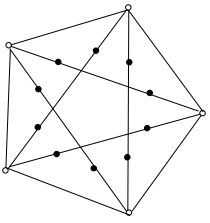

Fig. 9. Contains K_5 as a minor

5 Summary

There are many important properties and characteristics belonging to the Desargues graph. In this paper, we realized the Desargues graph that is cubic, bipartite, of non-planarity and so on from the perspective of the bipartite double cover. The proof of non-planarity of the Desargues graph, shown above, is both traditional and innovative. These ideas and methods of studying and discussing the special graph can help us realize the structures and properties of a general graph. For example, the Petersen graph is non-planarity, after the bipartite double cover operation, we obtain the Desargues graph, which is also non-planarity. In such a manner, for a non-planarity graph, whether is its bipartite double cover operation a non-planarity graph or not? This issue will be our focus of future research.

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Using Ontology and Rough Set Building e-Commerce Knowledge Management System

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Abstract. The variable precision rough-set model can be thought of as a generalization of the rough-set model. Rough set theory expresses vagueness not by means of membership, but by employing a boundary region of a set. The design of ontology can be based on classificatory knowledge or generic knowledge. The paper proposes using ontology and rough set to build the knowledge management model in e-commerce recommendation system, and to suffice the needs of theory and application in E-commerce recommendation system, and the experiments shows the CPU Time in the attribute numbers, indicating that ontology is superior to rough set in building the e-commerce knowledge management system.

Keywords: knowledge management, rough set, ontology.

1 Introduction

Ontology merging is employed to deal with the possibility of repeated ontologies when merging concept content and relationships based on ontology mapping results. A company should accurately know what the customers concerned for the product. It is very difficult for companies that strengthen business's competitive advantage if information only becomes to support the functions within company when facing to the heavy challenges coming from outsides surroundings. By using this semantic web technique, the information necessary for resource discovery could be specified as computer-interpretable [1]. Furthermore, early design concept evaluation can help in reducing the risk of late corrections which may result in costly and time-consuming design iterations.

Knowledge discovery in databases (KDD), or data mining, is an important issue in the development of data- and knowledge-based systems. The extent of damage of missing data is unknown when it is virtually impossible to return the survey or questionnaires to the data source for completion, but is one of the most important parts of knowledge for data mining to discover. The basic notions of rough sets and approximation spaces were introduced during the early 1980s. It is to describe the concept in formalization of symbol from extent and intent, and then realize the semantic information which can be understood by computer. Recently, the formal concept of attribute reduction with fuzzy rough sets has been proposed and an algorithm using a matrix for computing all attribute reductions has been designed. In

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this information-exploding era, the user expects to spend short time retrieving really useful information rather than spending plenty of time and ending up with lots of garbage information. In RST, this approximate set is called boundary set. To get a boundary set, we have to first compute the lower approximations and upper approximations with respect to the addressed data objects.

Variable precision rough set (VPRS) model is studied in this paper, include β value select algorithm, algorithm of reduction attribute and extraction rule. A decision tree is a flow-chart-like tree structure, where each internal node denotes a test on an attribute, each branch represents an outcome of the test, and leaf nodes represent class or class distributions. It is recognized that evaluators' judgments, assessment of qualitative attributes in design concept evaluation, in particular, may contain ambiguity and multiplicity of meaning. The paper proposes using ontology and rough set to build the knowledge management model in e-commerce recommendation system, and to suffice the needs of theory and application in E-commerce recommendation system. RDF is recommended by W3C and can deal with the lack of standard to reuse or integrate existing ontology. The experimental results indicate that this method has great promise. The experimental results show that the proposed approach can effectively recommend a travel route matched with the tourist's requirements.

2 The e-Commerce Knowledge Management System Based on Ontology

Personalization is a key element that facilitates the employ of complex services on mobile devices. Ontologies and knowledge bases are often constructed from texts and attempt to model the meaning of the text. Ontologies constitute a good candidate to represent this kind of domain model. An Ontology is a formal, explicit specification of a shared conceptualization. For example, a line interpolation method using a spatial information edge-direction detector has been proposed for accurate edge direction.

The design of ontology can be based on classificatory knowledge or generic knowledge[2]. While in classical set theory elements either belong to a set or not, in fuzzy set theory elements can belong to a certain degree. Compared with databases, ontology is more efficient and flexible in capturing and managing knowledge about concepts in the domain and relationships between these concepts. X and Y denote the non-empty subsets of U.

Ontology is one of the branches of philosophy, which deals with the nature and organization of reality. Applied to the study of artificial intelligence (AI) ontology is a logical theory that gives an explicit, albeit, partial account of a conceptualized real-life system. The complement, intersection and union set operations are performed by a negation function, a t-norm function (typically, the minimum) and t-conorm function (typically, the maximum) respectively. Hence, ontology can better represent the semantic meaning of a case and overcomes the synonym problem. Ontology, in its traditional, philosophical meaning, is the study of what there is.

Ontology $i \in I(c)$,i instantiates property p, ontology o. We say two random variables X and Y are independent if $P(x|y) = P(x)$. The variables X and Y are conditionally independent given the random variable Z if $P(x|y, z) = P(x|z)$.

$$\mathrm{MAP} = \frac{1}{q_N} \sum_{i=1,\ldots,s_{q_N}} AP_i. \tag{1}$$

In recent years, scientific workflows are emerging as a suitable practice to model and simulate the logical stages of a science process to create a science product. X is the subset of P that is similar to p, and Y is the subset of P that is determined similar to p by our case retriever R. There have existed plenty of researches related to the construction, learning, and evolution of ontology in miscellaneous applications and academic domains [3]. Generally speaking, there are three kinds of relationships that exist among concepts. These are independence, intersection and inheritance.

Nowadays, ontology is also a popular research topic in knowledge management, cooperative information systems, electronic commerce, information retrieval, intelligent information integration and medicine, among others. A defuzzified number is usually represented by the centroid of gravity (COG), which can be determined using the moment of area method defined as $\mathrm{COG}=(\int_X x\mu_B(x)\mathrm{d}x/\int_X \mu_B(x)\mathrm{d}x)$, where $\mu_B(x)$ is the aggregated value of the fuzzy variable B over the universe of discourse Z. $CjFx^B$ is the term set of the father concept for concept B, $CiCx^A$ and $CjCx^B$ are the term sets of the child concept for concept A and concept B, respectively, and $CiBx^A$ and $CjBx^B$ are the term sets for process relationship.

Step 1: *plug-in*, if G_o subsumes R than G_o could be plugged in place of R;

Step 2:Perform the text pre-processing steps: stemming, stop-list, spell-checking, either correcting or removing strings that are not recognized;

Step 3: schema integration. Performing the schema transformation by using the generic construct is a more general way to information;

Step 4: For x, y ∈ S, x, y are in the same class if and only if x, y ∈ δx ∩ δy.

We propose a semantic approach to cope with the data integration problems defining the JXML2OWL framework which can be used to map syntactic data in XML format to an ontology defined in OWL (Web Ontology Language).

3 Rough Set Model

The rough set philosophy is founded on the assumption that with every object of the universe of discourse we associate some information (data, knowledge). The variable precision rough-set model can be thought of as a generalization of the rough-set model. It allows for some degree of uncertainty and misclassification in the mining process. The variable-precision rough set (VPRS) approach has been used in many areas to support decision making. Assume U denotes the universe to be learned. X and Y denote the non-empty subsets of U.

Hence, rough set theory expresses vagueness not by means of membership, but by employing a boundary region of a set. If the boundary region of a set is empty it means that the set is crisp, otherwise the set is rough (inexact). In an application environment, the notion of a concept is used as a generic mechanism to deal with a group of related objects and to associate a meaningful label with such a group[4]. An example of a context (G, M, I) is shown in Table 1, where $G = \{g_1, g_2, \ldots, g_6\}$ and $M = \{m_1, m_2, \ldots, m_5\}$. For each $x \in U$, $[x]_R$ denotes the equivalence class of R

containing object x. Now if X represents a subset of U, the lower and upper approximations of X under R are defined respectively as. That is following equation 2.

$$\gamma(C,D,\beta)=\frac{POS(C,D,\beta)}{U} \tag{2}$$

Similarly, for $B \subseteq M$, $\alpha(B)$ is defined as the set of objects that possesses all the features in B. Rough set theory is a fairly new intelligent tool that is widely used for finding data dependencies, evaluating the importance of the attributes, discovering the pattern of data, reducing all redundant objects and attributes, and seeking the minimum subset of attributes.

$$authority(p) = Similarity(p) + \frac{1}{\left|\{q|q \to p\}\right|}\sum_{q \to p} Similarity(q) \tag{3}$$

Fig. 1 shows the relationship between β and γ. When documents of various data sources are entered, they must pass through different preprocessing methods in order for them to qualify in subsequent requirements.

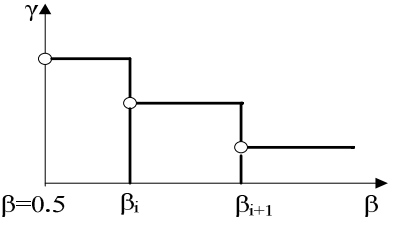

Fig. 1. The relationship between β and γ

First of all, we constructed an ontology to express the basic components of the FCA method, including formal object, formal attribute, formal context and formal concept. Second, concept lattices provide better foundation for knowledge processing, such as association rule discovery, intelligent search engine, semantic Web and natural language processing. According to rough set theory, the set of N_0 CRs can be defined as the set of conditional attribute $C^{cr} = \{CR_1^c, CR_2^c, \ldots, CR_r^c, \ldots, CR_{N_0}^c\}$, and corresponding to the conditional set. For example, in decision trees, too many instances lead to large decision trees which may decrease classification accuracy rate and do not clearly create the relationships which come from the training examples.

In contrast to most KDD tasks, such as clustering and classification, outlier detection aims to find small groups of data objects that are exceptional when compared with the remaining large amount of data, in terms of certain sets of properties. The notion of a set is not only fundamental for the whole of mathematics but it also plays an important role in natural language. Objects characterized by the same information are indiscernible (similar) in view of the available information about them. The indiscernibility relation generated in this way is the mathematical

basis of rough set theory. It has been proven to be an effective mathematical tool for describing and modeling incomplete and insufficient information.

4 Constructing e-Commerce Knowledge System Based on Ontology and Rough Set

Therefore, our current research uses the P2P infrastructure JXTA. The JXTA Search discovery and access model exposes content unavailable through traditional indexing and catching search engines using a query routing protocol (QRP) for distributed information retrieval. The ontology integration process is designed based on the above results. This process has four sub-processes, namely main process, ontology mapping process, ontology merging process and sub-concept merging process. In this method, ontology is involved to fully utilize the data obtained from the user interface of the graphical tool and other existing heterogeneous data resources, and to provide users proper and comprehensive information for conceptual design.

Our system runs on a Windows XP-based PC with an Intel Pentium 4 CPU at 2.8 GHz and 1 GB RAM. The system was developed using Java on Java SDK 1.4.2 platform. Denoting concept in symbol achieves formalized conceptual model.

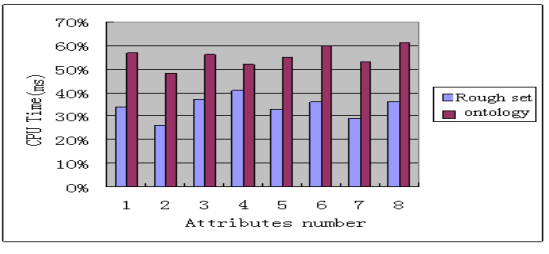

Fig. 2. Constructing knowledge management system compared result of rough set and ontology

Fig. 2 describes the method of building knowledge information system based on rough set and ontology. Ontology and rough set model is proposed based on integrating of ontology, rough set, and is used to reduce formal context. The experiments show the CPU Time in the attribute numbers, indicating that ontology is superior to rough set in building the information system.

5 Summary

The unified discovery system has three layers and adopts four types of ontology to implement distributed and semantic resource discovery. Compared with databases, ontology is more flexible and efficient at the representation of data relations, and is good at reasoning based on the relations. The paper proposes using ontology and rough set to build the knowledge management model in e-commerce recommendation system. Finally, we provide some numerical experiments to demonstrate the feasibility of the proposed algorithm.

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Analyses on Influence of Training Data Set to Neural Network Supervised Learning Performance

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Abstract. The influence of training data set on the supervised learning performance of artificial neural network (ANN) is studied in detail in this paper. First, some illustrative experiments are conducted, which verify that different training data set can lead to different supervised learning performance of ANN; secondly, the necessity of carrying data preprocessing to training data set is analyzed, and how training data set affect the supervised learning is summarized; at last, the existing methods about improving performance of ANN by using high-quality training data are discussed.

Keywords: Neural network, supervised learning performance, training data set.

1 Introduction

An artificial neural network (ANN) is a mathematical model or computational model that tries to simulate the structure and/or functional aspects of biological neural networks. An ANN is an adaptive system that changes its structure based on external or internal information that flows through the network during the learning phase. Supervised learning is one of the most important learning paradigms in ANN. Supervised learning is a machine learning technique for deducing a function from training data set. The training data set consist of pairs of input objects, and desired outputs. The output of the function can be a continuous value, or can predict a class label of the input object. The main task of the supervised learner is to predict the value of the function for any valid input object after having seen a number of training examples. To achieve this, the learner has to generalize from the presented data to unseen situations in a "reasonable" way. Supervised learning method is relatively easy to implement, but it is commonly used in applications demanding high quality training data set. In other words, the training data set should be typical and informative, which can represent the environment of applications.

Two factors that are known to have direct influence on the supervised learning of ANN, (1) the network complexity and (2) the representational accuracy of the training data [1]. Complexity refers to the number of independent parameters associated with the ANN model and many pruning algorithms are used to tackle this problem, but there is no direct solutions are known for the second. The goal for this paper is to

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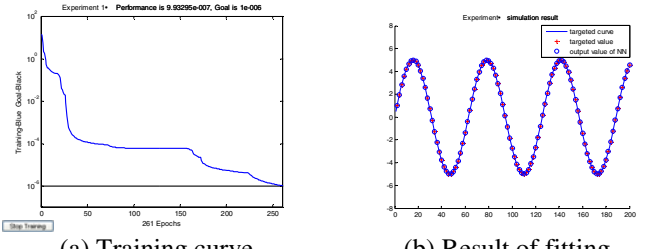
analyze the influence of training data set to supervised learning performance of ANN. Specifically speaking, the main points include: (1) how training data set affect the supervised learning performance of ANN is summarized and (2) the existing methods about improving performance of ANN by using high- quality training data set are discussed.

2 Illustrative Experiments

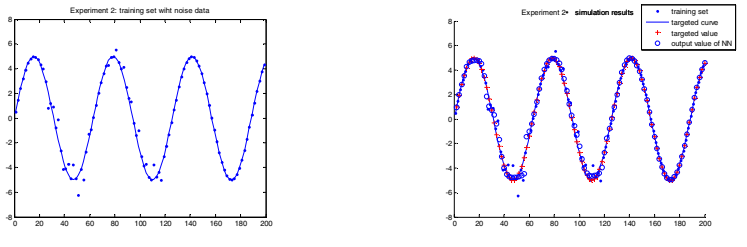
With the purpose of demonstration influence of training data on supervised learning, 4 illustrative experiments are conducted. For the convenience of comparison, the environments of all experiments is all uniform, that is using BP network to realize fitting equation: $y = 5 * \sin(0.1 * x)$, and the setting of BP network's configuration of all experiments is the same. The only difference is training data set. The number of training data of Experiment 1 is 100 and all the data are clear. The number of training data of Experiment 2 is also 100, but this training data set includes 20 noise data. The training data of Experiment 3 and Experiment 4 are clear, and the number is 80 and 200, respectively.

The results of Experiment 1 are shown in Figure 1. Figure 1(a) is training curve and the fitting curve is shown in Figure 1 (b). From the Figure 1 we can find that after 261 epochs, the network achieves training precision and the fitting curve accords with the object curve basically.



(a) Training curve (b) Result of fitting

Fig. 1. The results of Experiment 1



(a) Training data set including 20 noise data (b) Result of fitting

Fig. 2. The results of experiment 2

In the Experiment 2, the training data set also contains 100 training data, but 20 noise data are included. Data distribution (including noisy data) and the experimental results are shown in Fig 2. The experimental results indicate that the performance of BP network declines sharply due to the fact that the training data set has added noise data.

The results of Experiment 3 and Experiment 4 are basically alike. That is the performance of Experiment 3 and Experiment 4 are better than the Experiment 2, but is worse than the Experiment 1.

Table 1 shows the comparison of supervised learning performance of 4 experiments. All experimental environments are the same but the training data set, so the difference of experimental result is due to the difference of the training data set. It is clear that the performance of Experiment 1 is best and the performance of Experiment 2 is worst. It is apparent that performance degradation is caused by noisy data. The performance of Experiment 3 and Experiment 4 is between Experiment 1 and Experiment 2; this is because the size of training data is different although the training data sets of Experiment 1, Experiment 2 and Experiment 4 are all clear. The size of training data set is too low or too high will also cause supervised learning performance degradation of NN.

From illustrative experiments we can draw a conclusion that the training data set of ANN has a direct and decisive affect upon supervised learning performance. Hence, it is essential and necessary to use training data preprocessing technique to improve supervised learning performance.

Table 1. The comparison of performance

	MSE 1	MSE 2	Q	Learning speed (epochs)
Experiment 1	9.9330e-007	2.6487e-006	2.6487e-004	261
Experiment 2	0.1179	0.0855	8.5499	> 10,000
Experiment 3	9.9939e-007	4.2630e-006	4.2630e-004	1348
Experiment 4	2.8233e-005	3.6356e-005	0.0036	1968

MSE1: Square Error of training data set; MSE2: Square Error of testing data set; Q: the total error of testing data set

3 Analyses on Influence of Training Data Set to Supervised Learning Performance

Training data set has direct and decisive influence on the supervised learning of ANN, which is chiefly manifested in generalization ability, learning time, computation consumption, and accuracy etc. High-quality of training data set can bring high-performance of ANN.

A training data set can be described by the size and the distribution. The influence of the size on supervised learning can be briefly described as follow: when the size of training data set is over-small, the problem of inadequate training always easy appears; when the size of training data set is over-large, then the problem of

over-training may arises. For distribution of training data set, it should cover all classes as possible, and the amount of each class and its ratio should beneficial to establishment and evaluation of ANN model. As a result, in order to improve performance of supervised learning, it is necessary to preprocess training data set and get high-quality training data set. The necessity can be described in the following aspects:

(1) Usually supervised learning works well only when we have enough training samples. A huge amount of the training data may guarantee generalization ability of ANN. On the other hand, it will require a very long training time and amount of computations. Therefore, it is desirable to reduce the number of the training data and remove redundant and unnecessary data while maintaining generalization ability of ANN.

(2) A huge amount of the training data may require complicated network architecture of ANN. So we should reduce the number of training data and make structure simpler, e.g. fewer hidden nodes and/or layers for back-propagation ANN. This helps to solve the problem of overfitting.

(3) For real world problems, it is not always easy to obtain high quality training data sets that can cover all kinds of data. In fact, we only get a certain amount of training data in practice engineering. For the given training data set, the number and the distribution of training data set are indentified, so under the conditions of given sampling feature and/or ANN model, we face such problem that how to using these training data set to obtain the optimal performance of ANN model[2].

(4) In practice applications, training data set inevitably contain a variety of noise data. As we know, noise data are extremely harmful to performance of ANN. So how to delete the noise data efficiently form training data set is also an approach to improve quality of training data.

(5) Actually, each data in the training data set is unique and each data has different information. Unfortunately, we assumed that all the data have the same importance when we using training data set to train ANN. So we should have valid methods to weight training data to improve performance of ANN. Weighting training data is an open problem and no direct solutions are known for this question.

(6) For supervised learning, data label is of paramount importance. However, in many real-world applications, the number of labeled data available for training purpose is limited. This is because labeled data are often difficult, expensive, or time consuming to obtain as they require the efforts of experienced human annotators [3]. So the crucial issue in many classification applications is how to achieve the best possible classifier with a limited number of labeled data for training. Training data selection is one method which addresses this issue by selecting the most informative data for training.

When we train ANN, above mentioned problems often occur, more or less. If we have no effective strategy to process training data set, we must use the original training data which data quality is poor. In this case, the training becomes difficult and inevitably leads to drop in ANN performance. In a word, with purpose of improving performance of ANN, it is very necessary to refine original training data set and obtain high-quality training data set. However, preprocessing training data set is a very difficult job. This is because: (1) there is no standard theory and method to

handle training data set. In more specific terms, what size of training data set can lead to the best performance of supervised learning has no support by theory. Most researchers depend on experiment to test their own method; (2) for the distribution of training data set, the features of data embodied in training data set differ from each other in a thousand ways, which significantly increases the difficulty to preprocess the training data set. Training data set has very complicated influence on supervised learning. Many researchers proposed preprocessing methods to deal with original training data set from different points. The following is the research summary on how to improve the training data quality.

4 Summary of Preprocessing Methods to Improve Quality of Training Data Set

Low-quality training data perturb the performance of ANN. The aim of preprocessing to training data is improving training data quality and producing reliable models. The preprocessing methods of improving data quality include data selection, deleting of noise data, and detection of outliers data etc. So far, using preprocessing method to improve training data quality, thereby increasing performance of ANN have received considerable attention and many researchers have already focused on it [2, 4-10]. The following we summarize preprocessing methods from three aspects.

(1) About data selection method

In the supervised learning of ANN, it is intuitively obvious that some points in a given set of training data will have a greater effect on the performance than others. Hence, we should select these influential data. Selecting training data at random from the sample space is the most popular method followed. Despite its simplicity, this method does not ensure nor guarantee that the training would be optimal. Thus, there exist some improved methods. In [7] the authors present three methods to produce data point, that are even design method, orthogonal design method and ransacking method, and the authors use empirical study to test that under the same condition even design is the best method. When the function changes little with the variables, the orthogonal design is good method. In [8] the authors use the fuzzy cluster algorithm to select training data which include characteristic of original data. This method can solve the problem of learning speed. In [9], based on nearest neighbor (NN) rule, a training data selection method is proposed. This method can eliminate the redundancy, achieve better performance with fewer training data and less training time. Literature [10] propose that the training data selection should consider the characteristics of non-linear object approached and a training data selection method base on the uniform design and clustering theory is discussed. Application shows this method can improve the generalization ability of neural network.

(2) About data type of training data

There also exist many research works about selection of data type, especially for problems of classification and identify of ANN based on supervised learning. Different researchers stress different data types. In [2, 11], the authors verify the importance of boundary data. They select boundary data as training data set and demonstrate its advantages. In [12], the authors use boundary data and some random data as training data set. Some other existing works [13] put more emphasis on the

representative samples which are close-to class centers. In [14] the authors present three methods to select data point, that are center-based selection, border-based selection and hybrid selection, and the authors use experiments to proof that the boundary data and central data are used together as training data is better than just using boundary data or central data.

(3) About dealing with noise data of training data

In some situations, training data is noisy. If there are noise data in the dataset to learn, it will make a worse generalization quality of ANN. Noise data refer to morbid data, error data, outlier data, mislabeled data, etc. In [15], based on the search thought and the Hamming distance, the authors put forward a new approach to eliminate morbid samples that can efficiently eliminate noise data and improve the generalization ability of forward neural network. The network maybe not converges if there were morbid sample in training data. For solving this problem, an eliminating algorithm of voting that base mode similarity calculating is proposed in [16]. Mislabeled training data is an important source of noise. In [17], the authors offer a new approach which can identify the mislabeled data and handle of such data by using a preliminary filtering procedure.

5 Conclusions

Training data set has direct and decisive influence on the supervised learning of NN, so it is very essential and important to process training data for improvement of supervised learning performance. This work discusses the influence of training data set on the supervised learning performance of ANN, analyzes the necessity of taking data preprocessing technique to improve training data quality, and summarizes the existing methods about improving supervised learning performance by using high training data set.

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Multi-intelligence Agents Application in Cold-Bending Formation Theory to Modification

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Abstract. The cold-bending formation in plate metal is a complex process since influence factors are various. The forming defects are appeared at random in practice. They must be adjusted or modified to overcome on the spot. Cold-bending formation theory should be made necessary modification to accommodate varied information. A new theory with splines finite strip method is established to satisfy the practical demands. It determined the splines strip rationally and simplified boundary condition. Aiming at the qualitative shaping factors which are difficult to quantify, the situation of the information system and the effective advices of information construction is simply introduced. According to specialist experience, theory system of multi-Agent was established. This work can provide theoretical guidance for complex pass design.

Keywords: modification, computation model, multi-Agent, pass design.

1 Introduction

The cold-bending formation is an economical, high efficiency technology to save energy. It is applied widely in automotive manufacturing, constructing, road, and bridge. As a kind of economical rolled steel, it possesses the advantage of thickness uniformity, shaping efficiency highness, and so on. Cold roll forming is a bending deformation after serial layout sheet roll bent in the continuous extrusion at room temperature. Finally, a certain section is produced. Many experts have devoted themselves to study cold-bending formation theory. With the help of virtual techniques, they established the virtual laboratory to provide theoretical basis for product and design in practice.

At present, all of rolls are adjusted by hand with designer practical experience. It is such a way to manual design, cut roll, test roll, modify and re-test, re- modify. During adjustment operation, it is often to modify or adjust for roll pass on the spot to overcome forming defect. Information theorization is in demand. Cold-bending formation theory must be made necessary modification to accommodate varied information, which can provide theoretical guidance for complex pass design.

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2 Forming Principle

Cold forming process is an elastic-plastic deformation with long history. As comprehensive deformation and boundary conditions, there are many influencing factors in forming. In processing, the rigid rollers rotating at a constant speed is arranged in serial. Spline finite strip method is an effective way to study deformation of strip steel. It provides not only theoretical analyses to strip steel application, but also theoretical guidance to design tools for deformation of strip steel.

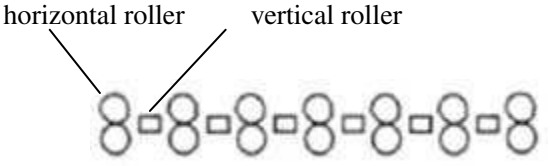

Fig. 1. Forming passes arrangement

Roll forming units is composed of a number of racks. Racks are generally divided into horizontal and vertical roller frame, showed in Fig.1. The exact quantity and arranged order are determined by characteristics and requirements of units. The frame is usually called forming pass. During deformation, the horizontal roller frame constituted forced shaping region, undertaking strip deformation tasks. It is driven by a power. While the non-powered vertical roller frame mainly plays a role of transitional deformation, to overcome the defects on the edge of the plate, such as wave, bulging etc. Every forced shaping region, as a unit, makes into or becomes computation model in relative coordinates system. Data switching model is found among adjacent units. Finally, product lines in absolute coordinates system constitute a computational system.

3 Establishing Computation Model

In practice, adjustment or modification to roller on the spot is necessary to ensure section steel quality. The modified information is collected and regulated. In building finite strip, boundary conditions is adjusted. Based on characteristic finite strip establishing, a new computation model is built. The new model reflects objectively, accurately the forming procedure of steel strip.

3.1 Establishing Unit Model to Compute

Splines function generally used cubic B-spline function. The finite strip is divided longitudinally into equidistant and un-equidistant. The product of polynomial shape functions in lateral direction constituted displacement function. Along the x1, x2, x3 directions, displacement increments can be expressed by u, v, and w respectively. The incremental form can be described as followed.

$$\begin{Bmatrix} \Delta u \\ \Delta v \\ \Delta w \end{Bmatrix} = \sum_{i=1}^{r} [N]_i [\varphi]_i \{\Delta\delta\}_i \tag{1}$$

In formula, the shaping function, row matrix of each cubic B-spline, displacement parameters can be expressed matrixes [N], [φ], and [δ] respectively. The parameter r is the number cubic B-splines.

Adopting pass structure of infection and radius meets the deformation balance along bandwidth. It also restricts wave stretching on the edge of the strip steel. By this design, there are extremely similar in every stretching of strip steel. The juncture between two arcs, as boundary lines, comes into characteristic boundary lines. The strip steel is divided into a series of regions in lateral direction. Based on displacement changes of $\partial \Delta u_i / \partial x_1 = \pm\varepsilon$ and $\partial \Delta w_i / \partial x_3 = \pm\varepsilon$, the number of strip partition is defined. In the expressed change, the positive sign indicates the adjacent arcs bending in same direction. Negative sign indicates the direct opposite. When $\varepsilon \le [\varepsilon]$, strip steel deforming is in a slow statement. The number of the strip can be reduced. When $\varepsilon > [\varepsilon]$, plates deform violently. The number of the strip is on the increase to describe the deformation accurately. When $\varepsilon = 0$, strip steel deformation doesn't occur in this pass. The present one is still being used. The deformation process of strip steel is expressed accurately, by using characteristic boundary lines. Dividing flexibly finite strip and establishing characteristic strip can be effective to avoid the massive amounts of data generated, which simplifies the boundary lines.

Displacements and strains constitute basic parameters in deformation of strip steel. Strain is Green's response as the basic configuration. The displacements in direction u, v, and w are large in cold-forming. The geometric equation of relationship between displacements and strains is expressed in equation (2).

$$\begin{cases} \Delta E_{11} = \dfrac{\partial \Delta u}{\partial x} + \dfrac{1}{2}\left[\left(\dfrac{\partial \Delta u}{\partial x}\right)^2 + \left(\dfrac{\partial \Delta v}{\partial x}\right)^2 + \left(\dfrac{\partial \Delta w}{\partial x}\right)^2\right] - z\dfrac{\partial^2 \Delta w}{\partial x^2} \\ \Delta E_{22} = \dfrac{\partial \Delta u}{\partial y} + \dfrac{1}{2}\left[\left(\dfrac{\partial \Delta u}{\partial y}\right)^2 + \left(\dfrac{\partial \Delta v}{\partial y}\right)^2 + \left(\dfrac{\partial \Delta w}{\partial y}\right)^2\right] - z\dfrac{\partial^2 \Delta w}{\partial y^2} \\ \Delta E_{12} = \dfrac{\partial \Delta u}{\partial y} + \dfrac{\partial \Delta v}{\partial x} + \dfrac{\partial \Delta u}{\partial x}\dfrac{\partial \Delta u}{\partial y} + \dfrac{\partial \Delta v}{\partial x}\dfrac{\partial \Delta v}{\partial y} + \dfrac{\partial \Delta w}{\partial x}\dfrac{\partial \Delta w}{\partial y} - 2z\dfrac{\partial^2 \Delta w}{\partial x \partial y} \end{cases} \tag{2}$$

3.2 Establishing Unit Model to Exchange

Strip steel deformation is described by units. Controlled parameters in all forming passes are deformation extent, represented by angle. According to total deformation

angle and deformation extent in every forming pass, deformation angle divided into uniformity or un-uniformity. The distribution in every unit is stored as data in table, showed in Table 1. Exchanging information of units is accomplished by pointer. The pointer only takes part in information transmission, not deformation. So it is not necessary to found equation for pointer. In order to simulate continuous deformation of strip steel, product lines in absolute coordinates system constitute a computational system by pointer to transfer information of very unit in a relative coordinates system.

Table 1. Deformation angles distribution in every frame

pass 1	pass 2	pass 3	…	pass n
15^o	30^o	30^o	…	30^o

4 Application of Multi-Agent System

Multi-Agent technique is a new method in the field of artificial intelligence. Cold forming is a complicated process. In particular, the useless work is driven by friction. Friction is unstable in deformation. It devotes one part to useful work, others to useless work to consume. The useless work is difficult to quantize. Furthermore, the forming defects and correction of the pass shape are appeared at random on the spot. All of these factors are influence on strip steel forming and product quality. Aiming at the above factors which are difficult to quantify, according to specialist experience, theory system of Multi-Agent was established by amending the Agent of knowledge containers and social relationships. Generally, a unit Agent does not employ multi-agent systems, on condition that a single intelligent Agent can complete behavior management. Intelligent Agent systems, based on the changing environment, have the application of force and ability of self-adjustment corresponding to environment changes. It can amend the influence of each factor in cold-bending by interactive mode with other Agent system. And it helps us to reveal accurately the mechanism of deformation in strip steel cold-bending.

5 Conclusions

The cold-bending formation in strip steel is a complex process since influence factors are various. The forming defects are appeared at random in practice. It must be adjusted or modified to overcome forming defect on the spot. Cold-bending formation theory must be made necessary modification to accommodate varied information. With theory of finite strip, an analysis on pass structure was made to satisfy the practical demands. It determined the strip rationally and simplified boundary condition. And it reduced the computation model complexity. In order to reflect objectively rolling process, informatization factors constituted Multi- intelligence Agents. The work of this thesis will be theoretically and practically beneficial to designing roller pass.

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Reconstructing Scanning Information of 2D Contour in Direct Slicing for RP

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Abstract. Data processing based on STL file, possessing a staircase effect at birth, restricts the further improvement of the part precision in Rapid Prototyping (RP). Using the original CAD model, direct slicing can maintained the interior topological and geometrical information of CAD model, improving the accuracy of RP. Slicing data processing is one of the most important steps in RP software. In this paper, the direct slicing data are processed in order to accurately extract and reconstruct the data information of the 2D contours, which can be used directly by the molding machine of RP. They are obtained by calculating points of the scanning path and a polygon intersecting each other in sequence. Aiming at the abnormity of the scanning paths and a polygon meeting at vertex, a combination of unifying and eliminating was applied to the same points. Based on the Windows operating system, the program above is developed with Visual C++ and the tools of ObjectARX in AutoCAD environment. The work will be practically beneficial to forming the scanning paths of 2D contour in CAD model.

Keywords: RP, CAD, 2D contour, scanning information, reconstruction, redevelopment.

1 Introduction

With the development of rapid prototyping technology, the part precision has been more and more recognized by people. And the prototyping precision can be greatly improved by improving the processing technology and material properties. However, the STL file based data processing method and the staircase effect in the present, which is inevitable during rapid prototyping process, restricts the further improvement of the part precision.

MDT is a parameterized software system for machine design, which integrated the two dimensions drawing into the three dimensions design in the environment of Windows operating system. Based on a close research of the interior representation of CAD model in MDT, this thesis picks-up the interior topological and geometrical information of model expressed in the boundary representation (B-Rep) using the development tools of ObjectARX. The picking-up information makes it successful to implement the direct slicing.

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2 Direct Slicing

Nowadays, nearly all types of rapid prototyping systems in information processing and conversion commonly adopt STL file as their data exchange interface. The STL file is a triangularization representation of CAD model surface. Using it to represent CAD model will reduce the part precision. Obtaining the section information directly from the CAD model, throwing STL file, is the inevitable trend in future. Using the original CAD model, direct slicing can maintained the interior topological and geometrical information of CAD model, improving the accuracy of rapid prototyping. This method can also reduce the data conversion process, decreasing in the amount of data of corresponding files. Aiming at the issues above, this thesis deals with the direct slicing. Cutting Function of CAD system is called directly, or an intersection algorithm of parametric surface and plane is presented by redevelopment.

Direct slicing is the center of the data processing module, which achieves CAD model slicing based on AcDbRegion( ) class and obtains boundary contours expressed in the directional line segments. The direct slicing data are processed in order to accurately extract and reconstruct the data information of the 2D contours.

3 Reconstruct Data Information of the 2D Contours

The data of the 2D contours have such features. The constitution of the layers is a series of inside and outside contour lines possessed a certain thickness. These lines come into a lot of proper closed loops. From beginning to end, the linear entity is consisted of the loops with rotation direction. Above all, the processing of the 2D contours is transferred to closed loops. There are the three data structures as follows applying in data process. The structure “Loop” is used to store loop information, the structure “Layer” for layer, and the structure “Rect” for maximum rectangle.

3.1 Rebuilding the 2D Boundary

There are many ways to establish the information of two-dimensional cross-section. In which, it is favorable for slicing to describe the outline of the graphic components into polyline (multi-segment line), which is easy to pick up information.

The algorithm of 2D boundary reconstruct is the following steps.

Step 1: One Layer is built.

Step 2: A region entity with a certain thickness from a solid is obtained.

Step 3: Using function explode( ), the region entity is decomposed into a series of simple curves, such as spline curve, line, arc, etc.

Step 4: Point-group “Ⅰ” is gained from the above-mentioned curve, and then added to point-group “Ⅱ”of region area. If curves are disposed completely, the process turns to step 6.

Step 5: If point-group “Ⅱ” of region area is a closed curve, then a new loop is rebuilt. The forming closed curve is a new loop, adding to the layer. Characteristic points and maximum surround rectangle are established as stated the above. And then, the point-group, named Ⅱ, is reset. Otherwise, the process turns to step 4.

Step 6: The maximum surround rectangle is obtained from the above information. All process is completed.

3.2 Judging the Inside and Outside Loops

The radius compensation of laser beam spot in processing of the 2D contours must be taken into account. The precondition is to judge the inside and outside loops for radius compensation. The outside loop is defined as the loop without being contained or contained, whose loops total is an even number. On the contrary, the loop is an inside one. The point, maximum coordinate X and minimum coordinate Y in each loop, is the characteristic point. In Fig. 1, Loop1 and Loop3 are outside loops, while Loop2 and Loop4 are inside ones. In Fig. 2, the frame abcd, surround rectangle, is the maximum. Points A, B and C respectively refer to characteristic point of Loop1, Loop2 and Loop3.

It is not necessary to judge the location relation among all the vertex and other loops in identifying the inside and outside loops. It is enough to judge from the characteristic point of loops. The following will briefly describe principles of automatic process.

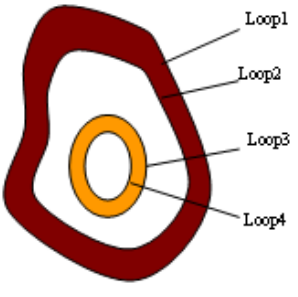

Fig. 1. Definition of the inside and outside loop

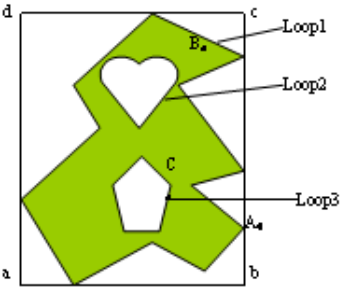

Fig. 2. Maximum surround rectangle and characteristic point

Step1: Inputting outline information of 2D boundary;

Step 2: If the loop vertex coordinate value is equal to one of four parameters of maximum surround rectangle, by traversing all the boundary loops, then it can be determined to an outside one, and be marked.

Step 3: A ray is made from the characteristic point of un-marked loop. Calculating the point number where ray and loop meet or intersect, if the value is odd, then the un-marked loop is an inside one. Otherwise, it is an outside. At last, it makes a sign.

Step 4: If there are un-marked loops, the process turns to step 3. Otherwise, all process is completed.

In step 3, the point number of intersection is calculated by computer graphics. The consuming time of automatic process to identity relates to the loop num and side num of 2D boundary.

3.3 Algorithm of Filling Lines

It is necessary to scan the 2D contour as well as the inside of a 2D contour in shaping process, according to RP characteristic feature. Filling way effects directly not only on the part precision and strength but also on machining time.

3.3.1 An ordinary Algorithm

In practice, the forms of polygon in 2D contour are many and varied, including the convex, concave, and eye polygon. For the 2D contour, the ordinary algorithm is such one. Firstly, the points where scanning line and polygon meet or intersect are calculated, by scanning line in sequence. Secondly, filling lines are constructed. A filling line building is showed in Fig. 3.

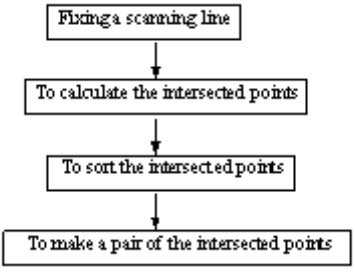

Fig. 3. Scheme flowchart to build filling line

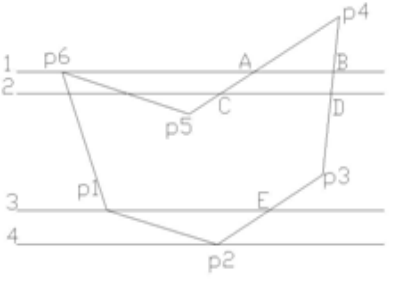

Fig. 4. Algorithm of the filling regions

3.3.2 Special Cases Disposal

For the 2D contour, the ordinary algorithm can arrive at the correct filling line in general. When scanning line intersecting with vertex of polygon, the abnormal condition will occur, showed in Fig. 4.

(1) Scanning line 1 meets line P5P6, P1P6, P4P5, P3P4 in point P6, P6, A, B. The intersect points are P6, P6, A, B in order. So the four points build filling lines P6P6, AB. The filling line P6P6 just is one point, which doesn't result to error, but can bring into redundant point in practice.

(2) Scanning line 3 meets line P1P2, P1P6, P2P3 in point P1, P1, E. The intersect points are P1, P1, E by ordering. Then filling line is P1P1 by ordinary algorithm, which is obviously a mistake.

(3) Scanning line 4 meets line P1P2, P2P3 in point P2, P2. The points to sort are P2, P2. Then filling line is P2P2, like circumstance (1).

Considering the above circumstances, for the abnormity of the scanning paths intersecting vertex of a polygon, an algorithm combined unifying and eliminating the same points is presented. Circumstances (1) and (3) adopt to eliminate the same point, while Circumstances (2) to unify. Unifying and eliminating the same points can reduce greatly redundant point in practice.

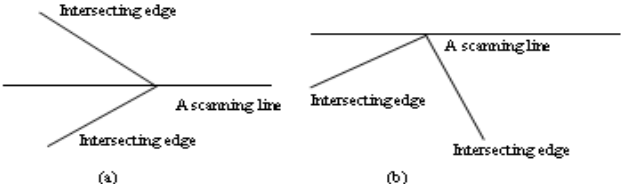

Fig. 5. Tatics to select for judgment (a) the opposite side (b) the identical side

In accordance with the position relationship, a combination of unifying and eliminating was applied to same points. The judgment is described in the following words. If the intersecting edges lie in the Opposite side of scanning line, showed in Fig.5 (a), then the intersecting points are unified. On the other hand, showed in Fig.5 (b), the intersecting points are eliminated. This method, optimizing the scanning lines, will improve shaping efficiency.

4 Conclusions

Three-dimensional CAD models is treated by direct slicing, using the development tools of ObjectARX. The work of this thesis will be practically beneficial to forming the filling paths of 2D contours in CAD model. Here are generated by this application. Each layer in CLI file, fill lines are both in horizontal, vertical directions, to ensure the realization of cross-grid scanning. CLI file are showed as the follow.

```
$$HEADERSTART
$$ASCII
$$UNITS/1
……
$$GEOMETRYSTART
$$LAYER/0.4
$$POLYLINE/0 1 5 762.570,258.667, 802.570, 258.667, 802.570, 298.667, ……
$$HATCHES/0 14 762.620, 259.167, 802.520, 259.167, 802.520, 262.167, ……
$$HATCHES/0 14 763.070, 258.717, 763.070, 298.617, 766.070, 298.617, ……
……
$$LAYER/39.4
$$POLYLINE/0 1 37 771.953,268.050, 773.376, 266.630, 775.070, 265.510, ……
$$HATCHES/0 9 773.411, 266.667, 791.711, 266.667, 794.675, 269.667, ……
$$HATCHES/0 9 770.570, 269.526, 770.570, 287.826, 773.570, 290.761, ……
$$GEOMETRYEND
```

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Situation and Risk of Earthquake-Induced Geo-hazards in Middle Reaches of Bailongjiang River, China

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Abstract. The middle reaches of the Bailongjiang River in southern Gansu province is one of the frequent geo-hazards areas and also the most damaged areas induced by 5.12 Wenchuan earthquake in China. Based on the information of secondary geo-hazards investigated by Gansu Provincial Department of Land Resources, the situation, risk and distribution characteristics of the earthquake-induced geo-hazards in study area have been analyzed. The analytical results showed that the situation of the disaster was not only related to the earthquake itself and its geological environments but also to human activities. The situation of the disaster and the potential risk are much more serious on both sides of rivers, roads, and the adjacent area of towns and villages. The 5.12 earthquake-induced geo-hazards appeared in large scale, dense distribution, serious disaster situation and higher risk in the downstream areas of many flowing basins with relatively higher population density and much frequenter human activities. These study results could be significance with some scientific basis to the post-disaster reconstruction and the prevention of secondary geological disasters.

Keywords: Wenchuan earthquake, secondary geo-hazards, situation of disaster, risk.

1 Introduction

The 5.12 Wenchuan earthquake induced a series of geo-hazards (including collapses, landslides and ground fissures etc.) which brought about serious losses of people's life and property. As the earthquake-stricken area becomes quickly an important field test site of multidisciplinary research of earth science after 5.12 earthquake, some new opportunities are brought to be used to study the secondary geo-hazards, at the same time, many productions have been obtained in this domain, such as remote sensing interpretation[1-2], influence factors analysis[3-4], basic characteristics [5-6], hazard and risk assessment[7] etc. Present studies mainly focus on remote sensing interpretation method and the seismic dynamic factors, while describing the basic characteristics of secondary geo-hazards and comprehensive evaluation are still the

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traditional geo-hazards investigation methods and work content. It is well-known that the distribution of secondary geo-hazards is related to the epicentral distance and topographic conditions, but its situation may not reflect the threat level of potential geo-hazards. Therefore, it is necessary to research on the situation of secondary geo-hazards and the risk for post-disaster reconstruction and geo-hazards prevention and reduction. In this paper, based on the information investigated by Gansu Provincial Department of Land Resources, the situation of the secondary geo-hazards and the distribution characteristics of risk are analyzed in the middle reaches of Bailongjiang River in the southern of Gansu province, and some scientific basis could be provided for selecting post-disaster reconstruction sites and geo-hazards' prevention and control.

2 Study Area

The study area located in the middle of the north-south seismic tectonic belt of China. The earthquake-induced geo-hazards are very serious. National highway of 212 and the other roads which cross this area are damaged frequently by landslides and debris flows. The study area which include Zhouqu county, Wudu county and Wenxian county is 12,687 km^2, with the population of 931,300 and mainly in agriculture. The average population density is 73.4 person/km^2, and 117.4 person/km^2, 49.9 person/km^2 and 43.9 person/km^2 respectively in Wudu, Wenxian and Zhouqu. The railway from Lanzhou to Chognqing under construction traverses this area.

3 Statistics of Situation and Risk of 5.12 Earthquake-Induced Geo-hazards

Based on the investigated information after 5.12 earthquake, at the end of 18:00 on May 27th, 2008, secondary geo-hazards caused 123 persons in death, 420 persons in injury, 2,738,567,000 RMB Yuan of economic losses and about 204,925 persons in threatening in Gansu province, mainly in Longnan prefecture, followed by Tianshui prefecture and Gannan prefecture.

In study area, the amount of the secondary geo-hazards was 2,321, thereinto, 2,076, 236 and 9 cases respectively in Wudu, Wenxian and Zhouqu. Large size and oversize disasters were primarily in Wenxian. Medium size and small size disasters were mainly in Wudu and Zhouqu. There were 163 cases of oversize landslide, including 98 and 65 cases respectively in Wenxian and in Wudu. The secondary geo-hazards induced 88 persons in death, 138 persons in injury, 2,517,992,000 RMB Yuan of economic losses and 198,125 persons in threatening (Fig.1).

The most serious casualties was in Wudu, 210 persons in injury and 58 persons in death, which accounted for 88.2% and 66.0%. The largest economic losses of 60.1% was in Wenxian. Population in threatening in Wudu and in Wenxian accounted for 50.9% and 48.1% respectively.

4 Situation and Risk of 5.12 Earthquake-Induced Geo-hazards

4.1 Condition of Disasters

In study area, casualties of each disaster site were mainly 3-10 persons, which accounted for 41.4% of the total. The death of 1, 2 and more than 10 persons accounted for 25.9%, 17.5% and 15.2% respectively. The injured persons of each case were mainly 3-10 persons, which accounted for 51.2%, 1 and 2 persons in injury accounted for 15.3% and 13.8% respectively. There were only two places one in Wenxian and another in Wudu where the injured were more than 10 persons, but these accounted for 19.7%. The death of 1 person mainly at most cases, these accounted for 48.8%, every of the death of 2 or 3-10 persons accounted for 18.6%. Only one place where more than 10 persons in death is in Wenxian, accounted for 14.0%. Overall, casualties concentrated mainly in Wudu (Fig.2), but the maximum accidents was 27 persons injured in Wudu and 11 persons death in Wenxian.

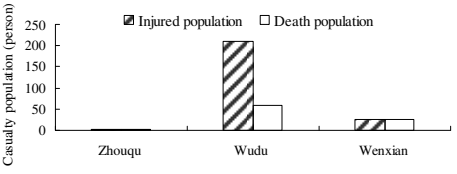

Fig. 1. Statistical diagram of casualties of the 5.12 earthquake-induced geo-hazards

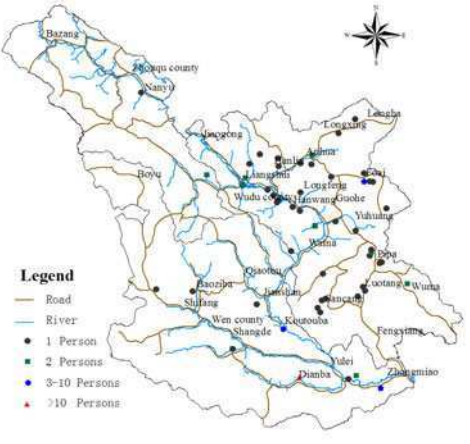

Fig. 2. Distribution map of death persons of the 5.12 earthquake-induced geo-hazards

The secondary geo-hazards caused economic losses with 2,517,997,000 RMB Yuan, including 166 cases under one million Yuan with the total of 65,462,000 RMB Yuan which accounts for 2.6%, 152 cases among 1.00-4.99 million RMB Yuan with the total of 356,920,000 RMB Yuan which accounts for 14.2%, 60 cases among 5.00-10.00 million RMB Yuan with the total of 42,171,000 RMB Yuan which account for 16.7%, and 87 cases over 10.00 million RMB Yuan with the total of 167,390,000 RMB Yuan which accounts for 66.5% (Fig.3).

Although the number of geo-hazards in Wenxian is less than in Wudu, but economic losses of single disaster was larger, so the total losse value was more in Wenxian. Most geo-hazards brought on economic losses among 1.00-1.99 million RMB Yuan, some cases over 5 million RMB Yuan, concentrate mainly in urban periphery and Beiyu River basin in Wudu. Geo-hazards over 5.00 million RMB Yuan are in the majority, most more than 10.00 million RMB Yuan in Wenxian.

The above shows that casualties and economic losses distributed mainly in Wudu and in Wenxian. Casualties were serious in Wudu as its more dense population. Economic losses were serious in Wenxian as its less epicenter distance. Wenxian located in the downstream of Bailongjiang River where mountains are high and steep, had many more large size and oversize secondary geo-hazards. The casualties and economic losses concentrated in both sides of rivers, roads and adjacent of the towns and villages, in which of dense population, frequent human activities and strong fluvial influencing, so the casualties and economic losses induced by geo-hazards were larger. This shows that the situation of disasters is closely related to epicenter distance, human activities and rivers etc.

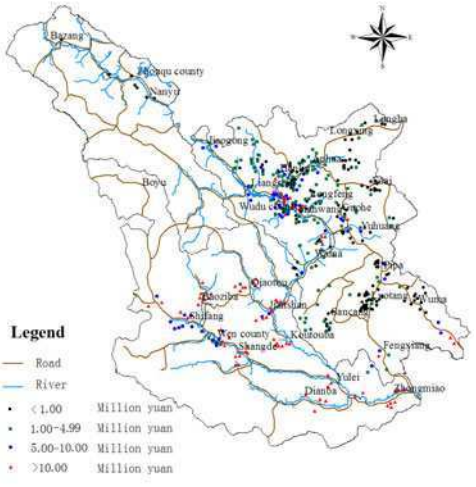

Fig. 3. Distribution map of direct economic losses of the 5.12 earthquake-induced geo-hazards

4.2 Risk of 5.12 Earthquake-Induced Geo-hazards

Because the evolvement of secondary geo-hazards is a gradually steady process, and the result of multi-factors, such as geological condition, human activities etc, so the potential danger of 5.12 earthquake-induced geo-hazards still seriously threaten to towns, villages and infrastructures.

The amount of being threatened people was about 198,125 by geo-hazards, in which mainly were hidden trouble geo-hazards sites of over 1000 persons, followed by 100-499 persons and 500-1000 persons, very few under 100 persons (Fig.4). According to the scale of threatened people in study area, there were 146 cases of hidden trouble sites under 100 persons with the total of 4583 persons which accounted for 2.3%, 221 cases of hidden trouble sites among 100-499 persons with the total of 55,768 persons which accounted for 28.1%, 74 cases of hidden trouble sites of 500-1000 persons with the total of 47,434 persons which accounted for 24.0%, and 25 cases of hidden trouble sites of over 1000 persons with the total of 90, 340 persons which accounted for 45.6%.

Threatened population by geo-hazards distributed widely in Wudu, followed in Wenxian. Hidden trouble sites of threatened population among 100-499 and 500-1000 persons were mainly in Wudu, some over 500 persons concentrated in Beiyu River basin.

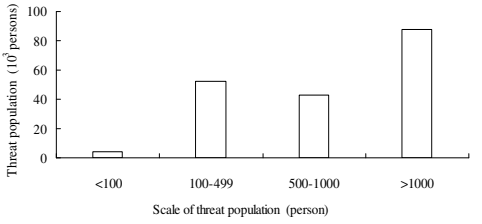

Fig. 4. Statistical diagram of the threatened population of the 5.12 earthquake-induced geo-hazards in study area

Hidden trouble sites of threatened population among 100-499 were most in Wenxian, some over 1000 persons concentrated in the vicinity of urban and Qiaotou Township. Risk distribution of the secondary geo-hazards is directly influenced by present geo-hazards and population density. The threatened population concentrated in Wudu, while with dense disaster sites and more dense population. More oversize earthquake-induced landslides were in Wenxian than in Wudu, as the epicenter distance was nearer and the influence of 5.12 earthquake was larger in Wenxian. Therefore, Although population density is smaller in Wenxian, there were still many more hidden trouble sites of great geo-hazards, comparatively, less secondary earthquake-induced geo-hazards and threatened population in Zhouqu.

5 Conclusions

Based on the post-earthquake investigation information, the situation and risk of the secondary geo-hazards are analyzed in study area. The results show as follows:

(1) The 5.12 earthquake-induced geo-hazards produced seriously injury and death in Wudu county, which accounted for 88.2% and 60.0% respectively. The economic losses accounted for 39.8% and 60.1%, and threatened population account for 50.9% and 48.1% in Wudu county and in Wenxian county respectively. The situation and risk of the geo-hazards mainly distributed in both sides of rivers, roads and adjacent area of towns and villages.

(2) Due to dense population, more frequent human activities and wide distribution of the secondary geo-hazards in Wudu county, the casualties were consequentially more serious, however, in Wenxian county both nearer epicenter distance and downstream of Bailongjiang River made more oversize disasters and more serious economic losses, Although population density is smaller.

(3) In despite of the denser of the earthquake-induced geo-hazards in Wudu county, the disasters scale is mainly small and medium. On the contrary, the disasters scale is mainly larger in Wenxian county with smaller density of disasters. Thus, both areas have similarly serious risk of secondary geo-hazards in Wudu county and in Wenxian county.

(4) Zhouqu is far away from the epicenter, with the smallest population density and in the upper reaches of the Bailongjiang River relatively, so the seriousness, situation and risk of 5.12 earthquake-induced geo-hazards are the most unimportant in study area. Therefore, it is obvious that the situation and risk of the secondary geo-hazards

is not only related to the number and scale of present geo-hazards, but related to the population density and various forms of human activities etc.

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An Empirical Study on the Nonlinear Impacts of CPI to Stock Market in China

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Abstract. This paper uses the smooth transition regression (STR) model to study the nonlinear relation between the consumer price index (CPI) and the composite index of Shanghai Stock Market in China from 1999 to 2011. The results show that there exists one way Granger causality relation from CPI to stock market in China; the internal relation between the CPI and stock market's composite index appears as linearity in most of the time, while it turns to nonlinearity during Subprime Lending Crisis.

Keywords: CPI, Stock Market, Nonlinear Relation, STR Model.

1 Introduction

Stock market is called "barometer" of national economy; it is an important component of capital market. CPI is a key indicator to reflect product prices; higher CPI indicates the inflation and may produce significant impacts to people's living level and economic growth. Generally speaking, the continuous upward of CPI may affect stock market by the following two paths: on one hand, inflation may lead to the profitability of the enterprises dropping by pushing the product prices to higher level; on the other hand, the currency measures of controlling inflation would have a significant impact to capital flows, this is obvious in stock market. Therefore, it is necessary to study the relationship between CPI and the volatility of stock market. The main aim is to take suitable measures to avoid the reduction of economic efficiency because of the fluctuations of economic cycle.

Many scholars have studied the effects of inflation to stock markets. The theoretical results mainly include the "Fisher effect hypothesis" (Fisher, 1930), "risk premium hypothesis" (Tobin, 1958), "inflation illusion hypothesis" (Modigliani and Cohn, 1979) and "proxy effect hypothesis" (Fama, 1981). Some empirical results can be found in the papers written by Gallagher and Taylor (2002), Cheng and Li (2004), Zeng and Jiang (2007), and Zhang and Dong (2010). Because there are some differences in research objects, research methods, research periods and etc. for these papers, the corresponding research results are also different.

In this paper, we attempt to use the STR model, which can effectively reflect the transition mechanism between variables, to study the internal nonlinear relation between the CPI and the composite index of stock market in China. As we know that nobody has employed such method to study this problem.

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2 Methodology

Model Description. The general form of a STR model is as follows:

$$y_t = x_t'\phi + (x_t'\theta)G(\gamma, c, s_t) + u_t, \tag{1}$$

where $x_t = (1, x_{1t}, \cdots, x_{pt})' = (1, y_{t-1}, \cdots, y_{t-k}, z_{1t}, \cdots, z_{mt})$ is an vector of exogenous variables, $t = 1, \cdots, T$, $p = k + m$; both $\phi = (\phi_0, \phi_1, \cdots, \phi_t)$ and $\theta = (\theta_0, \theta_1, \cdots, \theta_t)$ are parameter vectors; $u_t \overset{iid}{\sim} N(0, \sigma^2)$; $G(\gamma, c, s_t)$ is a bounded transition function of s_t.

If $G(\gamma, c, s_t) = 1 - \exp(-\gamma(s_t - c)^2)$ then the model (1) is called an exponential STR (ESTR) model. The model (1) is called a logistic STRK (LSTRK) model if $G(\gamma, c, s_t) = (1 + \exp\{-\gamma\prod_{k=1}^{K}(s_t - c_k)\})^{-1}, \gamma > 0, c_1 \le c_2 \le \cdots \le c_K$. Particularly, models LSTR1 and LSTR2 are corresponding to the cases $K = 1$ and $K = 2$ respectively.

STR Modeling Process. The STR modeling process consists of the following four steps: 1. Estimate the linear part in the model by regression method and fix the lagging order of the auto-regression based on AIC and SC; 2. Test the existence of nonlinearity with LM statistic and choose the optimal form of STR model and transition variables through sequential test; 3. Estimate the parameter vectors by Newton-Raphson method; 4. Evaluate the goodness-of-fitting of the model by no error autocorrelation test, normality test, heteroscedasticity test and no additive nonlinearity test; an ideal STR model should satisfy these conditions.

3 Empirical Analysis

Data Source and Prepare Treatment. In this paper, we will investigate the relationship between CPI in China and the Shanghai stock market's composite index (SI) from January, 1999 to February, 2011; both variables are monthly data collected from the Wind database. To avoid the heteroscedasticity in the model, let $\ln \Delta CPI$ and $\ln \Delta SI$ be the logarithm forms of these two variables, $\ln \Delta CPI(-t)$ and $\ln \Delta SI(-t)$ be their corresponding t-periods lagging-values.

Stationary Test of the Data and Granger Causality Test. In order to use STR model to study the relationship between CPI and SI, we need to require that both variables are stationary and there exists Granger causality relation between them. By using Phillips-Perron (PP) unit-root test, we can easily find both variables $\ln \Delta CPI$ and $\ln \Delta SI$ are stationary under different significant levels (1%, 5% and 10%) while CPI and SI are not stationary. Therefore, it only needs to consider the relation between $\ln \Delta CPI$ and $\ln \Delta SI$ in the follows.

According to AIC and SC, the optimal lagging order of the AR model is 3 and the two way causality test results are given in Table 1.

Table 1. The result of Granger causality test

Null hypothesis	F-value	P-value
$\ln \Delta CPI$ is not the Granger causality of $\ln \Delta SI$	2.660	0.049
$\ln \Delta SI$ is not the Granger causality of $\ln \Delta CPI$	2.241	0.084

The result above shows that there exists one way Granger causality relationship from $\ln \Delta CPI$ to $\ln \Delta SI$ under 5% significant level.

Estimation. In this section we employ the STR model to explore the internal relation between $\ln \Delta CPI$ and $\ln \Delta SI$ based on the above mentioned steps.

1. Estimation of the AR part of the model. We select the optimal lagging order for each variable by using AIC and SC criterion, and exclude non-significant variables according to their P-values. The obtained result of AR part is as follows:

$$\ln \Delta SI = 1.114 \ln \Delta SI(-1) - 0.198 \ln \Delta SI(-3) + 5.848 \ln \Delta CPI . \quad (2)$$

2. Selection of the transition variable and model form. After testing the nonlinear relation between the variables with F Statistics, the transition variable and nonlinear model form can be decided through the sequential test. The detailed results are given in Table 2 and show that LSTR1 with the $\ln \Delta SI(-2)$ as the transition variable is the best choice by comparing the P-values.

Table 2. The results of nonlinearity test

Transition variables	P-value of F- statistics				Model form
	F	F_4	F_3	F_2	
$\ln SI(-1)$	1.027e-30	7.808e-09	5.339e-13	8.860e-14	LSTR1
$\ln SI(-2)*$	2.623e-31	3.472e-21	1.692e-07	3.711e-07	LSTR1
$\ln SI(-3)$	5.711e-12	3.557e-05	1.077e-05	3.653e-05	LSTR2
$\ln CPI$	2.501e-18	2.663e-04	9.870e-07	6.367e-12	LSTR1
TREND	7.293e-01	9.587e-01	3.715e-01	4.218e-01	Linear

3. Model parameter estimation. Firstly, we can use lattice search to choose the estimate of (γ, c) effectively. Secondly, the Newton-Raphson method is employed to estimate the parameters in the model and the final fitted model can be obtained by deleting non-significant variables. The corresponding results are listed in Table 3.

Table 3. The estimation results of LSTR2

Variable		Initial Value	Estimate	P-values
Linear part	Constant	2.512	2.553	0.000
	$\ln \Delta SI(-1)$	-0.211	-0.190	0.023
	$\ln \Delta SI(-3)$	-0.460	-0.492	0.000
	$\ln \Delta CPI$	-0.086	-0.785	0.000
Nonlinear part	Constant	-2.746	-2.532	0.000
	$\ln \Delta SI(-1)$	1.216	1.144	0.000
	$\ln \Delta SI(-3)$	0.460	0.493	0.000
	$\ln \Delta CPI$	1.065	0.960	0.000
	γ	10.0000	76.92	0.100
	c	2.89579	2.910	0.000
Model fitting evaluation	-1.224 (AIC), -1.038 (SC), -1.149 (HQ), 7.576 (R^2), 0.750 ($\overline{R}^2$)			

According to the Table 3, the final fitted model is a LSTR1 model as follows:

$$\ln \Delta SI = 2.553 - 0.190 \ln \Delta SI(-1) - 0.493 \ln \Delta SI(-3) - 0.785 \ln \Delta CPI + G(\gamma, c, s_t) \\ (-2.532 + 1.144 \ln \Delta SI(-1) + 0.493 \ln \Delta SI(-3) + 0.960 \ln \Delta CPI) \quad (3)$$

Where

$$G(\gamma, c, s_t) = [1 + \exp(-76.916(\ln \Delta SI(-2) - 2.910))]^{-1}, (\gamma, c) = (76.92, 2.910), s_t = \ln \Delta \text{Index}(-2).$$

4. Evaluation

In this step, we use ARCH-LM test to check the homoscedasticity of residuals. The t-value and F-value of ARCH-LM test are 38.47 (p-value=0.5390) and 1.5354 (p-value=0.0635) respectively, which prove that the there are not exist homoscedasticity for residuals. The nonlinearity test results for residuals are given in Table 4. It also can be observed the model is fitted enough well from Fig. 1.

Table 4. The Test Result of Nonlinearity Test

Transition variable	P-values of test			
	F	F_4	F_3	F_2
$\ln \Delta SI(-2)$	2.1075e-18	4.2644e-01	6.1867e-02	8.26884e-2

4 Discussion and Conclusion

In the linear part of the model (3), the coefficients of $\ln \Delta SI(-1)$, $\ln \Delta SI(-3)$ and $\ln \Delta CPI$ are all negative. Many published papers have demonstrated the obvious sensitivity to policy of stock market and the anti market-behavior property of policy in China. That is, the Chinese government tends to tighten up monetary policy when

economic indicators like CPI climb high to prevent inflation; when they imply a falling risk of economic development, the government might boost it by investing more. Thus, current behavior of the stock market and CPI would lead the current policy to change, and then cause the opposite performance of the stock market.

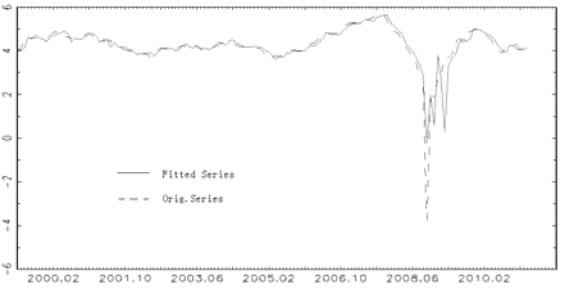

Fig. 1. Fitted series and original Series

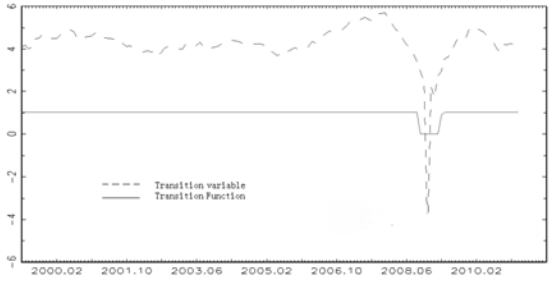

Fig. 2. Transition variable and transition function

The nonlinear part modifies the relation between $\ln \Delta SI$ and $\ln \Delta CPI$ in a specific period from linearity to nonlinearity. As a monotone increasing function of $\ln\Delta\mathrm{SI}(-2)$, $G(\gamma, c, s_t)$ directly decides how significant the modification is. The threshold value $c = 2.910$ fixes the moment of transition while the slope parameter γ=76.92 shows the modification process appear as a sudden jump with high speed.

From Fig. 2, we find that when CPI stops rising and drop dramatically until its nadir from August, 2008 to July, 2009, the transition function works. The reason of such a turning point lies mainly in the shock of Subprime Lending Crisis to the Chinese economics and the change of its corresponding policy, which try to avoid the economic recession instead of economic overheating. When $\ln\Delta\mathrm{SI}(-2)$ exceeds c, it informs the government of current macroeconomic situation and absolutely affects the adjustment of current policy. And CPI here also takes effect through impacting the policy-making of the government, profit-making of the enterprises and expectation of the investors. The dramatic transition process describes the crisis's sudden shock well.

In conclusion, there exists one way Granger causality relation from CPI to stock market in China; such relation is linear in most of time while it turns to nonlinearity during Subprime Lending Crisis. The government should take effective measures or mechanism to protect financial risk and control the impact of CPI to stock market.

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The Research of Lagrangian Support Vector Machine Based on Flexible Polyhedron Search Algorithm

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Abstract. Parameters selection is important in the research area of support vector machine. Based on flexible polyhedron search algorithm, this paper proposes automatic parameters selection for Lagrangian support vector machine. An equipment fault classification illustrates that lagrangian support vector machine based on particle swarm optimization has fine classification ability.

Keywords: Lagrangian support vector machine, flexible polyhedron search algorithm, fault classification.

1 Introduction

Statistical learning theory and support vector machine were presented by Vapnik [1,2]. He deduced the method to improve the classification ability with a few learning samples. In 2001, Lagrangian support vector machine (LSVM) was developed for classification and function estimation by Mangasarian [3]. LSVM is an iterative method which requires nothing more complex than the inversion of a single matrix of the order of the input space plus one, and thus has the ability to handle massive problems. For a positive semidefinite nonlinear kernel, a single matrix inversion is required in the space of dimension equal to the number of points classifier. Hence, for such nonlinear classifier, LSVM can handle only intermediate size problems [3].

In spite of these attractive features, the parameters of LSVM must be chosen accurately. σ is the kernel parameter and controls the LSVM's classification ability. Tradeoff parameter c is the regularization parameter that determines the fitting error minimization and smoothness. These parameters in LSVM need to be found their optimal values in order to minimize the expectation of test error. Nelder and Mead proposed flexible polyhedron search algorithm [4]. This algorithm not only makes full use of the speed of the gradients Method but also avoids local optimum of the gradients Method. For these advantages, an effective strategy of parameters selection for LSVM is proposed by using the flexible polyhedron search algorithm in this paper. An equipment fault classification Experiment illustrate the validity of the proposed method.

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2 Lagrangian Support Vector Machine

In compare with the standard SVM formulation[1,2]. Lagrangian support vector machines changes the 1-norm of error ξ to a 2-norm squared which makes the constraint $\xi \geq 0$ redundant. The term $\omega'\omega$ is used to maximize the margin between the parallel separating planes. Given training dataset $\{(\mathbf{x}_1, y_1), \cdots (\mathbf{x}_n, y_n)\} \subset \chi \times R$, where χ denotes the space of the input patterns, $y_i = \{1, -1\}$, $A = \begin{bmatrix} x_1^T \\ \vdots \\ x_m^T \end{bmatrix}$, $D = diag(y_1 \cdots y_m)$. Those reasons lead to the following reformulation of the LSVM:

$$\min J(w,e) = \frac{1}{2}(\omega'\omega + b^2) + \frac{1}{2}c\sum_{i=1}^{N}\xi_i^2 \qquad (c > 0) \tag{1}$$

$$s.t.\ y_i[(\omega \cdot x_i) + b] + \xi_I \geq 1 \qquad i = 1 \cdots m$$

This optimization problem including the constraints can be solved by using the Lagrange function as following:

$$\min L = \frac{1}{2}\omega'\omega + b^2 + \frac{1}{2}c\sum_{i=1}^{N}\xi_i^2 - \sum_{i=1}^{N}\alpha_i\{y_i[(\omega \cdot x_i) + b] + \xi_i - 1\} \tag{2}$$

where α_i is the Lagrange multiplier set. Through calculating the partial derivatives of L, the dual of this problem can be obtained as following:

$$\min \ \frac{1}{2}\alpha^T Q\alpha - e^T\alpha \tag{3}$$

where $Q = \frac{I}{c} + HH^T$, $H = D[A \quad -e]$, $e = (1, \cdots 1)^T$.

The LSVM Algorithm is based directly on the Karush-Kuhn-Tucker necessary and sufficient optimality conditions for the dual problem:

$$0 \leq \alpha \perp (Q\alpha - e) \geq 0 \tag{4}$$

By using the easily established identity between any two real numbers (or vectors) a and b:

$$0 \leq a \perp b \geq 0 \Leftrightarrow a = (a - \lambda b)_+, \lambda > 0 \tag{5}$$

These optimality conditions lead to the following iterative scheme for LSVM algorithm:

$$\begin{aligned} &\alpha^{i+1} = Q^{-1}(e + ((Q\alpha^i - e) - \lambda\alpha^i)_+), \\ &i = 0,1,\cdots, \lambda > 0 \end{aligned} \tag{6}$$

3 LSVM Model Parameters Optimization

In the LSVM model, the appropriate parameters are selected by the flexible polyhedron search algorithm. The polyhedron is constituted by m vertexes in n-dimensional space. The fitness value for each vertex is calculated. The worst vertex can be eliminated through the compare of every fitness value. For this reason, the new polyhedron moves closer to the feasible region. Each vertex in the iterative process is constantly moving to the point of optimal fitness value until this algorithm meets the convergence criteria. As what has been mentioned above, c and σ^2 become the vertexes, then the dimension of the vertexes is two. These vertexes can be expressed as following: $(c_i, \sigma_i^2), i = 1 \cdots m$. In function regression, the fitness function is the sum square error between the real output data of the system and the output data of the support vector interval regression model in the same input. The process obtaining the parameters by the flexible polyhedron search algorithm is as follows:

Step1: generate the initial vertexes of the polyhedron $(c_i, \sigma_i^2), i = 1 \cdots m$;

Step2: calculate the fitness value of each vertex, determine the greatest value vertex x_{best}^k, the least value vertex x_{worst}^k and the second greatest value vertex x_{better}^k of fitness function for all vertex;

Step3: calculate the centroid of this polyhedron $x_{cen}^k = \frac{1}{m-1}(\sum_{i=1}^{m} x_i^k - x_{worst}^k)$;

Step4: calculate the reflection point of this polyhedron $x_{refect}^k = x_{cen}^k + \alpha(x_{cen}^k - x_{worst}^k)$. α is the reflection coefficient and $\alpha > 1$;

Step5: If the fitness value of the reflection point is better than the greatest value vertex x_{best}^k, the expansion point can be calculated as follows. If not, algorithm must be transferred to step6;

(1)Calculate the expansion point $x_{enl\arg e}^k = x_{cen}^k + \lambda(x_{fefect}^k - x_{cen}^k), \lambda > 1$;

(2) the least value vertex x_{worst}^k is modified as follows:

$$x_{worst}^k = \begin{cases} x_{refect}^k, x_{refect}^k is \ \ better \ \ than \ \ x_{enl\arg e}^k \\ x_{enl\arg e}^k, x_{refect}^k is \ \ worse \ \ than \ \ x_{enl\arg e}^k \end{cases}$$

(3) $k = k + 1$ then go to step9

Step6: If the fitness value of the reflection point is only better than the second greatest value vertex x_{better}^k, the least vertex is modified as $x_{worst}^k = x_{refect}^k$. Then, go to step9. If the fitness value of the reflection point is only better than the least value vertex x_{worst}^k, the reduction point can be set as $x_{compress}^k = x_{cen}^k + \cdot\eta(x_{fefect}^k - x_{cen}^k), 0 < \eta < 1$. If the fitness value of the reflection point is worse than

the least vertex, the reduction point is calculated using the following compression point $x_{compress}^k = x_{cen}^k + \eta(x_{worst}^k - x_{cen}^k), 0 < \eta < 1$.

Step7: If the fitness value of the reduction point is better than the least value vertex x_{worst}^k, the least value vertex can be changed $x_{worst}^k = x_{comress}^k$. Set $k = k + 1$ and go to the step9; if the reduction point is worse than the least vertex, the polyhedron must be compressed;

Step8: The greatest vertex is maintained and the other vertexes is closed towards the greatest vertex. The formula is $x_i^k \leftarrow x_{best}^k + 0.5(x_i^k - x_{best}^k)$. Then, go to step9;

Step9: If $\sum_{i=1}^{m} \left\| x_i^k - x_{best}^k \right\| < (m-1)\varepsilon_1$. It is indicating that this polyhedron has been adjusted to the optimal state. A optimum parameters of SVIRM is obtained as $x_{best}^k = (c_{best}, \sigma_{best}^2),$. This algorithm runs over, or else go to step 2.

4 Experimental Results

Fault diagnosis is a research field for SVM[5,6]. Fault samples of one equipment are used as an illustration for LSVM in this paper. This set has samples which are octa-dimension data. Fault samples include FYSS, FYKS, PWKASHI and normal samples. In order to validate LSVM's fault classification ability with a few samples, only 75 learning samples as the training data are chosen and the rest samples are set as the test data. Some samples are expressed at Table 1.

Table 1. The Fault Samples of the Equipment

Alpha	Beta	Wy	···	Fault class
5.07373	0.00000000	-0.012120	···	Normal
5.07325	0.00000000	-0.022467	···	Normal
5.07255	0.00000000	-0.031017	···	Normal
⋮	⋮	⋮	⋮	⋮
5.06033	0.00007090	-0.042709	···	FYSS
5.05866	0.00029900	-0.085943	···	FYSS
5.05604	0.00066200	-0.120449	···	FYSS
⋮	⋮	⋮	⋮	⋮
5.06059	0.00201470	-0.026111	···	FYKS
5.05955	0.00812920	-0.055547	···	FYKS
5.05783	0.01787160	-0.079031	···	FYKS
⋮	⋮	⋮	⋮	⋮
5.07343	-0.0005253	0.890374	···	PWKASHI
5.10674	-0.0006942	1.675859	···	PWKASHI
5.22631	0.00083100	2.988022	···	PWKASHI
⋮	⋮	⋮	⋮	⋮

To validate the effect and efficiency of optimized LSVM model based on flexible polyhedron search algorithm, the comparison among the LSVM, is conducted. The comparison results are shown in Table 1. The verification rate of direct LSVM is the lowest, because parameters c, δ^2 are not optimized. From Table 2, it can be concluded that LSVM based on flexible polyhedron search algorithm has better results than that of the LSVM based on SGA.

Table 2. Comparison of Results of LSVM, Optimized LSVM

Method	c	δ^2	Verification rate
LSVM	100	1	83.15%
Optimized LSVM	21.37	1.45	98.75%

5 Conclusions

By using the flexible polyhedron search algorithm, an automatic parameters selection for LSVM is proposed. Simulation results of regression problem demonstrate the effect of the proposed approach.

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A Novel Objects Recognition Technique

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Abstract. In this paper, we assume that the objects can be classified according to the pattern in the contour, i.e. features such as dimension, position and orientation are only confounding factors which should not be used in the recognition process. Based on these assumptions, a novel patter Recognition technique was proposed to recognize two dimensional objects with closed contours via the use of Fast Fourier Transform and a constrained k-means clustering technique.

Keywords: pattern recognition, two dimensional objects, supervised classification.

1 Introduction

Pattern Recognition and automatic classification techniques have become a very important and effective tool in many real problems where objects can be grouped according to some characteristics and an automated technique is necessary to determine to which class an object belongs [1].The aim of this paper is to propose a supervised statistical patter recognition technique [2] suitable to discriminate between objects with respect to their two dimensional contour. The proposed technique can be used on 2D objects or on the two dimensional projection on a plane of a 3D object. The pattern recognition algorithm presented in this paper is a non parametric statistical pattern recognition algorithm base on a constrained k-means algorithm [3]. The proposed technique will be tested in a simulation study.

The main assumption of this paper is that only the contour is useful to classify objects. This assumption is valid in a variety of real classification problems such as, e.g. geometrical shapes, handwritten characters, OCR etc [4].

The rest of this paper is organized as follows. In Section 2, we describe the proposed algorithm. The feature extraction technique used to get invariant features will be shown in Section 3. In Section 4, we investigate the results of a simulation study. Our conclusion is given in the last section.

2 Proposed Algorithm

The construction of a supervised pattern recognition system is made up of three main steps:

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(1)A pre-processing is applied to the data in order to make them comparable and to filter-out the part of information which is not directly related to the classification problem.

(2) Feature selection and/or extraction is applied to the data in order to compact the dimension of the pattern vector trying to retain as much as possible of the information correlated to the classification problem. The features extracted should be invariant to incidental changes in environmental factors and sensing configuration.

(3) The pattern recognition algorithm is trained on a subset of the data set (training set) at hand and its performance is evaluated using a cross-validation scheme.

The algorithm presented in this paper is a supervised learning algorithm and is made up of two phases: in the first phase the algorithm needs to be trained using a dataset that has been previously classified by an expert or in any other way deemed appropriate (training set). In the second phase the algorithm can be used to classify new entities for which the class is unknown.

The aim of this algorithm is that of finding subclasses in the dataset which can be used to classify new vectors of unknown class.

Usually the performance of the algorithm is assessed via a cross-validation or a jackknife procedure [5]. Thus the dataset is split into two independent subsets, both composed of elements of known classes, one called training set that is used to fine-tune the algorithm, and one called test set, that is used to assess the performance of the algorithm in classification.

Given a dataset of n pattern vectors in R^p, assume a partition defined on the dataset, i.e. each pattern vector is assigned to one and only one of *k* known classes. Besides, lets assume a Euclidean norm be defined on the dataset. Let ξ be a function from R^p onto the set {1,2,3,…,*k*} which, for each pattern vector $s_j, j = 1, 2, ..., n$ gives the class it belongs to:

$$\xi : R^p \rightarrow \{1, 2, ..., k\}$$

The algorithm presented begins computing the barycentre of each class as the arithmetic mean of all the pattern vectors belonging to a class, yielding an initial set of k barycentre $b_j, j = 1, 2, ..., k$.

Compute the Euclidean distance of each pattern vector from each barycentre $b_j, j = 1, 2, ..., k$. If each pattern vector is closer to the barycentre of its class the algorithm stops, otherwise there will be a non empty set M of pattern vectors which belong to a class and are closer to a barycentre of a different class. In M select the pattern vector s_j that is farthest from the barycentre of its class. The pattern vector s_j will be used as a seed for a new barycentre for class $\xi(s_j)$ .A *k*-means algorithm will then be performed for all the pattern vectors in class $\xi(s_j)$ using, as starting point, the set of barycentre vectors for class $\xi(s_j)$ and the vector s_j . The k-means algorithm will be iterated until there will be no change in the centroids computed for class $\xi(s_j)$.

Once the k-means algorithm converges the set of centroids is composed of k+1 elements. The centroids at the new iterations need not be computed for all classes, but only for class $\xi(s_j)$ since the clusters in the other classes have remained unchanged. In the following step the distance of each pattern vector from all the centroids is computed anew, and so is the set M of pattern vectors which are closer to a centroid of other classes than to one of its own. If the set *M* is not empty then the pattern vector in M which is farthest from a centroid of its own class is once again selected to be a seed for a new centroid. Let this pattern vector be s_m, the number of centroids for class $\xi(s_m)$ is then increased considering the previous centroids and the new seed. For class $\xi(s_m)$ a k-means algorithm is then performed until there is no change in the allocation of each element of class $\xi(s_m)$ to a centroid. Once again then the distance of all the elements in the dataset from the updated set of centroid is then calculated and the subset of element closer to a centroid of a different class then to one of their own class is generated. This procedure iterates until the set *M* is empty. The convergence of the algorithm in a finite number of steps has been proved in various ways (see [6][7]).

Once converged, this algorithm yields a set of centroids which, in the worst case, are in a number equal to the number of elements in the dataset and which has a lower bound in the number of classes. It is worth noticing that if the partition defined on the dataset is consistent with the features considered, i.e. if the pattern vectors are linearly separable, then the algorithm generates a number of centroids equal to the number of classes. On the other hand, if the dataset is not linearly separable, then the algorithm continues splitting the classes until the subclasses obtained are linearly separable. It is obvious that it can continue splitting until all the subclasses are composed of only one vector (singleton).

The algorithm will not converge only if the dataset is not coherent, i.e. there are two vectors in the dataset which belong to different classes and are represented by the same pattern vector. In this case the algorithm will not be able to linearly separate these two vectors. This problem can be easily overcome increasing the dimension of the vector space until the two vectors occupy different point in R^p.

Once the algorithm has converged, the sets of centroids can be used to classify new pattern vector of unknown class (query points) assigning the new element to the class of the centroid it is closer to. It is worth noticing that if pattern vectors from the training set are used as query points, then the algorithm always classify them correctly because, once converged, all pattern vectors in the training set are closer to a centroid of their own class.

The following proposition then immediately follows:

Proposition: ([6][7) if the dataset is coherent the apparent recognition [4] rate of the algorithm is 100%.

Therefore if the training set is large enough to represent all the possible prototypes of the objects under consideration and if the features considered for each objects are sufficient enough to assure coherence of the dataset then the algorithm should be able to correctly classify any new query points.

3 Feature Extraction

Once the objects that need to be classified have been represented into a pattern vector, a fundamental part of every Pattern Recognition algorithm consists in extracting features from the pattern vector, both to get rid of non important features and to reduce the dimension of the vectors the algorithm has to work with [1].

The aim of this section is to describe the feature extraction technique used to map the pattern vector into a feature vector which is invariant to changes in position, size and rotation. Let's consider the closed contour of a 2D object. Set a polar coordinate system with pole at the barycentre of the object. Considering a constant increment equal to 2π/n for the angle of the polar coordinate system, n points are sampled from the contour going counterclockwise.

Therefore the object is represented by a set of n radiuses $\rho(i), i = 0,1,...,n-1$. On this sequence of n real numbers the Discrete Fourier Transform has been applied, obtaining another sequence $a(k), k = 0,1,...,n-1$, of *n* complex numbers describing the structure of the frequencies that make up the contour. To speed up the process the Fast Fourier Transform (FFT) has been used requiring only $O(n \log_2 n)$ numerations.

The feature vector obtained according to this procedure is invariant to change in position because the origin of the coordinate system is the barycentre of the object. To assure invariance to rotation, considering that a rotation in the object influences only the phase of each element of the FFT only the modulus of each complex element of the FFT will be considered.

Invariance to changes in dimension will be attained considering the equivalent radius r_{eq} for each object [4] which is the radius of circle with the same area of the considered object. Invariance will be attained dividing by the equivalent radius. Therefore the new patter vector will be flg.1.

The information in this pattern vector is then transformed using a Karhunen-Loéve expansion in order to reduce the size of the vector retaining only the information contained in the first few components of the expansion. This is particularly useful when the data is affected by noise, which can be filtered out considering only the information in the first few components.

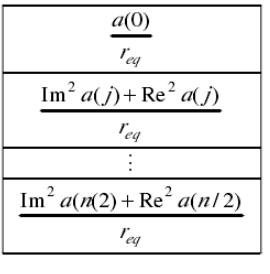

Fig. 1. New patter vector

4 Results

In this section the results of extensive experiments on simulated images will be presented. We have generated 2D images of circles, ellipses and dodecagons and we have tested our proposed technique on these images. To compare the performance of the proposed technique the results of Fisher Discriminated Analysis [9] on the same data have been used.

The dataset is composed of 2700 images, 900 circles, 900 ellipses and 900 dodecagons. The radiuses, the axes and the apothems have all been randomly generated sampling form a uniform distribution between 0 and 2000 with the only constraint that the two axes of the ellipse could not be equal.

The dataset has been split into two subsets: 2400 images have been used for training and 300 images randomly selected from the 2700 have been used for testing. The test dataset is the same throughout all the experiments to make results immediately comparable.

On each image 16 and 32 points have been sampled from the contour and then the 16 and 32 radiuses have been used as pattern vector to represent the image. The experiments have been conducted on this data and on the data perturbed by an additive random Gaussian noise with zero mean and standard deviation equal to 1,3,5,and 30 applied directly on the sampled radiuses.

On the pattern vector the FFT has been applied and then data have been made invariant to rotation and size as described in the previous Section and the Karhunen-Loéve (KL) transform has then been applied. For the experiments only the first 3,5,7,9 e 11 elements of the KL transform have been retained.

The results of the proposed technique for samples of 16 radiuses are depicted in Table 1. The proposed technique achieves 100% perfect recognition on the non perturbed data.

Table 1. The proposed technique for samples of 16 radiuses

Performance of the proposed algorithm on a sample of 16 points for each object (invariant data)					
Dimension of the feature vector	Original Pictures	Original Pictures with Gaussian additive noise			
	No noise	N(0,1)	N(0,3)	N(0,5)	N(0,30)
3	100	97.3	94.0	84.3	63.3
5	100	96.7	93.0	88.3	63.3
7	100	97.3	93.3	90.0	64.0
9	100	97.3	93.7	90.0	61.3
11	100	97.3	93.3	89.7	62.7

As expected the performance of the algorithm decreases as the level of noise increases. With a noise with a standard deviation of 30 the algorithm performs quite well with a correct recognition around 60%. The performance does not seem to be affected by the number of features retained from the KL expansion.

In Table 2 the analogous results for samples of 32 radiuses have been displayed. The performance of the algorithm seems to be quite comparable to the one achieved

with 16 radiuses, possibly meaning that we have reached Nyquist rate and then 16 radiuses are sufficient enough to capture the shape of the picture and therefore over sampling does not really effect the performance.

Table 2. He analogous results for samples of 32 radiuses

Performance of the proposed algorithm on a sample of 32 points for each object (invariant data)					
Dimension of the feature vector	Original Pictures	Original Pictures with Gaussian additive noise			
	No noise	N(0,1)	N(0,3)	N(0,5)	N(0,30)
3	100	96.7	90.0	89.7	63.7
5	100	96.7	90.3	90.7	62.0
7	100	96.7	91.3	91.7	67.7
9	100	97.0	92.3	91.0	66.0
11	100	97.0	93.7	90.0	61.7

In Table 3 the analogous results on 16 and 32 radiuses for Fisher Discriminant Analysis applied to invariant feature vectors have been displayed. More precisely, the 16 and 32 sampled radiuses have been transformed using FFT and then have been made invariant to rotation and size. No KL reduction has been applied on this data, mainly because FDA is already based on a dimensional reduction principle.

FDA never achieves a perfect recognition rate of 100% on the original data, and then the recognition rate decreased abruptly with the presence noise. It is nonetheless greater then the random recognition rate of 33% but is always worse than the performance of the proposed algorithm.

Table 3. The analogous results on 16 and 32 radiuses

Performance Fisher Discriminant Analysis sampling 16 and 32 points for each object					
Dimension of the feature vector	Original Pictures	Original Pictures with Gaussian additive noise			
	No noise	N(0,1)	N(0,3)	N(0,5)	N(0,30)
16	89.7	57.0	55.7	54.7	50.7
32	87.3	53.7	55.7	56.0	52.0

To test the effect of the invariant feature extraction technique the algorithms have been applied on the FFT complex output. The feature vectors obtained are still invariant to positioning but are no longer invariant to rotation and size variations. In Table 4 the performance of the proposed algorithm for samples of 16 radiuses has been depicted while in Table 5 the analogous results for 32 radiuses have been displayed.

In Table 6 the results for FDA applied on the output of FFT have been displayed. The performance of FDA is better than the one obtained on non invariant features but is still worse than the one obtained by the proposed algorithm on the same data. A

notable exception is the performance of FDA under high noise (70.3%) with samples of 16 elements which is better than the best results obtained by the proposed algorithm on the same data (63.0%).

Table 4. The results for FDA applied on the output of FFT

Performance of the proposed algorithm on a sample of 16 points for each object (complex data)					
Dimension of the feature vector	Original Pictures	Original Pictures with Gaussian additive noise			
	No noise	N(0,1)	N(0,3)	N(0,5)	N(0,30)
3	94.3	94.3	86.0	84.3	56.3
5	93.7	94.7	89.0	83.7	57.0
7	93.7	94.7	87.3	84.7	63.0
9	93.7	93.7	90.0	83.7	59.3
11	93.7	95.3	92.0	86.0	60.0

In Table 5 the results for 32 radiuses are comparable or worse than those obtained with 16 radiuses, except for a noise $N(0,30)$which requires a higher sampling frequency to capture the shape of the object.

Table 5. The results for 32 radiuses

Performance of the proposed algorithm on a sample of 32 points for each object (complex data)					
Dimension of the feature vector	Original Pictures	Original Pictures with Gaussian additive noise			
	No noise	N(0,1)	N(0,3)	N(0,5)	N(0,30)
3	93.0	90.7	90.3	82.0	62.3
5	93.7	93.7	88.3	83.0	62.3
7	91.3	94.0	91.0	84.3	60.3
9	91.3	92.7	90.3	84.0	64.7
11	91.3	93.0	90.3	85.3	62.7

5 Conclusions

The technique presented in this paper is a non parametric pattern recognition technique to recognize object with closed 2D contour. The principal assumption that has been made is that the shape and pattern in the contour are sufficient characteristics to classify the objects. This is the case for the proposed simulations study where objects with different contours have been recognized according to the frequency information on a number of radiuses systematically sampled from the contour of each image centering at the barycentre.

The technique with the invariant transformations allow to achieve perfect recognition of the object without noise, and more than holds its own when additive Gaussian noise is present.

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A Fast Lagrangian Support Vector Machine Model

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Abstract. Lagrangian support vector machine(LSVM) is a kind of method with good generalization ability. But, LSVM is not suitable for classification online because the computation complexity. So in this paper, a fast LSVM is proposed. This method can deduce running time because it fully utilizes the historical training results and reduces memory and calculates time. Finally, an example is accomplished to demonstrate the effect of fast LSVM.

Keywords: Lagrangian support vector machine, online learning, classification.

1 Introduction

Recently, LSVM is developed for classification by Mangasarian [1]. the LSVM has emerged as an alternative approach to neural networks. This is due to the fact that the LSVM is established based on the structural risk minimization principle rather than the empirical error commonly implemented in the neural networks [2,3]. For this reason, LSVM can achieve higher generalization performance [4,5] well fast convergence and higher precision than neural networks. Because LSVM algorithm is trained offline in batch way. There is a big obstacle for using LSVM to achieve classification on-line. In this paper, a fast LSVM based on incremental learning has been presented. The training of the LS-SVM can be implemented in a way of incremental learning avoiding computing large-scale matrix inverse but maintaining the precision when training and testing data. Because this method fully utilizes the historical training results and reduces memory and time. It can achieve classification online. Simulation results show the effective and efficiencies of the proposed algorithm.

2 Lagrangian Support Vector Machine

Given training dataset $\{(\mathbf{x}_1, y_1), \cdots (\mathbf{x}_n, y_m)\} \subset \chi \times R$, where χ denotes the space of the input patterns, $\phi(x)$ is a nonlinear function which maps the feature space of input into a higher dimension feature space and can be reached by the kernel strategy. ω is a coefficient determining the margin of support vectors and b is a bias term. The coefficients (ω, b) are determined by minimizing the following regularized risk function and using the equality constraints.

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$$\min J(w,e) = \frac{1}{2}(\omega'\omega + b^2) + \frac{1}{2}c\sum_{i=1}^{N}\xi_i^2 \qquad (c>0) \tag{1}$$

$$s.t.\ y_i[(\omega \cdot x_i) + b] + \xi_I \geq 1 \qquad i = 1 \cdots m$$

This optimization problem including the constraints can be solved by using the Lagrange function as following:

$$\begin{aligned} \min L &= \frac{1}{2}\omega'\omega + b^2 + \frac{1}{2}c\sum_{i=1}^{N}\xi_i^2 \\ &- \sum_{i=1}^{N}\alpha_i\{y_i[(\omega \cdot x_i) + b] + \xi_i - 1\} \end{aligned} \tag{2}$$

where α_i is the Lagrange multiplier set. Through calculating the partial derivatives of L, the optimal condition about equation (3) can be obtained as following:

$$\begin{aligned} &\frac{\partial L}{\partial \omega} = 0 \Rightarrow \omega = A^T D\alpha \\ &\frac{\partial L}{\partial b} = 0 \Rightarrow b = e^T D\alpha \\ &\frac{\partial L}{\partial \xi} = 0 \Rightarrow \xi = \alpha / c \end{aligned} \tag{3}$$

where $A = \begin{bmatrix} x_1^T \\ \vdots \\ x_m^T \end{bmatrix}$, $D = diag(y_1 \cdots y_m)$. From (2) and (3), the dual of this problem can be obtained as following:

$$\min \ \frac{1}{2}\alpha^T Q\alpha - e^T\alpha \tag{4}$$

where $Q = \frac{I}{c} + HH^T$, $H = D[A \quad -e]$, $e = (1, \cdots 1)^T$.

The LSVM Algorithm is based directly on the Karush-Kuhn-Tucker necessary and sufficient optimality conditions for the dual problem:

$$0 \leq \alpha \perp (Q\alpha - e) \geq 0 \tag{5}$$

By using the easily established identity between any two real numbers (or vectors) a and b:

$$0 \le a \perp b \ge 0 \Leftrightarrow a = (a - \lambda b)_+, \lambda > 0 \tag{6}$$

These optimality conditions lead to the following iterative scheme for LSVM algorithm:

$$\begin{aligned} &\alpha^{i+1} = Q^{-1}(e + ((Q\alpha^i - e) - \lambda\alpha^i)_+), \\ &i = 0,1,\cdots, \lambda > 0 \end{aligned} \tag{7}$$

Mangasarian establishes global linear convergence from any starting point under the easily satisfiable condition[3]:

$$0 < \lambda < \frac{2}{c} \tag{8}$$

The inverse matrix Q^{-1} can be calculated by Sherman-Morrison-Woodbury identity (SMW). The SMW identity can use a $n+1\,(n << m)$ inverse matrix to calculate Q^{-1}. For this reason, it largely deduced the computational complexity of Q^{-1}. It can be obtain as following:

$$Q^{-1} = (\frac{I}{c} + HH^T)^{-1} = c(I - H(\frac{I}{v} + H^T H)^{-1} H^T) \tag{9}$$

2.1 FAST Lagrangian Support Vector Machine

When a new training sample $(\mathbf{x}_{m+1}, y_{m+1})$ is given, the dual problem (4) will be changed as:

$$\min \quad \frac{1}{2}(\alpha^T \quad \alpha_{m+1}) Q_{new} \begin{pmatrix} \alpha \\ \alpha_{m+1} \end{pmatrix} - e^T \alpha \begin{pmatrix} \alpha \\ \alpha_{m+1} \end{pmatrix} \tag{10}$$

Assuming $h_{m+1} = y_{m+1}[x^T_{m+1} \quad -1]$, $H = D[A \quad -e]$, $H_{new} = \begin{bmatrix} H \\ h_{m+1} \end{bmatrix} = \begin{bmatrix} H \\ h \end{bmatrix}$, then Q_{new} can be presented as:

$$Q_{new} = \frac{I}{c} + \begin{bmatrix} H \\ h \end{bmatrix} \begin{bmatrix} H^T & h^T \end{bmatrix} = \begin{bmatrix} Q & Hh^T \\ hH^T & \frac{1}{c} + hh^T \end{bmatrix} \tag{11}$$

In order to compute $\alpha_{new} = \begin{pmatrix} \alpha \\ \alpha_{m+1} \end{pmatrix}, Q^{-1}_{new}$ must be calculated. But large-scale matrix inverse needs much time and memory to be calculated. Fast LSVM needs

LSVM to track the dynamics quickly. For this reason, the training of LSVM can be placed in a way of incremental chunk avoiding computing large-scale matrix inverse but maintaining the precision. So the Q_{new}^{-1} should be deduced as following:

$$Q_{new}^{-1}=\begin{bmatrix} Q & H h^T \\ hH^T & \frac{1}{c}+hh^T \end{bmatrix}^{-1^{-1}} =\begin{bmatrix} Q^{-1} & 0 \\ 0 & 0 \end{bmatrix}+FF^TW \tag{12}$$

Where $F=[HH^TQ^{-1},-1]^T$

$$W=\frac{1}{\frac{1}{c}+hh^T-HH^TQ^{-1}hH^T} \tag{13}$$

From Eq.(7), Q_{new}^{-1} can be deduced by Q^{-1} without computing Q_{new} inverse directly. This iteration process will save much time and memory. For this reason, fast LSVM can achieve classification online. The whole process of nonlinear time series prediction online with incremental LS-SVM model is presented as following

Step 1: Initialization training samples $\{(\mathbf{x}_1, y_1),\cdots(\mathbf{x}_n, y_m)\}$;

Step2: Computing the Q and Q^{-1};

Step3:Computing the α by Eq.(10);

Step4:Adding new training $(\mathbf{x}_{m+1}, y_{m+1})$ in to training samples.

Step5:Computing the Q_{new}^{-1} by Eq.(12)

Step6: $k=k+1$,go to step3.

3 Experimental Results

In this paper, two UCI data sets, Iris and Wine, are tested. Iris data set has four attributes: sepal length, sepal width, petal length, petal width. Iris data set contains three class data: Versicolor (class 1), Virginica (class 2), Setosa (class 3); Wine data set is three chemical analysis of Italian wine, Wine data set contains 13 attributes and three classes of data; These two standard data sets are used to test tradition LSVM and the proposed fast LSVM AT the same conditions. the two kinds of SVM have chosen the same RBF kernel functions. Table 1 is the test results. The main parameters are training time and classification accuracy.

As can be seen from the table, compared to tradition LSVM, fast LSVM ensures the accuracy of the sample and reduce the training time, the above characteristics of fast LSVM can be used to data samples.

Table 1. UCI data set test results

	Iris		Wine	
	LSVM	FAST LSVM	LSVM	FAST LSVM
Training time(ms)	25.7	6.17	43.6	12.5
Classification accuracy	100%	100%	95.59%	97.06%

4 Conclusions

In this paper, fast LSVM is proposed to solve the classification online. Two UCI data sets are used to test LSVM and fast LSVM. Simulation indicates that this fast LSVM method is effective. The training fast LSVM is in a way of incremental chunk avoiding computing large-scale matrix inverse but maintaining the precision.

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A De-noising Method Based on Sparse Representation under the Framework of MCA

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Abstract. Due to the good ability of Contourlet transform to represent image edges, and the effectiveness of redundant dictionary for capturing various geometrical structural features of images, it is possible to weaken pseudo-Gibbs phenomena in the process of image de-noising. According to Meyer's image cartoon- texture model, under the framework of morphological component analysis, a method for image de-noising based on Contourlet transform and learned dictionary is proposed. The method used Contourlet transform to represent the cartoon component, and constructed a redundant dictionary by learning algorithm to represent the texture component sparsely. Experimental results show that, in comparison with wavelet-based de-noising methods and some algorithms based on learned-dictionary lonely, our method has better de-noising ability, preserves more edge, contour and detail image information and improves the peak signal-to-noise ratio.

Keywords: sparse representation, image de-noising, Contourlet transform, redundant dictionary.

1 Introduction

Image de-noising is an important problem in image processing field. Researchers have paid much attention to finding a method which can effectively not only suppress noise but also preserve as much as edge and detailed information of image. Thus, the image information needs to be represented in an effective way. That is to say, the representation method should have the ability to capture the intrinsic information of images using as few coefficients as possible, to preserve the important information, and ability to distinguish the useful information and the noise of an image.

Wavelet transform can effectively capture point singular features, but it cannot represent the line singularity of two-dimensional image sparsely. Therefore, Donoho et.al. proposed multiscale geometric analysis methods, such as Ridgelet transform, Curvelet transfrom, Contourlet transform and so on. These transforms can represent the edge features of images better than wavelet by taking some geometric features of images into account. However, each transform can only represent some features sparsely, but not for others. Fortunately, sparse representation based on over-complete dictionary has received considerable attention for its abilities of sparsity, feature-preserving and distinguishability [1] in recent years. Ref. [2] proposed a dictionary

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learning algorithm which is applied to image de-noising. In the method, the dictionary learning problem was expressed as a box constrained quadratic program and a fast projected gradient method was introduced to solve it. Ref. [3] adopted the K-LMS algorithm which was obtained from generalizing the K-Means clustering to update the over-complete dictionary adaptively for image de-noising.

In order to improve the performance of the over-complete dictionary and get a better de-noising result, according to Meyer's image cartoon-texture model, under the framework of morphological component analysis (MCA)[4], we proposed a method for image de-noising based on Contourlet transform and learned dictionary. We used Contourlet transform to represent the piecewise smooth (cartoon-like) content, which could preserve the edge, contour and detailed information of the image. The K-LMS learning algorithm in Ref. [3] was used to learn the over-complete dictionary for representing the texture component. Experimental results show that, in comparison with wavelet-based de-noising methods and some algorithms based on learned-dictionary lonely, our method has better de-noising ability, preserves more edge and detail image information and improves the peak signal-to-noise ratio.

2 Related Theory

2.1 Morphological Component Analysis

Starck et al. proposed morphological component analysis method separating the signal or image to its components according to morphological diversity [5], at the base that suppose for each source of a mixture signal, there is a corresponding dictionary to represent it sparsely, and this dictionary cannot represent other sources sparsely. And some work has shown that for sparse enough solutions, MCA provided a result as good as BP at least. But it is faster than BP obviously. Therefore, MCA is a practical replacement of classical sparse decomposition technique.

Assume that the image x is a linear combination of K parts, $\mathrm{x}_k = \Phi_k \alpha_k$, where each x_k represents a different type of image to be decomposed. We propose to seek the sparest of all representations over the augmented dictionary containing all Φ_k. Thus we need to solve

$$\left\{\alpha_1^{opt},...,\alpha_K^{opt}\right\} = Arg\min_{\{\alpha_1,...,\alpha_K\}} \sum_{k=1}^{K} \left\|\alpha_k\right\|_0 \qquad s.t. \qquad s = \sum_{k=1}^{K} \Phi_k \alpha_k \,. \tag{1}$$

The problem formulated in equation is non-convex and hard to solve. This is a combinatorial optimization problem and its complexity grows exponentially with the number of columns in the overall dictionary. The Basis Pursuit (BP) method [6] suggest the replacement of the l^0-norm with an l^1-norm. Furthermore, by relaxing the constraints, a solution could be obtained approximately, Thus, we seek to solve the following equation.

$$\left\{\alpha_1^{opt},...,\alpha_K^{opt}\right\} = \underset{\{\alpha_1,...,\alpha_K\}}{Arg\min} \sum_{k=1}^{K} \left\|\alpha_k\right\|_1 + \lambda \left\| s - \sum_{k=1}^{K} \Phi_k \alpha_k \right\|_2^2 . \quad (2)$$

Therefore, the content (noise) which cannot be represented sparsely by any dictionary would be retained in the residual. Then we can remove the noise.

3 Sparse Representation for Images

In recent years, sparse representation theory for images has received considerable attention and application. Given an image x with size $N \times N$, we can represent it as,

$$\mathrm{x}=\hat{\mathrm{x}}+\varepsilon=\Phi\alpha+\varepsilon . \quad (3)$$

Where, Φ indicates the dictionary, which consists L atoms $\varphi_i \in R^N$ in total. Image sparse decomposition is to choose the best linear combination of some atoms from Φ for image representation. Actually, this is an approximate process [7]. $\hat{\mathrm{x}}$ is the approximate image of x, ε is residual, and α is coefficient.

Sparse representation means to look for a best expression with fewest atoms, namely $\left\|\alpha\right\|_0 \ll N$, under ε approximated the minimal. The optimization function is as follows,

$$\min \left\|\alpha\right\|_0 \quad s.t. \ \left\|\mathrm{x}-\Phi\alpha\right\| \le \varepsilon . \quad (4)$$

Where, $\left\|\alpha\right\|_0$ is the ℓ_0 norm, denotes the number of non-zero elements.

4 Image De-noising Based on Sparse Representation under the Framework of MCA

Assume that the image noise is additive noise, the observation model is as follows,

$$Y = X + n = \mathrm{x}_1 + \mathrm{x}_2 + n . \quad (5)$$

Where, $n \sim N\left(0,\sigma^2\right)$ is additive white Gausssian noise.

According to the description mentioned above, for piecewise smooth content (cartoon component), we decomposed it using Contourlet transform, and do threshold processing for the coefficients. In order to reduce ringing, we added Total Variation regularization term to guide the separation process. Total variation can avoid the ringing near of edge, and make cartoon component close to the piecewise smooth image.

For texture component, we used K-LMS learning algorithm in Ref. [3] to construct the over-complete dictionary, and updated dictionary atom by atom iteratively with the minimum mean square error. For K samples corresponding to the atom to be

updated, we computed the construction error, and updated the atom using LMS algorithm. Because every updating is along the direction of the residual error descent, after a certain iteration, the learned dictionary can represent the training samples much better.

The image de-noising method based on sparse representation in framework of MCA is described as below:

Step 1: Initialize a dictionary $\Phi^{(0)} = \left\{ \varphi_k^{(0)}; k = 1,..., K \right\}$, training set $\boldsymbol{F} = \left\{ f_i; i = 1,...M \right\}$, set the initial number of iterations $J = 1$, initial threshold $\lambda^{(1)}$, each morphological component as zero.

Step 2: Update of $s_j^{(J)}$, $j = 1,...,t$, assuming all $s_{i \neq j}^{(J-1)}$ are fixed:

For cartoon component,

1) Calculate the Contourlet transform of $s_j^{(J)}$ and obtained β_j, then soft threshold the coefficient β_j with the $\lambda^{(J)}$ threshold.
2) Reconstruct $s_j^{(J)}$ using hard threshold.
3) TV term regularize the piecewise smooth content.

For texture component:

1) Update coefficient $\alpha^{(J)}$ using orthogonal matching pursuit method to minimize the optimization problem $\min_{\alpha_i} \left\{ \left\| s_j^{(J)} - \Phi^{(J)} \alpha_i \right\|_2^2 \right\} s.t. \left\| \alpha_i \right\|_0 \leq T_0$
2) Update dictionary $\Phi_j^{(J)}$, for single atom $\varphi_k^{(J)}$ each by each

a) Select the subset represented by atom $\varphi_k^{(J)}$, $\Omega_k^{(J)} = \left\{ f_i \middle| \alpha^{(J)}(k,i) \neq 0 \right\}, i = 1,2,...,M$

b) Compute residual $R_k^{(J)} = \Omega_k^{(J)} - \varphi_k^{(J)} \cdot \alpha^{(J)}(k)$

c) Construct gradient operator $\nabla = -R_k^{(J)} \cdot \mathrm{pinv}\left(\alpha^{(j)}(k) \right)$

d) Update atom $\varphi_k^{(J+1)} = \varphi_k^{(J)} - \mu \cdot \nabla$, μ is step factor

3) Update the current image component $s_j^{(J)} = \Phi_j^{(J)} \alpha_j^{(J)}$

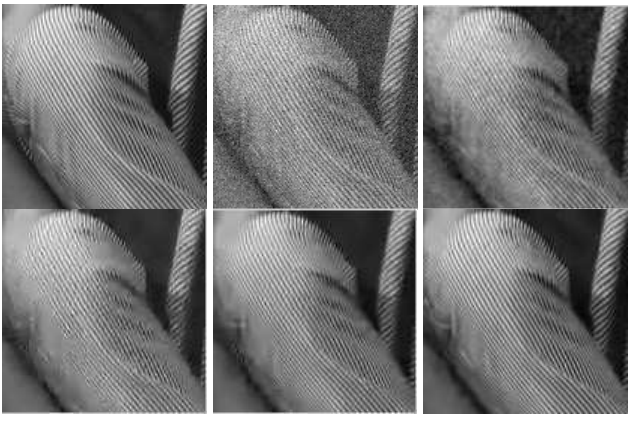
Step 3: Update iterative times $J = J + 1$ and the threshold $\lambda^{(J+1)} = \lambda^{(J)} \Big/ \sqrt[(I_{\max}-1)]{\frac{\lambda^{(1)}}{\tau\sigma}}$

Step 4: Repeate step 2 to step 4 until it satisfied the stopping criterion.

5 Experiments and Analysis

To verify the effectiveness of the proposed de-noising method, we demonstrate the results on several test images with different noise levels. And we adopt the peak signal-to-noise ratio (PSNR) to evaluate the de-noising results. PSNR is a term for the ratio between the maximum possible power of a signal and the power of corrupting noise that affects the fidelity of image.

In order to better visualize the results and their comparison, Fig.1 gives the local part of de-noised 'Barbara' with σ= 20. Table 1 gives the PSNR under different noise variance. The method based on UWT removed most homogeneous noise but blurred the edge. BLS—GSM method obtained a better restoration for edge and texture information than UWT, but introduced some artificial. The method based on DCT dictionary can represent the periodic signals fairly, so it obtained good de-noising performance for 'Barbara' with rich texture information, but for 'Lena' and 'Boat', the results was not such optimistic. Our approach used Contourlet transform to describe the piecewise smooth content of the image, and used K-LMS learning algorithm to obtain the learned dictionary which can describe the image adaptively, so it can not only remove the noise but also preserve the edge texture information. Notice that for these images, our approach outperforms the other three methods for all noise levels listed, and obtains a higher PSNR.



(a) original image (b) noisy image (c) UWT (d) BLS-GSM (e) DCT (f) Proposed method

Fig. 1. Comparison with local block of Barbara, $\sigma = 20$

Table 1. Comparison of different de-noising methods with PSNR

Test image	σ	PSNR				
		Noisy	UWT	BLS-GSM	DCT	Proposed method
Lena	10	28.14	33.98	35.22	35.33	35.53
	20	22.15	30.36	32.24	31.95	32.46
	30	18. 61	29.14	30.45	29.98	31.41
Barbara	10	28.15	32.16	33.13	33.98	34.55
	20	22.10	28.02	29.08	30.01	31.05
	30	18.58	25.36	26.79	27.58	28.01
Boat	10	28.15	33.26	33.48	34.26	34.87
	20	22.17	29.01	30.31	30.59	31.52
	30	18.59	26.98	28.43	27.91	28.89

6 Conclusion

In order to preserve the edge, contour, and detailed information and weaken pseudo-Gibbs phenomena in the process of de-noising, this work presented a image de-noising method based on Contourlet transform and learned dictionary under the framework of morphological component analysis. Contourlet transform was used to describe the piecewise smooth content (cartoon-like), and the dictionary was obtained using K-LMS learning algorithm trained on patches of the noisy image itself. The results have shown that our approach performs well from objective evaluation or subjective visualization, and obtained a higher PSNR.

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The Application of Neural Network Model in Earthquake Prediction in East China

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Abstract. This paper presents a full research about earthquake catalogue. We use the earthquake factor to describe the earthquake, make the prediction based on the earthquake data during the past period of time. Considering the nonlinear prediction ability and the generalization ability, we make the seismicity variation rate as the input and create a neural network model. Then validate the model by analyzing the seismicities in East China and illustrate the steps of this method.

Keywords: BP neural network; z-statistics; seismicity variation rate.

0 Introduction

Earthquake is one of the most deadly natural disasters in the world, seriously imperil economic development and the safeties of lives and property of the people. It brings great damages and disasters. So earthquake prediction is very important to decrease the damages. Exact earthquake prediction can help people take effective measures to reduce casualties and economic loss. The 7.1 (Ms) earthquake in Yushu shows that earthquake prediction is important and urgent, the academic research on earthquake prediction is significant.

The artificial neural nets (ANN) is extensively used in image recognition[2],pattern identification, etc and shows the availability in some nonlinear phenomenons [3][4][5][6]. Back Propagation (BP) given by Rumelhart DE in 1986 has very strong fault-tolerance, learning ability and adaptability and can analyse complicated nonlinear questions [7].

In this paper, earthquake catalogue is processed, earthquake magnitude range and seismicity rate variation are used to describe the earthquake. BP is used to predict earthquack. The time of the quake and seismicity rate variation are used as the inputs vector of BP neural networks. And the model is validated by analyzing the seismicities in East China.

1 Selecting the Factors of Prediction

Many factors can induce earthquake, After years of study, researchers discovered that the frequency of earthquake occurrence would change accordingly. And the changes

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may be the seen the premonition of future medium earthquake. According to this, we define the number of times earthquake occurs per unit time as seismicity rate variations, then do statistic analyze on seismicity rate variation within different magnitudes which are used as the inputs vector of BP neural networks. Thereby the time of the medium earthquake happens is predicted. To get best performance of the model, Numerical experiment is often used to seek optimum inputs aggregate. The model shows better effect when the inputs include seismicity rate variations and many time intervals in different seismic zone.

2 Basic Principle of Neural Network

BP Network (multiplayer feed forward neural networks) which adopt back propagation is the most common network in ANN. It usually includes input layer, hidden layer and output layer. As shown in Figure 1.The Details about BP can refer to the references [7].

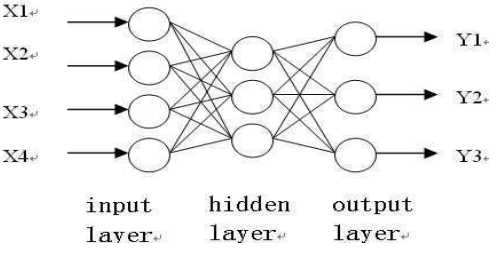

Fig. 1. BP neural network structure

3 Calculate on Seismic Data and Seismicity Rate Variation

3.1 Earthquake Data

Earthquake catalogues which are rich in content, including the area, time, site and longitude and latitude of the earthquake, are very important to earthquake prediction research, including the area, time, site and longitude and latitude of the earthquake. The data sources we adopt are from data management and service system of China Earthquake Network Center (CENC).And the data sources are the data which happened in China from January, 1970 to May, 2010

The data are numerous and include many noise data. So we adopt k-k rule to delete the aftershocks and the exactitude is increased accordingly. The data format preprocessed is showed in Table 1:

Table 1. Part of Data preprocessed

Date	longitude	latitude	magnitude
19860520	23.9	121.7	6.6
19870719	22.78	120.07	4.3
19900717	24.82	12€1.42	3.9

In this paper, we adopt the data space in East China: 29°-37°N□113°-124°E.There are 3286 records (M≥2.6, 1970.1-2010.5 年) which are included in this space. And East China is subject to earthquakes, It is significant to earthquake prediction.

3.2 Seismicity Rate Variations

Seismicity rate variations are not only related to time but also depend on the number's change of the quake. The change of cumulative number in East China from 1970 to 2010 is showed in Figure 2. It's showed that Seismicity rate variations are not only related to time but also depend on the number's change of the quake.

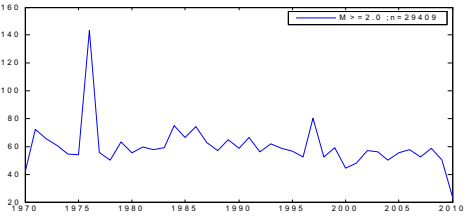

Fig. 2. Monthly Seismicity rate variation in East China from 1970 to 2010

Seismicity rate variation is always independent of all external influence in any prediction but it can be influenced by human factors. So z-statistics presented by Habermann will be used in this paper to reduce the error. It follows a formula like this:

$$z = \frac{\nu_1 - \nu_2}{\sqrt{\frac{s_1^2}{N_1} + \frac{s_2^2}{N_2}}} \tag{1}$$

Where ν_1 and ν_2 are the average rate of earthquake occurrence in two observation period, s_1, s_2 are the standard deviation, N_1, N_2 are the numbers of earthquake occurrence in each period. Z-value shows the change of intensity, a negative z-value indicates that the variation increases, a positive z-value indicates the variation decreases. To get the correct cut-off value, we adopt the magnitude label to check all the possible cut-off values.

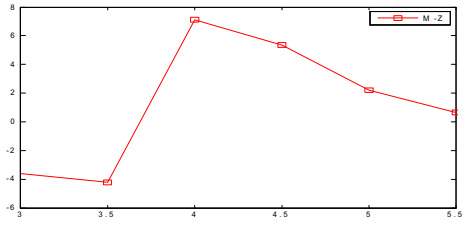

Fig. 3. The magnitude label in East China

Fig.3 shows the magnitude label in East China, all earthquake catalogues ($M \geq 2.6$) are divided into two periods (January 1970- December 1985 and December 1985-December 2000). The z-value is obtained by comparing the seismicity variation rate in two periods. The cut-off value in East China is 4.0 by calculating the z-value. We can see from Fig. To M4.0, the z-value vary mostly. Past level 40 or so, the z-value becomes stable. So the cut-off value is 4.0.

4 The Experiment

4.1 Calculating the Input Factor

From Jan.1980 to May.2010, there are 14 strong and moderate earthquakes (5.0M-8.0M) in East China which are almost in Tancheng-Lujiang seismic zone. As the mentioned above, the input info are the average rates of earthquake occurrence and the output info are the time intervals between two adjacency great earthquakes.

To get the optimum inputs, we adopt two seismicity variation rate, v_1 is the seismicity variation rate in the magnitude range which is from 3.5 to 4.0(N=28), v_2 is the seismicity variation rate in the magnitude range which is below 4.5(N=43). Introduce two parameters $v_{1,p}$ and $v_{2,p}$, where p is the time interval between the p time great earthquake to the next. And p=1,2,…13 in East China.

Table 2. Some data sample normalized in East China

P-value	Seismicity variation rate $(v_{1,p}, v_{2,p})$		Time Interval
P=1	0.1714	0.2286	0.0783
P=2	0.3175	0.1270	0.0427
P=3	0	0.1633	0.0376

When the training is finished, we will get the final weights and threshold and use the trained network model to predict the seismic tendency in the future.

4.2 The Experimental Results

We extracted a portion of the samples in East China as the experimental samples,and get the error curve as follows in Fig.4. It has a better convergence effect.

Fig. 4. The error curve in East China

A portion of the prediction results are showed in Table 3:

Table 3. A portion of the prediction results

Longitude	Latitude	Magnitude	Region	The predicted time of the earthquake	The actual time of the quake
115.28	35.27	6.2	Tan-Lu seismic zone(Shandong province)	Jan.1984	Nov.1983
121.55	32.48	5.1	Tan-Lu seismic zone(Jiangsu province)	May.1986	May.1986
115.72	29.72	5.2	Tan-Lu seismic zone(Anhui province)	Dec.2005	Nov.2005

5 Conclusion

In this paper, we preprocess the earthquake datas, predict the moderate strong earthquakes by using Neural Network model, make the seismicity variation rate between two adjacency great earthquakes and in different magnitude as the input, and train it, predict the happening time of the moderate strong earthquakes, and verify the reasonability and validity of the model through the experiment in East China area.

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Soil Moisture Content Error Detection Based on DBSCAN Algorithm

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Abstract. The utilize of GStar-I soil moisture content viewer has greatly changed the information management of meteorological departments, the accuracy of the equipment is a big problem. Checking the possible malfunction of the equipment from the collected data intelligently is a solution. DBSCAN algorithm is a clustering algorithm, which can help to discover the noise points help to classify the noise points can analyze the reason of malfunction.

Keywords: soil moisture content, DBSCAN, noise, error detection.

1 Introduction

The change of soil moisture content has direct influence on the growing development and out of crops. Some of the meteorological departments are still using traditional way to drill soil to measure the soil moisture content, though it is a precise way, it spend a lot of human resources in doing it. The work is even harder in the bad weather.

According to the strategic development of meteorological department, He Nan meteorological department and the No 27 institute of China electronic technology company have established strategic partnership to cooperate in comprehensive detection system and information network.

In order to solve the soil moisture content automatic detection problem, the GStar-I soil moisture content viewer is developed in 2005, and established in He Nan province, Shan Xi province and Gan Su province.

The main parts of the GStar-I soil moisture content viewer are Sensor, Data Collector System, monitor PC, Data Central Server as Figure1.

The transducer of soil moisture content is based on the Capacitance Sensor and Embedded PC, the change of moisture around the transducer cause the change of capacitance medium. The change of capacitance medium cause the change of oscillation frequency of LC oscillator, and then the High Frequency Signal is send to Single-Chip computer, the moisture content is calculated after count, conversion, revision process based on the mathematical model and related soil factor.

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The design of Data Collector System is based on ARM, the utilization of memory expansion technology has so many advantages such as vast storage, safe and easy fixed. It can also send command to the transducer to collect and store the soil moisture data.

The devices are laid under the earth, and there are 8 layers of data to be collected and sent to the database, 0-10cm layer1, 10-20cm layer2, 20-30cm layer3, 30-40cm layer4, 40-50cm layer5, 50-60cm layer6, 70-80 layer7, 90-100cm layer8. How to detect the equipment failure from the data collected is a question. Because of the limitation of human resource, it is impossible for the worker to check it everyday. The error data will bring big trouble to the agricultural production. How to detect and equipment failure from the data collected to repair it as quickly as possible is a hot topic.

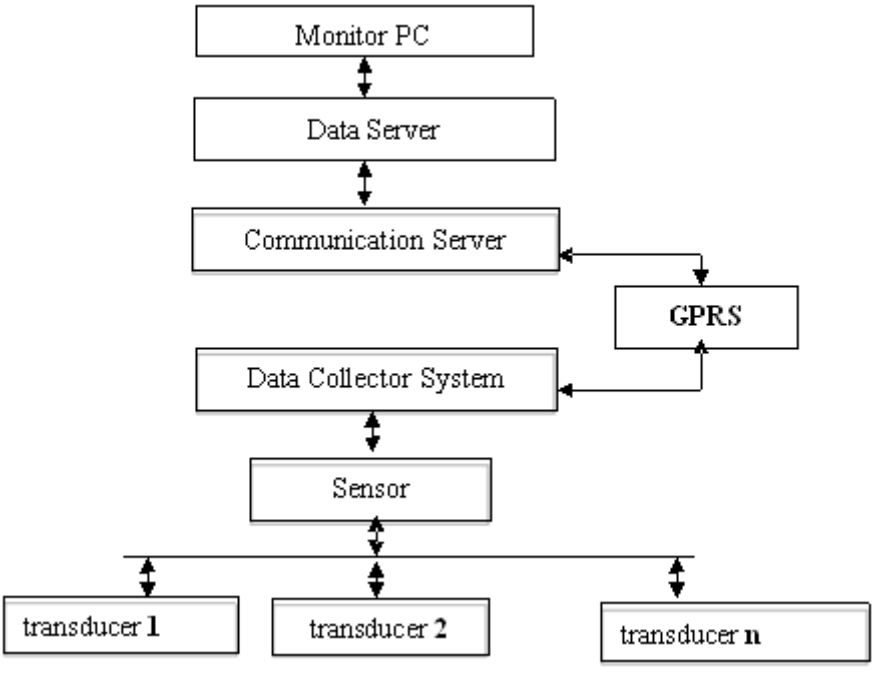

Fig. 1. GStar-I soil moisture content viewer

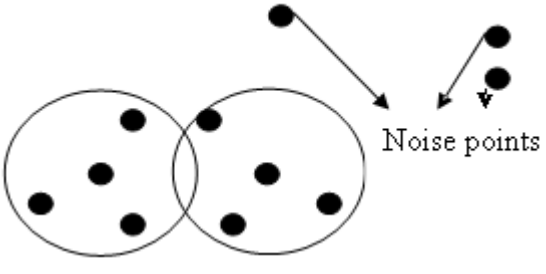

Fig. 2. DBSCAN algorithm

Usually, there is only one GStar-I soil moisture content viewer in one country, detecting the error data depends on the history data and the neighbor viewer' data is a feasible way to detect the equipment failures.

2 DBSCAN Algorithm

Clustering in data mining is a discovery process that groups a set of data such that the inter cluster is maximized and the inter cluster similarity is minimized. Existing clustering algorithms, such as K-means, PAM, CLARANS, DBSCAN, CURE, and ROCK are designed to find clusters that fit some static models. [1]Clustering is one of the most useful tasks in the data mining process for discovering groups and identifying interesting distribution and patterns in the underlying data. Thus, the main concern in clustering process is to reveal the organization of patterns into "sensible" groups, which allow us to discover similarities and differences, as well as to derive useful inferences about them [2]

DBSCAN (Density-Based Spatial Clustering of Applications with Noise) is a data clustering algorithm proposed by Martin Ester, Hans-Peter Kriegel, Jörg Sander and Xiaowei Xu in 1996. It is a density-based clustering algorithm because it finds a number of clusters starting from the estimated density distribution of corresponding nodes. DBSCAN is one of the most common clustering algorithms and also most cited in scientific literature. DBSCAN is designed to discover arbitrary shaped clusters in any dataset and at the same time can handle noise or outliers effectively. The core point in DBSCAN refers to such point that its neighborhood of a given radius (EPS) has to contain at least a minimum number (Minpts) of other points. The procedure for finding a cluster is based on the fact that a cluster can be determined uniquely by any of its core points[3,4].

DBSCAN's definition of a cluster is based on the notion of density reach ability. Basically, a point q is directly density-reachable from a point p if it is not farther away than a given distance ε (i.e., is part of its ε-neighborhood), and if p is surrounded by sufficiently many points such that one may consider p and q be part of a cluster. q is called density-reachable from p if there is a sequence $p_1,...,p_n$ of points with and $p_1 = p$ and $p_n = q$ where each p_{i+1} is directly density-reachable from pi. Note that the relation of density-reachable is not symmetric (since q might lie on the edge of a cluster, having insufficiently many neighbors to count as a genuine cluster element), so the notion of density-connected is introduced: two points p and q are density-connected if there is a point o such that o and p as well as o and q are density-reachable.

If a point is found to be part of a cluster, its ε-neighborhood is also part of that cluster. Hence, all points that are found within the ε-neighborhood are added, as is their own ε-neighborhood. This process continues until the cluster is completely found. Then, a new unvisited point is retrieved and processed, leading to the discovery of a further cluster or noise.

3 Error Detection Algorithm Based on DBSCAN

As is known to all, the neighbor countries usually have the similar soil structure and selected data sample. Here we try to use DBSCAN algorithm into the error detection algorithm. There are two reasons of error data collection, the first one is the equipment is abnormal during the data transmit process. Under this condition are equipment may not work anymore, the second one is the data is wrongly collected from some transducer. So the algorithm is mainly have two parts, one is testing the performance of one equipment; anther is testing the performance of layer data.

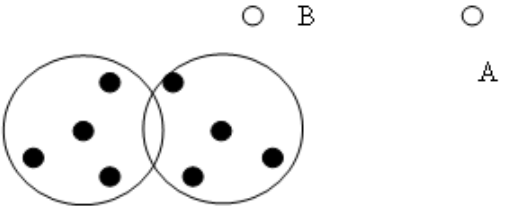

Fig. 3. Malfunction equipment detection

Every sample collected at the same time can be mapped into a 8 dimensional feature space $D_i = \{d_1, d_2, ...d_7, d_8\}, 1 \le i \le n$,n is the number of soil moisture observation station, d_1 is the soil moisture content under earth 0-10cm, d_2 is 10-20cm, d_3 is 20-30cm, d_4 is 30-40cm, d_5 is 40-50cm, d_6 is 50-60cm, d_7 is 70-80cm, d_7 is 90-100cm, ε (EPS) and minpts are given. DBSCAN algorithm is used to find the noise points as figure3.

In Figure3, the black circles in the clusters means the equipments can detect the data correctly, while the empty circles are equipments, which may exit problems. If the average of distance between a empty circle and black circles l is larger than $L_{\max}$, there are must be some wrong during the transmit process. If it is larger than $L_{\min} \le l \prec L_{\max}$, there must be some wrong with one or more transducers. The parameter $L_{\max}$ is given based on the hypothesis that if the machine parts are destroyed or the voltage is too low to send signal to the database, the signal is always 0 or low. The design of $L_{\min}$ is used to detect the transducer problem. d_i $1 \le i \le 8$ is the soil moisture content detected by transducer, if $L_{\min} \le l \prec L_{\max}$ something wrong seems to happen in $transducer_i$. It is not easy to find the broken transducers, history soil moisture record is used to analysis it.

A series of data get from transducer in a time span is selected to check the problem, $TD = \{D_1, D_2, ...D_{n-1}, D_n\}$ $D_j, 1 \le j \le n$ is the sample collected by

equipment in an n hours Continuous Time. $TDH = \{D_{H1}, D_{H2}, ...D_{Hn-1}, D_{Hn}\}$ is the history record of sample collected by equipment in an n hours Continuous Time. Checking the similarity between TD and THD, some of the data with the biggest similarity are selected, if d_{ij} is obviously different from the history record, then we can suppose that the $transducer_j$ is broken. Some experiments have been done to test the performance of the algorithm, the average testing precision is 92.3%.

4 Conclusion and Further Research

This paper has introduced DBSCAN algorithm to solve the soil moisture content viewer's error detection problem, the noise detection ability of DBSCAN is used to detect the reason of the equipment. The efficient algorithm can save human resources in dealing with this problem. How to given proper ε (EPS) and minpts is a question to be solved in the future.

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Research on the Aging Property of Electric Field Influence on Corn Seeds

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Abstract. Electric field as a physical factor, its impact on organism has become an important research topic in biophysics. Trying to find the rule of electric field's impact on plant growth has the important meaning for carrying out the deep research of the influence of electric field on plants and for developing and utilizing the electric biological effects. In this paper, we have processed the corn seeds through electric field firstly, and then carried out experimental determination on its germination situation. At last, we have analyzed the relationship between electric biological effects and processing conditions, as well as the aging property of electric biological effects. The results show that the influence of different processing conditions (different electric field intensity and different processing time) on the biomass of seed and seedling is different.

Keywords: Aging Property, Seedling growth, Corn seed, Electric field.

1 Introduction

Electric field as a physical factor, its impact on organism has become an important research topic in biophysics. Trying to find the rule of electric field's impact on plant growth has the important meaning for carrying out the deep research of the influence of electric field on plants and for developing and utilizing the electric biological effects. In 1963, Murr discovered that the simulated electric field can affect the growth of plant [1], which opened the research of electric biological effects for human, in which the effects of that electric field promotes seeds' germination and affects the growth of crops are obvious [2-5]. At present, the research for the impact of electric field on crops has permeated many fields of agriculture [6,7], and electric biological effect has become a method of transforming the mode of traditional agriculture production. In this paper, we have processed the corn seeds through electric field firstly, and then carried out experimental determination on its germination situation. At last, we have analyzed the relationship between electric biological effects and processing conditions, as well as the aging property of electric biological effects. The results show that the influence of different processing conditions (different electric field intensity and different processing time) on the

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biomass of seed and seedling is different. These results not only provide theoretical support for the links that the seeds processed by electric field are put on the market or are stored, but also have certain significance for promoting electric biotechnology in a wide range.

2 Materials and Methods

The experiment materials are corn (*Zea mays L.*) seeds that provided by Inner Mongolia agricultural science institute. We selected the seeds with uniform size and full grain, and divided them into 13 groups, each group had four repeat, each repeat had 50 grains of corn seed, of which one group was the comparing group, and the other 12 groups were processed separately with different electric field intensity. The electric field intensity is E_N=0.5*N (kV/cm), N=1, 2, …, 12, of which the comparing group is recorded as E0 (without electric field's processing). The processing time of corn seeds are T=10min and T=5min. The processed seeds are carried out the experimental determination separately at the same day, after 10 days' storage and after 20 days' storage. We determined the germination situation and germination rate of corn seeds according to national standard GB5520-85 standard. All determination results are carried out the significant test by Independent-Samples t Test of SPSS13.0 systems software.

3 The Impact of Storage Time to Corn Seeds' Germination after the Processing of Electric Field

3.1 The Impact of Storage Time to Seeds' Germination Situation after the Processing of Electric Field

Table 1 shows the determination values and t values of corn seeds' germination situation corresponding to different processing conditions when the electric field processes for 5min. Figure 1 shows the increased percentage of corn seeds' germination situation of the processed group compared with the comparing group when the electric field processes for 5min.

Table 1 and Figure 1 show that after the electric field with different intensity processing the corn seeds for 5min, the germination situation of each intensity has different degrees of improvement compared with the comparing group, which is in the case of without storage. When the electric field intensities are 1.0kV/cm, 1.5kV/cm, 3.0kV/cm, 3.5kV/cm, 4.0kV/cm, 5.0kV/cm, 5.5kV/cm and 6.0kV/cm, the improvement of germination situation are remarkable. After 10 days' storage, only under 4.0kV/cm intensity, the improvement of germination situation is remarkable compared with the comparing group. After 20 days' storage, the germination situation under each intensity has different degrees of decline compared with the comparing group. But the declines are not remarkable.

The experiment results show that after the electric field processing the corn seeds for 5min, the impact of electric field on the germination situation of corn seeds is remarkable in a short time, and the significance gradually disappears along with the extension of storage time.

Table 1. The effect of storage time on the germination energy of electric field treatment wheat seeds in 5 minute

Electric field strength(kV/cm	Corn germination energy					
	no storage		storage 10 days		storage 20 days	
	mean±std	t value	mean±std	t value	mean±std	t value
0.0	28.7±1.3	–	29.1±1.7	-	30.6±1.8	-
0.5	30.8±1.5	1.09	32.6±0.7	1.94	28.3±1.2	1.10
1.0	34.5±0.8	3.74*	30.9±1.6	0.76	25.0±2.1	2.02
1.5	34.5±0.8	3.85*	31.7±1.4	1.19	27.1±1.9	1.33
2.0	31.5±1.4	1.49	31.0±2.0	0.72	29.4±0.5	0.67
2.5	31.2±2.5	0.89	29.4±1.5	0.11	28.9±1.6	0.73
3.0	34.5±1.8	2.65*	31.7±1.0	1.28	26.8±0.9	1.94
3.5	34.7±1.3	3.31*	30.5±0.8	0.75	28.8±1.5	0.81
4.0	34.5±2.1	2.30*	31.6±1.2	2.22*	30.3±1.2	0.17
4.5	30.7±1.8	0.89	30.8±1.5	0.73	29.8±1.3	0.39
5.0	34.2±0.7	3.76*	28.3±1.5	0.39	29.3±1.3	0.62
5.5	33.8±1.3	2.77*	29.9±0.9	0.40	30.3±1.2	0.17
6.0	34.2±1.2	3.07*	28.4±2.2	0.27	30.6±1.1	0.00

Table 2 shows the determination values and t values of corn seeds' germination situation corresponding to different processing conditions when the electric field processes for 10min. Figure 2 shows the increased percentage of corn seeds' germination situation of the processed group compared with the comparing group when the electric field processes for 10min.

Table 2. The effect of storage time on the germination energy of electric field treatment wheat seeds in 10 minute

Electric field strength(kV/cm)	Corn germination energy					
	no storage		storage 10 days		storage 20 days	
	mean±std	t value	mean±std	t value	mean±std	t value
0.0	29.5±1.4	-	31.0±1.4	-	33.5±1.5	-
0.5	32.0±2.6	0.82	30.3±2.9	0.23	32.0±1.7	0.64
1.0	31.7±0.9	1.30	33.5±1.8	1.06	36.7±1.8	1.37
1.5	25.2±3.6	1.09	35.0±1.0	2.19	38.2±0.8	2.68*
2.0	32.2±1.2	1.44	31.5±2.7	0.16	40.0±1.4	3.04*
2.5	29.7±3.2	0.07	32.0±2.0	0.39	36.5±2.2	1.10
3.0	26.7±2.9	0.84	30.7±2.8	0.08	39.2±2.3	2.01
3.5	28.7±3.3	0.21	27.7±1.3	1.65	32.2±1.0	0.67
4.0	28.2±4.6	0.26	29.7±1.9	0.51	41.7±0.2	5.24**
4.5	28.0±2.0	0.60	28.2±3.3	0.76	37.7±1.6	1.87
5.0	33.0±1.4	1.73	29.5±2.1	0.58	37.5±2.7	1.28
5.5	26.0±1.0	1.94	28.2±0.9	1.57	36.5±2.4	1.05
6.0	22.7±2.1	2.65*	29.2±3.0	0.51	35.5±0.6	1.19

From Table 2 and Figure 2, we know that after the electric field with different intensity processing the corn seeds for 10min, the germination situation of most intensity has different degrees of decline compared with the comparing group, which is in the case of without storage. However, only under 6.0kV/cm intensity, the decline of

germination situation is remarkable. After 10 days' storage, the germination situation of most intensity has different degrees of decline compared with the comparing group, but the declines are not remarkable. After 20 days' storage, the germination situation under each intensity has different degrees of improvement compared with the comparing group. When the electric field intensities are 1.5kV/cm and 2.0kV/cm, the improvement of germination situation are remarkable. Under 4.0kV/cm intensity, the improvement of germination situation is extremely remarkable.

The experiment results show that after the electric field processing the corn seeds for 10min, the electric field inhibits the germination of corn seeds in a short time, and the significant improvement gradually becomes obvious along with the extension of storage time.

3.2 The Impact of Storage Time to Corn Seeds' Germination Rate after the Processing of electric Field

Table 3 shows the determination values and t values of corn seeds' germination rate corresponding to different processing conditions when the electric field processes for 5min. Figure 3 shows the increased percentage of corn seeds' germination rate of the processed group compared with the comparing group when the electric field processes for 5min.

Table 3. The effect of storage time on the germination percentage of electric field treatment wheat seeds in 5 min

Electric field Strength (kV/cm)	Corn germination percentage					
	no storage		storage 10 days		storage 20 days	
	mean±std	t value	mean±std	t value	mean±std	t value
0.0	28.8±2.4	-	30.1±3.2	-	32.3±3.6	-
0.5	31.2±3.2	1.18	33.4±1.6	1.81	30.3±2.8	0.89
1.0	35.0±1.4	4.40*	31.3±3.2	0.49	27.4±3.0	2.10
1.5	34.5±1.6	4.00*	32.5±2.8	1.10	28.4±3.4	1.57
2.0	32.0±2.4	1.91	31.6±4.2	0.56	30.3±1.6	1.05
2.5	31.5±5.2	0.93	30.3±3.0	0.06	30.5±3.2	0.73
3.0	34.7±3.4	2.80*	32.3±2.2	1.07	29.1±1.8	1.58
3.5	34.3±2.6	3.36*	30.9±1.2	0.43	30.5±2.4	0.82
4.0	34.5±4.0	2.41*	33.9±4.2	1.84	31.8±2.2	0.24
4.5	30.8±3.8	0.90	31.0±3.0	0.40	31.4±2.6	0.40
5.0	34.3±1.6	3.82*	29.0±3.0	0.51	31.0±2.4	0.59
5.5	34.5±3.0	2.98*	31.3±2.0	0.58	31.9±2.4	0.18
6.0	34.7±2.6	3.36*	28.6±4.6	0.53	32.3±2.4	0.00

From Table 3 and Figure 3, we know that after the electric field with different intensity processing the corn seeds for 5min, the germination rate under each intensity has different degrees of improvement compared with the comparing group, which is in the case of without storage. When the electric field intensities are 1.0kV/cm, 1.5kV/cm, 3.0kV/cm, 3.5kV/cm, 4.0kV/cm, 5.0kV/cm, 5.5kV/cm and 6.0kV/cm, the improvement of germination rate are remarkable. After 10 days' storage, the germination rate of most intensity has different degrees of improvement compared with the comparing group, but the improvements are not remarkable. After 20 days'

storage, the germination rate under each intensity all have different degrees of decline compared with the comparing group. But the declines are not remarkable.

The experiment results show that after the electric field processing the corn seeds for 5min, the impact of electric field on the germination situation of corn seeds is remarkable in a short time, and the significance gradually disappears along with the extension of storage time.

Table 4 shows the determination values and t values of corn seeds' germination rate corresponding to different processing conditions when the electric field processes for 10min. Figure 4 shows the increased percentage of corn seeds' germination rate of the processed group compared with the comparing group when the electric field processes for 10min.

Table 4. The effect of storage time on the germination percentage of electric field treatment wheat seeds in 10min

Electric field Strength (kV/cm)	Corn germination percentage					
	no storage		storage 10 days		storage 20 days	
	mean±std	t value	mean±std	t value	mean±std	t value
0.0	31.0±1.2	-	33.5±1.1	-	38.7±0.6	-
0.5	33.5±2.9	0.79	32.2±2.6	0.35	35.5±0.8	2.78*
1.0	33.5±1.1	1.46	35.0±2.2	0.60	38.5±1.5	0.00
1.5	27.0±3.5	1.06	37.5±1.1	2.61*	40.2±0.7	1.77
2.0	34.2±0.7	2.26	35.2±1.8	0.78	42.2±1.5	2.24*
2.5	31.7±3.0	0.23	34.2±1.8	0.34	39.5±1.8	0.51
3.0	28.2±3.2	0.80	33.2±2.0	0.11	42.0±1.2	2.42
3.5	30.7±3.1	0.07	30.5±2.5	1.07	36.7±1.4	1.08
4.0	29.7±4.5	0.27	33.0±1.8	0.23	43.5±0.6	5.48*
4.5	30.0±1.8	0.45	29.5±2.9	1.28	40.7±1.2	1.60
5.0	33.5±1.1	1.46	33.0±1.6	0.25	39.2±2.6	0.27
5.5	28.0±0.9	1.96	29.5±1.1	2.38*	37.7±2.4	0.34
6.0	24.7±2.5	2.25*	31.0±2.6	0.87	38.0±0.7	0.52

From Table 4 and Figure 4, we know that after the electric field with different intensity processing the corn seeds for 10min, the germination rate of most intensity has different degrees of decline compared with the comparing group, which is in the case of without storage. However, only under 6.0kV/cm intensity, the decline of germination rate is remarkable. After 10 days' storage, the germination rate of most intensity has different degrees of decline compared with the comparing group. When the electric field intensity is 1.5kV/cm, the improvement of germination rate is remarkable. Under 5.5kV/cm intensity, the decline of germination rate is remarkable. After 20 days' storage, the germination rate under each intensity has different degrees of improvement compared with the comparing group. When the electric field intensities are 0.5kV/cm, 2.0kV/cm and 4.0kV/cm, the improvement of germination rate are remarkable.

The experiment results show that after the electric field processing the corn seeds for 10min, the electric field inhibits the germination of corn seeds in a short time, and the significance gradually enhances along with the extension of storage time.

Generally speaking, we choose the electric field intensity according to own demand when electric field processes the corn seeds for different time (5min and 10min), If we want to plant immediately, we can choose the intensity that can significantly improve the germination situation and germination rate to carry out electric field processing under the condition of 5min's processing. If it is likely to storing for a period of time after the process, we can choose the intensity that can significantly improve the germination situation and germination rate to carry out electric field processing under the condition of 10min's processing. From the above experiments that process the corn seeds with electric field firstly and then store the corn seeds for different time, we know that if we want to obtain the best processing condition in the case of without storage, the processing time should not be too long. If we want to obtain the best processing condition in the case of storing for a period of time, the processing time should be extended appropriately.

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Experimental Study on Influence on Operation Temperature of Centrifugal Pump's Bearing for Different Compound Mode

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Abstract. The paper aimed at the problems of bearings running in the higher operating temperature for a centrifugal pump used in water treatment system to provide high-pressure water and analyzed the reasons caused bearings running in the higher operating temperature based on stress state of pump bearing and combined with internal flow pattern with centrifugal pump. The solution was raised to change bearing types and specifications and new bearing combination scheme. The solution achieved anticipated goal to reduce the operating temperature of bearings through the experiment proves. The scheme provides a reference method for operation and maintenance to the centrifugal pump and this conclusion can also provide the reference for pump structure design.

Keywords: centrifugal pump, running temperature, compound mode, bearing.

1 Introduction

Pump is a type of fluid machinery, which transforms mechanical energy of prime mover to kinetic energy and pressure energy of transported fluid. Pump product is widely used in the national economic construction because of their wide performance range, large working temperature range and broad pumping medium types [1]. Almost all occasions which need to transport the liquid and provide a certain medium pressure have pump exist. Pump products consumed about 25% of the national electricity every year according to statistics [2].

In all kind of pump conducts, centrifugal pump accounted for more than 70% according to statistics. So the high reliability and good performance is very important for them, then it required bearings working reliably and operating temperature control certain range.

2 The Original Compound Mode for Bearing in Pump

The original compound mode for bearing in pump is shown as Fig 1. Pump overall structure belongs to single grade and single suction cantilever horizontal centrifugal pump. Bearing distribution way is one single short cylindrical roller bearing near

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impeller side and pairs lateral back-to-back angle contact ball bearing near shaft stretch and bearing lubrication was adopted thin oil lubrication method. The bearings configuration forms was the in the classiest configuration forms in centrifugal pump. In the pump running process bearing played a role of supporting rotor to ensure that the rotation accuracy of rotor impeller. The single short cylindrical roller bearing undertook radial load, and the two angle contact ball bearing undertook axial load together.

3 Pump Operating Conditions

The pump was used in water treatment system to provide high-pressure water which is rinsing with normal temperature. The pump's operating conditions is as follows: rate of flow is 275m3/h, head is 222m, rotational speed is 2980r.p.m, specific speed is 52, supporting power is 280kW, installation conditions is flow backward state, the height of flow backward is 3.9m, Simultaneously ventilated condition and cooling conditions was well in installation position, the environment temperature is about 25 ℃ at that time. All of those complied with the operation requirement provided by the pump manufacturer.

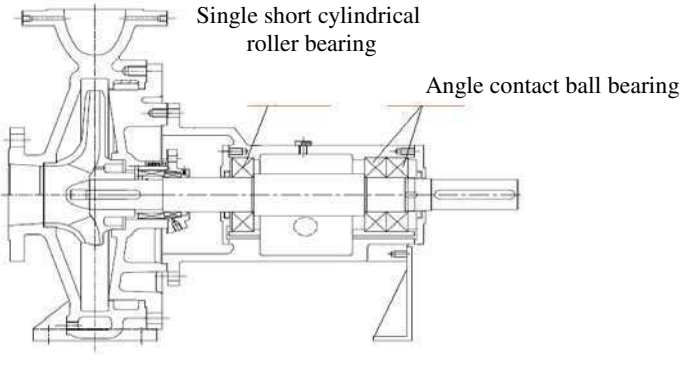

Fig. 1. The original compound mode for bearing

4 The Problem Arose in Process of Pump Running

Pump performance accorded with design requirements of the pump in operational process, and meet the water treatment process requirements. But bearings worked in higher operation temperature when bearings' temperature achieved stable state after pump ran about 70 minutes.

The surface temperature on suspension body is nearly 70 ℃, which the bearing was installed in. Obviously bearings operation temperature was sure to be higeer than the temperature. Bearing temperature may be more than 85°C if pump worked under the operation temperature nearly 40℃ in summer. In the pump running requirements, the highest operation temperature of bearing should be not more than 85°C during running process to ensure the safety and reliability of the pump running. It should run generally in about 60°C. Otherwise, it will influence the reliability of supporting

pump shaft and the normal operation of the pump. So effective measure should be taken to reduce the operation temperature of bearings.

5 Cause Analysis of the Problems

Contraposed the phenomenon of the higher temperature for bearing, We check carefully all of pump parts and bearing a itself firstly. The results showed that all parts processing and assembly were qualified, while pump installation conditions also accord with installation requirements, and pump selection was rational. So we regarded that the problem have something to do with stress, type of bearings and bearings specifications as well as configuration forms and so on. Finally, bearing stress state and bearing selection were analyzed in detail. Since bearings appeared higher temperature in running, and bearing temperature stopped rising and tended to a constant value when the temperature reaches stable state. As the structure of the pump is follow, body adopted double volute structure which can rise to balance the radial force. The two sealing rings and series of balance pore can balance axial force, which balance ability depends on balance aperture area and sealing clearance area [3].

Axial force and radial force size were difficult to accurate calculation because the flow rules of pump were very complex. So it is impossible to achieve the perfect balance to axial and radial force. While radial force will cause abrasion to the sealing rings and bushings and pump shaft of fatigue damage. For axial force, it may cause change of bearing installed state, pre-tightening degree, bearing clearance and contact angle, those change can cause the friction torque increases, bearing noise and calorific wait becoming serious. According to the above analysis, we thought the axial force existence was the main reason to lead to high operating temperature for bearings.

So we put forward the solutions based on making the axial force of bearings better. And they were validated by experiment. Concrete scheme are described below.

According to internal flow rules in centrifugal pump [4]-[8], we changed the type of bearings, specification and arrangement mode. The back-to-back paired installed two angle contact ball bearing were replaced by one deep groove ball bearings, the single short cylindrical roller bearing was also replaced by one deep groove ball bearings. Compound mode of bearings still used both ends fixed combinations [9]. Simultaneously two shaft housings were added to adjust position of bearings in the original structure. Two shaft housings, bearing end cover and suspension body common inherit residual axial force. The improved structure was shown as figure 2.

1. Experimental Verification

In order to validate the feasibility of the scheme, the experiment was done respectively on January 6, 2009 in a pump manufactory pump test-bed. Ambient temperature is 13 ° when the experiments were done. In order to have comparable with actual working condition the operating condition was consistent with on-site operation conditions. Computer automaticly gathered flow and pressure data through acquisition system, using electric valve to adjust pump operating conditions in experiment, and infrared thermometer was used for experiment temperature. Test temperature is surface temperatures of the corresponding position in suspension body, which the bearings were installed in. The experimental datum was listed in table 1. Temperature change rules for oil pool and bearings installed in corresponding position were shown as table 1.

Table 1. The experimental data obtained from the tests

Running time (min)	Bearing parts temperature (°C)		Oil pool temperature (°C)
	Shaft stretch end	Impeller end	
0	26	25.9	15
10	33.2	26.7	19.4
20	38.2	29.4	23.4
30	41	35.4	26.2
40	43	40.4	27.8
50	44.4	41.6	30.2
60	45.4	42.2	31.4
70	46	43.4	31.8
80	46.4	43.4	32
90	46.4	43.2	32

The improved pump's structures, temperature of bearings and oil pool will achieve stable state after pump running about 70 minutes, and the temperature is kept constant as time continuance. Temperature of bearings installed different position is inconsistency during pump running process and the temperature of bearings near axis stretch is always higher than that near impeller. For original structure, the temperature of bearings near axis stretch is around 6℃ higher than that near impeller, while for new structure, the temperature of bearings near axis stretch is around 2℃ higher than that near impeller.

2. The Temperature of Bearings and Oil Pool Were Obviously Decreased After Changing Bearings

Bearings' temperature drops from 55.4 ℃ to 46 9.4 ℃ near axial stretch, and it drops from 50.4℃to 43.4℃ near impeller. The change is same in oil pool, it drops from 44.5℃ to 31.8℃.

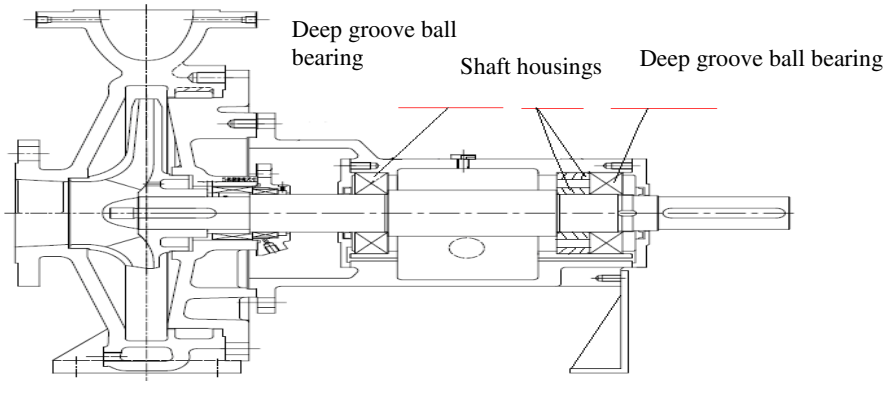

Fig. 2. Improved structure

6 Conclusion

We can draw some conclusions as follows.

1. Temperature of bearings and oil pool will achieve stable state after certain time, and the temperature is kept constant as time continuance, for centrifugal pump it is about one hour. Temperature of bearings installed different position is inconsistency during pump running process. For suspended frame structure of pump, temperature of bearings near axial stretch is always higher than that near impeller.

2. Bearings compound mode has some influence on bearing operating temperature in centrifugal pump. Rationally adjusting the compound mode can effectively reduce the bearing operating temperature.

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Combined Optimal Method of Drawing Reservoir Optimal Operation Figure

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Abstract. The optimal scheduling figure is an important means to realize the maximal comprehensive benefit of the reservoir. Based on the ideas of reservoir normal operation graph, the paper puts forward to combined optimal method of drawing optimal scheduling figure, the method presets lines and outputs first, and then ascertains scheduling line number, location and the outputs of each dispatch areas by progressive optimization algorithm (POA) using historical data. Case study shows the method has good optimization performance, and strong maneuverability and practicability.

Keywords: optimal scheduling figure, reservoir operation, combined optimal method.

1 Introduction

The reservoir optimization scheduling is the important means to realize the fully, reasonable and efficient utilization of water resources. As the shortage of water resources, water environmental degradation and flood threat of water problem is becoming more and more serious, how to maximize the benefits of water conservancy projects of comprehensive utilization, make full use of water resources become one of the important content of the reservoir operation management.

Reservoir operation chart can not only improve the reliability of reservoir management and efficiency of water resources, and play better reservoir comprehensive utilization efficiency [1]. The main method of researching the reservoir operation chart optimization is mainly based on genetic algorithm and their combination method, such as Chen L, etc [2,3], Oliveira R, etc [4], Chang F J, etc [5,6], YIN ZhengJie etc [7], Kim, etc [8], ShaoLin etc [9]; The artificial neural network optimization simulation research, such as Ilich N etc [10]; Based on dynamic programming optimization study of the diagram, such as ZhangMing etc [11]. These studies mainly optimize the scheduling line position, not for scheduling line number and scheduling area output.

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2 Composition and Analysis of Reservoirs Operation Chart

Composition of Reservoir Operation Chart. The reservoir operation chart is the comprehensive embodiment of scheduling rules, it drew up base on the data of history, the abscissa denotes time, y-coordinate denotes reservoir water level. Generally speaking, the dispatching lines and scheduling areas included in reservoir operation chart are: (1) basic scheduling lines and assuring output area. Basic scheduling lines has two lines, upper basic scheduling line (also called defending damage line) and the lower basic scheduling line (also called limit output line), the area between the two basic scheduling line is called guarantee output area. These reflect the guarantee operation mode and corresponding operation rules of hydropower station on design runoff conditions.(2) Increase output dispatch lines and increase output dispatch areas, these above the upper basic scheduling line. (3) Decrease output dispatch lines and lower output dispatch areas. these under the lower basic scheduling line. (4) Flood prevention dispatching lines and adjustable areas. This is the reservoir scheduling rules when flood occur. In actual application, the decision-maker makes decision (such as output, etc.) according to the current reservoir water level or water demand.

Analysis of Reservoirs Operation Chart. The information using of routine operation figure is not sufficiently. On the one hand, when using the routine operation figure, it considers only the current water level of the reservoir information, without taking into account the facing time inflow information. On the other, when making the routine operation chart, only the runoff of design low flow year and the several years which are similar to the design assurance rate are used, while the representative's runoff data of a long series are not utilized, so it can not fully reflect the role of the reservoir.

3 The Thinking of Combination Optimization Method

Refer to the routine operation chart, this paper got-up the optimize operation figure which decision by the available quantity of water at the beginning of each time span, it is to say, the y-coordinate of the optimize operation figure is available water. In the diagram, the number of scheduling line, the line position and the scheduling area output are finally determined by progressive optimization algorithm after calculated by a long series of runoff data. the method can realize the maximization of objective function and satisfy the requirements of comprehensive utilization.

The composition of the optimization scheduling figure is just like the routine operation chart, so the important work is to determinate the number and the position of scheduling line and the output of scheduling area.

4 The Steps of Combined Optimization Method

Default Scheduling Line Number and Scheduling Area Output. So we suppose the optimization scheduling figure has four scheduling lines and three areas at first.

Determine the Schedule Line Position. For every combination of scheduling line number and the scheduling area output, through long series simulation, statistical calculation result, record the scheme when the comprehensive utilization of

calculation results meets requirements, the most optimal location can be determined through changing each line point of each period by the progressive optimization algorithm (POA).

Determine the Optimal Output. Except of the guaranteed output area, the output of other areas can optimize. To a given scheduling line number, according to the settled step length (such as 0.1 times of guaranteed output) reduce or increase output change between expected output value and zero, after each change of output values, calculate mentioned above repeatedly, until finding the most optimal output of every scheduling areas.

Determine the Quantity of Line. From the above method, the optimal scheduling figure can draw out after given the number of the lines, so we can increase the line number one by one and optimize applying the above methods, write down the optimal scheduling line number, situation and the optimal output value which maximized the objective function and satisfied the design reliability requirements, then the optimal scheduling line number is determined.

5 Application of the Optimal Scheduling Figure

Outline of the Examples Reservoir. A multi-annual regulating reservoir, guaranteed output is 105MW, output coefficient is 8.5, dead water level is 242m, flood control water level is 284m, normal water level is 285m, the initial water level we selected is 263.5 m, which is the average data of dead level and the normal level, head loss is 0.5 m, the comprehensive utilization controlled by minimum discharged flow.

Draw the Optimization Scheduling Figure. According to the period of ten days inflow data between 1953 to 2006, through optimal calculation, and finally obtain optimal scheduling line number is six, optimal scheduling area and output top-to-bottom respectively is: expected output area, 3.0 times increase output area, 1.5 times increase output area, ensure output area and 0.1 times lower output area. The optimization scheduling figure is shown in figure 1.

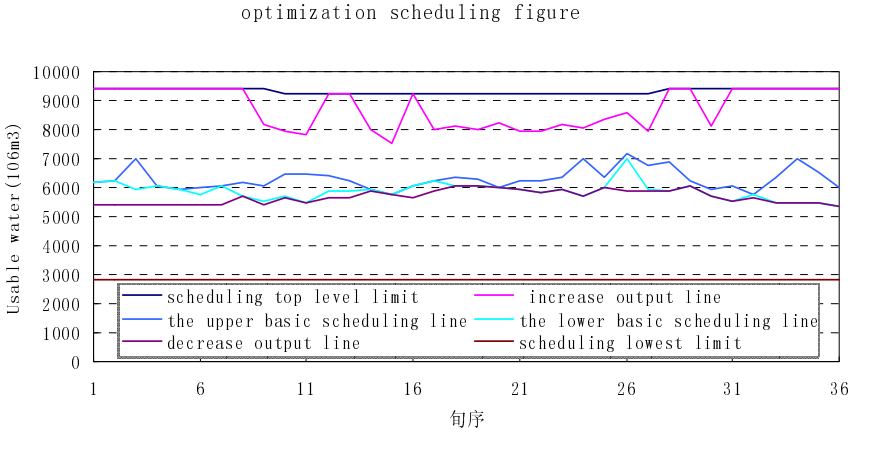

Fig. 1. Optimal scheduling figure of a reservoir

Apply of the optimization scheduling figure. Take the actual water level in early 2007 of 277.27m as initial water level, the paper calculates continually from 2007 to 2010 by the optimization scheduling figure. At the same time, calculates by dynamic programming - discrete differential dynamic planning (DP - DDDP method) under the same conditions, and calculates by the method of routine operation chart too. Table 1 shows the results of each method.

Table 1. The results of each scheduling method by the data of 2007-2010

Project	optimal scheduling figure	Deterministic optimized scheduling	routine scheduling figure
annual inflow discharge[m^3/s]	130.39	130.39	130.39
annual power discharge[m^3/s]	135.65	135.67	125.07
annual abandon discharge[m^3/s]	0	0	1.08
annual final level[m]	272.64	272.64	280.84
annual output[10^3kW]	148.8	152.6	139.8
annual capacity[10^9kWh]	1.31	1.34	1.23
ten-day power assurance[%]	97.22	100	100

The average annual generation of optimization scheduling figure is 1.31 billion kWh, the deterministic optimization scheduling is 1.34 billion kWh, the routine operation chart is 1.23 billion kWh. The results of optimization scheduling figure reach the 97.76% of the deterministic optimization scheduling, beyond 6.5% of the routine operation chart, thus do not consider the end water level. Abandoned water of routine operation chart is 1.08 m^3/s each year, but none of the optimization scheduling figure. the ten-day power reliability of optimal scheduling figure reached 97.22%, it is satisfied the hydropower design reliability. Therefore, the result of optimized scheduling figure is satisfied, it can be applied to optimize scheduling, instruct the actual operation of the reservoir.

6 Conclusion

This paper establish a method of drawing reservoir operation figure, it is fully uses the long series of runoff data and the characteristics of reservoir and hydropower station, optimizes scheduling line number and scheduling area. the optimization scheduling figure can be used directly to guide the dispatching operation of the reservoir, the optimal scheduling figure can be amended by the same methods when the data are increased. Example shows that the optimal scheduling figure is simple, convenient and efficient; it can be widely used in the reservoir with different adjustment ability.

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The Performance of SAF with Novel Media on Oestrogen Removal

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Abstract. Submerged aerated filters (SAFs) are an attractive technology in wastewater treatment with low capital costs and small footprint, but little was known on the refractory organic removal in this reactor. upflow SAFs filled with wool fleece media and Kaldnes was operated in the lab under well-controlled conditions. Experiments using E1, E2 and EE2 were employed to study the removal behaviour of SAFs. Oestrogen removal showed higher removal efficiency in the SAF with wool than that with Kaldnes. This was thought to be due to the fact that the adsorption characteristics of wool could lead to a better adsorption of hydrophobic pollutants in well mixed reactors, thus more microorganisms could accumulate for better removal behaviour.

Keywords: submerged aerated filter, oestrogen, wastewater treatment, media.

1 Introduction

Submerged aerated filters (SAFs) are potential bioreactors which have small footprints and flexible operation options to achieve either high organic removals or for use as tertiary treatment [1]. SAFs are more stable and less subject to variances of environmental factors than activated sludge, probably as a result of a larger population diversity, and total biomass. The SAFs can handle the short-term and long-term shock loads and demonstrate tolerance of up to triple ORL. The SAFs could also withstand less than 30% temporary increases of feed flow [2]. Literature also indicated that SAFs could successfully treat recalcitrant wastewaters such as from textile manufacture but also low biodegradable natural organic matter [3,4]. The high solids retention time for slow growing biomass and the high biomass concentration were shown to provide this ability of the SAF with novel media to treat the normal and shock loads will be studied in this project.

The combination of hydrophobic and hydrophilic adsorption sites on wool fibre pores and woven structure makes it a potential filter medium to remove dissolved residual organic materials with high molecular weight from wastewaters [5]. These adsorption characteristics of wool would lead to a longer retention time of pollutants inside reactors, thus giving more opportunity for slow growing microorganisms to

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give better removal behaviour. Current technology (ozone membranes and activated carbon) for refractory organics (hydrocarbon fuels, pesticides, dyes and pharmaceuticals) removal at low concentrations from effluents are energy intensive or generate undesirable sidestreams [6]. Therefore, the SAF packed with wool may be a good alternative technology. In order to evaluate the application of wool fleece SAFs, the ability to remove oestrogens are also important issues that were studied.

The last two decades endocrine disrupting chemicals (EDCs) have attracted growing scientific and public concerns over the potential adverse effects on the endocrine system in wildlife and humans. Some literature have reported the oestrogenic potential of surface water system [7,8]. Especially oestrone (E1), 17β-oestradiol (E2) and 17α-ethinyl oestradiol (EE2) appear in many sewage treatment effluents and can cause oestrogenic effects in fish even at low concentration (e.g. less than 1 ng/L 17α-ethinyl oestradiol) [7]. Oestrone (E1) and 17β-oestradiol (E2) are natural oestrogens. 17α-ethinyl oestradiol (EE2) is synthetic oestrogen, which is a component of contraceptive pills. The removal methods of oestrogens include biodegradation, Bioadsorption, superoxidation, etc. However, the cost- and energy-effective way is biodegradation. Some research found that E2 is rapidly (in less than 10 hrs) bio-transformed to E1 but which then biodegrades according to a first order equation at between 50-80% removal in 24 hrs depending on temperature and culture activity. The degradation of the synthetic oestrogen EE2 was poor in all the work with the maximum recorded as 20% removal in 24 hrs with well controlled conditions [9-12]. Both hydraulic (HRT) and solid retention time (SRT) during biological treatment process has been shown to be a major factor in reducing steroid concentrations in treated wastewaters by increasing the available time for biodegradation to occur [12,13,14]. SAFs with wool media would have the ability of the high solids retention time for slow growing biomass and the high biomass concentrations to treat the oestrognes. The performance of SAFs on oestrogen removal was discussed in this paper.

2 Materials and Methods

The construction and operation of lab-scale SAFs was presented in [15]. The filters are fabricated out of 140 mm (internal diameter) polypropylene columns. The total height of reactor is 610 mm and the empty bed liquid volume of the filter is 6.93 L. One SAF was packed with wool fleece in the 380 mm section above the grid, the other one was packed with Kaldnes. Air was supplied 75 mm above the base of the filter. The height of the filter area is 380 mm, which mean that 70% volume of the filter was packed with media.

The SAF influent was stored in one large tank (500 L) and pumped to the filters by two peristaltic pumps (Watson-Marlow Limited 505Du). After filtration, the effluent was collected in two tanks for composite sampling and then discharged to the sewer.

For routine analysis of temperature, pH, turbidity, SS, NH_4-N and TOC, these parameters were measured three days a week and all immediately analyzed after collecting (within 4 hrs). Samples for oestrogen analysis were collected once every week. Those for oestrogen analysis were then subjected to pre-treatment immediately and preserved under 4 ºC in the dark.

Due to the low concentrations of E1, E2 and EE2, a complex sample pretreatment protocol was employed to remove suspended solids and then concentrate the oestrogens by solid phase extraction (SPE). The use of ELISA kit for oestrogen analysis was based on the test protocol provided by the supplier (Japan EnviroChemicals, Ltd., 2003). The results were analyzed with a microplate reader (Thermo Electron Corporation) set at the wavelength of 450 nm.

3 Results and Discussions

The ELISA method has been effectively used to measure the oestrogen levels in a previous study [16]. In order to find out the reliability of oestrogens analysis in the synthetic sewage and the removal performance of the SAFs, analysis was carried out on three-replicate synthetic sewage samples.

In terms of the molecular weight of the oestrogens, they are all between 270-300 Daltons, (E1: 270.36, E2: 272.37, EE2: 296.39) with varying degrees of solubility so when oestrogens in the synthetic sewage flow through the SAFs, they may cross the liquid film boundary to the biofilm and approach the surface of biofilm. The attached oestrogens are then biodegraded intracellularly by the microorganisms in the film.

The SAFs may be an effective system to biodegrade the oestrogens. The E1, E2 and EE2 removal efficiency in the SAF with Kaldnes reached up to 77.08%, 69.71% and 77.24%, respectively. The E1, E2 and EE2 removal efficiency in the SAF with wool reached up to 83.54%, 88.71% and 93.17%, respectively. The previous study carried out by [16] found the low-HRT pilot trickling filter (0.1 $kgBOD_5/m^3.d$ for 84.31% nitrification) with the secondary settlement only got average 51%, 59% and 44% removal efficiency of E1, E2 and EE2, respectively. The trickling filters in a full scale Midlands STW also only reached an average 56.9%, 66.8% and 46.9% removal efficiency of E1, E2 and EE2, respectively. The high oestrogen removal performance of SAFs was due to long HRT and SRT and the ability to remove ammonia by nitrifying bacteria(99.70% and 94.38% respectively for the SAF with wool and Kaldnes). This has already been suggested by many researchers [8,12,13,17]. The oestrogen removal in the SAF with wool was apparently higher than that in the SAF with Kaldnes. This was however only in accordance with the general organic removal [18]. The reason may be that the hydraulic characteristics of the wool reactor was better [18] and led to a longer retention time of pollutants in reactors, thus more microorganisms would accumulate for better removal behaviour. It is possible therefore that SAFs operated as wastewater treatment at a modest organic load could approach the standard needed to avoid biodiversity effects. It is also interesting that removals of EE2 were so good. Previous work has shown EE2 was the least well removed. The nonpolar nature of the wool may actually be assisting in the retention of the synthetic oestrogen.

4 Conclusion

The ELISA method with more samples pre-treatment quantified the oestrogen removal efficiency of SAFs. Long HRT and SRT made the SAFs had better

performance than trickling filters. The results showed ideal oestrogen removal efficiency in the SAF with wool. This was thought to be due to the long SRT. In addition, the adsorption characteristics of wool could lead to a better adsorption of hydrophobic pollutants in well mixed reactors, thus more microorganisms could accumulate for better removal behaviour.

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Effect of Sulfur Dioxide Sub-chronic Exposure on Cytokine Levels in Lungs and Serum of Rats

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Abstract. Both male and female rats were exposed to SO2 while their controls were exposed to filtered air. Levels of interlukin-6 (IL-6), tumor necrosis factor-α (TNF-α), transforming growth factor- β1 (TGF- β1) in rat lung and serum were measured by the enzyme-linked immunosorbent assay (ELISA) after chronic exposure to SO2. A statistically significant increase in the levels of IL-6 and TNF-α was observed in the lung tissues of both male and female rats. No effects on tested cytokines were observed in rat serum, except for a significant increase in TNF-α level in male rats. There is no significant change in TGF- β1 level in rat lung and serum.

Keywords: sulfur dioxide, interleukin-6, tumor necrosis factor-α, transforming growth factor-β1, rat.

1 Introduction

Sulfur dioxide (SO_2), a ubiquitous air pollutant, influences human health and also the global ecological system of animals and plants [1]. Inhaled SO_2 can easily be hydrated in the respiratory tract to produce sulfurous acid, which subsequently dissociates to form bisulfite and sulfite derivatives (1:3 M/M in neutral fluid)[2]. It is generally regarded that exposures to SO_2 and its corresponding bisulfite/sulfite derivatives are toxic to the respiratory system and may cause allergic reactions [3].

Cytokines are low-molecular-weight protein with biological activity, mainly produced by many kinds of activated immunocytes. According to the function in the defense response, cytokines can be divided into pro- and anti-inflammatory cytokines. During the inflammatory response, organisms not only produced proinflammatory cytokines, but also released endogenous anti-inflammatory cytokines, which play a role in downregulating inflammatory processes [4]. Measurement of cytokines can provide information about the inflammatory status of an individual.

It was reported that inhaling SO_2 at low concentration may cause constriction of trachea and bronchus, wheezing; and at high concentration may induce acute bronchitis and pulmonary edema [5]. Acute lung injury is associated not only with over-inflammatory response, but also with the balance of pro- and anti-inflammatory cytokines[6]. Therefore, to determine the roles of cytokines in the toxic mechanism of SO_2, low-dose and long-term exposure to SO_2 was used to examine the immune response of serum and lungs in the male and females rats to this air pollutant.

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2 Materials and Methods

Animals and Treatment Protocols. Male and female Wistar rats, weighing 180–200g, purchased from Shanxi Academy of Traditional Chinese Medicine, China, were used for the present experiment. The rats were routinely screened for common rat pathogens and housed in rooms determined to be free of common pathogens.

The male and female animals were divided randomly into two equal groups respectively (each group containing 6 same sex rats). Two different sexual groups were exposed to 28.00±3.16 mg/m^3 SO_2 while their respective control groups were exposed to filtered air. They were housed in groups of 6 rats in stainless steel cages under condition of regulated temperature (24±2℃).

SO_2 was administered to the animals of the SO_2 groups in 1m^3 exposure chambers for 4h/day for 30 days. The control groups were exposed to filtered air in the other 1m^3 chamber for the same period of time. The SO_2 was diluted with fresh air at the intake port of the chamber to yield the desired SO_2 concentrations. SO_2 within the chambers was measured every 30 minutes by pararosaniline hydrochloride spectrophotometry in order to monitor the SO_2 concentration[7].

Serum Collection and Lung Tissue Homogenization. All rats were anaesthetised with a lethal overdose of sodium pentobarbital when they were deprived of food for 18 hours after final exposure. Serum was separated by centrifugation, divided in aliquots, quick frozen in liquid nitrogen and stored at -80℃. Then the rats were killed, and lungs were removed, washed and weighted. After PBS (0.1mol/L pH=7.4) were added (6ml/g lung tissue), lung tissues were homogenized in ice-cold water. Tissue homogenates were centrifuged at 15000r/min for 20min at 4℃. Supernatants were immediately divided in aliquots, quick frozen in liquid nitrogen and stored at -80℃ until assay.

Measurement Methods. Levels of IL-6, TNF-α, TGF-β1 were measured by the enzyme-linked immunosorbent assay and used IL-6, TNF-α kits (R&D Co, U.S.A.) and TGF-β1 kits (Biosource Co, U.S.A.). They were determined strictly according to the manufacturer's manua. The plates were read in ELISA reader (BIO-RAD Model 550).Protein was measured by Lowry method [8].

Statistical Analysis. Data were expressed as mean ± standard error, and compared with Student's t-test. A level of $p<0.05$ was accepted as statistically significant.

3 Results

SO_2 and Level of IL-6. Significant increases of IL-6 level were observed in male ($p<0.01$) and female rat lungs ($p<0.05$) treated with SO_2, relative to control rats. However, expose to SO_2 caused a slight and non-significant increase of IL-6 level in serum of both male and female animals compared with control animals (Fig.1).

SO_2 and Level of TNF-α. TNF-α levels in lungs of male and female rats were significantly increased in response to sulfur dioxide exposure, versus control groups ($p<0.05$). But in serum the only significant effect noted was an increase of TNF-α concentration in male rats, relative to control animals. However, for female rats the increase was not significant (Fig.2).

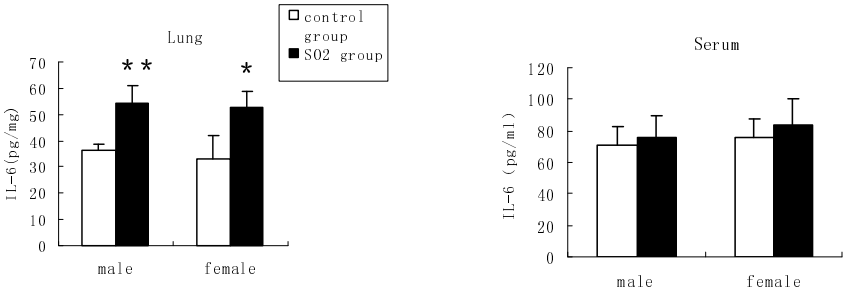

Fig. 1. Effects of SO_2 exposure on IL-6 levels in lungs and serum of rats. Significantly different from control groups, *p < 0.05, ** p < 0.01

SO_2 and Level of TGF-β1. In lungs from male rats, expose to SO_2 induced a slight and non-significant increase in TGF-β1 release. Nevertheless, in lungs from female rats and serum from both sexual rats expose to SO_2 yielded decrease of TGF-β1 levels, but these failed to achieve statistical significance (Fig.3).

4 Discussion

It was reported that exposed to SO_2 for long time downregulated gene expression of inhibitory factor of nuclear translocation NF-kB in the lungs of rats [9]. NF-kB is a ubiquitous transcription factor for genes that encode proinflammatory cytokines such as IL-1, IL-6 and TNF-a. Activation of NF-kB results in the binding of specific promoter elements and the expression of mRNAs for proinflammatory cytokine genes[10]. In the present experiment, low-dose and long-time exposure to SO_2 caused a statistically significant increase of IL-6 levels in male ($p<0.01$) and female rat lungs ($p<0.05$), relative to control rats. TNF-α levels in lungs of male and female rats were significantly increased in response to sulfur dioxide exposure, versus control groups ($p<0.05$). The results indicated that SO_2 activates immunocytes such as lymphocytes in blood and AMs in the alveolus, which produce abundant IL-6 and TNF-α.

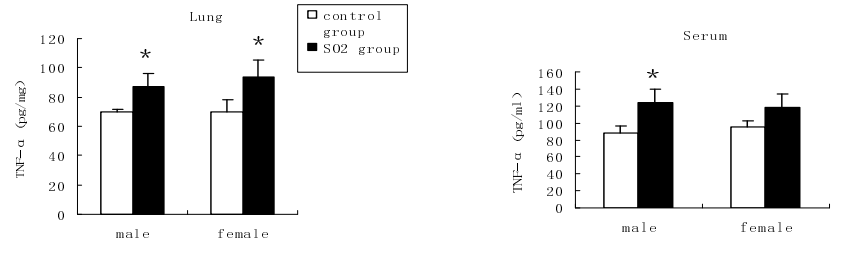

Fig. 2. Effects of SO_2 exposure on TNF-α levels in lungs and serum of rats. Significantly different from control groups, *p < 0.05

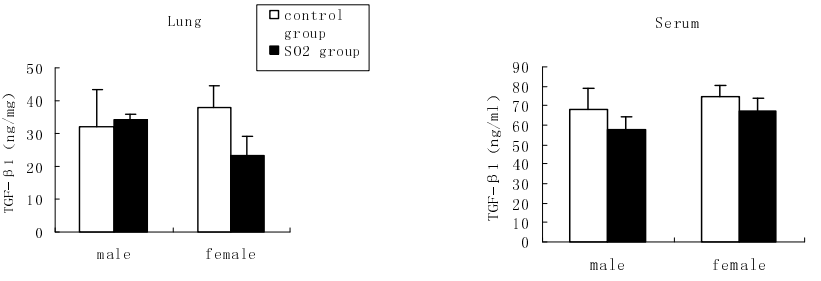

Fig. 3. Effects of SO_2 exposure on TGF-β1 levels in lungs and serum of rats

TGF-β1, formerly known as inhibitory factor of cytokine synthesis, can act as negative regulator of immune response. Cytokines with anti-inflammatory activity can inhibit pro-inflammatory cytokine synthesis [11], affect the function of monocytes and diminish the antigen-presenting capacity. Meanwhile some of them can inhibit the activity of T cells, B cells and proliferation of T cells with antigenic specificity[12]. Exogenous TGF-β1 suppressed TNF-a and IL-6 production by rat alveolar macrophages [13]. The present study showed the level of TGF-β1 in lung from male rats had a slight and non-significant increase in TGF-β1 release, compared with the control group, but in lungs from female rats expose to SO_2 yielded a non-significant decrease of TGF-β1 levels.

These results reported in this paper suggested inflammatory response plays a leading role and anti-inflammatory response is weaker in the rat lungs after low-dose SO_2 exposure for long time. Walley et al [14] have reported that overproduction of proinflammaory cytokines may result in damage of cells in tissue, as well as overproduction of anti-inflammatory cytokines may also result in impairment of immune function. Therefore, lung injury could be regarded as a result of effect of overproduction of inflammatory response and immune function disorder.

However, in serum, the levels of TNF-α and IL-6 were increased in both male and female animals after expose to SO_2, compared with control animals. But only significant effect noted was an increase of TNF-α concentration in male rats. The result suggests that inflammatory status from male rats was more serious than that from female rats. It appears likely that because TNF-α is a primary pro-inflammatory cytokine and IL-6 is a secondary multifunctional pro-inflammatory cytokine, the level of TNF-α was increased firstly after exposure to SO_2. It was reported that TNF-a mRNA expression might be a previous prerequisite for IL-6 gene transcription. TNF-a induces the activity of specific transcriptional factors that activate IL-6 gene transcription[15]. TGF-β1 levels in serum from both sexual rats expose to SO_2 yielded nonsignificant decrease. TGF-β1 may be induced at a later stage in the course of recovery. Further experiments are required to elucidate why the levels of TGF-β1 in serum from both sexual rats and lungs from female rats were decreased.

In summary, this study has shown a marked pro-inflammatory response in lungs of both sexual rats sub-chronic exposed to SO_2, mainly characterized by significant increases in levels of TNF-a and IL-6, and pro-inflammatory response is, at least in part, balanced by a phased anti-inflammatory response. And male rats seem to be

more sensitive to SO_2 than females. It indicates that lung injury is associated not only with increased levels of pro-inflammatory cytokines but also with a significant derangement of the balance between pro-inflammatory and anti-inflammatory cytokines. It also indicated measurement of cytokines in serum or plasma may not provide information about the inflammatory status in lung correctly, and measurement of cytokines in lung tissue may be valuable than that of serum or plasma.

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Development of Ontology-Based Information System Using Formal Concept Analysis and Association Rules

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Abstract. Recent advances in information system development suggest the use of ontology as a main knowledge management tool. Ontology contains concepts, a hierarchy, arbitrary relations between concepts, and possibly other axioms. However, there are some defects between several kinds of existing ontology construction methods in many aspects. After analyzing and comparing, this paper makes up these defects by applying formal concept analysis and association rule theory to construct concept hierarchies of ontology. This paper puts forward formal concept analysis and association rules applied in ontology learning based on non-structured of source data. The experimental results have shown our suggested ontology-based information system will increase precision and performance.

Keywords: Information system, Formal concept analysis, Domain ontology, Association rules.

1 Introduction

Experiences in developing information systems have shown it to be a long and expensive process. Recent advances in information system development suggest the use of ontologies as a main knowledge management tool. Ontologies are formal, explicit specifications of shared conceptualizations of a given domain of discourse. But this field is still being discussed today. For example, the integration of an e-commerce application with an ERP system for a newly created sales order would most definitely be a process integration activity[1]. An ontology is a hierarchically structured set of concepts describing a specific domain of knowledge, that can be used to create a knowledge base. Ontology contains concepts, a subsumption hierarchy, arbitrary relations between concepts, and possibly other axioms. A growing number of Web services are implemented and made available internally in an enterprise or externally for other users to invoke. These Web services can be reused and composed in order to realize larger and more complex business processes.

Ontology-based information systems can retrieve pages that refer to precise semantics, not just keywords, and can greatly increase the rationality of query responses. The current methods use conjunction of the least upper bound of a concept as the upper approximation of the concept, and use disjunction of the greatest lower bound as the lower approximation. As a branch of applied mathematics, formal

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concept analysis comes of the understanding of concept in philosophical domain. The user then has to spend more time waiting for query responses. A more refined range is used for the function that represents the meaning of a proposition. That is why ontology is becoming increasingly recognized as a crucial element of scalable multi-agent system technology. Recently, there are plenty of literatures. Ontology is an agreement about a shared conceptualization, which includes frameworks for modeling domain knowledge and agreements about the representation of particular domain theories.

Finally, Ontology served as standardized, community-accepted descriptions of the information content. There existed previous attempts to apply ontology in the field of image processing. The ontological model, along with the coordination model and user interface model form a collaborative system. Ontologies present semantics for interpreting data instances. These standards concern recommended practices and guidelines for software components, tools, technologies and design methodologies that facilitate the development, deployment, maintenance and interoperation of computer implementations of educational components and systems. We also perform a survey of ontology mapping and evaluate commonly used tools that use various techniques to map ontologies. FCA models the real world as objects and attributes. FCA will define concepts in their given content and study the inter-concept relationship regarding the structure of the lattice that corresponds to the content. The ontology and FCA-based method described in this paper can help retrieve and save the complex relations, support the reasoning, integrate heterogeneous data resources and offer users more accurate, proper and comprehensive data.

2 Formal Concept Analysis and Association Rules Model

Data mining is a young multidisciplinary field, drawing work from areas including database technology, machine learning, statistics, pattern recognition, neural networks, artificial intelligence, and data visualization etc. In order to make collaborative systems communicate with each other, it is required to build a common terminology. A precisely defined common terminology enables applications to communicate with each other. Ontology is a conceptualization of a domain into a human understandable, machine-readable format consisting of entities, attributes, relationships, and axioms.

2.1 Formal Concept Analysis Model

As a branch of applied mathematics, FCA (formal concept analysis) comes of the understanding of concept in philosophical domain. It is to describe the concept in formalization of symbol from extent and intent, and then realize the semantic information which can be understood by computer. It is to extract all connotative concepts and connections between them from formal context according to the binary relationship so as to form a hierarchical structure of concept[2]. This paper puts forward formal concept analysis method applied in ontology learning based on non-structured of source data. In particular, for $x \in X$ and $m \in M$, denote xIm to express that an object x is in a relation I with an attribute m. A context is a triple (X,M,I),

where X and M are two finite sets called objects and attributes, respectively, and I is a binary relation between X and M. we define Eq. 1.

$$\forall A_1 \subseteq A : f(A_1) = \{ y \in B \mid \forall x \in A_1, xRy \}$$
$$\forall B_1 \subseteq B : g(B_1) = \{ x \in A \mid \forall y \in B_1, xRy \} \quad (1)$$

Eq. 1 express that the set of attributes common to the objects in A and the set of objects which have all attributes in B, respectively. According to the goal of ontology, the pivotal problem of ontology constructing is to find the concepts and relationship among concepts after confirming the field, but these are connotative in the brain or store the file of this field in actual life.

FCA starts with a context K = (G; M; I), where G is a set whose elements are called objects, M is a set whose elements are called attributes, and I is a binary relation between G and M [(g; m) $\in I$ is read "object g has attribute m"]. Concept lattices have been regarded as perfect abstraction of knowledge system. There are two significant aspects. As a branch of applied mathematics, FCA (formal concept analysis) comes of the understanding of concept in philosophical domain.

After analyzing and comparing, this paper makes up these defects by applying formal concept analysis theory to construct concept hierarchies of ontology, and expresses the relevancy of concepts and documents in combination with probabilistic model for ontology presentation[3]. Let (U,A,R) be a formal context, then for $\forall x \in U$ and $\forall y \in A$. If $X \subseteq Y$, we would make no classification error when we partition X into Y as Eq. 2.

$$\bigvee_{i \in I} (X_i, g(X_i)) = (g(f(\bigcup_{i \in I} X_i)), \bigcap_{i \in I} g(X_i)) \quad (2)$$

The intent provides the attributes of context while extent covers the objects that are included in the concept. Below a basic definition of a formal concept analysis shall be carried out and the concepts shall be emphasized.

The process of concept lattice generated from a formal context is a process of concept clustering. In this paper, clustering concept by FCA mainly includes constructing formal context and generating relevant concept lattice. It will lead to the disunity of ontology construction because different domain experts adopt different views. Concept lattice constructing is a crucial problem in the theory of FCA (Formal Concept Analysis). The traditional algorithms usually build a lattice directly in terms of a context while they cannot use existing lattice to generate a new one.

In a given context, let us assume that the concept lattice is modeled together with a C=<V, E> undirected graph. Here, V represents the nodes and E represents the edges. Each concept thus forms a pair of mutually fitting sets (A,B), where A in this instance represents the set of objects, whilst B represents the set of attributes, corresponding to the former's set of objects. In the next step, we attempt to reduce the superfluous values of the condition attributes in whole decision rules.

Step 1: Based on the initialization, construct initial formal context in which the set of classes C as objects, the set of properties A as characteristics; The initial formal context is K=(G, M, I), where $G = C$, $M = A$ and $I = C$xA.

Step 2: K := (G, M, W, I) and I $\subseteq$ $G \times M \times W$. This component uses various clustering methods (such as document clustering and author clustering) to mine the citation database.

Step3: $I = \bigcup \{A \times B \mid (A,B) \in \beta(G,M,I)\}$. Add the sets of [empty set], {1, 2, ..., n} onto the V (C) set.

Concept lattice visualization provides an intuitionist method for analyzing and observing the internal relation of knowledge components. But the automatic layout of the concept lattice is quite difficult. Concept lattice constructing is a crucial problem in the theory of FCA (Formal Concept Analysis). Figure. 1 describes the drawing of concept lattice.

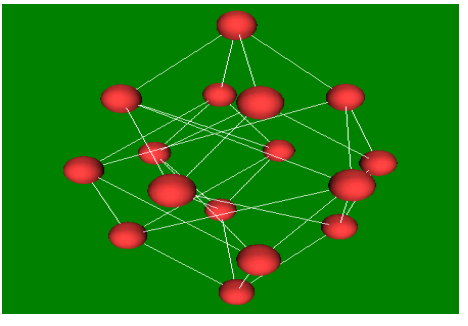

Fig. 1. Concept lattice drawing

2.2 Association Rules Model

Association rule is one of the important research areas in data mining. Its goal is to discover previously unknown, interesting relationships among attributes from large databases. To sovle the different importance and unbalance of individual items in database, the paper will put the emphasis on mining the weighted association rules. Association rule mining is to find out association rules that satisfy the predefined minimum support and confidence from a given database: The C-positive region of D is the set of all object from the universe U which can be classified with certainty to classes of U/D employing attributes from C, i.e., POSC(D)=$\bigcup_x$xU/DC-(X) where C−(X) denotes the lower approximation of the set X with respect to C[4]. This paper proposes a famous Apriori Algorithm for mining frequent itemsets for Booleam association rules and an improved FP-growth Algorithm for mining frequent itemsets without candidate generation. Though test the algorithm can mine informations which better show decision-maker's practical demands. Association rules are usually required to satisfy a user-specified minimum support and a user-specified minimum confidence at the same time. Association rule generation is usually split up into two separate steps.

(1) C_1=Generate_C_1(D);
(2) L=∅;

(3) for(i=1;i≤Size;i++)
(4) L_2={c∈ C_2|*WSup*(c)≥*wminsup*};
(5) for each transaction in D do
(6) (SC,C_1)=Counting(D,W); k=1;
(7) while(|C_k|≥k)
(8) k++;
(9) Rules(*wminconf*,L).

The famous algorithm--- MINWAL(O) Alogrithm is thoroughly studied. Some problems in this algorithm and others are pointed out. Many efficient algorithms have been proposed in the literature.

3 Development of Ontology Information System Based on FCA and Association Rules

These days, the study of ontology in the Semantic Web suggests the setting up of ontology that will represent Web data during the preliminary stages of constructing the website. Recently, ontology and agent technology have been widely applied to various domains. By this way we can simplify the manual workload of ontology building. But the technology can't search concepts and the relation among all connotative concepts in the field, moreover, it can't present the concepts and conceptual model with definite formalized way. The Web Ontology Language for Services (OWL-S) is imported to express the process ontology and process control ontology. In virtue of the Web services semantic markup, development the agents to support the automatic reasoning and fulfilling the composition of Web Services and inter-operation is possible.

According to the goal of ontology, the pivotal problem of ontology constructing is to find the concepts and relationship among concepts after confirming the field, but these are connotative in the brain or store the file of this field in actual life. According to above-mentioned theory, ontology-based information system based on FCA and association rules is designed and developed. Figure. 2 describes the drawing of ontology based on FCA and association rules.

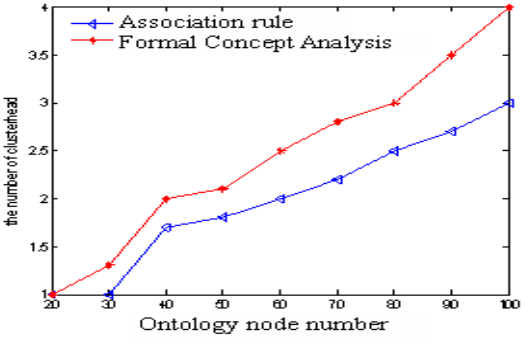

Fig. 2. Numbers of ontology nodes based on compared FCA with association rule

4 Summary

The paper probes into ontology information system based on formal concept analysis and association in order to constructing the ontology model in the Semantic Web. This paper puts forward formal concept analysis method applied in ontology learning based on non-structured of source data. FCA and association model is proposed based on integrating of ontology model and formal concept analysis, and the experimental results have shown our suggested information system will increase precision and performance.

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Research of Fault Diagnosis on Numerically-Controlled System

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Abstract. Based on the cause of fault while the numerical control machine produces, the principle and traditional methods of fault diagnosis were expounded about the numerical control machine. Using sensors and Intelligent CNC system, a new method was advanced, the method can well test the fault of numerical control machine, and the foundation was established to develop further the fault Diagnosis method.

Keywords: Numerical Control System, Fault Diagnosis, Maintenance, Sensors, Intelligent Control.

1 Introduction

The Numerically-controlled machine is the integration equipment that the collection machine, electricity and liquid, at present, it was used more and more extensive at machinery manufacturing industry, so the requirement of stability and accuracy is higher and higher to it. Its common accuracy requirement is the work precision, the geometry precision and the position precision. The geometry precision include the straightness, the vertical degree, the flatness, the pitch degrees, the twisting and the parallel degree etc. the position precision include the positioning accuracy, the repositioning precision and the trace displacement accuracy etc.

In the Numerically-controlled machine use, it will present some fault sometimes. These breakdowns are mainly the microelectronics system hardware and software malfunction. So needs to carry on rapid diagnosis, to clear the malfunction. At present, the emphasis of the fault diagnosis is these join spot that the Microelectronics systems combined with the mechanical, the hydraulic, the pneumatic and the optics etc. new the diagnosis system is the combine of hardware and software, and the content constantly update, the method constantly improve. From the fault detection to troubleshooting, the digital control devices, the programmable device, the microelectronics hardware and software of drive system, these parts is that the difficult is the most biggest, that the workload is the most more, and that the interdisciplinary subject intersected is the most extensive. In addition, because the various kinds and complicated structure of computerized numerical control(CNC) system, these will bring many difficulties to the test and monitoring.

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2 The Principle of Fault Diagnosis

The CNC system fault refers to that the CNC system lost provisions function. From the manifestation, the nature and the cause, the fault may divide into many kinds of types. But no matter to which kind of fault type, when carries on the diagnosis, the diagnosis must follow the following principle [1-4].

2.1 Full Investigation Fault Phenomena

The investigation includes two aspects. The first is the investigation of operator, to detailed inquiry the fault entire process, those phenomenons produced and those measures taken etc. In the investigation process, the candid cooperation of operator is extremely important. The second is the meticulous investigation on site, all trace of site should be checked carefully, for example the outward appearance of system, the display content of cathode ray tubes, the warning demonstrated and burn of each printed circuit board etc. On the other hand, when the system were electrified, and not have the danger, the inspector can electrify for the system, and press down the system reset key, and to observe the system whether there is exceptionally, the warning whether to vanish, if the warning can disappear, the fault is random happened more, even operating errors caused.

2.2 Earnest Analysis the Cause of the Trouble

When the CNC system take place the fault, although the identical phenomenon and warning number, it may have many the kinds of causes, even some fault source was the machine, but the phenomenon was reflected in the system. As the above reason, when the inspector search the cause of fault, whether the CNC system, the integrated electrical, the mechanical and the hydraulic, so long as it possibly cause this fault, the inspector must list. Then the inspector makes comprehensive judgments, optimization and choice, through essential experiment, to make sure the likely cause of failure.

3 The Traditional Fault Diagnosis Method

The Intuitionistic Judgment Method. Using the induction organs of inspector, to watch the machine revolution without exception, the method is a kind of primitive method, but often use.

The Alarm Lamp Shows Method. According to the alarm indicator shows the fault, the inspector can roughly judge the position of fault. For example, the servo control board of spindle has four light of alarm indicator, they can form the different combinations, and these different combinations represent the different fault[5].

The paper has met the servo 0010 alarm of spindle. The method of paper is: the first the inspector checks the motor whether overload, and the tools, cutting condition and feed quantity whether meet requirements. Then, the inspector uses the multimeter to measure the fuse whether fusing, if fusing, and to check the speed change whether too frequently in the run, and to check the connection of speed feedback signal and motor. The finally, the inspector finds out the power transistor module damage.

The Replacement PCB Method. If there is the spare PCB, when the fault occurs, the inspector can exchange the new PCB, to judge the fault in the old PCB. If there is not the spare PCB, the inspector can use the machine itself conditions to judge. For example the RE5020 vertical machining center, its system is the AB8400 of American, its Z axis servo plate with X axis is alike, when its X axis servo system has fault, the inspector can use Z axis servo plate to exchange it, and to judge the X axis servo whether damage[6]. But when to exchange, the manipulator must pay attention to the consistency of position of potentiometer, if change memory board, the memory must be initialized, and to reset all sorts of CNC data etc

The Alarm Signal Analysis Method. The CNC equipment have the self-diagnosis function, it can quick collect and deal whit the signal of system fault, then the fault point was judged by the diagnosis program. For example the XH754 horizontal processing center, when the screen shows the 401 alarm, the servo unit has the fault by instruction booklet, then to search servo system, the fault point was found quickly and expediently. So when the fault was diagnosed and analyzed, the first, the inspector should check the alarm number of screen, this may stint greatly the time.

4 The CNC System Development and Intelligent Diagnosis

Along with the computer technology development and application, the development way of CNC system is the intelligent control, the key problem is the intelligent control of processing, and the self planning of processing tasks, and the intellectualization of fault diagnosis. Because of the CNC system variety, complex structure and changeful form, the test and monitoring have many difficulties, so the diagnosis methods can not completely apply the traditional test methods and test methods. Therefore the new instrument must be developed for diagnosis and monitoring and maintenance.

The important characteristic of intelligent CNC system (ICNC) is its independence, it reflects the self-discipline of system on environmental and itself changes, namely to each kind which appears exceptionally, the system can automatic control own condition, to ensure the realization of the system target, when the abnormal failure can not be overcame by the system itself, the system can eliminate adverse effect prevent abnormal expand, and guarantee system safety, and the analysis results were reported to the superior by itself.

The Fig1 shows the principle figure of relationship between the ICNC servo control and the diagnosis maintenance. The sensor collects the information of environment and machine, the relevant information of servo control is directly transferred to the intelligent servo control, the other information is transferred to the fault diagnosis module, and the fault diagnosis module analyze and process the information. The result is informed the maintenance module, and is analyzed and diagnosed. If there are the faults, according to the fault type, to inform the task analysis module, the task analysis module give the instruction to adjust task or terminate servo control, the maintenance module can make self-repairing or give the maintenance instructions.

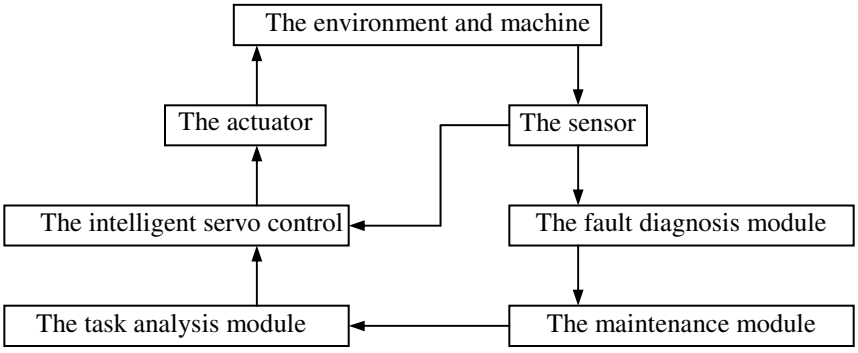

Fig. 1. The principle figure of relationship between the ICNC servo control and the diagnosis maintenance

In the fault diagnosis module, when the CNC machine was not disturbed, the signals generated during the running regard as a standard signals, the standard signals was regarded as the son module, and save in diagnosis module. When the CNC machine run, the sensor will collect the signal of each part, the signal was carried on the fault diagnosis module to analyze and compare with standard signal. If the part of CNC machine makes the fault, the signal of part will produce deviation with the standard signal, the deviation result will be sent to the maintenance module, the maintenance module will judge this result, and then it sends out the corresponding signal and instructions.

Through the above analysis, the paper can conclude that the maintenance module system of ICNC directly participate in the machining control, thus the intelligent link have the real-time speciality.

In the machining, the real-time speciality of intelligent control is the most strongest, it was completed in millisecond, according to the principle which the intelligence increases along with the precision reduces, at this level the simple and quick decision can improve the real-time speciality, and can realize the high precision position control and the signal processing. But the tool-position and feed speed of conventional machine is set. So the method fit the reducing cutting quantity, thereby to ensure the processing quality and the reliability and the security, so it is conservative. Thus using intelligent adaptive control, under the premise of increases the precision, through the change feed speed to control the cutting force, and to achieve the optimal machining efficiency.

5 Conclusion

Along with the development of the information society, the manufacturing industry automaticity is enhancing unceasingly. The market enhances unceasingly to the product processing precision and the quality request, the testing and servicing of equipment were finished in short time. Especially for the complex CNC equipment, the failure detection set a higher request, the paper propose a new fault Diagnosis method, also the foundation was established to develop further the fault Diagnosis method.

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Using Ontology to Build Information Recommendation System in e-Commerce

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Abstract. The aim of ontologies is to formalize domain knowledge in a generic way and provide a common understanding of a domain, which may be used and shared by applications and groups.This study attempts to propose a framework to improve and upgrade the effectiveness of E-C recommendation by ontology building algorithms. As a result, a e-commerce system is built using the existing standards cited above by overcoming their limits and sharing their different advantages. This paper puts forward using ontology to build information recommendation system in e-commerce. The experimental results have shown our suggested information system will increase precision and performance.

Keywords: Information recommendation system, e-commerce, ontology.

1 Introduction

The ontology defines terms that are linked together to form a directed acyclic graph. Gene products are annotated with a number of ontology terms. Annotation with a given term also implies annotation with all ancestors of the term. Ontologies are formal, explicit specifications of shared conceptualizations of a given domain of discourse. But this field is still being discussed today. The Semantic Web is meant to overcome this limitation via a shared conceptualization. Machines are liable to process, convert, and reason data in more useful and meaningful ways[1]. Many applications in modern information technology utilize ontological background knowledge. Knowledge representation is an old field in AI and has provided numerous models from frames and KL-ONE to recent variants of description logics and RDFS and OWL. The information has, in turn, provided the important basis for the organization's decision makers to set up marketing strategy, sales strategy, etc.

The B2B architectures are difficult to conceptualize because they handle several scenarios as a Business Process (BP) and several contents with different formats as product catalogs defined separately by different organisations. Ontologies are the knowledge models that provide a controlled vocabulary and semantics for describing and sharing data in a domain (data models). These two pieces of information are defined separately by each standard in a specific format. The FMA Protégé representation relies heavily on some of the features that are common in frame-based representations but are not so common in OWL (and, in particular, in OWL DL) ontologies. Natural language interfaces are an interesting option to interact with

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mobile devices due to their limited input and output functionality. Educators at all levels represent a growing and increasingly essential community of digital library users. Re-purposing the digital assets of library collections for educational use is a challenge that builders of digital libraries are slowly beginning to recognize and address.

Ontology have proved their usefulness in different applications scenarios, such as intelligent information integration, knowledge-based systems, natural language processing. As a result, a B2B system is built using the existing standards cited above by overcoming their limits and sharing their different advantages. This work aims to define an adaptive infrastructure using ontologies for the electronic commerce, especially in the B2B framework. The user may then have to refine the search multiple times before finding relevant information. Search techniques used for current information retrieval processes are mostly based on word matching algorithms that use syntactic matching schemes and do not apply semantic correspondence for data labels. Many recommendation mechanisms have continuously tried to develop new methods from various theories that can assist their users to seek more relevant and more effective information. As a result, if an enterprise is able to use this concept to deeply explore and analyze the hidden association between information, and through the combination of information sharing and the spreading mechanism, the enterprise can provide better and more suitable recommendations for customers. This study attempts to propose a framework to improve and upgrade the effectiveness of E-C recommendation by ontology algorithms. The project probes into building e-business domain ontology in order to constructing the ontology model of e-commerce recommendation system, and to suffice the needs of theory and application in E-commerce recommendation system.

2 The Information Management System Based on Ontology Model

One of the first attempts to exchange order information within electronic markets were the Electronic Data Interchange (EDI) protocols. In addition, we design a mapping tool that uses WordNet and mutual information between data instances and compare its performance to other techniques. Ontologies have shown to be the right answer to the structuring and modelling problems arising in Knowledge Management. They provide a formal conceptualization of a particular domain that can be shared by a group of people. Ontology is a conceptualization of a domain into a human understandable, machine-readable format consisting of entities, attributes, relationships, and axioms.

Recently, ontologies have gained popularity as the means of achieving syntactic and semantic interoperability of data, the knowledge engineering artefact for computerised knowledge representation and management. Represent only the information that is explicitly present in the frames representation of the FMA or that can be directly inferred from the semantics of Protégé frames[2]. This paper puts forward formal concept analysis method applied in ontology learning based on non-structured of source data. In particular, for $x \in X$ and $m \in M$, denote xIm to express that an object x is in a relation I with an attribute m. Let G be a set of objects and M be a set of fuzzy or crisp attributes. $\forall g_1, g_2 \in G$, one can define τ as follows, we define Eq. 1.

$$R_G \subseteq G \times G : \{(g_1, g_2) \mid g_1, g_2 \in G,\ \text{Weight}(g_1) = \text{Weight}(g_2)\}$$
$$\forall B_1 \subseteq B : g(B_1) = \{x \in A \mid \forall y \in B_1, xRy\} \quad (1)$$

Eq. 1 express that the set of attributes common to the objects in A and the set of objects which have all attributes in B, respectively. On-line learning is a growing business. Thus, the number of organizations working on online learning and the number of courses available on the Internet is growing rapidly.

We report on the accuracy of the matches generated by our approach, as well as other characteristics such as the average number of sample sets generated and the average run times until the EM iterations converge.

This study employs Web Ontology Language (OWL) as the notation for representing content sequencing knowledge. Since current OWL has only a limited ability to represent relationships between individuals, for example in role chaining, the rules are used to complement the inference of OWL ontology. Users can easily search for the most relevant information using the order of the related documents and concepts, so that search efficiency is improved. For any subset $X \subseteq U$, the β lower approximation of X with respect to f is defined as Eq. 2.

$$RM \subseteq M \times M : \{(m1, m2) \mid m1, m2 \in M,\ Weight(m1) = Weight(m2)\}$$
$$\text{Value}(m) = \text{BinToDec}(b_1 b_2 \ldots b_k) \quad (2)$$

The operational model of knowledge integration for enterprise collaboration includes three mapping layers: the enterprise collaboration lifecycle layer, the system operational layer, and the mechanism operational layer.

The construction method of ontology is mainly divided into two kinds at present: One is manual ontology building, in which the problem is: (1) In a complicated field it is time-consuming and strenuous;(2) We adopt different standards and modeling methods while building ontology, so that ontology is not currency;(3) It's of great subjectivity. It will lead to the disunity of ontology construction because different domain experts adopt different views. It is the most important that the methods which we adopt are distinct when searching concepts and relationship between concepts in domain.

In computer and information science, we attribute the ontology to the specification of a conceptualized domain and express it in terms of computer interpretable format, such as the XML. Ontology is used for agent's knowledge sharing and is becoming a crucial element for building a multi-agent system[3]. For a collection of problem space with t distinct collection-wide terms, the similarity coefficient measurement is $SC(P_q, P_t) = (\sum_{j=1}^{t} w_{qj} \times w_{tj})$, where t is the number of distinct terms in problem space collection (i.e. $\vec{V} + \vec{N}$).

The information management system based on ontology building algorithms:

0. Initialization: Initialize parameters L, ρ, σ, α, θ_w, θ_c.

Input vectors: $D_j=(F_{1j}, F_{2j}, \ldots, F_{ij}, \ldots, F_{nj})$, $j=1, 2, \ldots, m$. Output nodes: Y_k, $k=1, 2, \ldots, m$.

Set Y_k does not learn any input pattern.

1. Input the pattern $D_1, D_2, \ldots, D_j, \ldots, D_m$.

2. A *PTBox* PT=(T,P) consists of a classical (description logic) knowledge base T and a finite set of conditional constraints P

3. Selection of winner node: $T_k = \Sigma W_{jk}\ h_{jk} = \Sigma W_{jk}\ h(D_j\ ,\ W_{jk}\ ,\ W_{kj})$ Max $\{T_k\}$ is the winner node.

4. for (all l $\in$L(Fgs)) do

if (SimBetweenNodes (r, l) > Threshold).

5. Learning: Update the bottom-up and top-down weights for winner node T_k

If Y_k has not learned any pattern before: $W_{jk}^{new} = L/(L\text{-}1+n)$, $W_{jk}^{new} = D_j$

If Y_k has learned some patterns before

6. for (all groupNum $\in$list) do

groupInstances = getGroupInstances(groupNum, Ord)

7. Instances Result_list

We used SWRL for this research. SWRL is a combination of the OWL DL and OWL Lite sublanguages of the Web Ontology Language (OWL), with the Unary/Binary Datalog RuleML sublanguages of the Rule Markup Language. Figure.1 denotes ontology figure based on formal concept analysis Sim[((*D*,*E*,*G*),(*r*,*t*)),((*A*,*E*,*G*),(*r*,*s*))]and attribute oriented concept lattice associated with formal context (U↘{5,6},A,R∩(U↘{5,6}×A)).

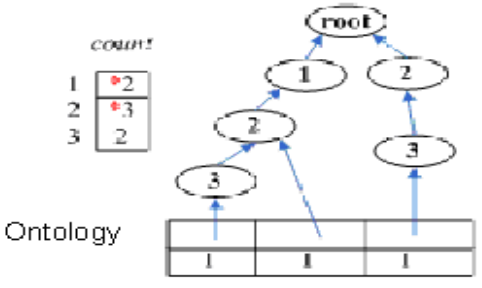

Fig. 1. Information management system based on ontology

OWL Ontology is our new choice primarily for its machine processability, while still being natural enough. Secondarily, OWL Ontology possesses semantic clarity to annotations and can be easily integrated on WWW. The aim of ontology is to obtain, describe and express the knowledge of related domain. Ontology provides common understanding of the domain knowledge and confirms common approbatory vocabulary in the domain, as well as gives specific definition of the relation between these vocabularies from formal model of different levels[4]. Ontologies play a key role in information retrieval from nomadic objects, Internet and heterogeneous data sources. These knowledge assets are indexed in terms of consultancy, innovative products, expert reports, and intellectual properties. Extract significant keywords from the *symptom remark* field with respect to the information in the corresponding *cause* field to refine the values of the *symptom* field. There are many relations among the different forms a creation can take during its life cycle.

3 Using Ontology to Build Information Recommendation System in e-Commerce

The domain ontology adopts two types of inter-conceptual relations, namely the "*association*" and "*instance of*". Protégé is an open-source development environment for ontologies and knowledge-based systems. Protégé OWL Plugin has a user-friendly environment for editing and visualizing OWL classes and properties. But the technology can't search concepts and the relation among all connotative concepts in the field, moreover, it can't present the concepts and conceptual model with definite formalized way.

Ontologies play an important role to realize this vision allowing data to be defined and linked in a way that it enables its use for more effective discovery, integration, re-use across various applications and machine processing. To resolve this problem, contextual information retrieval (CIR) has been brought forward and became one of the focuses of research in IR. Figure. 2 describes the drawing of information system in e-commerce based on ontology. Ontologies were first developed in artificial intelligence (AI) to facilitate knowledge sharing and reuse, and gained popularity in the early 1990s in several field applications, such as knowledge engineering, natural language processing, and knowledge representation.

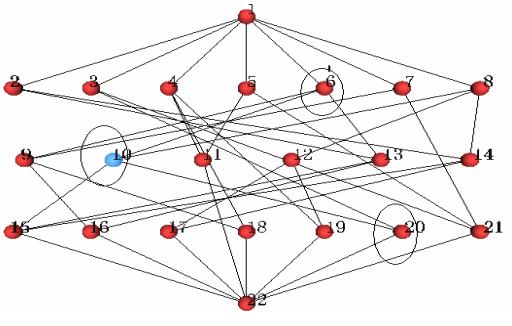

Fig. 2. information recommendation system in e-commerce based on ontology

4 Summary

The paper probes into information recommendation system based on ontology in order to constructing the ontology model of e-commerce system, and to suffice the needs of theory and application in e-commerce recommendation system. This study attempts to propose a framework to improve and upgrade the effectiveness of E-C recommendation by ontology algorithms. The experimental results have shown our suggested information system will increase precision and performance.

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Multi-focus Image Fusion Using M-Band Wavelet Transformation

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Abstract. For the purpose of solving the problems posed by multi-focus image fusion in wavelet domain, we propose the M-bands wavelet transformation based image fusion method. As the M-bands domain is superior to 2-bands domain in two aspects of energy compaction and direction selection. Considering the multi-scale, multi-direction and local correlation attributes in M-bands wavelet domain, a cross-band-window based image fusion approach is brought forward. The experimental results show that the approach is superior to the 2-bands wavelet based method both in visual effect and quantized norms.

Keywords: multi-focus image fusion, M-bands wavelet transformation, cross-band-window, energy compaction, direction selection.

1 Introduction

Since the camera's limitation in depth of field, the single CCD camera is hard or impossible to imaging all the targets clearly in the scene. The multi-focus image fusion provides an effective solution to the issue, which merges redundant and complementary information come from different image sensors by some algorithm and get a synthetic image to more fully and accurately describe the scene[1].

The Typical multi-focus image fusion algorithms include the weighted average method[2], tower decomposition method[3] and wavelet transformation approach[4]. The weighted average method is most simple and easy, but the contrast is poor. The components between layers of tower method have strong correlation, which result in the effect is not so satisfactory. The wavelet transformation inherits the advantages of the tower method and enjoys good frequency-domain localization and directivity ability, so it gets a high performance than that of others and becomes a hot topic in the field of image fusion.

Compare to the 2-bands wavelet, when the M-bands wavelet maintains a certain approximation order can also have good orthogonality and approximate symmetry as well as stronger direction selection feature. As a result, it can overcome defect of 2-bands wavelet to some extent and express excellent performance in image processing field[5]. We proposed to utilize M-bands wavelet transformation to perform image fusion researches and developed a novel fusion strategy, combine with the wavelet transform domain multi-scale and multi-direction and local correlation of images, a multiple subbands window based fusion method. The algorithm is applied to multi-focus image fusion and evaluates the effect from two aspects of subjective and objective, which indicate that the performance is superior to 2-bands wavelet.

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2 M-Bands Wavelet Transformation

M-bands wavelet is the generalization and extension of 2-bands wavelet theory. Let $\varphi(t) \in L^2(R)$ is the scaling function of scale analysis which corresponds to M-1 numbers of wavelet function $\psi^{(i)}(t)$, $i=1,2,\ldots,M-1$, they meet the Equation (1).

$$\begin{aligned} \varphi(t) &= \sqrt{M}\sum_n h(n)\varphi(Mt-n) \\ \psi^{(i)}(t) &= \sqrt{M}\sum_n g^{(i)}(n)\varphi(Mt-n), i=1,2,\cdots,M-1 \end{aligned} \tag{1}$$

$$\begin{aligned} A_j(n) &= \sum_n h(Mn-k)\bullet A_{j-1}(k) \\ D_j^i(n) &= \sum_k g^{(i)}(Mn-k)\bullet A_{j-1}(k), i=1,2,\cdots,M-1 \end{aligned} \tag{2}$$

Where, $h(n)$ and $g^{(i)}(n)$ are low-pass filter and M-1 numbers of high-pass filters respectively.

We can achieve the analysis and integration of signal using the above mentioned filter groups with the joining of Mallat algorithm and a one-dimensional signal.

Analysis formula is shown as Equation (2).

Integration formula:

$$A_{j-1}(n) = \sum_k h(n-Mk)\bullet A_j(k) + \sum_{i,k} g^{(i)}(n-Mk)\bullet D_j^{(i)}(k) \tag{3}$$

$$\begin{cases} \psi^{(0,i)}(x,y) = \varphi(x)\psi^{(i)}(y) \\ \psi^{(i,0)}(x,y) = \psi^{(i)}(x)\varphi(y) \quad i,j = 1,2,\cdots M-1 \\ \psi^{(i,j)}(x,y) = \psi^{(i)}(x)\psi^{(j)}(y) \end{cases} \tag{4}$$

Where, A_{j-1} and A_j are approximation of original signal on scale $j-1$ and j. $D_j^{(i)}$ is the ith high frequency component of signal on scale j. And the analysis-integration system of M-bands wavelet is shown in Figure 1.

In order to achieve the M-bands wavelet transformation, it is generally to extend above one-dimensional M-bands wavelet to two-dimensional style in the way of tensor product and perform cascade treatment horizontally and vertically, continuously. The scaling function in two-dimension and M^2-1 numbers of wavelet functions can be written as follows:

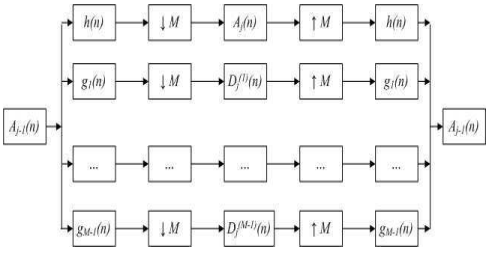
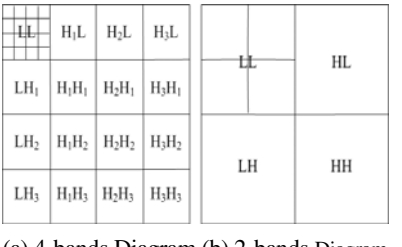


Fig. 1. System Structure of M-bands Wavelet Analysis



(a) 4-bands Diagram (b) 2-bands Diagram

Fig. 2. The Result of Wavelet Decomposition

Scaling function: $\Phi(x,y)=\varphi(x)\,\varphi(y)$

Wavelet function is shown as Equation (4).

Accordingly, a single M-bands wavelet transformation on an image will produce a low-frequency component *LL* and M^2*-1* numbers of high-frequency components *LHi, HiL, HiHj (i,j=1,2…M-1)* and the incoming decomposition only being done on low-frequency component *LL*. Take M=4 as an example, the result is shown in Figure 2.

3 M-Bands Wavelet Based Image Fusion

M-bands wavelet transformation decompose image to a series of frequency channels and then attain the tower multi-resolution representation of the image and impose fusion on certain channels of different decomposed layers according to the specific integration strategy, which integrate information from different sources of image together, effectively.

When determining the image fusion strategy in wavelet domain, two issues have to be considered.

1. The local characteristics of the image are often represented by a number of pixels rather than a single pixel and there is usually certain relevance between pixels. Therefore it is not wise to isolate a single pixel and should use the window features or regional characteristics to conduct the feature extraction in wavelet domain [6].

2. The wavelet coefficients with the same spatial coordinate at different frequency channels actually describe the same spatial location in different directions. They have a strong correlation, so the feature extraction should be done and combine more sub-bands at the same time in wavelet domain [7].

Considering the above two factors, the paper presents a multi sub-bands window feature based fusion strategy, which is used for the feature extraction of M-bands wavelet transform domain and the steps are described as follows:

1. Conduct n-layers of M-bands wavelet transformation to registered original images A and B.

2. Operate the weighted average operator associated fusion on the low-frequency in transformed domain.

$$F_{LL}=\omega_A A_{LL}+\omega_B B_{LL} \tag{5}$$

3. Extract features on high-frequency information of the transformed domain with multi sub-bands window method. In all high-frequency sub-bands of the decomposition level, we first obtain the regional characterization of a pixel based on a specific $N\times N$ window W and then combine the regional characteristics of sub-band on the corresponding position within the same layer to measure the importance of this factor. By comparing the importance of the coefficients in different spatial positions of different images to achieves the coefficient selection in wavelet domain.

$$\begin{bmatrix} F_{LH} \\ F_{HL} \\ F_{HH} \end{bmatrix} = \begin{cases} \begin{bmatrix} A_{LH} \\ A_{HL} \\ A_{HH} \end{bmatrix} & \sum_i W|A_{LH}| + \sum_i W|A_{HL}| + \sum_{i,j} W|A_{HH}| > \\ & \sum_i W|B_{LH}| + \sum_i W|B_{HL}| + \sum_{i,j} W|B_{HH}| \\ \begin{bmatrix} B_{LH} \\ B_{HL} \\ B_{HH} \end{bmatrix} & \text{otherwise } i,j = 1,2,L\ ,M-1 \end{cases} \quad (6)$$

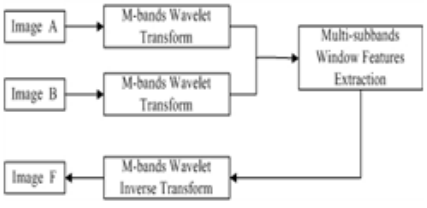


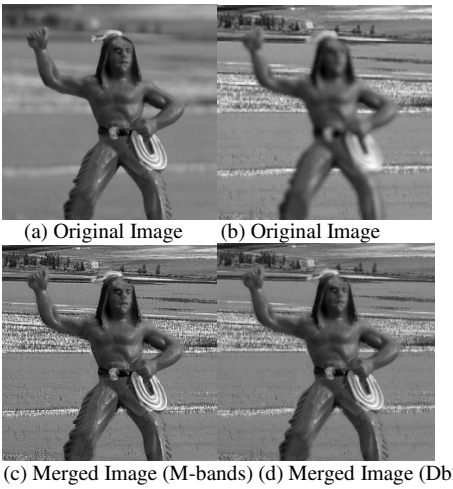
Fig. 3. The M-bands Wavlet based Image Fusion

4.Perform n layers of M-bands inverse wavelet transformation on the multi-resolution image and get the fusion image F. Figure 3 shows the overall framework of the algorithm.

4 Experiment and Realization

We employ the M-bands wavelet transformation based image fusion strategy described in the section 3 to a class of multi-focus image fusion experiments. The source hosts are two registered gray scale images both with the size of 250×250. The first one is with a clear foreground and blurry background in Figure 4(a) and the second one is with a blurry foreground and clear background in Figure 4(b).

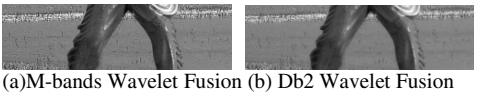
The simulation select a class of orthogonal M-bands wavelet (M=4, filter coefficients are listed in Table 1) which enjoy second-order approximation and approximate symmetry; In addition we also adapt orthogonal wavelet base Db2 that possess second-order approximation but a poor symmetry to compare to M-bands in performance. The multi sub-bands window algorithm is used as the fusion strategy, where the weighted average operator in low frequency field are ω_A=ω_B=0.5 and the fusion window in high frequency field is a 3×3 Gaussian window $W = \begin{bmatrix} 1/16 & 1/8 & 1/16 \\ 1/8 & 1/2 & 1/8 \\ 1/16 & 1/8 & 1/16 \end{bmatrix}$.The above



(a) Original Image (b) Original Image

(c) Merged Image (M-bands) (d) Merged Image (Db2)

Fig. 4. The Image Fusion Experiment



(a)M-bands Wavelet Fusion (b) Db2 Wavelet Fusion

Fig. 5. The Subset Selection based Watermark Detection

two type of mentioned wavelet based fusion images are shown in Figure 4(c) and 4(d) respectively.

We assess the effect of the image fusion from two aspects of subjective visual evaluation and objective quantization. From the point of visual effect, the M-bands based wavelet achieves a smaller distortion. To better illustrate this, partial magnify the two fusion images respectively, as shown in Figure 5(a) and 5(b), which clearly demonstrate that there are a substantial reduction in blur and block effect in 5(a) compare to that of 5(b) and 5(a) can better protect the edge features.

Table 1. The Coefficients of M-bands Filter Groups(M=4)

	h(n)	*g1(n)*	*g2(n)*	*g3(n)*
0	0.125602	0.025916	0.135988	-0.086652
1	0.375299	-0.325358	-0.213768	0.086652
2	0.523839	-0.466531	-0.325232	0.114628
3	0.523839	0.146511	0.620053	-0.394188
4	0.364187	0.670285	-0.189378	0.565525
5	0.113206	0.315525	-0.476652	-0.565525

We choose such information content norm as the entropy, mutual information (MI) and cross entropy (CE) to quantitatively evaluate the fusion result[8]. The rules are: the entropy is bigger, the image contains more abundant information; the cross entropy between fusion image and original one is smaller, the mutual information is bigger, which indicate that the fusion image extracts a great more information content from the original one, the loss of the information content is small and the fusion effect is better. The result of evaluation is shown in Table 2 which shows us that any of norms can be promoted to some degree by employing the M-bands wavelet based method, which represent better fusion performance.

Table 2. The Evaluation of Fusion Performance

	Entropy	*MI*	*CE A*	*CE B*	*Average CE*
M=4 Wavelet	3.718	2.492	0.150	0.162	0.159
Db2	3.625	2.254	0.205	0.179	0.202

5 Conclusions

The paper proposed a M-bands wavelet transformation based image fusion algorithm in the light of the existent problems of multi-focus image fusion in wavelet domain currently. The algorithm employed the multi-scaled and the multi-directional information of the M-bands wavelet domain effectively as well as adapted the multi-subbands window features to produce the fusion rules considering the local correlation of the images. The simulation demonstrated a second order approximated 4 bands wavelet joined multi-focus image fusion experiment, which indicated that the algorithm achieved a better performance in image fusion field than the Db2 of the same order refer to the evaluation from two aspects of visual effect and information content norms.

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Error Detection Technique for Soil Moisture Content Viewer

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Abstract. The error detection of soil moisture content viewer is a hot topic to meteorological departments, this paper introduces a soil moisture content error data detection system to detect the broken devices, support vector machines theory is used to be the classifier to detect the error device from the collected data. The structure of the system is also introduced in this paper. The experiments have shown its feasibility.

Keywords: soil moisture content, SVM, malfunction detection, SMCEDDS.

1 Introduction

In order to solve the soil moisture content automatic detection problem, the GStar-I soil moisture content viewer is developed and established in He Nan province, Shan Xi province and Gan Su province to supervise the change of soil moisture content which has direct influence on the growing development and out of crops.

Though it is a precise way to collected data manually, it spends a lot of human resources in doing it. The work is even harder in the bad weather. The progress of science and technology and the appearance of GStar-I has changed the traditional viewpoint of soil moisture content supervision.

The error detection of soil moisture content viewer is a hot topic to meteorological departments, SMCEDDS is a system, which can solve this problem greatly.

This paper has the following organization. Section 2 briefly reviews the concept of support vector machines. Section 3 introduces the structure of SMCEDDS and classifying theory. Section 4 contains description and discussion of the experiments, and Section 5 is a conclusion.

2 Support Vector Machines

Support Vector Machines (SVM) are learning systems that use a hypothesis space of linear functions in a high dimensional feature space, trained with a learning algorithm from optimization theory[1]. SVM is a classification technique based on statistical

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learning theory. Geometrically, the SVM modeling algorithm finds an optimal hyperplane with the maximal margin to separate two classes[2]. A set of training sample $(x_1, y_1), (x_2, y_2).....(x_n, y_n), x \in R^m, y \in \{+1, -1\}$ separated by the hyper-plane

$$(w \cdot x) + b_0 = 0 \tag{1}$$

If the vector set can be separated by the hyper-plane without error, and the distance between the hyper-plane and their nearest vector is maximized, we can say the vector set can be separated by the optimal separating hyper-plane. In the linear SVMs, it can be described as Figure 1.

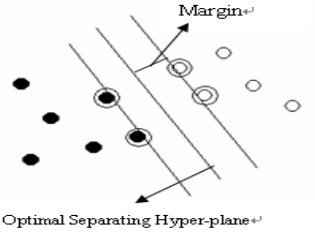

Fig. 1. SVM

The separating hyper-planes can be described as follow:

$$y_i[(w \cdot x_i) + b_0] \geq 1 \quad i = 1, 2, 3...n. \tag{2}$$

Training examples that satisfy the equality are termed support vectors. The support vectors define two hyperplanes, one that goes through the support vectors of one class and one goes through the support vectors of the other class. The distance between the two hyperplanes defines a margin.

The optimal separating hyper-plane can be described as:

$$(w \cdot x_i) + b_0 = 0 \tag{3}$$

The margin of the separation is equal to $1/\| w \|$. Solving the problem to construct the optimal separating hyper-plane as follow:

$$\min \phi(w) = \frac{1}{2}(w \cdot w)$$

subject to

$$y_i[(w \cdot x_i) + b] \geq 1 \quad i = 1, 2, 3...n. \tag{4}$$

One advantage of SVM's is that they are remarkably intolerant of the relative sizes of the number of training examples of the two classes. In most learning algorithms, if there are many more examples of one class than another, the algorithm will tend to correctly classify the class with the larger number of examples, thereby driving down

the error rate. Since SVM's are not directly trying to minimize the error rate, but trying to separate the patterns in high dimensional space, the result is that SVM's are relatively insensitive to the relative numbers of each class[3]. As SVMs are able to handle only binary class classification problems, so it is widely used in error detection problem.

3 System Structure

In this section, we propose error detection model. The new intrusion detection system, named to SMCEDDS (soil moisture content error data detection system), is designed to satisfy all the following requirements: (1) Fast detection of new unknown error data to the system. (2) Cost-effective maintenance due to fast and efficient learning and update. (3) Increment of system.

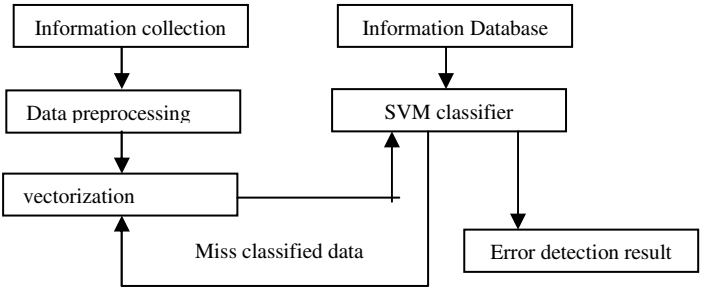

Fig. 2. Soil moisture content error data detection system

As shown in Figure 2, SMCEDDS consist of two main components; training part and testing part. The training part is used to make the SVM classifier based on the history data record from information database, the data are collected from the GStar-I database directly. There are eight transducers in the GStar-I, every transducer detect the soil moisture content under different depth of the earth, 0-10cm layer1, 10-20cm layer2, 20-30cm layer3, 30-40cm layer4, 40-50cm layer5, 50-60cm layer6, 70-80 layer7, 90-100cm layer8. The data are sent every hour, so the interval of the data is one hour.

Information collection is the process of receiving the transducer signal, the process is described in the GStar-I instruction.

Data preprocessing is a dimension reduction process. More than 8 transducer data are sent to the database such as voltage, the data except the 8 transducer data is useless to the SVM model, so some of the features are neglected in this process.

Vectorization is mapping the data into a 9 dimensional feature space. $x_i = \{x_1, x_2, ...x_7, x_8, y\}$ $y \in \{+1, -1\}$ is a new sample, $1 \le i \le n$, n is the number of soil moisture observation station, x_1 is the soil moisture content under earth 0-10cm, x_2 is 10-20cm, x_3 is 20-30cm, x_4 is 30-40cm, x_5 is 40-50cm, x_6 is 50-60cm, x_7 is 70-80cm, x_7 is 90-100cm.

The SVM classifier is constructed after training all the samples in database. The high time complexity make it difficult to be applied in a large dataset, some algorithm have been proposed to solve this problem, SMO is one of the best approximate algorithm, some algorithms also try to eliminate the sample number, in this system, clustering SVM[4] is used. Only the support vectors are useful to the construction of SVM classifier, the algorithm is based on the hypothesis, the clusters with both positive samples and negative samples are useful clusters, which may contain support vectors. So only the impure clusters are trained as figure3.

The testing process is also the error detection process, y=-1 means the new sample unknown is error data, some parts of the GStar-I is broken. One more possibility to be explained is that the missing classified condition, once it happens, the SVM classifier has to be reconstructed.

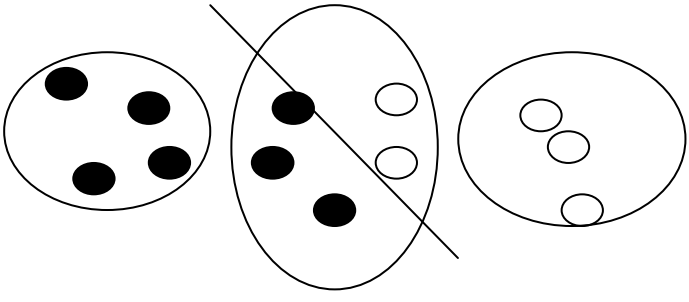

Fig. 3. Clustering SVM

4 Experiment

To study the feasibility of our system, a series of experiments have been done to evaluate its effectiveness. The original data contains 20 MB data; the data set has 8 attributes for each connection record plus one class label. The performance is shown as figure 4.

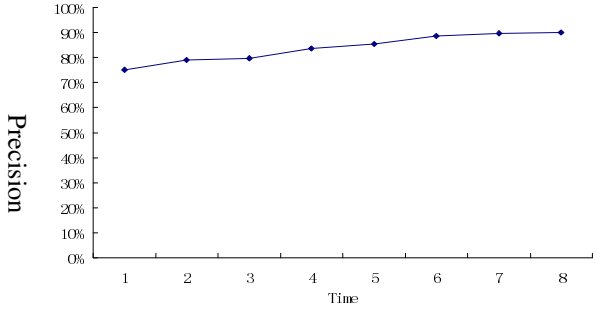

Fig. 4. Precision of the system

As the time changing, the testing precision is increasing. The reason for the increasing is the miss classified sample, more miss classified appeared, more perfect the system is. Higher testing precision means the malfunction soil moisture content viewer will be found more precisely, human resources can be saved.

There is no doubt that as the samples number increases, the burden of Server will be higher, the performance of clustering SVM has been shown in many other papers, the introduction of clustering algorithm helps a lot to decrease the training time.

5 Conclusion

This paper mainly introduces the structure and theory used by SMCEDDS, the efficient system can save human resources in dealing with this problem. The appearance of the system is profound to the malfunction detection of weather system devices.

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Image Fusion Method Based on Multi-band Wavelet Transform

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Abstract. Image fusion is one important application in information processing area. The goal of image fusion is to integrate complementary information from multi-sensor data such that the new images are more suitable for the purpose of human visual perception and computer-processing. Wavelet analysis, which has the local excellence both in time and frequency domain, has become a principal technique in image fusion. With the development of the multi-band wavelet in recent years, image fusion based on wavelet has come into a new area. We give the decomposed and reconstructed algorithm of M-band wavelet, and propose an image fusion scheme which is based on the M-band wavelet transform. By compare with the fusion scheme, we find the M-band wavelet scheme has better quality in image fusion.

Keywords: Image fusion, Wavelet transform, M-band wavelet, reconstruction.

1 Introduction

With the availability of multi-sensor data in many fields such as remote sensing, medical imaging, machine vision, and military applications, sensor fusion has emerged as a new research area [1]. The definition of sensor fusion is very broad and the fusion can take place at the pixel, feature, and symbol level. Pixel-level fusion serves to increase the useful information content of an image such that the performance of image processing tasks such as segmentation and feature extraction can be improved [2]. Feature-level fusion enables the detection of useful features with higher confidence [3]. Finally symbol-level fusion allows the information from multiple sources to be effectively used at the highest level of abstraction. In this paper, we specifically address at the problem of pixel-level fusion.

Before image fusion, we must do image registration. Image registration ensures the information from each sensor has to the same physical structures in the environment. In this paper we assume that the images to be combined are already perfectly registered [4]. Multi-sensor data often presents complementary information about the region surveyed. Image fusion is trying to combine information from several images (sensors) taken from the same scene in order to achieve a new fused image, which contains the best information coming from the original images [5]. Hence, the fused image has better quality than any of the original images.

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The simplest image fusion method is to take the average of the two image pixel by pixel. However when this direct method is applied, the contrast of features in either of the images is reduced [6]. In order to solve this problem, several fusion schemes have been proposed in recent years [7]. The basic strategy here is to use a feature selection rule to construct a fused scheme of the original data. The composite image is obtained by taking an inverse transform.

In this paper we suggest a fusion algorithm based on the M-band wavelet transform. The M-band wavelet transform offers certain advantages over the wavelet transform.

The remainder of this paper is organized as follows. Section 2 introduces the characteristics of wavelet. Section 3 introduces the characteristics of multi-band wavelet transformation, especially the decomposition and reconstruction algorithm. Section 4 reviews and analyzes the methods for image fusion with multi-band wavelet. Section 5 gives the conclusions.

2 A Review of Wavelet Transform

We defined a serial of basis spaces of V^j, which $V^0 \subset V^1 \subset V^2 \subset \cdots \subset V^j \subset \cdots$. The basis functions for the spaces V^j are called scaling functions $\phi(x)$.A simple basis for V^j is given by the set of scaled and translated functions [8]

$$\phi_k^j(x) = \phi(2^j x - k), \qquad k = 0, \cdots, 2^j - 1 \tag{1}$$

where $\phi(x) = \begin{cases} 1 & for \quad 0 \le x < 1, \\ 0 & otherwise. \end{cases}$

The wavelets can be defined as

$$\psi_k^j(x) = a^{-j/2}\psi(a^{-j}(x - kba^j)) \tag{2}$$

The Haar wavelet transform is given by a = 2 and b = 1.

The compact support of ψ_k^j is then $[2^j k, 2^j(k+1)]$.

Haar described the following function as one that provides an orthonormal basis. The wavelet analysis of a continuous variable is a step function

$$\psi(x) = \begin{cases} 1 & if\, 0 \le x < 1/2 \\ -1 & if\, 1/2 \le x < 1 \\ 0 & otherwise \end{cases} \tag{3}$$

So the wavelet coefficients of the signal $f(x)$ can be calculated by the inner product

$$a_k^j = \left\langle f(x), \psi_k^j(x) \right\rangle = \int f(x)\psi_k^j(x)dx \tag{4}$$

And signal $f(x)$ can be reconstructed via

$$f(x) = \left\langle a_k^j, \psi_k^j(x) \right\rangle = \sum_{k,j} a_k^j \psi_k^j(x) \tag{5}$$

The scaling function $\phi(x)$ can be written as $\phi(x) = \sqrt{2}\sum_{n\in Z} l(n)\phi(2x-n)$, where $l(n)$ are the scaling coefficients. And the $\sqrt{2}$ remains the norm of the scaling function with the scale of two. The scaling coefficients $l(n)$ satisfy $\sum_{n\in Z} l(n) = \sqrt{2}$ and $\sum_{n\in Z} l(n)l(n-2k) = \begin{cases} 1 & if \quad k=0 \\ 0 & otherwise \end{cases}$

The mother wavelet (x) is related to the scaling function via

$$\psi(x) = \sqrt{2}\sum_{n\in Z} h(n)\phi(2x-n) \tag{6}$$

where $h(n)$ are the wavelet coefficients, which related to the scaling coefficients by $h(n) = (-1)^n l(1-n)$.

A J-level discrete decomposition can be written as [9]

$$f(x) = \sum_{n\in Z} c_n^0 \phi(x-n) = \sum_k c_k^J \phi_k^J(x) + \sum_{j=1}^{J}\sum_k d_k^j \psi_k^j(x) \tag{7}$$

where $c_k^j = \sum_{n\in Z} c_k^{j-1} l(n-2k)$, $d_k^j = \sum_{n\in Z} c_k^{j-1} h(n-2k)$, for $j = 1, \cdots, J$.

A reconstruction of the original fine scale coefficients of the signal can be made from a combination of the scaling coefficients and wavelet coefficients. All of these functions are orthonormal, so we have

$$c_k^j = \sum_{n\in Z} c_n^{j+1} l(k-2n) + \sum_{n\in Z} d_n^{j+1} h(k-2n) \tag{8}$$

3 Multi-band Wavelet

The multi-band wavelet can be considered as a more generic case of the two-band wavelet transformation. It can be considered as a branch of wavelet analysis. Though the multi-band wavelet has been much researched in recent years, the application to image fusion is still limited. This section will give a brief introduction of multi-band wavelet.

3.1 Multi-scale Analysis of Multi-band Wavelet

Wavelets are functions in a space $L^2(R)$ of a basic wavelet function. In multi-band wavelet, we take a specific M-band wavelet, where M is a positive integer. There are

M-1 wavelet functions $\{\psi_s(x) \mid 1 \le s \le M-1\}$ for a scaling function $\phi(x)$ [10]. The functions $\phi(x)$ and $\psi_s(x)$ satisfy the following scaling equations:

$$\phi(x) = \sum_{k \in Z} c_k \phi(Mx-k),\ \psi_s(x) = \sum_{k \in Z} d_k^s \phi(Mx-k) \tag{9}$$

where $\{d_k^s\}$ is a set of wavelet coefficients and $\{c_k\}$ is a set of scaling function coefficients.

3.2 Decomposition and Reconstruction of M-Band Wavelet

By using the tensor product, two-dimensional orthogonal wavelet bases can be obtained from one dimensional wavelet bases. Thus, the multi-band wavelet decomposition and reconstruction of an image $\{a_{0,k,l}\}$ $(k,l \in Z)$ can be obtained. The decomposition formula of M-band wavelet can be written as[11]

$$a_{j+1,k,l} = \sum_m \sum_n c_{m-Mk} C_{n-Ml} a_{j,m,n} \tag{10}$$

$$b_{j+1,k,l}^{t,s} = \begin{cases} \sum_m \sum_n c_{m-Mk} d_{n-Ml}^s a_{j,m,n} & t = 0, 1 \le s \le M\text{-}1 \\ \sum_m \sum_n d_{m-Ml}^t c_{m-Mk} a_{j,m,n} & 1 \le s \le M\text{-}1 \\ \sum_m \sum_n d_{m-Ml}^t d_{n-Ml}^s a_{j,m,n} & 1 < t,s \le M\text{-}1 \end{cases} \tag{11}$$

where $j = 1, 2, \cdots$. The reconstruction formula is

$$a_{j,k,l} = \sum_m \sum_n c_{k-Mm} c_{l-Ml} a_{j+1,m,n} + \sum_{t,s=0,s+t\neq 0}^{M\text{-}1} \sum_m \sum_n d_{k-Mm}^t d_{l-Mn}^s b_{j+1,m,n}^{t,s} \tag{12}$$

where $j = 1, 2, \cdots, \{a_{j+1,k,l}\}$ is the low-frequency portion of the $(j+1)$ level M-band wavelet decomposition of the image $\{a_{j,k,l}\}$ and $\{b_{j+1,k,l}^{t,s}\}$ is the high-frequency portion of the $(j+1)$ level. Hence, by applying the M-band wavelet transformation, the imagery is decomposed into one low-frequency portion and (M^2-1) high-frequency portions. By an inverse wavelet transformation, the original imagery can be reconstructed.

4 Image Fusion Methods Based on Multi-band Wavelet

In this section, we review and analyze image fusion methods based on M-band wavelet method and give some experiment.

4.1 Image Fusion Scheme with Wavelet

The basic idea of image fusion with multi-band wavelet transform is that a low resolution image is replaced by the low frequency portion of the image in a multi-band wavelet transformation. The main procedure for the multi-band wavelet-based method is described below:

Step 1: some images are generated, and their histograms are also specified.

Step 2: these images are decomposed into multi-band wavelet transformed images.

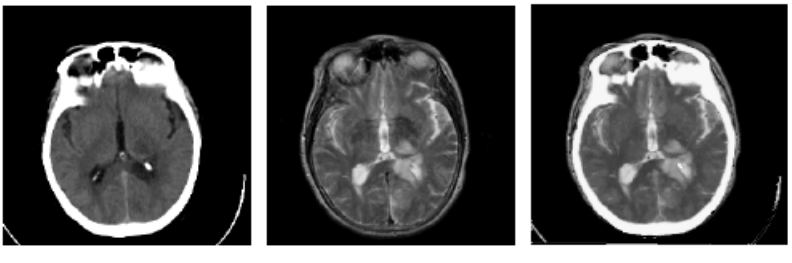
Step 3: re-sampled with the images, and use the re-sampled images to replace the low frequency portions of the wavelet transformed images respectively.

Step 4: take inverse multi-band wavelet transformations for every images, and compound the original images into one fused image.

4.2 Fusion Experiments

We now present an experimental study of applying the image fusion with multi-band wavelet methods, there we let M=3.

Experiment 1: The experimental images are a CT image (Fig.1(a)) and a MRI image (Fig.1(b)) based on the multi-band wavelet fusion methods. Fig.1(c) is the image fused by multi-band wavelet transformation. The fused image includes the anatomical information of MRI and the functional information from CT. In the fused image, the relative position of the functional information is clearly displayed.



(a) (b) (c)

Fig. 1. (a) CT image (b) MRI image (c) Fused image

Experiment 2: The experimental images are a image focus on left part (Fig.2(a)) and a image focus on right part (Fig.2(b)) based on the multi-band wavelet fusion methods. Fig.2(c) is the image fused by multi-band wavelet transformation. From the experiment, we can see the fused image has the excellence of focus on left part and focus on right part. In the fused image, the relative position of left and right all display clearly.

(a) (b) (c)

Fig. 2. (a) Image focus on left part (b) Image focus on right part (c) The fused image

5 Conclusions

This paper focused on the analysis of image fusion methods based on multi-band wavelet. The multi-band wavelet fusion method can be more widely used than other fusion methods. The multi-band wavelet transformation gives a more direct solution for fusing two images when the spatial resolution ratio is M. M-band wavelet transformation has more merit than two-band wavelet. Only one-step computation is needed by M-band wavelet transformation, but for the two-band wavelet transformation, it must take more steps. From the fuse experiments, we can see that there are good results in image fuse based on multi-band wavelet transformation.

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Vegetation Coverage Change Trend in Inner Mongolia of China during 1998-2008

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Abstract. Vegetation is sensitive to reflect the change of ecological environment, so it is significant to study the vegetation dynamics for ecological environment protection and ecological early warning. Based on the time series of the SPOT/VEGETATION NDVI dataset, this paper has obtained the spatial distribution of NDVI in Inner Mongolia (IM), analyzed the characteristics of NDVI change trend in the period of 1998-2008 by Maximum Value Composites (MVC) and Mann-Kendall test. The main findings are as follows: (1) NDVI time series in most regions of IM has tendency in the recent 10 years. (2) The significant increased areas of vegetation cover are mostly distributed in the area of severe desertification, and the significant decreased areas of vegetation cover are mainly located in the typical steppes.

Keywords: Vegetation coverage, NDVI; Tendency, Mann-Kendall Test.

1 Introduction

Vegetation is the main part of the terrestrial ecosystem, and is considered as a sensitive indicator for environmental change by reflecting the land cover change to a certain extent [1]. As one of the core issues for Land Use/Land Cover Change (LUCC), related studies about vegetation-covered change have been the important part for the research of global change [2]. scientists have recognized the value of evaluating spatial ecosystem patterns and temporal processes using data archives [3, 4].

Among the surface parameters extracted from the remote sensing data, NDVI (Normalized Difference Vegetation Index) is an extensive used indicator for vegetation condition [5]. NDVI is closely related to the vegetation coverage, phytomass, leaf area index and net primary productivity, and it can reflect the coverage information objectively in a large spatial and temporal scale, which is a fine index to the condition of vegetation growth and the density of vegetation spatial distribution [6, 7]. In this research, the data of NDVI time series, which was obtained from the Environmental and Ecological Science Data Center for West China, National Natural Science Foundation of China (http://westdc.westgis.ac.cn), covering the

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period from April 1998 to July 2008, consists of 372 SPOT/VEGETATION scenes. The dataset, which has made atmospheric correction, radiometric correction and geometric correction by Vegetation Image Processing Center. The 1 km spatial resolution was nearly constant across the whole 2,250 km swath covered, which meant that there was almost no distortion at the image edge [8]. To display conveniently, every pixel's gray value of 372 scenes applied in this paper has taken linear stretch by i_{ndv}=DN×0.004－0.1, converting the data range to between 0 and 1.

The study area we selected is the Inner Mongolia Autonomous Region (IM). It lies between the latitudes as 37°24′～53°23′ N and longitudes as 97°12′～126°04′ E, and traverses the northern frontier of China from northeast to west, which is totally up to 1,183,000 km^2. In IM, flat plateau is its major terrain, with an average altitude of 1000～1500m, and the area of grassland is up to 880,000 km2, accounting for 21.7 % of the total nation and taking as the leader of five largest grasslands in China.IM is the typical temperate grassland in the world with mid-latitudinal & semiarid ecological type. Owing to the droughty climate and excessive reclamation & grazing, the vegetation ecosystem in IM has been very fragile and the condition for land desertification and vegetation degradation is very severe. Simultaneously, there is an obvious contradiction between high-insensitive land development and vegetation protection. Therefore, it is necessary to evaluate the characteristics of vegetation dynamic, what is offer decision making for sustainable development.

This paper has analyzed the spatial distribution condition of NDVI in the past 10 years, in the basis of the IM remote sensing data of NDVI from 1998 to 2008. Here, Maximum Value Composites and Mann-Kendall Test was alculated from NDVI time series of each pixel, and every pixel's NDVI variation trend was determined. It can reveal the inherent regularity of vegetation change in IM, by the further analysis for the results.

2 Maximum Value Composites

In the present study, the Maximum Value Composites (MVC) method was applied to generate the NDVI representative value every year, i.e., to obtain a maximum NDVI value in a year for each pixel. The algorithm is as follows:

$$NDVI_i = \mathrm{Max}\{\, ndvi_{i,j} \,\} \tag{1}$$

where, i= 1, 2,…, 11, j=1, 2,…, 37, and $NDVI_i$ is the i^{th} year's composite value, as well as $ndvi_{i,j}$ is the j^{th} period's actual value in the i^{th} year. Then, compute the annual mean value for the maximum NDVI in the years of 1998-2008 for every pixel, and obtain the synthesized data of MNDVI.

Here, the MVC method was selected for the reason that the influences of clouds, atmosphere and solar altitude will weaken in case the real NDVI value is underestimated.

3 Mann-Kendall Test

With the MK test for NDVI trend testing, the paper treat 10-days NDVI for each pixel as one time series, and MK test statistic Z_c and Kendall gradient β as the NDVI

attenuation indexes for unit pixel. The statistic of the Mann-Kendall statistical test, Z_c is expressed as:

$$z_c = \begin{cases} \dfrac{S-1}{\sqrt{\mathrm{var}(S)}}, & S > 0 \\ 0, & S = 0 \\ \dfrac{S+1}{\sqrt{\mathrm{var}(S)}}, & S < 0 \end{cases} \tag{2}$$

where, the expressions of S and var(S) can be find in literature [9], and will no be elaborated.

The Mann-Kendall test can be used in the following manner, for the null hypothesis H_0, if $|Z_c|>Z_{(1-\alpha)/2}$, then refuse the null hypothesis, where, $Z_{(1-\alpha)/2}$ is the standard normal variance, and α is the significance level for the test. When $|Z_c|>Z_{(1-0.05)/2}=1.96$, it means that the confidence level of this time series is less than 0.05, and the trend variation is significant. Conversely, when $|Z_c|<1.96$, the trend variation is not significant.

4 Result and Discussion

Distribution of NDVI. Figure 1 is the grid map of the NDVI distribution in the period of 1998-2008 in IM by calculated the mean inter-annual maximum composite value of NDVI time series for every pixel. It can be found that the spatial distribution of IM vegetation cover has the obvious characteristic of gradually decaying from northeast to southwest. In the eastern, the Greater Higgnan Mountains is the high NDVI value region, where has a better vegetation cover from forest and forest steppe. In the western, Central Gobi, Badain Jaran Desert, Tenger Desert and Ulanbuh Desert are the low NDVI value regions displayed from west to east, where filled with desert and desert steppe. In the midlands, NDVI is relatively concentrated, and high value region and low value region are distributed alternately, with high value in the Hetao Plain and Xilingol Grassland, and low value in Ortos Plateau and Otindag Sandy Land, what is consistent with the alternate distribution of the topographic pattern of Plateau Mountain in IM.

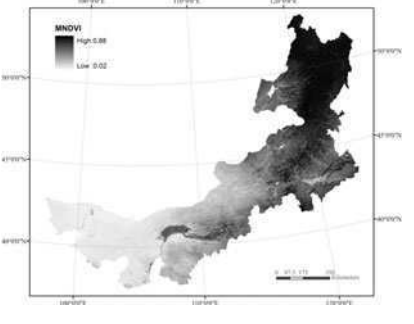

Fig. 1. NDVI distribution in IM in the period of 1998-2008 based on the MVC

NDVI Change Trend. Based on the MK test, NDVI change trend distribution in IM in the period of 1998-2008 (Figure 2) was obtained by calculating statistic Z_c of NDVI time series for each pixel. Taking significance level as 0.05 and critical threshold as $|Z_c| = Z_{(1-0.05)/2} = 1.96$, vegetation change trend was divided into 4 types.

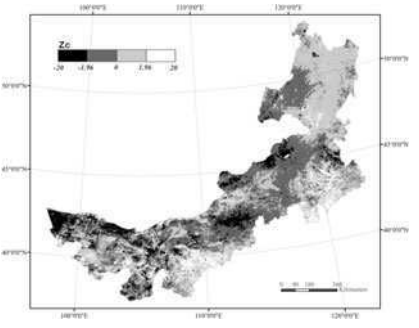

Fig. 2. NDVI change trend in IM in the period of 1998-2008

As for the space distribution, vegetation that of significantly increased and decreased all showed out concentrated distribution. Specifically, most regions that have vegetation significantly improved are desert regions, which are concentrated in Keerqin Sandy Land and Ortos Plateau, as well as the scattered regions distributed in the middle section of the Greater Higgnan Mountains, the Otindag Sandy Land and in the south rim of the Alxa Plateau. Obviously, desert control project has achieved remarkable results in the desert region of IM since 1998. On the other hand, there are serious crises in some steppe regions. For instance, regions with significantly decreased vegetation are mainly concentrated in typical steppe regions excepting for the Gobi and desert areas in the west. Especially, the Xilingol Grassland and Ulanqab Grassland have appeared obviously reduced vegetation in large area. As is known to all, the ecosystem of these typical steppe regions is very sensitive and fragile, and irrational animal husbandry production, sharply increased population and rapid urbanization have brought great pressures to ecological environment.

As for the proportion of area, there is 10.16% of the total area having attenuated trend, and 7.53% of the total area showing increased trend (Table 1). Where, the two are less than one-fifth of the total area, for the reason that many regions have the increased or attenuated trend in vegetation cover, but did not pass the test of significance level on 0.05. Generally speaking, the pixels have increased trend are a little more than the pixels have attenuated trend, which can be said that the overall condition of vegetation in IM is taking a favorable turn in the recent 10 years.

Table 1. Occupied area and proportion of different types vegetation variation trend

Vegetation variation trend		Area(km^2)	Proportion
attenuation	significant	120189.4	10.16%
	not significant	464716.4	39.28%
enhancement	significant	89115.5	7.53%
	not significant	506584.2	42.82%

5 Conclusions

Based on the calculation of the mean inter-annual maximum composite value and statistic Zc in MK test for each pixel's NDVI time series, this paper has drawn the spatial distribution maps and analyzed the temporal evolution characters of the IM vegetation change trend in the period of 1998-2008. According to the analytic results, we may come to the following conclusions:

In the recent 10 years, the vegetation cover in IM is improved in the whole, but there are still 10.16% of IM presenting significant attenuation trend. However, it cannot ignore deterioration of vegetation in some areas, and it needs to strength the ecological monitoring in the areas with vegetation significantly decreased. According to further analysis on the spatial distribution of the vegetation areas which are obviously increased and attenuated, they are concentrated in space. Where, the significant increased areas of vegetation cover are mostly distributed in the area of severe desertification, and the significant decreased areas of vegetation cover are mainly located in the typical steppes.

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Integrated Transport Development and Ecological Environment Game Identification

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Abstract. Taking both side of the Integrated Transportation System and Ecological Environment System as the research object, the interaction between Integrated Transportation System and Ecological Environment System is analyzed, and then the concepts of identification for game of them, influence force, game force, resultant game force and predominance are put forward herein. Adopting the game identification method discussed to analyze Integrated Transportation System and the ecological environment aimed to achieving sustainable integrated transportation system in the development and finding out the influence in the dominant key factor for the future development of an integrated transportation system to provide a scientific basis for decision-making.

Keywords: Integrated Transportation System, Ecological Environment System, Game-identification, Grey Relation Analysis.

1 Introduction

In recent years, the developments of integrated transport system in China meet the social and economics' needs, but it also causes some environmental problems. In order to coordinate an integrated transport and environment development, it requires in-depth analysis of relations between integrated transport system and environment system. Integrated transport is an important part of the national economy, play an important role in people's lives. Eco-environmental system is related to human survival, which includes water resources, land resources, biological resources, and climate resources. The development of integrated transport needs to occupy lands, also consumes large amounts of natural resources and produces air pollution, noise and other environmental pollution. Therefore, we must follow the principle of sustainable development and make integrated transport development compatible with environmental protection, establish an ecological comprehensive transport system.

2 Integrated Transport Development and Ecological Environment Game Identification Definition

In this paper, game identification method used for analyzing of the relationship between two systems. Here are main definitions [3][4].

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(1) *Force*: One of the integrated transport system (eco-environmental system) factor changes caused by the change of a factor of eco-environmental system (the integrated transport system) changes;

(2) *Game force*: The integrated transport system (eco-environmental system) state changes caused by the change of a factor in eco-environmental system (the integrated transport system) changes;

(3) *Resultant game force*: The integrated transport system (eco-environmental system) causes changes in eco-environmental system (integrated transport system) change of state;

(4) *Game dominance*: The integrated transport system and eco-environmental system in the overall force in the game process

3 Model and Solution

3.1 Index System

Establish the integrated transport index system and eco-environmental index system [1][2] as shown in Figure 1:

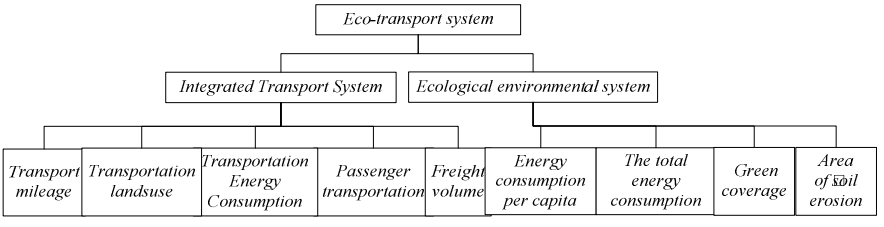

Fig 1. Integrated transport index system and ecological environment index system

3.2 Calculate the Value for Index

(1) Select reference series and comparing series ,give initial value: T represents the integrated transport index system, B represents eco-environmental index system. The Integrated transport index is T_i, the eco-environment index is B_j, $i = 1,2,3,\cdots,n$ and $j = 1,2,3,\cdots,n$;

(2) Grey relational coefficient and gray relational grade calculation: This topic has been explored before, this paper follows the major content and revises several details based on it, please refer to literature for details [1] [2].

(3) Game force calculation: Step (2) get all the force value of a single factor, $gf(t)_i$ is game force of the integrated transport index i on ecological environmental system, $gf(b)_j$ is game force of the ecological environment index j on integrated transport system,

$$gf(t)_i = \sum_{j=1}^{m} \beta_i \times f(t)_{i \to j} \tag{1}$$

$$gf(b)_j = \sum_{i=1}^{n} \alpha_i \times f(b)_{j \to i} \tag{2}$$

β_i in Eq. 1 is the index i weight of ecological environmental index system, α_i in Eq. 2 is the index i weight of integrated transport index system.

(4) Resultant Game force and game dominance calculation: $rgf(t)$ is resultant game force of the integrated transport system on ecological environment system, $rgf(b)$ is resultant game force of the ecological environment system on integrated transport system,

$$rgf(t) = \sum_{i=1}^{n} \alpha_i gf(t)_i \tag{3}$$

$$rgf(b) = \sum_{j=1}^{m} \beta g(b)_j \tag{4}$$

β_i in Eq. 4[4][5] is the index i weight of ecological environmental index system, α_i in Eq. 3 is the index i weight of integrated transport index system. $gd(t)$ is game dominance of integrated transport system on ecological environment system, $gd(b)$ is game dominance of the ecological environment system on integrated transport system, Eq. 5 , Eq. 6 get $gd(b)$ and $gd(t)$.

$$gd(b) = \frac{rgf(b)}{rgf(t)} \tag{5}$$

$$gd(t) = \frac{rgf(t)}{rgf(b)} \tag{6}$$

3.3 Applications

According to the development of integrated transport, we take the 2000-2008 statistical data [6], every four years as a period, and a total of five periods. Taking integrated transport as a reference sequence, and ecological environment as the comparison sequence, we get the gray correlation degree of each factor of integrated transport relative to environment. Meanwhile, taking ecological environment as a reference sequence, and integrated transport as the comparison sequence, we get the gray correlation degree of each factor of environment relative to integrated transport.

Table 1 shows game force of ecological environmental system on the integrated transport system ; Table 2 shows game force of integrated transport system on the ecological environmental system; Table 3 shows the resultant game force of integrated transport system and ecological environmental system; Table 4 shows game dominance of integrated transport system and ecological environmental system.

Table 1. Game force of ecological environment on the Integrated transport

period	Energy consumption per capita	The total energy consumption	Green coverage	Area of soil erosion
2000-2004	0.8522	0.8481	0.7964	0.7940
2001-2005	0.8160	0.8107	0.7865	0.7846
2002-2006	0.7274	0.7310	0.8048	0.7544
2003-2007	0.7991	0.7976	0.7876	0.7963
2004-2008	0.9100	0.9092	0.8957	0.8942

Table 2 Game force of Integrated transport on the ecological environment

		2000-2004	2001-2005	2002-2006	2003-2007	2004-2008
Mileage	railway	0.8083	0.7478	0.7285	0.7372	0.7166
	Highway	0.5509	0.7776	0.6962	0.6183	0.5076
	river	0.783	0.7197	0.7162	0.6933	0.6846
	airline	0.7126	0.7209	0.6712	0.5955	0.6183
	Pipeline	0.7262	0.7633	0.7437	0.7058	0.6775
Transport energy consumption		0.7219	0.7827	0.7572	0.7158	0.7380
Transportation landsuse		0.6453	0.5436	0.7709	0.75289	0.7546
Passenger volume	railway	0.7279	0.6990	0.6082	0.7442	0.7159
	Highway	0.6525	0.7153	0.6491	0.7263	0.7505
	river	0.6507	0.6241	0.5959	0.6755	0.7561
	airline	0.7237	0.7280	0.7051	0.6102	0.6436
Freight volume	railway	0.7064	0.6468	0.5919	0.631	0.6451
	Highway	0.7469	0.6784	0.6310	0.7508	0.8245
	river	0.7667	0.7689	0.6842	0.5934	0.6540
	airline	0.6570	0.7051	0.7427	0.6878	0.6700
	Pipeline	0.8361	0.7809	0.7619	0.6911	0.5795

Table 3. The resultant game force of of integrated transport and ecological environment

Resultant game force	2000-2004	2001-2005	2002-2006	2003-2007	2004-2008
B TO T	0.8227	0.7995	0.7544	0.7952	0.9023
T TO B	0.7149	0.7154	0.6879	0.6841	0.6867

Table 4. The game dominance of integrated transport and ecological environment

Game dominance	2000-2004	2001-2005	2002-2006	2003-2007	2004-2008
T	0.869	0.8948	0.9119	0.8603	0.761
B	1.1508	1.1175	1.0966	1.1624	1.3141

3.4 Analysis

According to table 4, we draw figure 2, it shows the trend of the overall force of two systems. Then make the following analysis.

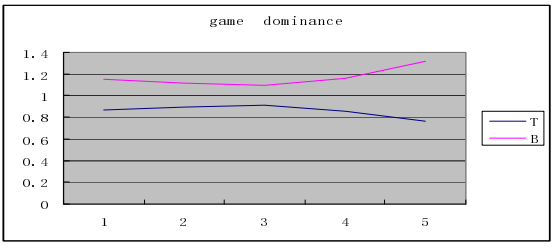

Fig. 2. The game dominance of integrated transport and ecological environment

In Fig2, T represents the game dominance of integrated transport index system, and B T represents the game dominance of eco-environmental system.

We can see that from game dominance of the integrated transport system and eco-environmental system, the ecological environment system is always in the leading position in the interaction of two systems. As time goes on, the ecological environmental system plays a leading role more and more; the ability of integrated transport system affects ecological environmental system gradually weakened. This indicates that the development of integrated transport must pay attention to ecological and environmental protection, therefore, in order to save energy and reduce waste of resources, need to develop ecological transport. In the integrated transport system, railway has a large volume, and high transport capacity, passenger and cargo transport in the most use of rail transport. During the coordinated development of ecological environment, we should give full play to rail transport; it has less pollution, low energy consumption advantages. Adjust to build a reasonable structure of integrated transport system can better achieve the ecological transport.

4 Prospects

This paper identified the relationship between integrated transport system and ecological environment system, based on the relevant study, and inquired into the different factors in two systems influence the stability of another different system through practical examples. This provides the groundwork for development of ecological transportation decision. However, due to the limitation of objective conditions, the participant identifying factors were selected in identification of the comprehensive transportation system and ecological environment system are not many, there are likely other factors that influence the stability of the system and any mode of transport mode in comprehensive transportation system of different share and ecological environment system different effect, which need further research and discussion.

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Optical Path Alignment Method of the Soot Concentration Measurement System Using the Scattering Integral Method

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Abstract. The soot concentration measurement system based on the scattering integral method has more advantages. However, the poor optical path alignment will directly affect the measurement accuracy. The measurement error caused by the poor optical path alignment of the measurement system is analyzed. For the measurement system, a new type of optical path adjustment method is brought out which is divided into two parts: coarse and fine adjustment. A new type of four-quadrant photoelectric sensor is designed to adjust easily optical path. Experimental results show that the optical path alignment method can improve the precision of optical path adjustment and reduce the soot concentration measurement error.

Keywords: optical path, alignment, Scattering Integral Method, soot, concentration.

1 Introduction

With the rapid development of China's economy, environmental pollution is getting worse. The soot emitting from the coal-fired power plants and industrial boilers are the major soot source of atmospheric pollution. For the atmosphere environmental protection, the soot concentration is an important parameter. The overall soot mass flowrate can be calculated and provided the fundamental basis for the pollutant emissions control.

At present, the soot concentration measurement apparatus are based on the different measurement principles. The apparatus based on the Scattering Intrgral principle are increasingly more and more applications because of its advantages, such as measurement speed rapidly, high resolution, real-time online measurement etc. However, when using the optical measurement system, a basic and very important requirement is that the measurement light beam is shine vertically to the active area center of the photodetector; otherwise it will inevitably lead to the measurement error. A new optical alignment method is brought out in this paper to reduce the measurement error.

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2 Soot Concentration Measurement Principle of the Scattering Integral Method

The formula of the Scattering Integral measurement system is

$$C_V = \frac{V_P}{sA_L} = \frac{4\pi}{ksA_L}\int_0^{2\pi}\frac{I(\theta)}{I_0}\mathrm{d}\theta \tag{1}$$

So the volume concentration of the particles can be calculated from the space integrated intensity of the scattered light [3-4].

The principle of the Scattering Integral measurement system is shown in Figure 1. The laser 1 stands at the focus of the collimation lens 2. The laser beam sends through the collimation lens and forms the parallel light; the parallel beam passes through the semi-penetrate semi-transparent prism 5 is divided into two beams. The reflected light is focused on the photodiode 3 through the condenser lens 4 and is converted into the original light intensity signal. The transmission beam passes through the soot space 6 and the laser beam includes the scattering light and the transmission light. Passed through the lens 7, the light beam is divided into two beams by the semi-penetrate semi-transparent mirror 13. The transmission light is focused on the silicon photocell 10 and is converted into the transmission light intensity. The reflected light is focused on the photodiode 12 and is converted into the scattering light intensity. The active area of the photocell is large, so the converted signal includes the transmission and the scattering light signal. The area of the photodiode is very small and a pinhole filter device is placed in front of the photodiode, so the converted signal includes the transmission light and the small-angle scattering light. The difference between two signals is a certain angle range of scattering light intensity [5]. So the soot concentration canbe calculated from the formula (1).

Because the pipeline is closed and can not be observed the duct inside, so the light path adjustment is difficult. In order to adjust easily the optical path, the camera 11 is set in the optical path to observe the light path inside the duct while adjusting the optical path.

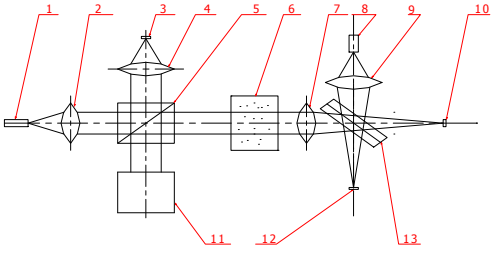

Fig. 1. Optical principle of the measurement system

1-laser; 2- collimation lens; 3-photodiode; 4- condenser lens; 5- the semi-penetrate semi-transparent prism; 6-the soot space; 7- condenser lens; 8- laser; 9- condenser lens; 10-photoelectric generator; 11-camera; 12-photodiode; 13- the semi-penetrate semi-transparent mirror

3 Influence of the Poor Optical Alignment

The poor adjustment of the measurement light beam includes two types, one is that the light beam is not shine vertically on the photodetector surface; the second is that the center photodetector does not coincide with the incident light axis (eccentric) [1] [2] [3]. The two types are shown in Figure 2.

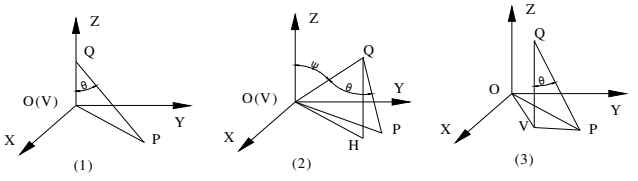

Fig 2 the different optical alignment conditions

(1) good alignment; (2) oblique; (3) eccentric

The installation environment of the soot concentration measurement system is relatively worse and the apparatus vibration is larger. If the connection force between the receiver and transmitter devices of the measurement system with the flange installed on the duct is not enough to prevent the measurement apparatus movement, the optical path drift of the soot concentration measurement system occurs.

The optical alignment method of the soot concentration measurement system based on the Scattering Integral method is that the measurement system is closely connected with the flange and the light path adjustment is used the three-dimensional high stability frame. Although the probability of the light path drift is greatly reduced, but this does not completely guarantee that the light path drift doesn't occur. The long-term serious vibration of the measurement system will cause:

(1) The fine pitch adjusting bolt locknut of the three-dimensional high stability frame loose, the measurement laser is turned and the emission angle of the light beam is deflected;

(2) The receiver and transmitter devices of the measurement system is shifted because of the bolt connection loosing with the flange.

The photoelectric sensor poor alignment of the measurement system is induced by the measurement light path drift. If the light path drift is serious, the photoelectric sensor can not receive the light scattering signal. The error of the received luminous flux signal is produced and the calculated soot concentration will not accurately representative of the actual source emissions systems running.

The photoelectric receiver of the soot concentration measurement instrument is generally using a large active area photocell. The measurement error caused by poor optical alignment is shown in Figure 3. The active area of the photocell includes two parts 1 and 2. In the case of the good optical alignment, the scattering light is shining on the two parts 1 and 2. When the incident light is shine oblique or eccentrically on the photocell, the scattering light will be shined on the two parts 1 and 3. The photocell can only receive the light flux of the active area 2 and can not receive the

flux of the active area 3. Therefore, the measurement flux is smaller than the real flux and the soot concentration is smaller too. Therefore the measurement optical path should be carefully adjusted to reduce the error.

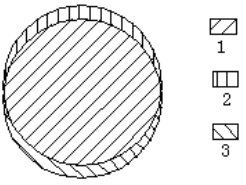

Fig. 3. The alignment analysis

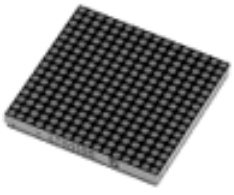

Fig. 4. The dot matrix LED

4 The Optical Path Alignment Method

The optical path adjustment method is divided into two steps:

(1) Preliminary optical adjustments (coarse adjustment)

Because there is no visible reference in the duct, the light spot on the duct wall can be observed by the camera, but the direction and distance of the optical path drift are not determined. A "cross" type sight is designed to adjust the optical path. The dot-matrix LED controlled by the microcontroller is used as the sight light source. While the optical path adjusting, the diagonal LED of the dot matrix LED is lighting to form a cross. The dot matrix LED is shown in Figure 4.

The seal window is removable to clean the window easily. While the measurement system running, the seal window structure is shown in the Figure 5. When the optical path must be adjusted, the seal window is changed. The seal window structure is shown in Figure 6. The dot matrix LED is installed on the slider.

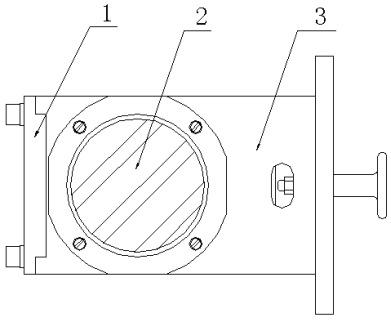

Fig. 5. The seal window structure while measuring

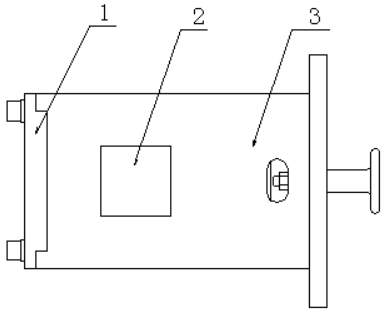

Fig. 6. The seal window structure while measuring

1-basement; 2-the seal window; 3-slider.1-basement; 2-the dot matrix LED; 3-slider.

The dot matrix LED center is on the optical path. While the measurement system adjusting, the diagonal LED is lighting and the "cross" type sign can be observed by the camera. When the light spot is coincide with the "cross" intersection point, the preliminary adjustment is completed.

(2) The precise adjustments (fine adjustment)

In order to precise adjusting the optical path, a new type of the photoelectric sensor is designed. The sensor structure is shown in Figure 7. The active area of the photoelectric sensor is divided into 9 sections:

① a fixed diameter circular photosensitive region 1 is located in the sensor center, which is used to measure the transmission light and the forward small angle scattering light;

② four fan photosensitive area sensor 2 to 5 are outside the center circle used as a four-quadrant photoelectric sensor to measure the scattering light.

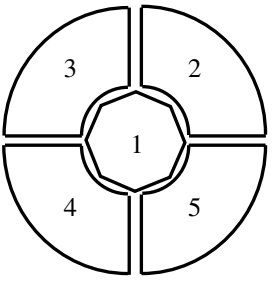

Fig. 7. The photoelectric sensor

If the optical beam of the measurement system is coincide with the light beam axis, the transmission and scattering light is focused on the center of the photoelectric sensor area 1 and the Luminous fluxes measuring by the active area 2 to 5 of the sensor is approximately equal. Conversely, if the measurement beam is not focused on the active area center of the sensor and is deviated from the active area center 1, the luminous flux values of the 2 and 5 active area are not equal. According to the difference among the four sensors, the optical path drift direction can be determined, so the optical path can be adjusted.

5 Conclusion

The new optical path adjustment method is used on the soot concentration measurement system based on the Scattering Integral method. The optical path adjustment result is proved that the adjustment method is easily.

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The Quantai Ecological Urban Design Based on the Dark-Green Concept

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Abstract. The dark green type of eco-village is the symbol of city which means that city has a high sustainable development. This paper proposed the "network overlay" design of the eco-city from the eye of "dark green" which based on the coal power station re-design of Xuzhou in China. The combination of the public space network, the public transport networks and the energy circulation network has positive feedback to spatial layout in social, cultural and economic aspects. During the planning process of eco-village, the LEED-ND rating system which is introduced to assess the level of carbon, can be used to prove the results are consistent with the sustainable standards.

Keywords: Dark green type of eco-village, “network overlay", The LEED-ND rating system.

1 Introduction

As the ecological crisis and global environmental issues are growing in intensity, eco-city is becoming the main development direction of urban design. Systematic construction of Dark green type of eco-village is a good way to put the sustainable development into practice, which not only concerns about the green, but also adds urban energy systems, waste systems, sewage treatment system and eco-city technical support system into the construction. The paper proposes a Dark green type of eco-village in Quantai coalmine in Xuzhou, and it combines the historical and contemporary reality to focus the future.

2 The Concept and Reference of Dark Green

The concept of dark green. From the seventies of last century, the green culture has become a far-reaching global social thought. The dark green, as a green product of evolution of cultural trend, represents the thinking, attitudes and responses on the environmental issues, it contains a kind of Ecological Holism.

The dark green philosophy should emphasize the mastery of the deep structure. Beside the aspects of the environment itself, the design should have a good grasp of the social dimension to explore the social reasons. Based on that, the solutions can be found to prevent and intercept the occurrence of environmental problems and reduce

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the negative impact of the environment development, which can enhance positive effects to our social development.

Dark green for urban design. Dark green idea is a deep analysis and thinking in urban design, which provides a new viewpoint and understanding. This has some inspirations to the construction of organic and sustainable space environment which can produce interaction with urban social development.

The urban design may lead to other social problems when we can't catch the real factors in space environment problem. By the insight into the nature of the relationship between social, cultural, economic and the environment, reasonable urban design can play an active role to produce a positive interaction between the physical environment and urban reality.

3 The Construction of Dark Green Eco-village

Based on the existing environment economic conditions and social problems, how to build an organic, sustainable and overall positively interactive urban design is discussed. And in this paper, an ecological urban design is built in Quantai coalmine.

The background and the overall planning. The Quantai coalmine locates in the northeast of Xuzhou and it is a supplement and continuation of the "eco-green wetland" of Pan'an Lake. So building the Quantai coalmine into an ecological urban area is the goal. And for the excellent environment, several specific implements are proposed. The plan is defined as a model village of sustainable development which supports the development goals of Quantai coalmine. At the same time, it is designed to achieve the concept of sustainable development and implements specific solutions to provide excellent environment for the city and residents in the long-term, medium-term and short-term.

The "network overlay". The Quantai coalmine eco-village planning includes four levels under the localization. The details are introduced as follows.

The level of functional organization: Ecological urban design highlights the balance of the organization and it includes three aspects. Firstly, it creates jobs by the creation of space environment, and that could solve the problems of unemployment caused by the demolition. Secondly, residential areas could solve the housing problem. Lastly, through offering service, educational, social, commercial, recreational and other facilities the urban design could create better economic and social benefits while promoting the development of surrounding areas.

The level of traffic organization: In the city, reasonable transport system organization can be helpful to create a good social life. What's more, it is the basis to ecological design.

The level of public services: The ecology lies in the efficient use of public services. The diversity of use and reasonable layout of public service facilities will help to promote economic development and social integration.

The level of energy design: Under the deep green concept, ecological urban design can be reflected in the improvement of the urban space, and it also reflected in the design of low-carbon energy.

Thus, based on status's bases, the "network overlay" approach is introduced. It is a design technique superposing different networks to be a unique multi-level urban ecology. It contains the public space network, the public transport networks and the energy circulation network. The multi-layer network of Quantai coalmine will be described in detail below.

The functional arrangement. The planning of Quantai coalmine respects the local character and the historical traditions. Firstly, under mechanism and characteristics of the original site, planning for roads, entrance and functional layout. Secondly, retaining the Baimuyiyuan and transforming it into green ecological theme park. Thirdly, we turn the historic industrial area into industrial park, so the industrial could contains commercial, cultural and tourism. Finally, the area is planned to be three new communities which are fusion of urban planning, landscape, architecture, art and infrastructure (refer with: Fig. 1).

Fig. 1. The plan of scheme

In the design the three communities were divided into low-density, medium density and high-density villages. And at the same time, the three communities were defined as the wellness-type village, the economical village and the intensive village, respectively. So the entire region could be an attractive mix of the three villages. All in all, the goal is to create one environment which has a positive impact on commercial, residential and cultural.

The multi-layer network superposition

Public Space Network; Eco-village public space consists of two parts, one part is the water and green networks, the other part is the nodes, streets and squares. They are the main place for public social activities, not only integrating closely with the surrounding built environment, but also contacting each village.

● Based on the fully accounts of the blue and green network, the design is build on the geographic of hydrological conditions and the green of the area, and that can form ecological framework (refer with: Fig. 2, Fig. 3).

Fig. 2. The blue Network

Fig. 3. The green Network

● The nodes are the distinctive village centers, such as the activity center, coffee lounge house, reading room, exercise gym. Streets and squares are the industrial culture park and green ecological park. All these spaces are connected by the river network and green corridor network.

Public transport network; As we know, the urban traffic congestion, energy consumption and greenhouse gas emissions are closely related to the traffic problems. So the sustainable infrastructure and traffic patterns are the basic foundation in the eco-city. The planning first should put the priority to pedestrians, bicycles public transportation system, and under this consideration, we can form the road network composed by the main roads and secondary roads. So people can get access to open space, public places and surrounding green space conveniently, this will be good to form a healthy lifestyle (refer with: Fig. 4).

Fig. 4. Public transport network

Energy cycle network; Low-carbon energy plan is based on efficient-energy systems and green buildings. Eco-cycle model of Quantai coal is a program which can solve problems occurring in energy, waste and water resources. The planning is designed according to the following principles:

● Through the construction of energy efficient buildings, equipments and systems, we can minimize the building energy to the demand.

● By the rational use of underground space of Quantai coalmine, ground source heat pump system and water source heat pump system are used as the energy supply options. This supply is run by solar, waste incineration, industrial waste heat or other renewable energy.

● Reducing the water consumption and the treatment of rain are also important for sustainable.

This model is a network system throughout the three villages, and it could provide the basic protection for sustainable development.

The results of eco-village design

Spatial pattern. Finally, formed by the "overlay network", the spatial pattern of Quantai coalmine includes three aspects.

● The existing textures are the basis of urban layouts and features.

● The original road traffic and transport system determine the basic layout of public transport network and the three villages.

● Green Corridor and blue channel form organic systems which can penetrate into the villages.

The planning could be adapted for the expansion speeds and ways of the three villages. Flexible overlay network structures provide a wide range of possibilities for the development of the various functional areas. It has great benefit for environmental, economic, social and spatial aspects, and this would benefit for the overall optimization and system tuning.

The LEED-ND system assessment. The planning is being adjusted to satisfy the criteria of the LEED rating system requirements, as shown in Table 1.

Table 1. The LEED-ND system assessment

Expected energy consumption	*The total area*	*Total energy demand*	
	[m^2]	[MW.h/a]	[PJ/a]
Low-density residential	84360	3709	13.35
Multi-storey residential	79463	14854	53.47
High-density residential	234150	205069	738.25
Education	8000	4190	15.08
Business	20000	23530	84.71
Office	8000	16124	58.05
Leisure	12000	14707	52.94
Sports	6000	658	237
Health Care	3000	1442	5.19
Public Facilities	8000	496	1.29
Total	462973	284779	1259.33

4 Summary

Good urban design can contribute to the establishment of the space environment. And the space environment can provide the development of economic, social and cultural. To some extent, good urban design may prevent and curb the production and impact of negative issues produced by the construction of physical space environment. The dark green type of eco-village can achieve material and social balance. In the Quantai coalmine planning, this paper combines the social factor and the spatial environment for the sustainable development, which is a source of reference of the dark green type of eco-village.

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Analysis and Protection of SYN Flood Attack

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Abstract. This paper described the basic principles of SYN flood attacks, and then described in detail the implementation of two more effective and convenient defense method, SYN-cookie technology and state-based monitoring of the source address technology. SYN-cookie technology achieved a stateless handshake, to prevent the resources consumption of SYN flood. Based on monitoring of the source address state technology can connect to each server's IP address to monitor the status of the initiative to take measures to prevent SYN flood attacks. These two technologies are the most mature and proven technology for the defense of all SYN flood attacks.

Keywords: SYN flood attack, denial of service attack, SYN cookie, IP address.

1 Introduction

Denial of Service (DoS) is more effective and very difficult to defense of a network attack, its purpose is to make the server not able to properly access the users. Therefore, DoS closely relies on the Internet for some businesses and organizations operating to bring the deadly threat.SYN Flood is the most effective and popular form of a DoS attack. It uses TCP three-way handshake protocol of the defect, to the target host to send a large number of forged source address of the SYN connection request, by the resource consumption of the target host for server not to provide service for normal users.

TCP Connection Establishment Process. To grasp the basic principles of SYN Flood attacks, we must first introduce the three-way handshake mechanism of TCP.

TCP three-way handshake process is as follows.

1) The client sends a SYN to the server Set the TCP packet contains the client using the port number and the initial sequence number x.

2) Server-side before the client sends to the SYN packets after the client sends a SYN and ACK bits are set to TCP packets, including confirmation number for the x +1 and the server's initial sequence number y.

3) The client receives returned SYN+ACK packet FROM the server, returned a confirmation number of x +1 with number of ACK packet of y +1 to the server, a standard TCP connection to complete. It is shown in Fig.1.

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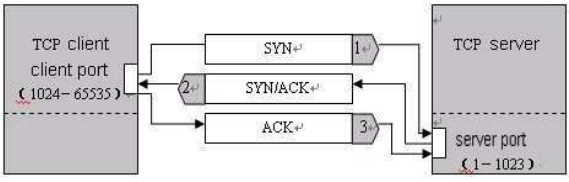

Fig. 1. Process of TCP Connection Establishment Under Normal Circumstances

Attacks Principle. In the SYN Flood attack, the hacker sends a large number of the victims of forged source address of TCP SYN packets to host machines, a vulnerable system allocated the necessary resources, and then return to the source address of the SYN + ACK packet, and waits for ACK packets back to the source side, as shown in Fig.2 . Since the source address is forged, so the source side will never return ACK packets, the victim host continues to send SYN + ACK packet, and the backlog of semi-connected into the port queue, although the general mechanism and the host has a default timeout retransmission times, but because half of the port connection queue length is limited, in the victim host sends a large number of TCP SYN packets, half-connection queue will fill up quickly, the server refuses new connections, will result in the port can not respond to connection requests to other machines, eventually exhausted the resources of a vulnerable system.

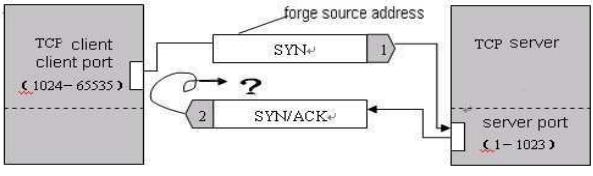

Fig. 2. SYN Flood Attack Diagram

2 Defense Technology

After SYN Flood attacks made a significant impact to the Internet, how to defend against SYN Flood attacks there are several more effective technology.

SYN-cookie Technology. Under normal circumstances, when the server receives a TCP SYN packet, immediately allocated buffer for the connection request, then returns a SYN + ACK packet, then form a half-connection. SYN Flood is the use of this point, sending a large number of forged source address of the SYN connection requests, and not complete the connection. This consumes a lot of server resources.

SYN-cookie technology standard aiming at this shortcoming of in TCP connection establishment process for the allocation of resources to change the resource allocation strategy. When the server receives a SYN packet, the buffer allocation is not immediately, but to use the connection information to generate a cookie, and this cookie will be returned as a SYN+ACK packet the initial sequence number. When the client returns an ACK packet, the header information according to calculation of

cookie, and return the confirmation serial number (the initial sequence number +1) comparing the top 24, if the same, it is a normal connection, then, allocation of resources , establish the connection.

The clever technique point is that to avoid incomplete information in connection before the arrival of resource allocation, so that SYN Flood attacks, resource consumption is invalid. And the key lies in cookie calculation. cookie contains the calculation should be done in this connection state information, so that an attacker can not fake cookie. cookie calculation process is as follows.

1) After the server receives a SYN packet to calculate a message digest mac.

mac = MAC (A, k).

MAC is a cryptographic message authentication code function, which is satisfied with the nature of a security key hash function, which provides computing needs cookie security.

A is for the client and server IP address and port number, and parameter t of the series combination.

A = SOURCE_IP | | SOURCE_PORT | | DST_IP | | DST_PORT | | t

K is unique key for the server;

Time parameter t is the time counter 32 bits long, plus 1 per 64 seconds;

2) Generated cookie.

cookie = mac (0:24): that the value of taking mac first 0 to 24 bits;

3) The setting will be returned SYN + ACK packet the initial sequence number, set the process is as follows:

a)Use the cookie instead of 24-bit high;

b)The next 3 bits with customer requirements instead of the maximum packet length of the MMS;

c)The last 5 bits for the t mod 32.

Client receives SYN + ACK packet from the server, and returns a ACK packet, the ACK packet will take a cookie (confirmation number for the server sends the SYN ACK packet over the initial sequence number plus 1, it does not affect High 24-bit), recalculated at the server-side cookie, and the confirmation number before the 24-bit comparison, if the same, then the explanation has not been modified, the legal connection, server then complete the process of establishing connection.

SYN-cookie technology during the connection is established because the server does not need to save any information, to statelessly achieve the three-way handshake to effectively defend the SYN Flood attack. However, there are some weaknesses of the method. As the cookie calculation involves only the header part of the confidence in the connection establishment process is not server-side save any information, it lost many of the features of the agreement, for example, retransmission timeout. In addition, calculation of a certain cookie computation, increasing the connection set up delay time, therefore, SYN-cookie technology can not serve as a means of defense high-performance servers. Usually dynamic resource allocation mechanism, when the allocation of resources after a certain use cookie technology, Linux is the way to achieve. Another problem is that when we avoid the SYN Flood attacks, while also providing another denial of service attack, the attacker sends a large number of ACK packets to the server busy verified. However, in the prevention of SYN Flood attacks, SYN-cookie technology is still an effective technique.

Address Status Monitoring Solution. Address status monitoring solution is to use monitoring tools on the network to connect the TCP packet monitor, and monitor the data packet for processing. Treatment was based primarily on the source address of the connection request.Each source address has a corresponding state, a total of four states.

Initial state: the state of any source address first;

NEW state: the first time or many times can not conclude that there exists a source address of the state;

GOOD status: determine the existence of the state in which the source address;

BAD state: source address does not exist or is not up to the time in which the state.

Specific actions and state transitions under the TCP header in the bit code value of the decision:

1) listening to the SYN packet, if the source address is the first time, then set the source address for the NEW state of the state; if NEW state or BAD status; is the location of a RST packet and then re-issued to, if it is GOOD state without any treatment.

2) listening to the ACK or RST packet, if the source address of the state for the NEW state, then turned GOOD status; If it is GOOD status will remain unchanged; if the state were to NEW BAD state; if the state were to NEW BAD state.

3) listen to from the server to the SYN ACK packet (the destination address is addr), addr that the server has been sent from the connection request to establish a half-connection, to prevent the establishment of too many half-connection to the server sends a ACK package, a connection at the same time, start time, if time-out, has not received ACK packets do not reach that addr, addr if the state at this time is for the GOOD to NEW condition; if addr state to state, in turn, NEW the BAD state; If addr state to BAD state will remain unchanged.State transition diagram shown in Figure 3:

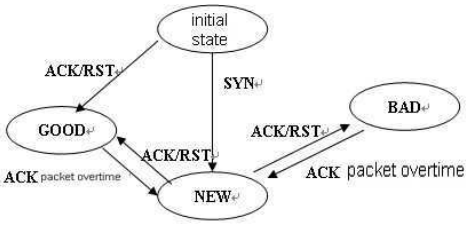

Fig. 3. Addresses the State Transition Diagram

The following analysis of the condition monitoring method based on address how to defense SYN Flood attack.

1) For a forged source address of the SYN packet, if the source address the first time, the source address for the NEW state of the state, when the monitor to the server SYN + ACK packet, indicating that the server has been the source address of the

connection request to establish half-connection. At this point, monitoring procedures on behalf of the source address to send an ACK packet to complete the connection. This half-connection queue is not a lot of half-connections. Timer start time, as the source address is forged, it will not receive the ACK packet, overtime, the monitoring program to send RST packets, the server releases the connection, the source address of the state to the BAD state. Later, as each one from the source address of the SYN packet, monitor will take the initiative to send a RST packet.

2) For a legitimate SYN packet, if the source address the first time, the source address for the NEW state of the state, the server responds to a request, send a SYN + ACK packet, monitor send ACK packet, a connection is completed. After the ACK from the client will soon be reached, the source address of the state to the GOOD state. Server can better handle duplicate ACK packets arrive.As can be seen from the above analysis, based on monitoring method can be very good defense SYN Flood attacks, without affecting the normal user's connection.

3 Summary

This paper described the basic principles of SYN Flood attacks, and then described in detail the implementation of two more effective and convenient defense method: SYN-cookie technology and state-based monitoring of the source address technology. SYN-cookie technology achieved a stateless handshake, to prevent the resources consumption of SYN Flood. Based on monitoring of the source address state technology can connect to each server's IP address to monitor the status of the initiative to take measures to prevent SYN Flood attacks. These two technologies are the most mature and proven technology for the defense of all SYN Flood attacks.

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Simultaneous Denitrification by Complex Adsorption in Bubbling Reactor

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Abstract. The process and mechanism of NO and SO2 adsorption by [Co(en)3]2+ in bubble reactor were investigated. Under the experimental conditions that temperature was 20℃, pH value was 13.0, and concentration of [Co(en)3]2+ was 0.025mol/L, 1g CaO, NH3·H2O, NaOH and carbide slag were added respectively, the solution added NH3·H2O and carbide slag gave a high NO removal rate, and after continuous absorption for 60min the NO removal rate was maintained above 93.5%, Adding NaOH and NH3·H2O, the removal of SO2 were high.

Keywords: ethylenediamine, cobal, absorption, flue gas denitrification, desulfurization.

1 Introduction

The simultaneous removal of NO*x* and SO_2 is an emerging process for flue gas cleaning. The absorption of NO*x* by means of complexes is a method by which metal complex solutions react with the absorbed NO to form metal-nitrosyl complexes rapidly [1]. Fe (Ⅱ)EDTA is used the most widely used as agents form a complex with NO[2-4]. However, the common metal complex solution Fe (Ⅱ)EDTA can be easily oxidized to Fe(Ⅲ)EDTA species and loses the ability to bind NO. Long [5] put forward to remove NO with cobalt ethylenediamine solution by dissolving soluble cobalt salts ($CoCl_3$) and ethylenediamine into aqueous solution. The $[Co(en)_3]^{3+}$ ion produced by ethylenediamine binding cobalt acts as a homogeneous catalyst to oxidize NO into soluble nitrogen dioxide and realize the oxidation and absorption of nitric oxide in the same reactor. But our former experimental results showed the $[Co(en)_3]^{3+}$ solution is not stable and commercial disappearance is $CoCl_2$ (Co^{2+}) not $CoCl_3$ (Co^{3+}).

So, in this paper, $[Co(en)_3]^{2+}$ was chosen as complex absorption liquid, simultaneous absorption of NO and low concentrationSO_2 was undergone in bubbling reactor.

2 Experimental

The experimental setup and flow sheet of the complex absorption of $[Co(en)_3]^{2+}$ solution and NO is shown in Fig.1.

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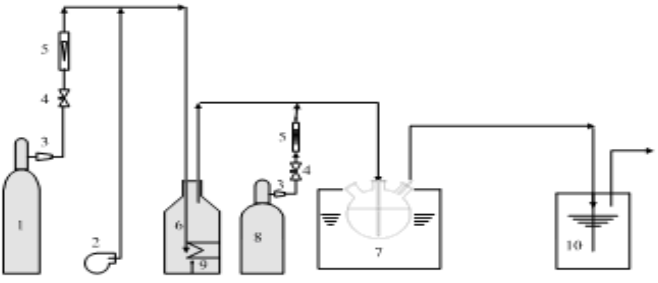
The dimension of the customized reactor is Φ20 mm×240 mm with a water jacket around the tower body, which can be used for reaction temperature controlling. Standard SO_2 gas and laboratorial made NO gas were continuous feed with a gas velocity of 180mL/min. The concentration level of SO_2 and NO are controlled respectively at 800-1300ppm and 200-400ppm. Before the experiment started, non-oxidative condition was acquired by inflow of concentrated N_2 gas for 10min. Measured amounts of cobalt dichloride and $H_2NCH_2CH_2NH_2$ were dissolved in 500 ml distilled water. $[Co(en)_3]^{2+}$ cation was formed after $CoCl_2$ was dissolved in aqueous solution. A pH-electrode was immersed into the liquid to check the pH-value, which is adjusted by adding NaOH or HCl. The concentration of SO_2 and NO of both inlet and outlet were measured at regular time by iodometry and flue gas analyzer (KANE, KM940), respectively. The concentration of NO^{2-} and NO^{3-} was analyzed by Ion Chromatography (Switzerland Metrohm, 761-IC).The removal efficency was described by the following equation:

$$\eta = \frac{C_1 - C_2}{C_1} \times 100\%$$

η: removal rate, C_1: concentration of inlet (ppm), C_2: concentration of outlet (ppm).



1-SO_2 cylinder, 2-air compressor, 3-reducing valve, 4-valve, 5-flowmeter, 6-buffering cylinder, 7-bubbling reactor, 8-NO cylinder, 9-heatingcord, 10-concentrated nitric acid solution

Fig. 1. Experimental apparatus and flow diagram

3 Results and Discussion

3.1 Effect of pH on SO_2 and NO Removal

pH is one of the important controlling parameters in flue gas desulfurization and denitrification. The effect of pH in absorb solution on SO_2 and NO removal rate was studied while the oxygen content is 5% and the concentration of $[Co(en)_3]^{2+}$ is 0.025mol/L. SO_2 and NO removal rate after 30min of continuous absorption is shown in Fig. 2.

Fig.2. pH gets a significant effect on SO_2 and NO removal rate, the removal rate of SO_2 was 76.6% and NO removal rate reached 90% when initial pH was 13.0 after 30min of reaction while 55.5% and 83.6% when initial pH was 5.

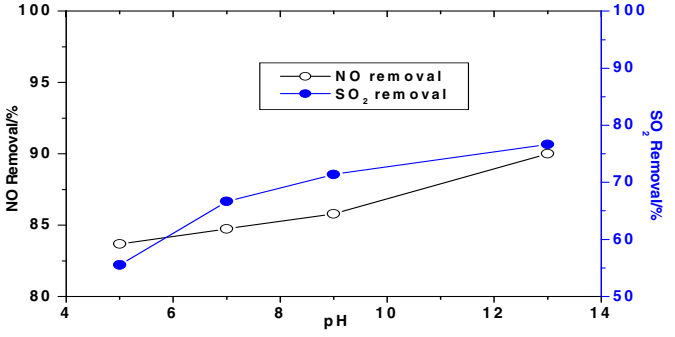


Fig. 2. Effect of pH in absorb solution on SO_2 and NO removal rate

3.2 Effect of SO_2, CO_2 and NO_2 on NO Removal

The effect of SO_2, CO_2 and NO_2 in the flue gas should be studied if the denitration by $[Co(en)_3]^{2+}$ is to used for industrial applications, the effect of SO_2, CO_2 and NO_2 on the absorption of NO was referenced in this work under the condition 0.025mol/L complex absorption solution, 13.0 initial pH value and 50□ reaction temperature, and the NO removal rate was shown in Fig. 3.

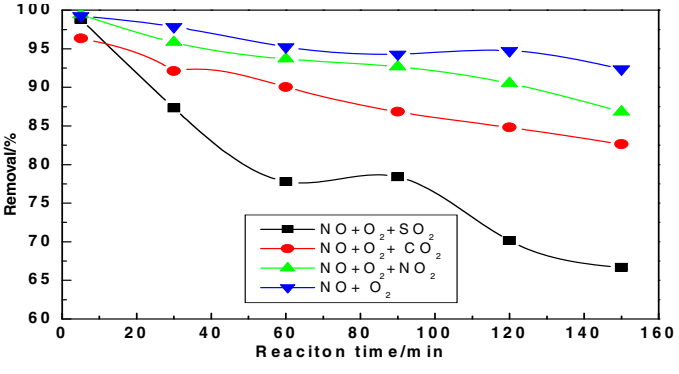


Fig. 3. Effect of SO_2, CO_2 and NO_2 on removal NO

Fig.3. The existence of SO_2, CO_2 and NO_2 reduced the NO removal rate more or less, among them, SO_2 has significant negative effect on NO removal rate, in 90min, the removal rate of NO by $[Co(en)_3]^{2+}$ absorption solution just maintained above 70%. Owing to the solubility of SO_2 in alkaline solution was far larger than the one of NO, and SO_2 took part in the complex reaction with $[Co(en)_3]^{2+}$ and competed with NO, which consumed a large amount of $[Co(en)_3]^{2+}$, additionally along with the reaction,

pH value dropped to 3.5 in a sudden, which went against to the general complex absorption reaction by changing the strong alkaline environment the reaction needed. Meanwhile, the increasing of SO_3^{2-} in the solution may form $Co_2(SO_3)_3$ as sediments and reduced the concentration of active component, so SO_2 in the flue gas reduced the removal rate of NO by $[Co(en)_3]^{2+}$ significantly.

As well as SO_2, the solubility of CO_2 was far larger than the one of NO, after the absorption of CO_2, the pH value of the solution dropped to 7.5 from the initial one of 13.0. So along with the reaction, the NO removal rate got lower and lower, which was caused by the dropping in pH value.

3.3 Effect of Different Desulfurization Agents on SO_2 and NO Removal

Compared with SCR, wet flue denitration is superior significantly in achieving simultaneous desulfurization and denitration by one apparatus, and through which the cost is reduced. The effects of different industrial desulfurization agents were studied under the condition of 5% oxygen concentration, 0.025mol/L $[Co(en)_3]^{2+}$, 50℃ and pH value 13.0 in this work, including CaO, $NH_3{\cdot}H_2O$, NaOH and Carbide slag. The result is shown in Fig. 4.

Different desulfurization agents added into the $[Co(en)_3]^{2+}$ solution had different effects on the removal rate of SO_2 and NO, complex absorption solution with $NH_3{\cdot}H_2O$ and carbide slag had a high and steady removal rate which can be maintained above 93.5% after 60 min's reaction. There was a quick descend in removal rate when NaOH added into the solution and the denitration rate dropped to 76.6% after 60 min's reaction. This was basically caused by the complex compound $[Co(NH_3)_6]^{2+}$ formed by $NH_3{\cdot}H_2O$ and Co^{2+} and contributed to the absorption of NO, which gave a steady removal rate and even ascended after 60 min's reaction. Among

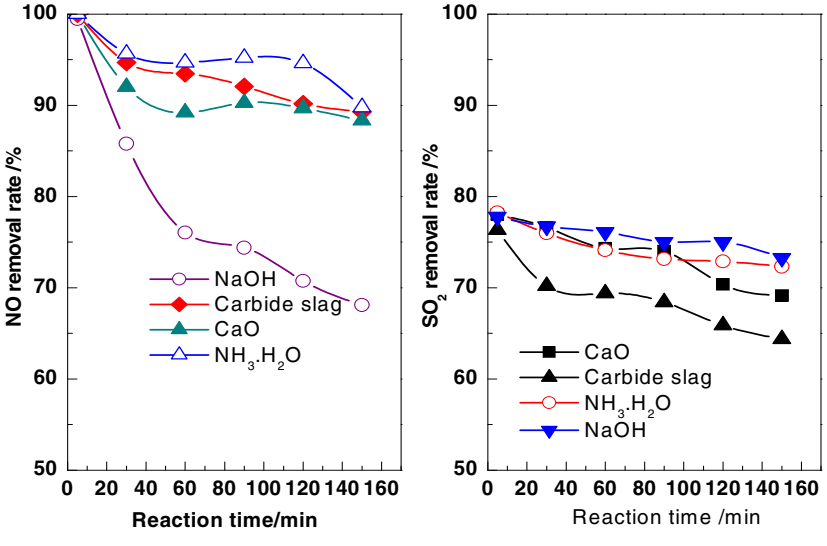


Fig. 4. Effect of different desulfurization agents on SO_2 and NO removal

CaO, $NH_3 \cdot H_2O$, NaOH and carbide slag, NaOH and $NH_3 \cdot H_2O$ had the best desulfurization effects, the two desulfurization agents dissolved readily in water, and the absorption of SO_2 was a gas-liquid reaction, but CaO and carbide slag were hardly dissolvable, the three-phase reaction was slowly.

Experiment shows that the NO complex absorption by $[Co(en)_3]^{2+}$ and wet gas desulfurization can be carried out in one apparatus, and achieve simultaneous desulfurization and denitrification.

4 Conclusions

(1). The pH value, the components in flue gas and different desulfurization agents added had different effects on the simultaneous desulfurization and denitrification in various degrees, among them the effects of pH value and the kinds of desulfurization agents were significant.

(2). A certain amount of CaO, NH_3H_2O, NaOH and carbide slag was added into the solution under the condition that the initial concentration of $[Co(en)_3]^{2+}$ was 0.025mol/L, pH value was 13.0, under the reaction temperature of 50℃ separately, find that the complex absorption solution with $NH_3 \cdot H_2O$ and carbide slag gave a high NO removal effects and steady while the best one with NaOH and $NH_3 \cdot H_2O$.

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Analysis and Improvement of Vault Algorithm Theory Based on Fuzzy Extraction Technology

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Abstract. Based on fuzzy extraction technology a fingerprint key algorithm to improve vault algorithm is designed, which has proved a device error in fuzzy vault algorithm: the use of RS code is unreasonable. The algorithm overcomes most of the problems in the existing fingerprint key algorithm.

Keywords: Fuzzy commitment algorithms, Treasury algorithms, RS code.

1 Introduction

Juels (1998) of U.S. RSA laboratory proposed "fuzzy commitment algorithm" in ACM Conference on Computer and Communications Security, which combines error-correcting codes with cryptography to obtain a new cryptography notion, called fuzzy commitment. This algorithm, similar to traditional cryptography algorithm, can achieve hiding and binding which not only makes it impossible for the attackers to obtain commitment value, but also makes the commitment person use more than one way to decrypt commitment value. The fuzzy property can guarantee the user to successfully obtain a commitment value with a minor error in the held information.

U.Uludag proposed a vault algorithm based on fingerprint characteristics. Besides xy-coordinates of the fingerprint characteristics, the fingerprint characteristics of this algorithm also have an angle of the corresponding ridge line. Before the generation of fingerprint key this vault algorithm first templates the pattern and the input fingerprint to eliminate the rotation angle. Compared with the xy-coordinates of fingerprint, if the remainder of two points' xy-coordinates values of two fingerprints is within a threshold, the two points are considered the same one.

2 The Analysis of Fuzzy Vault Algorithm

2.1 Fuzzy Vault Algorithm

Juels proposed fuzzy vault, a new cryptographic concept in I EEE International Symposium on Information Theory. Its basic thought: A user Alice can put a secret value S in a fuzzy vault and lock it with a set A. If user Bob wants to unlock the vault, he may only use a similar set B to set A to obtain the secret S when the two sets intersect to a certain extent.

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In the locked algorithm, set A refers to the x-coordinates of the "correct" points in R. The "correct" points refers to the function values obtained by the true polynomial. During the unlocked process, user Bob will offer a similar set B to set A to recognize the correct points and its corresponding function values from R. If set B and set A are extremely similar, set B can recognize much more correct point pairs. But set B and set A are only similar , not identical, so it is impossible to recognize all the correct point pairs.

2.2 Analysis of Fuzzy Vault Algorithm

If we need to generate RS code with error-correction capability c, first a polynomial on GF(q) must be generated which needs to meet the following conditions: the generated polynomial of RS code must have 2c roots, and these roots are a continuous index. Namely:

$$g(x) = \prod_{j-1}^{2c} (x - a) \tag{1}$$

a refers to the original root of GF(q). The degree of generated polynomial is t-k, expressed as

$$g(x) = g_0 + g_1 x + g_2 x^2 + K + g_{t-k} x^{t-k} \tag{2}$$

Use the polynomial with the degree of k-1

$$m(x) = m0 + m_1 x + m_2 x^2 + K + m_{k-1} x^{k-1} \tag{3}$$

to code (0 ,c 1, …,c k-l), m(x) multiplying g(x) to obtain:

$$c(x) = m(x)g(x), c(x) = c_0 + c_1 x + c_2 x2 + K + c_{k-1} x^{k-1} \tag{4}$$

RS code decoding process can be divided into the following steps:

(1) Calculate type S(x) from the receiving polynomial R(x)

There are three ways : the first method is based on the equation $S(x) = R(x) \bmod g(x)$ with the application of a g(x) divider circuit. The second method is based on the following two equations

$$s = (s\,1, s_2, \Lambda s_i \Lambda s_{2t}) \ : \text{ and } s = R(x)|x = a^i = R(a^i) = E(a^i) i = 1, 2, \Lambda, 2t \tag{5}$$

to obtain R(ai) by direct calculation, then Si and the type are obtained.

The third method is to divide the corresponding minor polynomial of a^i by receiving polynomial R(x) to get its remainder and type.

(2) Obtain the error pattern E(x) from type S(x).

(3) Calculate C(x) =R(x) - E (x) to obtain the code evaluations. If they are non-systematic codes, we need calculate m(x) =C(x) / g(x) from C(x) to obtain information group.

From above we can see generated polynomial g(x) or original root a plays an important role during the generating process of type S(x). The importance of g(x) and a in RS decoding process is decided by its function in RS coding process.

$$\therefore R(x) = C(x) + E(x) = m(x)\,g(x) + E(x) \tag{6}$$

$$\because R(x) \bmod (x)\,g(x) = E(x) \bmod g(x) = S(x)$$

To obtain error pattern E(x), type S(x) needs to be first calculated; if we need to get S(x), g(x) divider circuit is applied.

The encoding process and the check matrix have the following relationship :

$$H = \begin{bmatrix} 1 & \alpha & \cdots & \alpha^{n-1} \\ 1 & \alpha^2 & \cdots & (\alpha^2)^{n-1} \\ \cdots & \cdots & \cdots & \cdots \\ 1 & \alpha^{2t} & \cdots & (\alpha^{2t})^{n-1} \end{bmatrix}$$

So there is $s = (s_1, 2, \Lambda si \Lambda s_{2t}) = (r_0, r_1, \Lambda r_{n-1})$. $H r = (e_0, e_1, \Lambda e_{n-1})$. In this way, we can get equation (5) and the second and third method of the corresponding type S(x).

3 The Improvement of Fingerprint Key Algorithm

Fingerprint key algorithm can be divided into two parts: the fingerprint key generation and the key password recovery.The first part of the algorithm is fingerprint key generation. Users collect and generate fingerprint image by fingerprint collector, and preprocess the fingerprint by orientation field estimation and Gabor filtering. At the same time we remove the false features by fingerprint image post-processing technique.

3.1 Fingerprint Key Generation

Fingerprint image processing is used in practice to extract fingerprint minutiae, expressed as $\{x_i, y_i, \theta_i, t_i, d_{in}, a_{in}\}$, in which xi and y_i are the coordinates ; $_i$ is direction, an angle from x-axis to the part ridge line by counter clockwise; t_i is the type of minutiae; din and a in mean respectively the length of a line segment between the sample point on the ridge line and the minutiae and the angle between line segment and the corresponding direction ofθi.

Similar to fuzzy vault algorithm, after users fingerprint image is processed, the generated fingerprint minutiae data consist of locked set A. User's password and key are hidden in a corresponding polynomial. Every 16 digits of password and key as a coefficient are embedded in a polynomial until all passwords and keys are embedded into a polynomial to generate a corresponding polynomial p. The xy-coordinates of user's minutiae and noise spot will be input into the corresponding values of this polynomial.

Noise spots are generated as the following: noise spots are prohibited to generate in a certain scope of around user's minutiae. We use a square τfor this scope. The attribute data of $\{x_n, p`(x_n), \theta n, n, d_{nn}, a_{nn}\}$and $\{y_n, p(y_n), \theta_n, t_n, d_{nn}, a_{nn}\}$ can be generated as the following.

When VC random functions in the whole fingerprint image do not belong to x-coordinate x_i and y-coordinate y_i of randomly chosen noise spots of the square scope, θi can be obtained. Likewise, d_{max}, a max and d_{min}, a $_{min}$ of user true minutiae d_{in} and a $_{in}$ can be calculated by the type t_i of random function chosen spot noise.

3.2 The Recovery of Password and Key

Just like the fingerprint key generation, key recovery requires to process the collected user fingerprint image. The processing method is the same as the fingerprint key generation: firstly fingerprint image is processed, then the fingerprint minutiae data are obtained, also expressed as {xi ,yi , θi , i ,din,a in}.

Fingerprint key and user's fingerprint minutiae data are both input into key recovery algorithm to recover user's password and key. Password and key recovery algorithm is as the following:

Step1. Choose reference point pair.

Match fingerprint minutiae M(V)(i)(1 ≤i ≤m(V) in key set with the user newly collected and generated minutiae M(U)(j)(1 ≤i ≤m(U) to get a reference point pair. Otherwise, repeat the former steps to choose another point pair M(V)(i) 和M(U)(j) or go into step 2; if all minutiae are considered, go into step 4.

Step2. Check the two minutiae sets to their reference ones. M(U)(j) and M(V)(i) are used as reference minutiae. Every minutiae in M(U) and M(V)is changed into polar coordinates according to corresponding reference minutiae by the equation:

$$\begin{pmatrix} \overline{r_i^s} \\ \overline{\omega_i^s} \\ \overline{\theta_i^s} \end{pmatrix} = \begin{pmatrix} \sqrt{(x_i - x^s)^2 + (y_i - y^s)^2} \\ \tan^{-1}\left(\dfrac{y_i - y^s}{x_i - x^s}\right) \\ \theta_i - \theta^s \end{pmatrix}$$

$$M(V^t) = \{M(V^t)(k) = (\overline{r_k}^t, \overline{\omega_k}^t, \overline{\theta_R}^t t_k, d_{kn}, a_{kn}; n = 1,2,\Lambda\ ,l)^T; k = 1,2\Lambda\ ,m(V)\}$$

$$M(U^s) = \{M(U^s)(l) = (\overline{r_l}^s, \overline{\omega_l}^s, \overline{\theta_l}^s, t_l, d_{ln}, a_{ln}; n = 1,2,\Lambda\ ,l)^T; l = 1,2\Lambda\ ,m(U)\}$$

Step 3. Match M (Pi) with M (Q j). S(i, j) is for the matching result of M(Pi) and M(Q j)

obtained in such a calculation:

$$S[i][j] = \sum_{K-1}^{M} \sum_{i-1}^{M} S_{ki} \tag{7}$$

If M(Q j)(l) and M(Pi)(k) meet the following conditions: s_{kl} =1, M(Q j)(l) is in the bounding box of M(Pi)(k) (the direction remainder of $\overline{\theta_k}^i$ and $\overline{\theta_l}^j$ is less than a predetermined threshold valueξ ; R(k ,l) =400), it means the related spinal cords of M(Q j)(l) 和M(Pi)(k) should be similar. Otherwise, s_{kl} =0.

Then we go into step 1.

Step 4. Output matching results.

$$Sr = \max\{S(i, j)\} \tag{8}$$

The higher the matching score Sr, the more likely P and Q are from the same finger. If Sr ≥ξ,Q and P can be considered from the same finger. Otherwise, P and Q are considered from different fingers.

The points of Kl =1, as candidate points recognized from fingerprint key by unlocked point set are used to solve key k. The size c of candidate point set is possible larger than the degree k-1 of polynomial. Every time we only need to select k points from candidate point set to calculate key through combination. If the corresponding hash value of k is equal to the corresponding hash value pre-stored key k, the key recovery is successful. Otherwise, we need to repeat the above steps, until we try all the combinations of k.

4 Conclusion

First we have introduced the fuzzy vault algorithm theory and analyzed its algorithm design, property and all factors that affect fingerprint key algorithm performance. Secondly, an improved approach to vault algorithm based on fingerprint is proposed. Lastly it is proved that in theory the improved algorithm can solve many problems in the existing fingerprint key algorithm.

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Truck Position Monitoring System Using the Photoelectric Signal Detection Method

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Abstract. The truck position cheating method can lead to large economic losses. Aimed at the truck cheating method, a new truck position monitoring system based on the photoelectric signal detection method is brought out. According to the falling edge number of the rectangle wave, whether the truck position cheat method exists or not can be determined. Based on the monitoring principle, the truck position monitoring system is designed. Experimental results show that the monitoring system can on-time detect the truck position cheating method.

Keywords: monitoring, cheating, truck position, photoelectric, electronic truck scale.

1 Introduction

Electronic truck scale, as a convenient, fast, standard weighing instruments, are widely used in automotive transportation. With China's rapid economic development, cargo traffic has grown rapidly, more and more electronic truck scales are used for the accounts. So it becomes the more important measurement equipment in trade settlement,

To seek illegal profits, lawbreakers make many kinds of electronic truck scale cheating system. The main cheating method is to reduce truck self-weight and increase the goods weight when weighing through a variety of methods. Many companies have a very large economic losses and even cause some serious economic disputes. With the technological development, the cheating methods of the electronic truck scale are more and more sophisticated.

The truck position cheating method is more convenient, so it is brought more serious consequences. In this paper, the truck position cheating monitoring system is designed to reduce the economic losses.

2 Principle of the Electronic Truck Scale

The electronic truck scale weighing system is mainly composed by the scale platform, the pressure sensors, the signal conversion and the weighing meter. Electronic truck scale system is shown in Figure 1.

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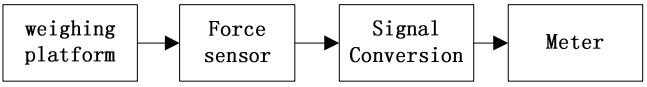
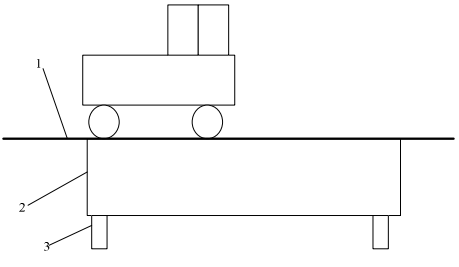


Fig. 1. The electronic truck scale weighing system

The scale platform is supported by the four sensors. Under the action of the truck force, the deformation of the pressure sensors is generated and the mV signal which is proportional to the truck weight is output. The mV signal is transmitted to the meter by the signal conversion. The truck weight data is displayed on the meter after processing. The goods weight is the difference between the full loaded weight and the empty weight of the truck.

3 Principle of the Truck Position Cheating Method

The principle of the truck position cheating method is shown in the figure 2. It can be divided into two kinds. The one is that the truck is not driving on the platform entirely. That is to say the back wheel or the front wheel of the truck is not on the platform in order to reduce the empty truck weight. The other is that many trucks are on the platform. That is to say the front or back wheel of the other truck is driving on the platform while the truck weighing in order to increasing the full loaded truck weight. So the goods weight is heavier than its actual weight.

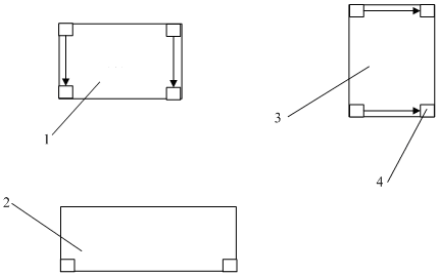


1-surface; 2-platform; 3-sensor

Fig. 2. The truck position cheating method

4 Principle of the Truck Position Cheating Monitoring System

Aimed at the truck position cheating method, the truck position cheating monitoring system is brought out. The monitoring system includes two parts: the photoelectric signal detection system and the data processing system. Take the double-axial truck for an example. The multi-axial car is similar with the double-axial truck. The photoelectric detection system is shown in figure 3.



1 - front view; 2 - side view; 3 - Top view; 4- infrared sensor.

Fig. 3. The photoelectric detection system

The infrared sensors are respectively installing on the front and back of the weighing platform. The infrared light is emitted from the infrared emission device and can be received by the photoelectric sensor. The light signal is changed into the current signal.

The output light current signal is shown in the figure 4. While the electronic truck scale weighing, the infrared emission device emits the infrared light. When there is no wheel between the emission device with the receiving sensor, the receiving sensor can receives the infrared light, so the output current signal remains high level. When the truck front wheel is on the scale stage, the receiving sensor can not receive the infrared light at the same time and the output current signal is changed into the low level signal.

While the truck front wheel is out of the photoelectric measurement area, the output current signal is changed into the high level signal. At the moment of the truck back wheel on the weighing platform, the infrared light can not be received by the receiving sensor and the output current signal is changed into the low level signal. When the truck is entirely on the weighing platform, the output current is changed into high lecel signal and remains the high level while weighing. The current signal while the truck is driving out of the weighing platform is opposite to the signal while the truck is driving on the weighing platform. So in the current signal figure, there are

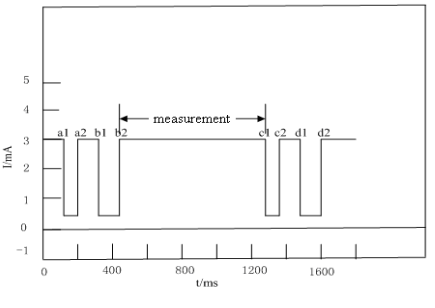


Fig. 4. The output current signal

four falling edge of the rectangular pulse in turn in which two pulse edges are generated when the truck is driving on the platform and the others are generated when the truck is driving out of the platform.

According to the sensor output current signal figure of the double-axial truck, whether the truck position cheat exists or not can be judged directly. If the falling edge number of the pulse is less than 2, it shows that the truck is not on the platform entirely. If the falling edge number of the pulse is more than 2, it shows that the other truck wheel is driving on the platform. So the truck position cheat is existed in the weighing system, refuse to weighing and alarm.

5 Design of the Truck Position Cheating Monitoring System

The truck position cheating monitoring system is mainly consists of the photoelectric detection system, the A/D conversion unit and the data processing system, the watchdog system, the Communication system and the power system. The truck position monitoring system is shown in figure 6. The photoelectric detection system is consists mainly of the photoelectric sensor, LM324 amplifier and A/D converter chip ADC0832. The photoelectric detection circuit is shown in the figure 7. The infrared light signal is received by the photoelectric sensor and light signal is changed into the voltage signal. The voltage signal is amplified by the amplifier LM324 and is changed into the digital signal by the ADC0832.

6 Conclusion

The truck position cheating monitoring system is experimentally studied. The experiment results shows that the monitoring system can detect the cheating method on time.

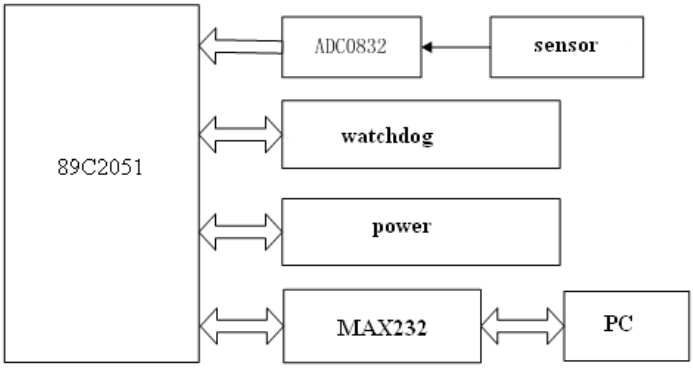


Fig. 6. The truck position monitoring system

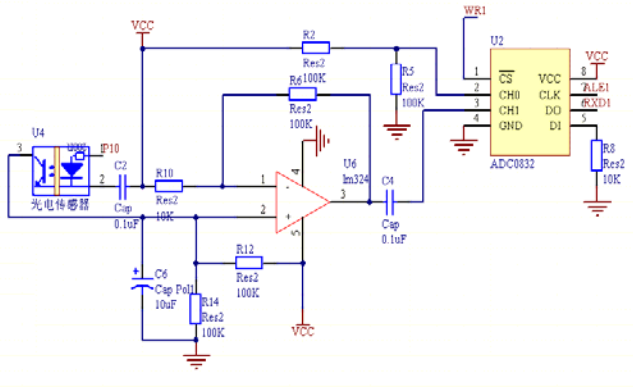


Fig. 7. The photoelectric detection circuit

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Study on Computer Output Characteristic of CSI Based on Battery Material

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Abstract. Perfect out characteristic of current source inverter (CSI) can be obtained by simulation. It can output very large output current although actually the output current is limited by the battery materials of DC source and both Thevenin equivalent internal resistant et al. This makes testing result polemicist against simulations. Based on the distinct difference results between simulation and test, output characteristic of CSI is studied. A method to simulate the battery in actual output characteristic of CSI is proved. Simulation and test proved the rationality of the conclusion.

Keywords: battery behavior, Computer simulation, CSI, power, battery material.

1 Introduction

Bi-direction current source inverter (CSI) is widely used in applications as SMES [1], STATCOM [2], et al, for its steady output current and fast response speed. With the wide application CSI, the research and application of the space vector modulation (SVPWM) and sine pulse width modulation (SPWM) become wide. Simulations can create a visual testing environment and check the correctness of main ideas. But the elements in the simulation soft ware are ideal element, sometimes the difference between simulation and actual test is large. This paper showed the miss distance when CSR is studied for its max ultimate output power and discussed the technology of the difference.

Structure of CSI is showed in fig.1(a) and recommended battery model [3] is showed in fig.1(b) which is applied to battery simulations in many occasions. When the CSI is running in invert state, CSI is worked as a negative resistance and the power of battery feed back to the power grid.

But there are somewhere improper of the battery model when applied in CSI because there are some rule that should be abide by. This paper discussed the main factor which caused the evident difference between the simulation and the test and proposed a modified simulation method based on power transition theory and battery characteristics.

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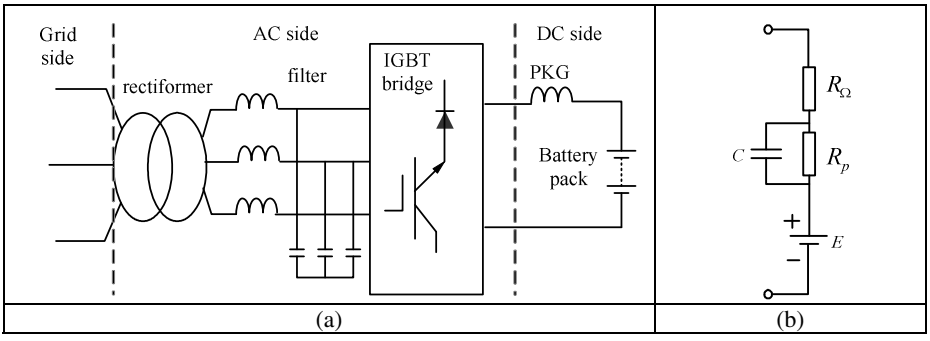


Fig. 1. Simulation model of CSI and battery pack

2 Power Transition in Sinusoidal Steady Circuit

The maximum power transmission problem is typical application of Thevenin's theorem and Norton's theorem. In teaching material the maximum power-transfer theorem is that, when $Z_L=Z_{eq}^*$, load Z_L get the maximum energy from power source and the maximum transfer power is

$$P_{\max} = \frac{U_{oc}^2}{4R_{eq}} \tag{1}$$

Where R_{eq} is resistance component of port's equivalent impedance Z_{eq}

U_{oc} is equivalent voltage source effective value

Apply maximum power transmission theorem in Sinusoidal Steady Circuit. When one port of the linear circuit has fix equivalent power and inner resistance $Z_{eq} = R_{eq}+jX_{eq}$, and the load's impedance $Z_L=R_L+jX_L$ ($R_L$is fixed and X_L can be adjusted). Because R_L is fixed, when $R_{eq}\neq R_L$, Optimal matching condition $Z_L=Z_{eq}^*$ is dissatisfied. Analysis the expression of load's power P.

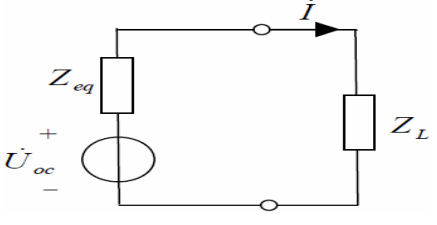


Fig. 2. Equivalent circuit of Sinusoidal Steady Circuit

$$\dot{I} = \frac{\dot{U}_{oc}}{Z_{eq} + Z_L} = \frac{\dot{U}_{oc}}{(R_{eq} + R_L) + j(X_{eq} + X_L)} \tag{2}$$

$$I = \frac{U_{oc}}{\sqrt{(R_{eq} + R_L)^2 + (X_{eq} + X_L)^2}} \tag{3}$$

$$\text{So } P = RI^2 = \frac{R_L U_{oc}^2}{(R_{eq} + R_L)^2 + (X_{eq} + X_L)^2} \tag{4}$$

In eq.3 there is only one variable X_L so it can be deduced that when X_L=- X_{eq} there will be the max transmission power $P_{max} = \frac{R_L U_{oc}^2}{(R_{eq} + R_L)^2}$. And if R_L=R_{eq}, the conclusion meet maximum power-transfer theorem.

For CSI, imaginary part of the DC side impedance is reactance because the capacitor of battery is suppositional. imaginary part of the AC side impedance is also reactance. Because the power grid impedance in China is inductive, and the inductance of CSI AC filter is larger than the capacitive resistance [4].

3 Battery Characteristecs

First, to be exact, the battery is a semi-capacitive load. When it is charged, it store energy and its inner potential will rise along with the growth of power. The rise is simulated by the capacitance C in fig.1(b). But it isn't a physical capacitance. If the battery is connected in series with an inductance, resonance can't emerge. But in simulation it would emerge. So when the CSI is running, the influence that the capacitance to the filtering inductance should be considered.

Second, the invert energy is limited by many factors. For example, The battery materials of DC source and both Thevenin equivalent internal resistant, et al. The battery's practical released capacity is related to the discharge current. With the rise of discharge current the battery efficiency fall. A 12V/24Ah battery for example, when discharge current is 0.4C, the discharge time of termination voltage is 1hour and 50 minutes. The practical released capacity is 17.6Ah. the efficiency is 73.3%. But when discharge current is 7C, the discharge time of termination voltage is only 20s. The practical released capacity is 0.93Ah. the efficiency is 3.9%. Normally the battery's discharge current is set no more than 2C. But in simulation, when the battery is applied in CSI, STATCOM for example, when the identified discharge current is very large the system can still output large currents. This made the simulation outcome don't meet the practice test outcome.

Third, the inner resistance of battery will change a lot during the procedure of charging and discharging. There is a rule that the distribution contrast of the inner impedance of the battery unit changed with discharge depth is described with the family curves of the inner impedance [5]. So the battery model should abide the inner dump energy. The polymer battery magnification discharge curve which is showed in fig.3

4 Amended Battery Model

The amended battery model in MATLAB is shown in fig.4. A s_function and a current controlled voltage source are used to adjust the output current of the battery. S-function detect battery's charging current. Once the current is larger than 2C, s_function made CCVS out put a counter electric force to restrict the current. It simulates a procedure that the increase of battery's inner resistance and simulates the real working condition of the battery.

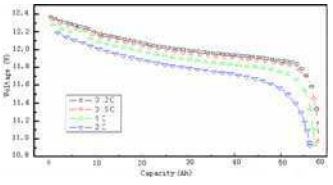


Fig. 3. The polymer battery magnification discharge curve

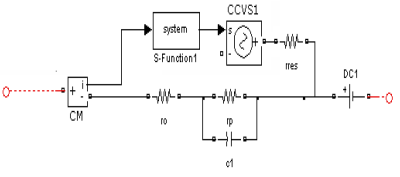
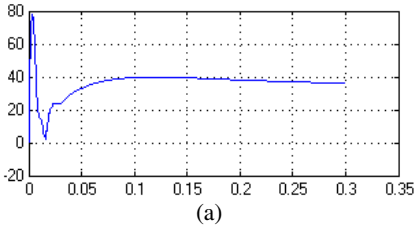


Fig. 4. Amended battery model

5 Simulations and Tests

First a model is set to simulate the test circumstance by MATLAB. The line voltage of the transformer is18.9 V. So in MATLAB the peak value of the phase voltage is 15.4V. CSI is controlled by double-loop SPWM control. Fig.5(a) showed that when the given current is 40A, CSI output a value approximate to 40. Fig5(b) showed the PI parameter of active component i_{rq} which has reach the output extremity of CSI.



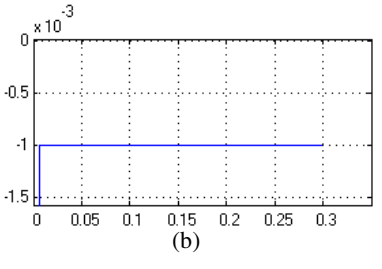


Fig. 5. Battery's discharging current and I_{rq}

Fig.6 showed that, with a model to simulate the changer of inner resistance, the battery out put a lower current of about 15A. At the AC side, the output voltage and the grid current invert phase. The power of battery feed back to the grid. Fig.7 is the inverting test result outputted by CSR. The testing parameters are the same as the simulation parameters. It proves that to make a counter CVVS to simulate the inner resistance of the battery can make the simulation result approximate to the test. But there are still differences about the output AC current due to CSR's duty circle. This paper would study the difference in future.

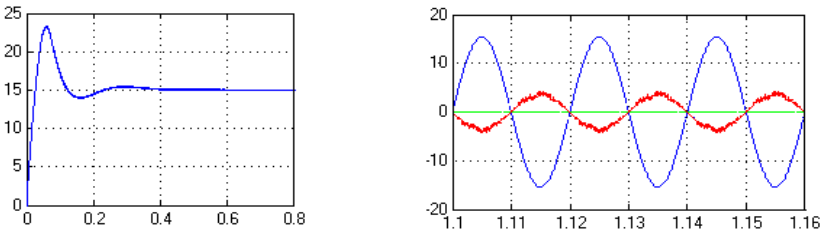


Fig. 6. DC current and AC voltage output by CSR

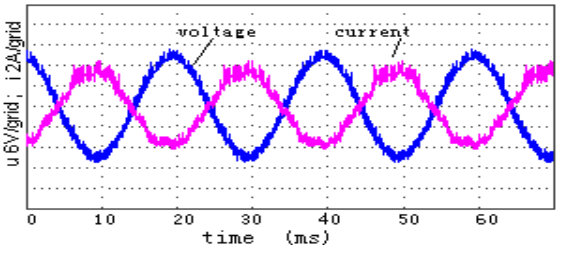


Fig. 7. Test result output by CSR

6 Conclusions

When discharging, the battery's inner impedance changed with discharge depth which can be described with the family curves of the inner impedance. To add a counter CVVS to simulate the inner resistance of the battery can make the simulation result approximate to the test. This paper introduced a method to simulate the characteristic of battery. Simulation and test proved the rationality of the method.

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Optimization of Support Pretreatment for Rh/AC Catalyst

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Abstract. Activated carbon has been widely used as porous support in heterogeneous catalysis. The special pretreatment of carbon support could tune the physical-chemical properties and the catalytic performance of the supported catalyst. The high-temperature chemical pretreatment of carbon support could effectively enhance the activity of carbon supported rhodium catalyst for hydroformylation of mixed octenes. The optimal conditions of pretreatment were studied by the Taguchi method. The results showed that the optimized parameters were 1.0 weight ratio of KOH to carbon, 1063 K treated temperature, 9.0 pH of carbon surface, and 75 min treated time. Under these conditions, the yield of aldehydes for hydroformylation reached up to 50.5%.

Keywords: Activated carbon, Pretreatment, Orthogonal array design, Hydroformylation.

1 Introduction

Activated carbons are widely-used as porous supports in heterogeneous catalysis due to their high surface areas, easy recovery of active components, and chemically inert to acidic and basic media [1-3]. They can be produced from various carbonaceous sources, such as coals, coconut shells, bamboos, and woods, etc. Their porosity and surface characteristics are dependent on the feedstocks and the following activation processes, which have significant effects on the performance of accomplished catalysts [2]. Although it had been reported that the surface oxygen groups in carbons dominated the properties of the supported catalyst [3], many efforts were still needed to devote to understand the impacts of surface features. In order to meet specific requirements, activation pretreatment was often used as a common tool to tailor the physical-chemical properties of carbon supports. For example, wet-oxidation pretreatments with HNO_3, HCl, HF, H_2SO_4, H_3PO_4, and H_2O_2 enabled oxygen-containing acid groups to assemble densely on the carbon surfaces [4-6]. The gas-phase oxidation pretreatments (e.g., in O_2 and air) could also enhance oxygen groups and change carbon properties dramatically as well as the thus-achieved supported catalysts [4,7]. However, the ability of heating treatment to eliminate the surface oxygen brought about graphitization to some degrees and created more π-complex structures (π-sites) in the carbon basal planes [8, 9].

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Hydroformylation of alkenes is a kind of typical atom-economic reaction in which olefins reacted with synthesis gas to yield aldehydes [10]. The homogenous soluble transition metal (cobalt or rhodium) complexes were used as catalysts for this reaction. However, the separation of homogeneous catalysts from products and their recycling were difficult for hydroformylation of higher alkenes. A possible approach to simplify the separation of catalysts from products was to load cobalt or rhodium onto a solid support. Our groups had prepared the carbon-supported rhodium-based catalyst (Rh/AC) and studied their activity for hydroformylation of mixed octenes [11]. The Rh/AC exhibited good activity and recyclability for hydroformylation reaction of higher alkenes.

Herein, the pretreatment of carbon support and optimal conditions were studied and determined by orthogonal experiments. Hydroformylation of mixed octenes to isononyl-aldehydes (iso-NA) was used to evaluate the activity of Rh/AC catalyst.

2 Experimental

Reagents. Rhodium trichloride trihydrate ($RhCl_3 \cdot 3H_2O$, 39.0 wt.% Rh) was purchased from Shanxi Kaida Chemical Engineering Co. Mixed octenes were obtained by the dimerization of mixed butylenes, comprising of 2,4,4-trimethyl-1-pentene, 2,4,4-trimethyl-2-pentene, and other octene isomers. Nitrogen (99.5 vol.%), hydrogen (99.5 vol.%) and carbon monoxide (99.99 vol.%) were obtained from Shandong Semiconductor Institute and used without further purification.

Support Pretreatment Method. The starting activated carbon (coal based) was purchased from Beijing Pacific Activated Carbon Products Co., Ltd. For convenience, it was designated as AC. Firstly, the activated carbon was boiled with distilled water to remove potential catalyst poisons and pore plugging materials before use. After filtration, the obtained support was dried using vacuum drying oven.

The chemical pretreatment at high-temperature was performed in a tubular reactor. First, the carbon support was mixed with an aqueous solution of KOH in a desired weight ratio, followed by soaking for 24 h at room temperature. After dried at 393 K for 12 h, the sample was placed in the tubular reactor with nitrogen flow and high-temperature treated for 15-90 min. Then, the furnace was shut off and cooled under nitrogen to room temperature. Finally, the obtained sample was washed to a certain pH value using deionized water and dried.

Catalyst Preparation. $RhCl_3$ had been used as the metal precursor. Typically, it was introduced into the pores of the supports by incipient-wetness impregnation, while Rh content in the solutions was adjusted to get the Rh loading of 0.01 gram per gram of the support. The obtained samples were dried in an oven at 393 K. Then, phosphoric acid had been impregnated with loading 5.0 wt.% in the same method. Finally, the solids were calcined at 673 K to obtain Rh/AC catalyst.

Hydroformylation Reaction. All hydroformylation experiments were carried out in a 500 mL batch-stirred autoclave with internal mechanical stirring. A given amount of catalyst and mixed octenes were introduced into the reactor. After gas blowing displacement, the reactor was charged with synthetic gas (CO/H_2=1/1) to the required pressure and heated to the desired temperature with constant stirring at 600 rpm. After the reaction, the reactor was cooled to room temperature and depressurized. Then, the

solid catalyst was separated and collected. Reaction conditions: catalyst 0.5 g, mixed octenes 40 mL, temperature 380 K, initial pressure 5.0 MPa. The liquid samples were analyzed by the Hewlett-Packard (5890) gas chromatograph equipped with a capillary column PONA and flame ionization detector (FID). The products were mainly 3,5,5-trimethylhexanal (denoted as 1-C_9^{CHO}), 2,2,4,4-tetramethylpentanal (denoted as 2-C_9^{CHO}), isooctane and small amounts of other aldehydes.

3 Results and Discussion

Effect of Support Pretreatment on the Performance of Rh/AC. The conditions of pretreatment for pretreated-AC were the KOH/C ratio 1.0, treated temperature 1023 K, pH of washing solution 9.0 and treated time 45 min. Table 1 showed the results for the hydroformylation of mixed octenes over catalysts of Rh/AC using the pristine and pretreated carbons as supports. As revealed in Table 1, when using pristine carbon supported Rh as the catalyst (Rh/pristine-AC), the conversion ratio of mixed octenes was 39.1% and yield of aldehydes was 22.1%. This was mainly due to the occurrence of hydrogenation side-reaction, the selectivity of byproduct (isooctane) was high (24.6%). If Rh/pretreated-AC as the catalyst and kept other conditions unchanged, the conversion of mixed octenes and selectivity of 1-C_9^{CHO} could be significantly improved, and the yield of aldehydes increased up to 44.1%.

Table 1. Hydroformylation performance of Rh/AC using the pristine and pretreated carbon supports

Catalyst	Conversion(%)	Selectivity (%)			Yield of iso-NA (%)
		Isooctane	1-C_9^{CHO}	2-C_9^{CHO}	
Rh/pristine-AC	39.1	24.6	47.0	9.6	22.1
Rh/pretreated-AC	48.0	3.1	91.8	0.2	44.1

Optimization of Pretreatment Process. In this part, Taguchi method was applied to determine the optimum conditions of the pretreatment of support. An orthogonal array L_9 (3^4) was used. The selected factors were weight ratio of KOH to carbon (KOH/C), treated temperature, treated time and pH of activated carbon surface. The factors and their levels were given in Table 2.

Table 2. Experimental parameters and levels

Level	Factor			
	A: KOH/C ratio	B: Temparature (K)	C: Time (min)	D: pH
1	0.6	973	10	8.5
2	1.0	1023	45	9.0
3	1.4	1063	75	9.5

The yield of iso-NA was used as a target to examine the catalytic performance of the catalysts achieved under different pretreatment conditions. The levels of factors

and the yields to aldehydes were shown in Table 3. The range analysis was adopted to evaluate the results. Here, M_i represented the mean of the sum of response at level i for each factor while using different values of other parameters. The significance of the factors on the pretreatment could be estimated by the results of the range R, which was defined as $R = M_{i,max} - M_{i,min}$. As shown in Table 3, the order of R was $R_B > R_A > R_D > R_C$. The higher values for the calculated R, the greater influence of the corresponding factor on the experiment outcome was. Therefore, it could be found that treated temperature (B) and KOH/C ratio (A) were the significant parameters affecting yield of iso-NA and the optimum conditions were A_2, B_3, C_3, and D_2.

Table 3. Results for hydroformylation experiments

Entry	Factors and their levels				Yield of iso-NA (%)
	A	B	C	D	
1	1	1	1	1	38.6
2	1	2	2	2	39.0
3	1	3	3	3	42.2
4	2	1	2	3	37.8
5	2	2	3	1	40.8
6	2	3	1	2	47.2
7	3	1	3	2	38.6
8	3	2	1	3	25.9
9	3	3	2	1	40.4
M_1	39.9	38.3	37.2	39.9	
M_2	42.0	35.2	39.0	42.6	
M_3	34.9	43.3	41.5	35.3	
R	7.0	8.0	3.3	6.3	

The KOH/C ration had a great effect on the structure of carbon support. From Table 3, it could be seen that the best yield of iso-NA was obtained when the KOH/C ratio was 1.0. The mesopores and oxygen-containing groups increased with increasing KOH/C ratio when the ratio was less than 1.0 [12]. After the ratio was more than 1.0, however, the conversion of alkenes decreased because a more violent KOH-C reaction resulted in the collapsing of pores and deterioration of support properties, leading to the loss of anchoring sites and reduction in the conversion of mixed octenes by about 16.7%. The carbon-KOH reaction during the pretreatment process was described as [13]:

$$4KOH + {=}CH_2 \rightarrow K_2CO_3 + K_2O + 3H_2\uparrow \quad (1)$$

$$8KOH + 2 \equiv CH \rightarrow 2K_2CO_3 + 2K_2O + 5H_2\uparrow \quad (2)$$

$$K_2O + C \rightarrow 2K + CO\uparrow \quad (3)$$

$$K_2CO_3 + 2C \rightarrow 2K + 3CO\uparrow \quad (4)$$

Analogously, the treated temperature should not be too high and treated time not too long, which also caused the collapsing of pores and decline in carrier properties. In the range of pH from 8.5 to 9.5, the yields of aldehydes increased first and then decreased, and got the peak value at 9.0. The pH of carbon surface had a great effect on the adsorption performance of $RhCl_3$. At pH below 9.0, the rhodium complexes could adsorb and disperse onto some inner walls of carbon support, which was an inaccessible area for mixed octenes and resulting in the low catalytic activity of Rh/AC. On the contrary, the dispersion of Rh could be also declined because the

rhodium agglomerated to a certain degree at high pH value. In summary, the optimal parameters for support pretreatment were the KOH/C ratio 1.0, treated temperature 1063 K, pH of carbon surface 9.0 and treated time 75 min.

In addition, the experiment corresponding to optimum pretreatment conditions was not present in the orthogonal array experiment. In order to test the optimal results, confirmation experiment was carried out under the same catalyst preparation and reaction conditions. The yield of iso-NA was 50.5% under optimal conditions for the support pretreatment, and the selectivity of hydrogenation decreased to 2.5% accordingly, which was higher than those produced in orthogonal experiments.

4 Conclusions

The pretreated carbon supported Rh catalyst exhibited good activity for hydroformylation reaction of mixed octenes, and effectively restricted hydrogenation side-reaction of alkenes. In order to achieve highly efficient heterogeneous catalyst, Taguchi method was exploited to optimize the pretreated conditions. The factors included ratio of KOH to carbon, temperature, time, pH of carbon surface. Finally, the optimal conditions of pretreatments were achieved, which showed the ratio of KOH/C was a significant factor in obtaining Rh/AC with desired catalytic activity. The optimal conditions were ratio of KOH/C with 1.0, treated temperature of 1063 K, pH of carbon surface with 9.0, and treated time of 75 min. When using Rh/AC obtained under optimal conditions as the catalyst, the result of catalytic reaction indicated that the yield of iso-NA had been reach up to 50.5%. The present work was beneficial to the design of heterogeneous catalysts for Hydroformylation of alkenes.

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Recognition of Handwritten Chinese Character Based on Least Square Support Vector Machine

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Abstract. Recognition of handwritten Chinese charater has been applied to diversified fields in terms of industrial demands as well as in daily life, since transformation from handwritten charaters into computer-processible binary digits inevitably bring people convenience and joy. However such ubiquitous facility suffers drawbacks within current recognition schema, such as complex training process, low recognition accuracy and slow identification. In light of these dissatisfation, a novel recognition method is proposed to hadle Chinese characters, which is based on the least square support vector machine. This approach evades solving traditional QP problem in the stage of machine learning where the training is time consuming. It, however, works in a way that transforms the recognition constraints into a series of generalized inequitions. Test results show that the proposed method enjoys better recognition acccuracy compared with existent approaches.

Keywords: handwritten Chinese character, recognitin, Least Square Support Vector Machine, case simulation.

1 Introduction

Handwritten Chinese character recognition is an important topic in the field of artificial intelligence. It has broad applications to Chinese information processing, office automation, machine translation, artificial intelligence and other high-tech fields. So far, in addition to the effective numeral offline identification methods [1,2], recognition of handwritten characters has been an attentive research area in light of new approaches [3-6].

Current handwriting recognition feature extraction methods belong to two categories, namely the structure identification and statistical decision making. Structure identification method is to find a basic unit (primitive) relationship. This method is intuitive and can reflect the structural characteristics. However Chinese character is complex, meanwhile the extraction of word elements is not easy. Besides, the relationship of each primitive is also complex and hard to determine. Statistical decision method is based on similar models utilizing the same features as the foundation of recognition. Attributes are used to describe something called the characteristic parameters, which can be achieved by mode measurement of multiple

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samples for statistical analysis to extract according to certain criteria. This method is more convenient and has better anti-interference performance. Its disadvantage is that the structure does not make full use of model features. Structural identification method is based on similar models with similar structure based identification method.

Support Vector Machines (SVM) is a new hotspot of machine learning field. Using support vector machine to extract feature is actually a kind of transformation that converting Chinese character image into high-dimensional space, so that the characters of different types become more separable in order to implement pattern classification and recognition. Looking for better transformation is still a problem that needs to solve. Classifier defines a family of surfaces in the feature space by its topology and parameters. The family of surfaces will divide feature space into different classes in order to achieve the purpose of classification. The feature space of handwritten Chinese characters is very complex. We have not yet found fully separable feature maps and the corresponding surface. By means of designing a single classifier, we hope to make a measure for evaluating the spatial complexity of sample space and classifier that can adjust its structure according to the distribution of feature space.

Although the performance of SVM has been verified in many practical problems, such as handwriting recognition [4,5,6], speech recognition, fingerprint recognition, face recognition, gait recognition, speaker recognition, Labeled point pattern matching [7] and et al. But the training speed of SVM is too slow in solving optimization problems, hence Dr. J.A.K. Suykens [8] proposed the least squares support vector machines (LS-SVM) which is to change the form of original convex quadratic optimization problem into a linear optimization problem and it effectively enhances the training speed. In this paper, least squares support vector machine algorithm is used for recognition of offline handwritten Chinese character.

2 Basic Recognition Methods of Handwritten Chinese Characters

Image Preprocessing. Preprocessing normally involves image smoothing, noise reduction, segmentation of adhesion character, binarization of character image, thinning, normalization, etc. Fig.1 shows the whole process: the handwritten text is scanned by a digital instrument then converted by the analog-digital converter into a certain gray value of the digital sample signal where it was sent into the computer. The preprocessing section normally includes the elimination of noise, binarization, segmentation of lines, smoothing, normalization, linear or nonlinear transformation. After the preprocessing, the character turns to standardized binary lattice information, where "1" indicates stroke section, "0" indicates the background section. For the binary matrix, in accordance with the requirements of identification, there extracts the characteristics on behalf of the character and compared with the characteristics of the known standard text information stored in the computer so as to find out the closest character in the dictionary. Finally the processed character is considered to be the recognition result.

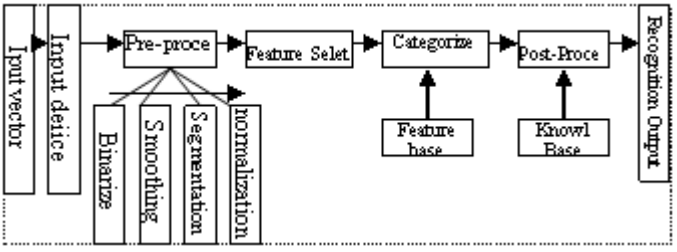


Fig. 1. Handwritten Chinese character recognition system

As the core part of the character recognition, feature extraction includes the domain transformation methods, statistical and structural features characteristic methods. Overall procedure is illustrated by Fig. 2. Due to its burdensome calculation, transform domain methods is not practically feasible, such as HOUGH transform, KL transformation, FOURIER transformation, FOURIER descriptors and so on. Statistical features include global and local features. Statistical features are classified into most relevant information from the raw data for the purpose of minimizing the gap between different classes.

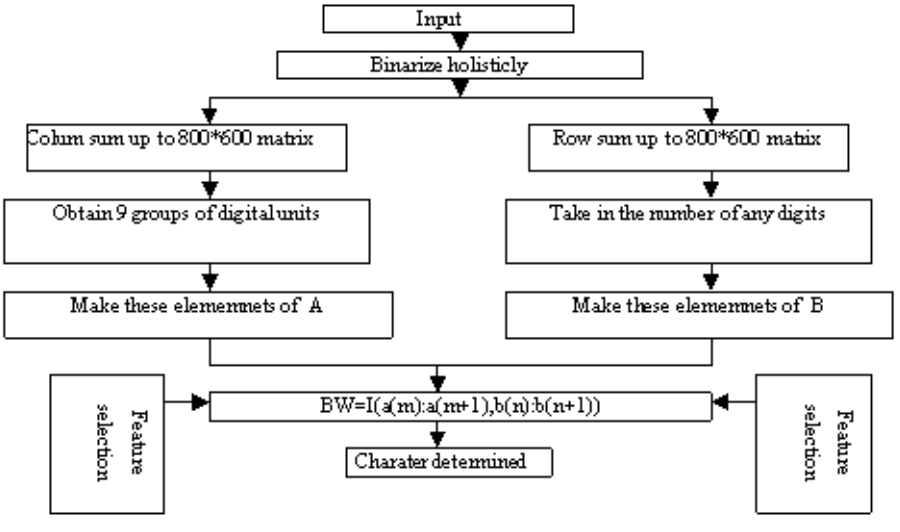


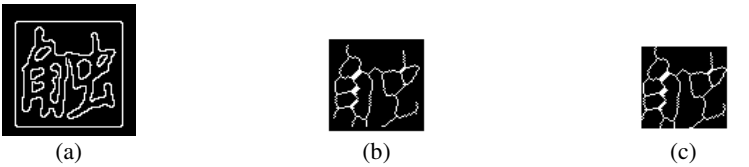
Fig. 2. Preprocessing a character

A New Method of Feature Extraction. The new design utilizes statistical method based on feature extraction of the structure feature of handwritten Chinese character. Detailed extraction process follows by: to implement edge detection for the image, get image skeleton and further normalization. Using thinning algorithm based on point pixel to obtain the character frame can avoid the huge difference of pixel gray values

due to the uneven thickness of strokes, thus reducing the computation cost. In order to utilize statistical density of a character to extract features, the character needs to be further normalized after the skeletonizing. Although the size of the skeleton image is different, they all reflects the structural features of each character very well. Subsequently, the image ought to be equally divided into Ⅰ,Ⅱ,Ⅲ,Ⅳ quadrants. Cumulative sum up of each quadrant's pixels, the image should be divided by the area of the quadrant in order to obtain the density of each quadrant. The process is exemplified by three characters, namely "擋" "触" "川". Fig. 3-6 show the process respectively.

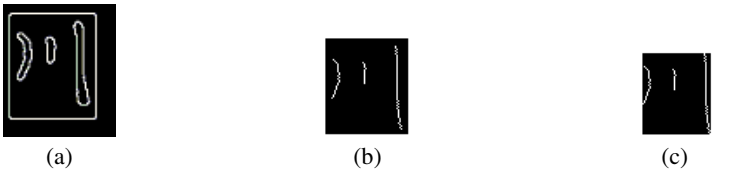
(a) (b) (c)

Fig. 3. Feature extraction of character "擋". (a) Image after edge based detection, (b) Image based on skeleton extraction, (c) Further normalized image



(a) (b) (c)

Fig. 4. Feature extraction of character "触". (a) Image after edge based detection, (b) Image based on skeleton extraction, (c) Further normalized image



(a) (b) (c)

Fig. 5. Feature extraction of character "川". (a) Image after edge based detection, (b) Image based on skeleton extraction, (c) Further normalized image

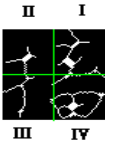


Fig. 6. Equally divide the image into Ⅰ,Ⅱ,Ⅲ,Ⅳ quadrants

3 Recognition of Handwritten Chinese Characters Based on the Least Squares Support Vector Machines

Different from the traditional support vector machines proposed by Vapnik, the least squares support vector machines uses SRM criteria to construct the minimize the objective function as follows:

$$\min_{\omega,b,e} J = \frac{1}{2} w^T w + \gamma \frac{1}{2} \sum_{k=1}^{l} e_k^2 \tag{1}$$

$$y_k = w^T \varphi(x_k) + b + e_k, k = 1,.....l \tag{2}$$

Define Lagrange function:

$$L = J - \sum_{k=1}^{l} a_k [w^T \varphi(x_k) + b + e_k - y_k] \tag{3}$$

where a_k is Lagrange multipliers. According to the KKT (Karush-Kuhn-Tucker) condition:

$$\partial L / \partial w = 0 \rightarrow w = \sum_{k=1}^{l} a_k \varphi(x_k) \tag{4}$$

$$\partial L / \partial b = 0 \rightarrow \sum_{k=1}^{l} a_k = 0 \tag{5}$$

$$\partial L / \partial e_k = 0 \rightarrow a_k = \gamma e_k \tag{6}$$

$$\partial L / \partial a_k = 0 \rightarrow w^T \varphi(x_k) + b + e_k - y_k = 0 \tag{7}$$

For $k = 1, \cdots l$, eliminate w and e to obtain the following equations:

$$\begin{bmatrix} 0 & 1^T \\ 1 & ZZ^T + \gamma^{-1} I \end{bmatrix} \begin{bmatrix} b \\ a \end{bmatrix} = \begin{bmatrix} 0 \\ Y \end{bmatrix} \tag{8}$$

$$l = [1, \cdots, l] \quad Y = [y_1, ..., y_l]^T, a = [a_1, ..., a_l]^T \quad z = [\varphi(x_1)^T, \cdots, \varphi(x_l)^T]^T \tag{9}$$

Determine a and b from the equation (8) by least square method, which derives the predicted output:

$$y(x) = \sum_{k=1}^{l} a_k \varphi(x)^T \varphi(x_k) + b \tag{10}$$

Using the method of kernel function, making

$$K(x, x_k) = \varphi(x)^T \varphi(x_k) \tag{11}$$

Therefore the forecast output is:

$$y(x) = \sum_{k=1}^{l} a_k K(x, x_k) + b \tag{12}$$

Above equations reveal the principles of least squares support vector machines (LS-SVM). Compared with the classical support vector machines, least squares support vector machines (LS-SVM) use equation constraints instead of inequation constraints so that the solution process is transformed to solving a set of equations. This transformation avoids solving time-consuming QP problems, and it thus relatively speeds up the solution. As for the commonly used insensitive loss function, LS-SVM no longer needs to specify the approximation accuracy.

The entire recognition steps for handwritten Chinese characters are illustrated by Fig. 7.

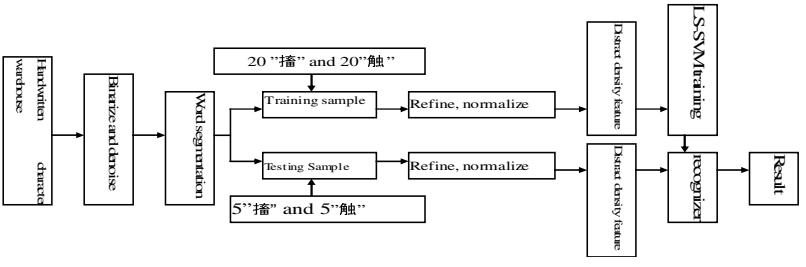


Fig. 7. Flowchart of handwritten Chinese character recognition

3.1 Application Procedures and Results Analysis

The database of this design is selected from the SCUT-IRAC HCCLIB handwritten Chinese characters image database.

Using three databases of character "搐","触","川", each database has 40 single-character samples written by different writers. We conduct preliminary screening of single character samples before training, then select 20 characters as training samples and 5 characters as testing samples from each sample database. Next, two types of recognition are conducted for the character "川(1) and 搐(-1)", "川(1) and 触(-1)", "触(1) and 搐(-1) " respectively.

Feature vector database is composed of matrix with 20 rows and 4 columns, in which 20 rows are composed of 20 training samples (10 testing samples). The 4 columns comprise the density of each single character falling into the four quadrants.

To enhance the versatility of the system and to speed up the convergence, we need to conduct normalization processing for data feature of input raw data. The normalization is to transform each sample vector component on different scale into the same scale.

Commonly used normalization method is:

$$IN[t]=\frac{x_i(t)-\min(S_i)}{\max(S_i)-\min(S_i)} \tag{13}$$

$$S_i=\{x_i(1),\cdots,x_i(t)\},i=1,2,3,\cdots n \tag{14}$$

where $IN(t)$ is the input value after transformation. $x_i(t)$ is the input raw data. $\min S_i$ is the minimum value of the raw data. $\max S_i$ is the maximum value of the raw data.

Afterwards, we can transform the initial data into interval [0,1] so as to facilitate the predicting process. Training steps are specified as follows.

1) Training the machine in a hybrid way that the 20 characters "川" "搐" are sequenced in cross manner as "川川触触川触川川触触". Table 1shows the step.

2) Identify the characters "川" and "触" in the sequence of "搐搐川搐川搐搐川川搐" which is displayed by Table 2.

3) Identify the characters "触" and "搐" in the sequence of "搐触搐触触搐触触搐搐" as illustrated in table Table 3.

4) Formulate the training function and testing function.

5) Run the experiment and calculate the recognition error Calculate the error according to

$$error = \frac{1}{n}\sum_{i=1}^{N}(y-\bar{y})^2 \tag{15}$$

Where y indicates true value and $\bar{y}$ stands for prediction.

6) Analyse the recognition rate of the experiment.

Table 1. Training of川 (1) and 触(-1)

sample	feature vector				Expectation	Experiment	error	Recognition rate
川	0.2052	0.0638	0.8376	0.0349	1	0.93679	0.00669	100%
川	0.0878	0.0756	0.4338	0.0276	1	0.90893		
触	0.6564	0.7982	0.2885	1	-1	-0.91893		
触	0.6057	0.741	0.0641	0.4985	-1	-0.91886		
川	0.0408	0	0.3462	0.311	1	0.90639		
触	0.8752	1	0.6752	0.8343	-1	-0.91892		
川	0.2324	0.0066	0.7457	0.0567	1	0.94356		
川	0	0.1269	0	0	1	0.89983		
触	0.7367	0.8452	0.8248	0.1337	-1	-0.91939		
触	1	0.7234	1	0.4128	-1	-0.9194		

Table 2. Training of 川(1) and 搐(-1)

sample	feature vector				expectation	experiment	error	recognition rate
搐	0.2932	0.7385	0.25	0.7489	-1	-0.9434	0.007148	100%
搐	0.8233	0.7439	0.3	0.6176	-1	-0.92527		
川	1	0.9084	0	0.0053	1	0.89296		
搐	0.3735	0.7305	0.4155	0.768	-1	-0.93961		
川	0	0	0.1833	0	1	0.89442		
搐	0.506	1	0.0733	0.8358	-1	-0.92587		
搐	0.0161	0.2507	1	1	-1	-0.92523		
川	0.1807	0.2857	0.2955	0.1959	1	0.8998		
川	0.2489	0.283	0.0655	0.0456	1	0.8997		
搐	0.3092	0.814	0.0366	0.506	-1	-0.92749		

Table 3. Training of触(1) and 搐(-1)

sample	feature vector				expectation	experiment	error	recognition rate
搐	0.0836	0.2465	1	0.7997	-1	-0.92398	0.005469	100%
触	0.7018	0.2552	0.0861	0.7352	1	0.96501		
搐	0.3236	0.2023	0.0375	0.9384	-1	-0.92478		
触	0.6636	0.2491	0.0782	0.7438	1	0.95857		
触	0.6945	0.184	0	0.6724	1	0.93493		
搐	0.1309	0.1181	0.2864	0.782	-1	-0.93791		
触	0.8273	0.7969	0.4789	0	1	0.8942		
触	1	1	0.421	0.894	1	0.8942		
搐	0.2036	0.1181	0.0596	0.804	-1	-0.93624		
搐	0	0	0.9562	1	-1	-0.924		

Experiment results are illustrated by Fig. 8-10, in which red slash lines represent the expected output while the black lines stand for the predicted outputs. The horizontal axis represents the 10 testing samples. The vertical axis is the predicting accuracy in the unit of percentage.

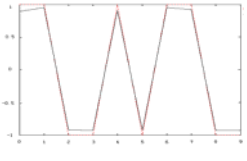


Fig. 8. Experimental results for川(1) and 触(-1)

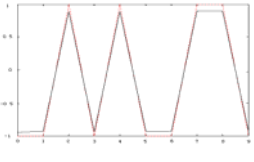


Fig. 9. Experimental results for川(1) and 搐(-1)

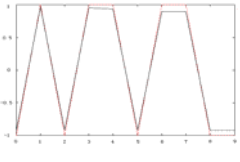


Fig. 10. Experimental results for触(1) and 搐(-1)

We can infer from the diagrams and the tables that the predicted value and expected value do not differ too much, and the recognition rate can reach nearly 100%. The result is satisfactory.

According to the characteristics of the samples, the recognition results accords with requirement thanks to the fact that this method fully reflects of the difference of characters when proceeding the feature extraction. However, the recognition rate of some individual character is low. This attributes to the reasons such as the limited numbers of samples, the difference of the writing habits amongst writers and unsatisfactory processing of the cross point for individual characters in the step of skeleton feature extraction,

There derives satisfactory result of using the least squares support vector machine to recognize handwritten Chinese characters. The experiment indicates that the proposed approach in this paper has excellent generalization ability in working on handwritten Chinese characters recognition.

4 Summary

The proposed novel approach tries to use statistical density method based on structure characteristics to proceed feature extraction for handwritten Chinese characters. Then it divides the image into four quadrants after preprocessing and counts each quadrant density to construct feature vectors. By employing least squares support vector machine algorithm, the novel approach modifies the model of the original convex quadratic optimization problem on the basis of traditional SVM into a linear optimization problem. Thus it finishes recognizing handwritten Chinese character. Experiment achieves good result in that the recognition accuracy is greatly improved and the error range is reduced.

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Effect of Modified Atmosphere Tent Combined with Modified Atmosphere Packaging on Cooking and Eating Quality of Storage Rice

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Abstract. The characteristics of starch, such as gelatinization temperature (GT), apparent amylose content (AC), gel consistency (GC) and other physicochemical properties, determine the quality of various products of rice, e.g., eating, cooking and processing qualities. In this work, we using the big paddy hermetic tent as the modified atmosphere tent storage rice. And the effect of modified atmosphere tent (MAT) combined with modified atmosphere packaging (MAP) of 0.05mm PE (PE1) and 0.08mmPE (PE2) on cooking and eating quality were investigated. The results showed that the MAT&MAP of PE1 was the best treatment for milled rice eating and cooking quality fresh keeping. MAT & MAP was the distinctly energy conservation storage method for rice cooking and eating quality refreshing.

Keywords: Rice, MAT, MAP, free fatty acid, storage.

1 Introduction

More than half of the world's population uses rice as a source of carbon intake every day. Improving grain quality is thus essential to rice consumers. The three main properties that determine rice eating and cooking quality were amylase content, gel consistency, and gelatinization temperature, which correlate with one another [1]. Rice eaters, Asians in particular, have always known that the cooking-eating properties of rice change dramatically with its storage after harvest. This phenomenon was usually termed ageing [2].

Preservation of rice is affected by temperature, humidity, gas concentration, packaging and other factors. Low O_2 and increased CO_2 concentrations slow down respiration. Modified atmosphere packaging (MAP) has the potential to prolong the shelf-life of fruits or vegetables stored by modifying O_2 and CO_2 [3]. However, the respiration rate of grain is lower than fruits or vegetables, so MAP was not so significantly action for preserving grain fresh.

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Currently, this research aims to develop a big paddy hermetic plastic tent for rice grain preservation, which combined modified atmosphere (MA) and controlled atmosphere (CA). The gel consistency (GC), alkali spreading value (ASV) and insoluble amylose content were to investigate of plastic tent, 0.05mm PE MAP, 0.08mm PE MAP and cotton cloth bag packaging in air condition. And a desired GC, GT and insoluble amylose content can be achieved through MAT with PE_1 and PE_2 packaging MAP preservation method.

2 Materials and Methods

Rice Sample and Storage Condition. *Japonica* rice variety W45 was used in this study. W45 was grown in rice growing season in 2009 on the experimental farms of Tianjin rice original seed farm, in Tianjin, China. At maturity, rice grain was random harvested. After drying, grain was stored at room temperature for 6 months, maintaining about 14.3% of moisture.

Then, 1 kilogram grain was divided into 0.05mm PE (PE1), 0.08mmPE (PE2) and cotton cloth bag. Then they were put into 0.5mm PE big paddy hermetic tent, which charged 5% O_2 and 5% CO_2, The stored temperature was room temperature. And another replications were stored in room as the CK treatment. Then cooking and eating characteristic of milled rice and grains were tested after 6 months storing. Each portion divided evenly into 3 groups for the repeat test.

Gel Consistency. The GC was measured in duplicates according to the method of Cagampang et al. [4]. Briefly, 100 mg rice flour was weighed in a 10 mm × 110 mm culture tube, to which 0.2 ml of 95% ethanol containing 0.025% thyml blue was added to prevent clumping of the powder during gelatinization. One milliliter of 0.2 N KOH was added and vortexed thoroughly. The tubes were covered with glass marbles and boiled vigorously in a water bath for 8 min. After standing at room temperature for 5 min, the tubes were put on ice for 20 min, and then laid down horizontally on a table surface.

The gel length was measured 1 h later as the distance from the bottom of the tube to the front of the gel migration. The gel length thus obtained provides a measurement of the gel consistency: the longer the distance, the softer the gel.

GT. The GT was measured on the basis of individual grains expressed as the alkali spread value (ASV) using the method of Little et al. [5] with minor modifications. Each sample was tested three times. Each time, 15 intact milled grains from sample were put in a weighing boat, to which 15 ml of 1.7% KOH was added. The grains were carefully separated from each other using a forceps and incubated at 30□ for 23 h to allow spreading of the grains. The spreading value of the grains was scored by visual assessment, essentially as described by Jennings et al. [6].

Grains swollen to the extent of a cottony center and a cloudy collar were given an ASV score 4 and used as a check for scoring the rest of the samples. Grains that were unaffected were given an ASV score of 1, and grains that were dispersed and disappeared completely were given a score of 10. A low ASV corresponds to a high GT, conversely, a high ASV indicates a low GT. Every sample was averaged over replications for further analysis.

3 Results and Discussion

3.1 Effect of MAT Combined with MAP on Gel Consistency (GC)

Gel consistency showing how stickiness the cooled paste of cooked rice flour is and used as a criterion for evaluation of cooked rice texture. Regarding the GC, which have been grouped based on continuous movement of the alkali gel during test using rice kernal powder, are divided into three groups namely soft, intermediate and hard with 16-32, 24-36 and 37-60 mm gel length, respectively [4,7].

The different between MAT&MAP with MAP in grain and milled rice were showed in Figure 1 after six months storage. The results showed that GC was decreased during storage despite MAT&MAP or MAP. And the grains' GC of MAT&MAP in PE_1, PE_2 and cotton cloth were 70mm, 71mm and 67mm, respectively, which were slowly change than only MAP treatment. The same time, milled rice GC of MAT&MAP in PE_1, PE_2 and cotton cloth were 68mm, 52mm and 48mm, which were distinctly lower than grains. Especially, the MAT&MAP of PE_1 was so better for GC freshly preservation.

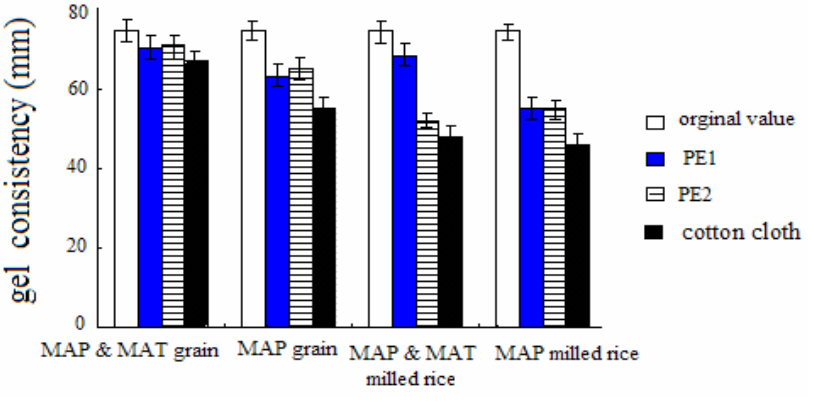

Fig. 1. Changes of GC from paddy to milled rice using MAT &MAP during six months storage

3.2 Effect of MAT Combined with MAP on Alkali Spreading Value (ASV)

The GT of starch can be measured indirectly by alkali spreading value. And low-GT rice have a softer texture than high-GT rice among freshly cooked. During storage, the alkali spreading value was decreased. It predicated that the texture become harder. The figure 2 showed that MAP and MAT grain and milled rice alkali spreading value in different package after 6 months storage. And in the different MA package, the rice grain alkali spreading value decreasing control capability was $PE_1 > PE_2 >$ cotton cloth. But in milled rice, the alkali spreading value of MAP & MAT of PE_1, PE_2 and cotton cloth were $PE_2 > PE_1 >$ cotton cloth.

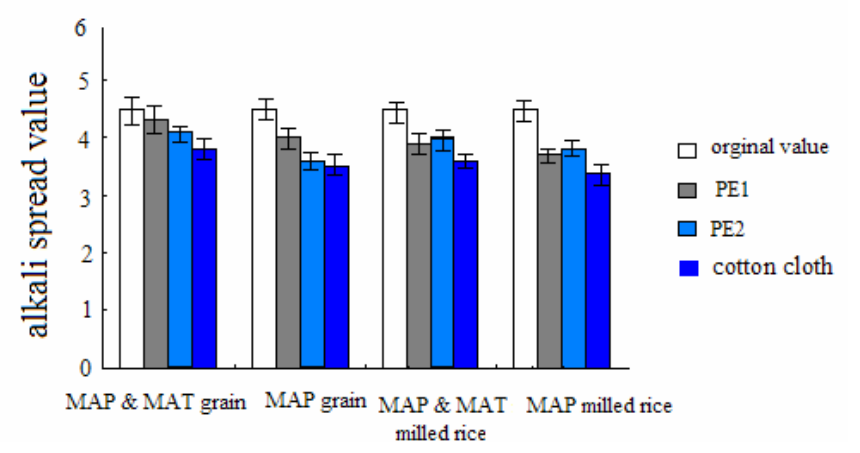

Fig. 2. Changes of ASV from paddy to milled rice under MAT &MAP

3.3 Effect of MAT Combined with MAP on Insoluble Amylose Content (IAC)

Amylose content is considered the single most important characteristic for predicting rice cooking and processing behavior. Bhattacharya *et al.* reported the importance of percentage insoluble amylose, calculated from total amylose and soluble amylose at 100 °C, as a determination of rice quality [8].

During storage, the insoluble amylase content was increased and the IAC in grain was lower than milled rice samples. And in the different MA package, the IAC increasing control capability was $PE_1 > PE_2 >$ cotton cloth. In milled rice, the IAC of MAP & MAT of PE_1, PE_2 and cotton cloth were increased 15.49%, 16.83% and 20.13%, respectively. However, the only MAP samples IAC of MAP & MAT of PE_1, PE_2 and cotton cloth were increased 17.94%, 19.77% and 20.94% (Figure 3).

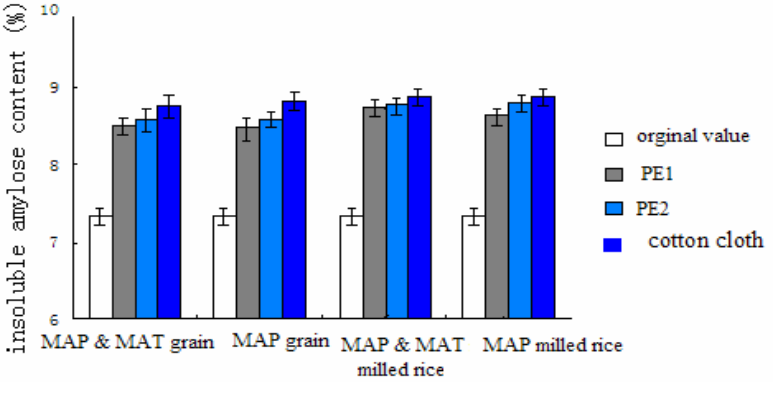

Fig. 3. Changes in insoluble amylose content under modified atmosphere package storage

4 Conclusions

The results of this study clearly have important implications in rice storage. It showed that MAT & MAP was the better storage method for rice grain and milled rice eating and cooking quality keeping. The changes in gel consistency (GC), alkali spreading value (ASV) and insoluble amylose content (IAC) all were controlled, especially the MAT and PE_1 MAP treatment. Therefore, the big hermetic plastic tent was good for rice preserving, and would be considered to be energy conservation storage method.

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The Training of Agricultural Extension Workers of Heilongjiang Province

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Abstract. Heilongjiang grain production accounts for the grain production 1/10, to safeguard the country's food security plays a very important role. Farmers' income from agricultural science and technology and agricultural science and technology can be accepted by farmers so that they can not be separated into primary productivity of agricultural technicians. This paper analyzes the Heilongjiang agricultural technology status and problems of personnel training, training in agricultural technology through needs analysis, proposed to improve the environment, to enhance the sense of personnel; innovative mechanisms to give full play to the role of human resources; increase investment, effective protection of personnel and funds recommendations.

Keywords: Agricultural technology, Agricultural workers, Training.

1 Introduction

Agricultural extension is to promote the importance of social and economic development of rural public welfare undertakings, and agricultural extension staff as an important social force of agricultural extension, in promoting rural economic development and social progress has played an irreplaceable role. Strengthen the agricultural capacity and quality of professional and technical personnel training and exercise vigorously continuing education of agricultural professionals to accelerate the train agricultural extension personnel, is to develop the rural economy, building a moderately prosperous society in an inevitable requirement for the party and government in a rural of important basic work.

2 The Status of Agricultural Technology Training in Heilongjiang Province

Heilongjiang Province, the current training of agricultural technicians situation mainly in the following areas:

(1) Changes in industrial structure, the structure of the corresponding technology needs change. some new industries support the lack of necessary technical reserves. The survey found that in 2009 77.2% of the people to participate in the agricultural sector had held various short-term practical technical training, the average number of

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training days for 5 days, but still nearly 22.8% of agricultural workers unable to receive any training.

(2) Change the mode of agricultural operation, its technology has also undergone a significant change in pattern. To organize with the idea of industrial agricultural production, is an unavoidable significant technical practice.Survey found that family members of the training is intended primarily to increase revenue, accounting for 95% of respondents; second is to enhance the skills, accounting for 75%.

(3) Science and technology with a new theory to arm the minds of the majority of scientists. Understanding of the survey, farmers on the current state help farmers better understanding of preferential agricultural policies, especially agricultural taxes, seed subsidies, food subsidies, agricultural subsidies, agricultural subsidies, level of understanding of the five policies were 100%, 88%, 97 %, 48% and 70%.

3 Problems of Agricultural Technology Training in Heilongjiang Agricultural

Denied training for the development of agriculture plays a very important role, but due to a lack of systematic training of agricultural technology, sustainability, tend to ignore the practical needs of agriculture.

(1) Agricultural technology extension system is not perfect, the lack of training needs based on science.Survey of training programs on the basis of many training managers, training for work is very important, but to do this work not know where to start. Training needs of their own is not clear,making the training with a lot of blindness and randomness.There is no specific technical staff , the importance of agricultural training of the upper and lower level will be greatly reduced.

(2)Thematic content of a single training, lack of training system layered.First, training needs analysis. Full use of the same questionnaire, the same set of training options, simply based on the findings to develop training programs based on demand. Second training settings. All staff to participate in the same training program to learn the same content knowledge.

(3) Teaching content selection surface is relatively narrow, internal training system is flawed, ignoring internal resources.No system for training of security is likely to cause a temporary stage work. Agricultural technology are often attached great importance to the introduction of outside training and training resources, but does not know that the best understanding of the situation of agricultural technology.

(4) Be strengthened professional training of managers.Training for the development value of agricultural technology to a certain extent, depends on the training of management personne. Today, management of agricultural training into the people's vision has gradually become the focus of the agricultural sector.

4 Agricultural Technology Trainin Needs Analysis

Various parts of the training system is interconnected network. Heilongjiang Province to make training more relevant agricultural technology and the applicability of the following areas of demand.

(1)The compare of the number of Heilongjiang Agricultural technicians and professionals.

Table 1.

Year	2000	2001	2002	2003	2004	2005	2006	2007	2008
Agriculture	31134	29905	29564	30731	28149	28008	28653	32285	34084
Engineering	182346	175644	158157	155432	127635	118318	115626	116311	111820
Health Care	135295	132167	130269	132671	123452	132515	130183	137244	140072
ScientificTechnology	5252	5069	5047	5694	3251	6244	7043	7448	6955
Teaching	383863	394674	393502	391876	357853	367913	378329	384827	390153

Table available in recent years, stable development of agricultural technicians, but the whole years of personnel changes within the agricultural technology is not great, the whole class to see other professional and technical personnel, the proportion of agricultural technicians are not great. Rose slightly after 2005, an average of about 30,279, which shows that although the number of personnel increased year by year, but the proportion is still small, especially in China as a major agricultural country, shortage of agricultural technicians, to develop or to improve on The overall demand for agricultural technicians.

(2) Heilongjiang provinces and the situation of township agricultural extension services

Table 2.

Region	Agricultural extension services(a)	Agricultural extension service practitioners (a)	Agricultural extension services /The average number of employees (a/ agencies)
National Total	51958	313147	6.03
Heilongjiang	976	7005	7.18

This form can be obtained, Heilongjiang province agricultural extension service personnel and service percentage. Heilongjiang province in which agricultural extension services accounting for about 1.88%, Heilongjiang Province, agricultural extension service practitioners about 2.24%. Agricultural extension services and the ratio of the average number of employees seen, Heilongjiang Province, exceeded 1.15% of the national statistical data. Agricultural extension services which that person engaged in very short supply.

(3) Various professional and technical staff compared the number of titles

Table 3.

Category	Total		Members with Senior Titles		Members with Secondary Titles	
	2007	2008	2007	2008	2007	2008
Total	809295	816621	108610	117266	328693	336809
Agriculture	116311	111820	14536	15690	40531	36478
Agriculture	32285	34084	2411	2779	10004	11357
Health Care	137244	140072	16592	19835	52005	50578
Scientific Research	7448	6955	3096	2810	1986	2032
Teaching	384827	390153	54376	58044	175094	183210
Economy	131180	133537	17599	18108	49073	53154

According to the table, from the perspective of titles, medium and low percentage of senior and intermediate titles in other types of agricultural technical staff only professional and technical personnel with intermediate grade of 3.2%, 2.3% higher. This note, to improve the overall level of agricultural, improve agricultural technology, the senior title is also an important task ratio.

5 Further Increase the Agricultural Extension Staff Training Measures

First, optimize the environment to enhance the human consciousness.

One should pay attention to agriculture and technical personnel. Vigorously promote the use of a variety of media personnel in the rural economy, agricultural technology development and new rural construction in the outstanding contribution and important role in advocating them based on their own, make contributions, services. Second, we must reuse of agricultural technicians. Party committees and governments to fully use boldly agricultural and technical personne and to be fully at work support and try to take care of their daily lives. Third, we must rewarded agricultural technicians.

Second, the innovation mechanism, give full play to the role of human resources

One needs to be innovative institutional mechanisms. Through the "withdrawal, transfer, and release " means make an inventory of rural agriculture-related station.Second, innovative training mechanisms. All levels of government must increase funding for the training of training inputs, training in the implementation of the education system and continuing education system at the same time. Third, we need innovation incentives. The distribution of agriculture-related units to actively implement the autonomy to allow development of agriculture-related units outstanding technical staff to tilt the allocation of measures.

Third, increase investment, effective protection of personnel expenses.

New rural construction requires a lot of agricultural and technical personnel, improve agricultural technology would require a large input of funds, capital accumulation. Update the knowledge of agricultural technology, further education, the introduction of training, would require the government, institutions, social and

individuals to increase capital investment. Therefore, the proposed increase at higher levels in particular, the central cause of agricultural extension services, financial investment.

6 Conclusion

Through technical re-training so that technical staff constantly updated knowledge of agricultural science and technology, quality improved, and people with advanced technical knowledge of agricultural development is the most fundamental competitive advantage. Technical staff in the work process knowledge gained through re-training is more practical, more focused, technical personnel to meet the needs of their own self-development. From another perspective, the training is to strengthen national competitiveness and improve the overall agricultural economic part.

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The Comparison of Financing Efficiency between Small and Medium-Sized Enterprises and the Research of Financing Channel Management

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Abstract. In the development of small and medium-sized enterprises, difficulty in financing is always the focus of discussion. In this thesis, on the base of the summary of factors influencing small and medium-sized enterprises' financing efficiency, the evaluation model of financing efficiency is formed and corresponding suggestion for financing channel management is proposed on the base of empirical analysis.

Keywords: small and medium-sized enterprises, financing efficiency, influencing factor, channel management.

1 Introduction

Since reform and open, small and medium-sized enterprises rise abruptly and make great contribution for economic construction. Meanwhile, the financial resource demanded for the development of small and medium-sized enterprises can not get fulfilled in long time. In this thesis, the computation model of financing efficiency is preliminarily built on the base of the factors of small and medium-sized enterprises' financing efficiency being summarized, besides, financing efficiency of various channels is selectively analyzed and corresponding suggestion is proposed for building financing channels finally.

2 Modeling for Small and Medium-Sized Enterprises' Financing Efficiency

2.1 The Confirmation of Variables and Factors

2.1.1 Definition of Financing Efficiency

Enterprise's financing efficiency is defined as the efficiency that enterprise raises and utilizes funds that is the relationship between financing and return. Under this frame, financing efficiency can be divided into two parts. One part is the efficiency of financing activities, mainly referring to the factors of enterprise's financing channels; the other part is utilizing efficiency of funds, mainly referring to enterprise's internal factors.

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2.1.2 Selection of Influencing Factors

When distinguishing the factors influencing enterprise's financing efficiency, the thesis adopts Wang Mingxia (2008)'s distinguishing method to divide them into six aspects: financing cost, financing timeliness, fund utilization efficiency, procurability of channels, degree of freedom of financing subject and liquidity. [1]The detailed analysis for these six influencing factors is as below.

Financing cost (C) represents the cost which is needed to be spent raising funds, including both interest and the price of other funds and the expenses for raising funds. Because of the differences among financial methods, financing cost is different. It does not impact enterprise obviously, therefore, it belongs to influencing factor of financing channel.

Financing timeliness (T) represents the time which is needed to obtain funds. Financing time is related to enterprises' own condition, but related to financing method and channel further, thus, it can be sorted as influencing factor of financing channel.

Fund utilization efficiency (E) represents the degree of return on utilizing funds. It is related to a series of factors including management level, executive capability and so on, belonging to enterprise's own controllable scope. Thus, it belongs to enterprise's internal influencing factor.

Availability of channel (P) represents the possibility that enterprise obtains funds in this channel. The enterprise hopes to apply all financing channels, but can not determine whether the channel can be obtained. Thus, this factor also belongs to influencing factor of financing channel.

The degree of freedom of financing subject (F) represents bound level of different financing methods. Enterprise's financing is not unconditional. This factor belongs to subsidiary condition of financing channel, thus also belongs to influencing factor of financing channel.

Liquidity (L) means the capability repaying capital and interest after enterprise's financing, particularly debt financing. In enterprise's controllable scope, the liquidity can be improved by enterprise itself, thus belongs to enterprise's internal influencing factor.

2.1.3 Classification of Factors

According to enterprise's impact, the above six factors can be divided into two categories: influencing factor of channel and enterprise's internal influencing factor. Thereinto, financing cost (C), financing timeliness (T), availability of channel (P) and the degree of freedom of financing subject (F) are influencing factors of channel; fund utilization efficiency (E) and liquidity (L) are enterprise's internal influencing factors.

2.2 Modeling

2.2.1 The Model of Enterprise's Internal Efficiency

Fund utilization efficiency (E) and liquidity (L) are enterprise's internal influencing factors.

The higher fund utilization efficiency explains that the opportunity cost of idle fund is smaller and the effect is made more fully,. Meanwhile, the objective of utilizing fund is to generate return. However, the return just with the consideration of

utilization but without investment is unscientific. Thus, enterprise's return on investment (I) is used to stand for fund utilization efficiency..

Enterprise's liquidity often involves the proportional relationship between enterprise's own asset and external capital, so the reciprocal of assets liabilities ratio (AL) is used to stand for enterprise's liquidity. The higher assets liabilities ratio, lower liquidity and larger risk refers to the smaller financing possibilities and lower financing efficiency;.

Thus, computation model of enterprise's internal influencing factor can be built.

$$E_i = E \times L = \frac{I}{A\ L} \tag{1}$$

E_i is enterprise's internal influencing factor.

2.2.2 The Model of Efficiency of Financing Channel

Financing cost (C), financing timeliness (T), availability of channel (P) and the degree of freedom of financing subject (F) are influencing factors of channel.

Generally speaking, financing cost (C) is in inverse proportion to financing efficiency. The formula can be indicated:

$$C = I' + \frac{C_f}{N} \tag{2}$$

C is financing cost; I' is interest rate; C_f is the fixed expense of financing activity; N is financing amount.

There is timeliness for financing activity. It can be represented by financing time directly.

The availability of channel means the possibility that enterprise can obtain funds in this channel. In the measurement, the proportion between obtained capital amount in the channel and local aggregate supply is used to explain this index. Thus, this index is a variable within 0-1 value range and becomes different as different channels. Generally speaking, the higher the availability of channel is, the better financing effect and efficiency is.

The degree of freedom of financing subject reflects the restriction from different financing methods. In a general way, the less restriction is given, the more benefits enterprise gets and the better financing effect and efficiency is.

Through above analysis, the computation model of influencing factors of channel can be preliminarily built.

$$E_o = \frac{F \times P}{C \times T} = \frac{F \times P}{\left(I' + \frac{C_f}{N}\right) \times T} \tag{3}$$

E_o is the efficiency of financing channel; F is the degree of freedom of financing subject; P is the availability of channel; C is financing cost; T is financing timeliness.

2.2.3 Comprehensive Financing Efficiency

On the base of above-mentioned enterprise's internal efficiency and the efficiency of financing channel, the model of comprehensive financing efficiency can be built.

$$E_f = E_i \times E_o = \frac{F \times P \times I}{\left(I' + \frac{C_f}{N}\right) \times T \times AL} \tag{4}$$

E_f represents enterprise's comprehensive financing efficiency.

3 Analysis of Past Experience

3.1 Internal Efficiency Improvement

Internal efficiency involves the capability of management and operation, and is nothing to do with the financing channels, so the internal efficiency enhancement is based on the improvement of operation ability and financial management level. Choosing the projects with appropriate risk and return rate on investment, as well as efficiently and reasonably utilizing the capital has new requirements for the small and medium-sized enterprise on how to improve the quality of enterprise. On the other hand, because of the diversity in each enterprise's operation fields, there are differences in return rate, risk and asset-liability ratio. Hence, we won't make a concrete analysis.

3.2 The Option of Financing Channel

We interpret the financing behavior of small medium-sized enterprises based on the analysis that focus on the financing channel efficiency. Currently, there exist limitations to small medium-sized enterprises on stock right financing and bond financing, so the probability of adopting these channels is close to zero, according to the model, the financing efficiency is also close to zero. Hence, the two channels are excluded from our analysis. We focus on the financing efficiency based on the channels of internal financing, bank credit and non-government financing. We choose the small and medium enterprises in Wenzhou as the study subject, for which have developed financial system, active non-government financing, and a complete market-oriented financing system

3.2.1 Internal Financing

Internal financing is adopted most by small and medium-sized enterprise especially the enterprise in the junior period. Based on the model, internal financing is adopted according to enterprise's own need without limitations, so the freedom degree of financing entity (F) could be defined as 1; self-financing has no barriers, so the procurability of channel (P) could be also defined as 1; self-owned fund, as an investment, is without interest and financing charges. In order to have clear comparison, the opportunity cost of capital is used to represent financing cost herein. The annual deposit rate in 2009 is 2.25%, so the financing cost (C) is 2.25%; self-owned fund has no financing time problem, in order to easily compare the model with

other forms, we define internal financing time (T) as 1(day). Therefore, we can work out the financing efficiency of this channel:

$$E_0 = \frac{1 \times 1}{2.25\%} = 44.4 \tag{5}$$

The internal financing efficiency is 44.4, which means it is a high efficient financing channel.

3.2.2 Bank Credit

Bank credit plays a role in supporting small medium-sized enterprise with capital. In 2009, sorts of loans in Wenzhou account RMB 439.371 billions, among which the loans taken by small and medium-sized enterprise is 65.76 billion. Based on above information, we can get that the channel procurability of Wenzhou bank credit (P) in 2009 is 0.15. In 2009, Wenzhou annual basic interest rate of loan is 5.31%, the loan interest rate of small and medium-sized enterprise regularly increase by more than 20%, based on the 20% increase, loan interest rate could be worked out to be 6.372%. Under the assumption that the guarantee meets the standard of bank credit and loan charges is about 0.655% of the total loan (appraisal cost takes up 0.5%, guaranty registration fee is 0.15%, stamp duty for loan agreement is 0.005%, other fees are too little to take account), we can work out the cost of bank loan (C) is 7.027%. Taking 3 months into account as the average time for loan, the timeliness (T) is 90 days. Due to bank credit, it has strict limitation to enterprises, so the freedom degree F is less than 1, and it is defined as F_1.

Based on above information, we could calculate the financing efficiency of bank credit channel:

$$E_o = \frac{F_1 \times 0.15}{7.027\% \times 90} = 0.024F_1 \tag{6}$$

Based on the result, we can find that the financing efficiency is very low via the financing channel of bank credit.

3.2.3 Non-government Financing

Non-government financing is popular in Wenzhou; it is significant to study this financing channel. The monitoring report based on interest rate of non-government loan from the people's bank Wenzhou central branch shows that, in 2009, the rate per mensem of non-government loan weighted average in Wenzhou is 10.84%, annual rate is 13.008%. Most of the non-government loan happens between relatives and friends without official research carried by financial institutions, and cost little borrowing fees which can be ignored compared with the loan amount. So the financing cost (C) is just the lending rate, which is 13.008%; owning to the familiarity between lending party and borrowing party, it takes short time, and mostly the whole process can be completed within a week, it even takes few days to sign an agreement. We define a week as the financing time limit, then the timeliness (T) is 7 days; most of capital of the non-government loan flow to small and medium-sized enterprises for production and operation activities (the capital used for production and operation

activities in 2008 reached to 88.5%)[1]. So we define channel procurability (P) as 0.8; as a sort of loan, non-government loan has certain limitations, but there are fewer limitations compared with bank loan limitations, so the freedom degree is higher than bank loan's freedom degree, but lower than the freedom degree of internal financing. It can be defined as F_2, then F_2 meet the condition of $1>F_2> F_1> 0$.

Based on above data, we can calculate the financing efficiency of non-government financing channel:

$$E_o = \frac{F_2 \times 0.8}{13.008\% \times 7} = 0.879F_2 \tag{7}$$

The 2009 financing efficiency of non-government loan is $0.879F_2$, which means this is efficient financing channel.

3.3 Channel Comparison

Because $1>F_2>F_1>0$, according to the result calculated via the model hereinbefore, we can get:

$$0.879F_2>0.024F_1 \tag{8}$$

Based on this result, before the small and medium-sized enterprises especially the enterprise in junior period choose financing methods, internal financing is supposed to be firstly considered. However, corporate internal financing can not meet the demand in light of limited self-owned fund, and then external financing is needed. When choosing external financing channel, non-government financing usually come first before bank loan based on the traits of fund demand and different efficiency of different channels.

4 Conclusions and Suggestions of Channel Construction

Based on the efficiency analysis on various channels, we find that channel procurability (P) is the key factor to restrain financing efficiency. To enhance efficiency of a financing channel, the procurability of this channel is supposed to be improved at first. So the capital market threshold should be lower and banks should improve the procurability of bank loan.

Secondly, financing timeliness (T) is another significant factor. Bank loan can not meet the fund demand because it takes long time (average 90 days), which balance out the advantages on interest rate. On the contrary, non-government finance can meet the demand and enhances the whole efficiency. So, financial institutions should simplify the procedures and promote the loan timeliness.

In respect of borrowing cost (C), banks should have hold an advantage on interest rate, but due to the high fixed bank charges, the edge is less attractive. So banks can lower the cost through mass appraisal to improve the whole channels' financing efficiency.

[1] Reference the 2008 monitoring report based on interest rate of non-government loan from the people's bank Wenzhou branch.

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Empirical Study for the Development of Producer Services and Upgrading of Manufacturing from the Perspective of Industrial Interaction

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Abstract. Based on the perspective of industry interaction, this study analyzes the interaction relationship between the development of producer services and manufacturing upgrading, and then makes an empirical study on it. Finally, countermeasures for interactive development of producer services and upgrading of manufacturing are put forward through the relevance and regression analysis for the development of producer services and upgrading of manufacturing in Ningbo.

Keywords: industrial interaction, producer services, manufacturing, upgrading.

1 Introduction

Development of modern service industry has become a major motivation to increase world economic growth.Riddle believes that the producer services can promote the growth of other sectors, and they can facilitate economic transactions of all industries [1]. Park & Chan(1989), Shugan(1994) and Bathla(2003)suggest that the demand for productive services will increase rapidly along with the expansion of the manufacturing industries, thus will promote the development of producer services,which will further help to support upgrading and competitiveness of the manufacturing industry in turn [2]. Liu Zhibiao makes a research on relationship between producer services and adjustment and optimization of manufacturing structure based on actual development of the Yangtze Delta region [3]. This paper takes consideration of the actual development of industry structure and producer services in Ningbo from the perspective of industry interaction based on the analysis of the relationship between the producer services and upgrading of manufacturing. An empirical analysis is made to prove that producer services can promote the optimization and upgrading of manufacturing in Ningbo.

2 Interactive Relationship between the Development of Producer Services and Upgrading of Manufacturing

2.1 Outsourcing of the Producer Services Decreasing the Cost of Manufacturing and Improving Its Efficiency

When manufacturing rises at the beginning, most chains such as research and development, production and marketing are mostly conducted inside the company.

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However, as competitions in market become fierce, it is very difficult for traditional companies with large scale to maintain competition advantage in the long run. Companies intend to achieve competitiveness by outsourcing more frequently if the necessary intermediate products or services can be obtained from outside at lower costs. Manufacturing enterprises will give up certain links in the value chain according to its own strength and characteristics and focus on the most competitive link or links by service outsourcing. Some producer service activities which are used to be conducted inside the company such as R & D, advertising, marketing and packaging continue to be replaced by outsourcing. With the deepening of this professional division of work, producer services activities within the enterprise are becoming more and more specialized and finally lead to economies of scale and specialization of the economy. The evolution of producer service from internalization to outsourcing will further reduce costs. Therefore, it promotes economic efficiency in manufacturing and increase its competitive advantages.

2.2 Demands for Upgrading and Transformation of the Manufacturing Sector Contribute to the Rapid Development of Producer Services

Upgrading of the manufacturing refers to the evolution process of manufacturing developing from low-skilled and low added-value stage to high-tech and high value-added stage [4]. Manufacturing have brought tremendous development and market prosperity for the developed countries. However, great changes have taken place for the development mode of the manufacturing since 20th century due to economic globalization, advanced information technology and development of advanced manufacturing technology. The traditional manufacturing is gradually upgrading and transforming from manufacturing low-end primary products to high-end modern manufacturing industry. Modern manufacturing industry pay more attention to penetrating two ends of "smiling curve ", that is design and R & D links and other links such as brand, marketing and so on. The transformation of the manufacturing industry boost the producer services quickly from an intermediate- input one to an independent industry sector. Hence it can be inferred that prosperity of producer services comes from transformation and upgrading needs of manufacturing industries. Producer services are detached gradually from manufacturing sector along with the deepening of social division of labor and intensified competition.

3 An Empirical Study on Interactive Development of Producer Services and Upgrading of Manufacturing: Take Ningbo as an Example

3.1 Correlation Analysis on Producer Services and Manufacturing Development in Ningbo

Ningbo is the economic center and manufacturing center in southern wing of Yangtze River Delta. At present, manufacturing-based second industry is still the subject of Ningbo economy and producer services as intermediate inputs of the manufacturing industry play an important role in the development of manufacturing in Ningbo. To

further analyze relationship between producer services and development of manufacturing sector in Ningbo, this paper makes a correlation analysis by software SPSS 17.0 based on statistics during 2004-2009.We take added value of manufacturing in Ningbo as(Y); added value of producer services as X1; added value of transport, storage and post industry as X2; added value of the financial industry as X3; added value of information transmission, computer services and software industry as X4; added value of leasing and business services as X5; added value of scientific research, technical services and geological prospecting as X6.

Results of correlative analysis show that the correlation coefficients between manufacturing's added value with that of major producer services such as transportation, storage and postal industry, the financial industry, information transmission, computer services and software, leasing and business services, scientific research, technical services and geological prospecting are respectively 0.998 and 0.945,0.996,0.933,0.922,0.965. The above analysis indicates that there is high positive correlation between services industry (especially major producer services) and manufacturing in Ningbo City, This means that the increase in output value of manufacturing is closely related with the increase of output value of service industries in particular that of producer services.

Linear process of SPSS statistical software is adopted to make regression analysis, in which added values of service industry and major producer services during 2004 to 2009 in Ningbo are regarded as explanatory variables (X1-X6) respectively and added values of manufacturing during this period are taken as the dependent variable (Y). The results are as follows:

Regression analysis for X1 show F test is 812.79, significant level is 0.000 (less than 0.01), reaching very significant levels. At the same time, there is significant positive correlation between X1 and Y as p = 0.000 (less than 0.01). The standard regression coefficient is 0.998 indicating producer services have significant impact on added output value of the manufacturing.

Regression analysis for X2 show F test is 33.12, significant level is 0.005 (less than 0.01), reaching very significant levels. At the same time, there is significant positive correlation between X2 and Y as p = 0.005 (less than 0.01). The standard regression coefficient is 0.945 indicating transportation, storage and postal industry have significant impact on added output value of the manufacturing.

Regression analysis for X3 show F test is 454.23, significant level is 0.000 (less than 0.01), reaching very significant levels. At the same time, there is significant positive correlation between X3 and Y as p = 0.000 (less than 0.01). The standard regression coefficient is 0.996 indicating financial industry has significant impact on added output value of the manufacturing.

Regression analysis for X4 show F test is 26.77, significant level is 0.007 (less than 0.01), reaching very significant levels. At the same time, there is significant positive correlation between X4 and Y as p = 0.007 (less than 0.01). The standard regression coefficient is 0.933 indicating information transmission, computer services and software industry have significant impact on added output value of the manufacturing.

Regression analysis for X5 show F test is 22.65, significant level is 0.009 (less than 0.01), reaching very significant levels. At the same time, there is significant positive correlation between X5 and Y as p = 0.009 (less than 0.01). The standard regression

coefficient is 0.922 indicating leasing and business services have significant impact on added output value of the manufacturing.

Regression analysis for X6 show F test is 53.78, significant level is 0.002 (less than 0.01), reaching very significant levels. At the same time, there is significant positive correlation between X6 and Y as p = 0.002 (less than 0.01). The standard regression coefficient is 0.965 indicating scientific research, technical services and geological prospecting services have significant impact on added output value of the manufacturing.

3.2 Interactive Development Strategies for Producer Services and Manufacturing in Ningbo

First of all, scale of producer services should be further expanded to enhance its influences on economic growth. In recent years, the proportion of producer services in Ningbo has been increased gradually. But the current proportion of the tertiary industry in Ningbo accounts for only about 40% of GDP and the proportion of producer services is far lower while service industry in Beijing and Shanghai account for 50% of GDP. The limited scale of the service industry in Ningbo constrains its role in promoting economic growth. Therefore, producer services in Ningbo should be enlarged and become more professional by continuously expanding the scale of the industry and total production of the service economy so as to continuously enhance the role of producer services to boost economic growth.

Secondly, levels of producer services should be increased continuously and the internal structure of services should be optimized to upgrade manufacturing in Ningbo. The analysis on the industrial structure and development of producer services show that transportation, storage and postal industry, the financial industry still account for a relatively high proportion while the proportion of information transmission, computer services and software, leasing and business services industry and other producer services are significantly lower. Hence, the focus of development of producer services should be further emphasized in the future, it is of great importance to develop knowledge-intensive producer services such as science and technology, computer software and information services.By improving the level of producer services and optimizing the internal service structure,it will achieve the transformation success of the economic structure in Ningbo.

Thirdly, we should adhere to speeding up two-way interaction linkage between producer services and the manufacturing to further perfect interactive development mechanism between producer services and the manufacturing in Ningbo. At present, Ningbo's industrialization is in the mid-and-late development stage in which the manufacturing competitiveness will depend primarily on producer service. Therefore, while we are focusing on the development of manufacturing in Ningbo, we should pay attention to the fact that the development of manufacturing would stimulate the rapid development of producer services. Interactive development mechanism should be perfected between producer services and manufacturing in Ningbo. We should adhere to industry's interactive linkage and enhance added value and level of manufacturing with the help of producer services so as to speed up the optimization and upgrading of manufacturing in Ningbo.

4 Conclusion

As the world continues to adjust the industrial structure, producer services have become an important force for a country's economic growth and industrial upgrading. The following conclusions can be drawn from this study:

Firstly, producer services play an important role in optimizing and upgrading manufacturing in Ningbo during the industrial structure adjustment process and the optimized manufacturing structure drive the development of producer services in turn. The relationship of two industries is mutually promoted and closely interacted;

Secondly, the actual situations of manufacturing and producer services in Ningbo reveal that there still exist issues such as insufficient scale, obscure advantage and so on in the process of promoting structural optimization and upgrading of producer services in Ningbo.

Thirdly, interactive development between manufacturing and producer services is still on the top agenda in Ningbo in future. More efforts should be made to develop high-end producer services and optimize the structure of services continuously so as to accelerate the structural adjustment and optimization of manufacturing in Ningbo.

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The Change Trend and Driving Factors of Beijing's Total-Factor Energy Efficiency: An Empirical Study

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Abstract. Beijing has witnessed rapid increase in energy consumption and lower energy intensity, its energy consumption elasticity remains below one, so, how is the total-factor energy efficiency(TFEE) in Beijing? This paper takes input-oriented Data envelopment analysis(DEA) to evaluate Beijing's TFEE from 1991 to 2009 as compared with China's average level. Furthermore, we use Grey relational analysis(GRA) to explore the driving factors of Beijing's TFEE. The result shows: (1) The TFEE in Beijing has been rising from 1991 to 2009. (2) The main driving factors of the improvement are the restructure of its local industries and technical advances.

Keywords: TFEE, DEA, GRA, energy consumption.

1 Introduction

In 1990s, China's economy has enjoyed a golden time of fast development, its annual growth rate is over 10% from 1991 to 2009[1]. The fast development of its economy resulted in rapid increase in energy consumption. In 2009, China's total energy consumption was equal to 3.66 billions of SCE, 5.2% increase over last year, annual growth rate is raised 1.3 percentage. The energy consumption in 2009 was almost a two times increase over 1991, annual average growth grate was around 6.2% [2]. At the same time, China has a big problem with the structure of its energy consumption. China is over dependent on fossil fuel. By the end of 2009, coal consumption accounted for 70.4% in China's total energy consumption, petroleum near to 18%, natural gas near to 4%, while renewable energy accounted less than 8% [1]. By the influence of global warming, safely supply of energy, etc, "Energy Efficiency" has drawn more and more heed.

As China's political, economic and cultural center, Beijing has crucial effect on the whole nation's economic development. To study the change trend and driving factors of Beijing's TFEE, we could help make plans & take measures for the development & transformation of the its economy scientifically, and take the lead nationwide.

Hu et al defined a new index of energy efficiency, named total-factor energy efficiency (TFEE), which is constructed as the ratio of the target energy input that is derived from DEA to the actual energy input in a region [3]. Now DEA has been

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applied widely to evaluate the relative efficiency of industries [4-6] and welcomed in the analysis of energy efficiency also [7-12]. Zhang et al used a total-factor framework to investigate the energy efficiency in 23 developing countries during the period of 1980–2005, among which China experienced the most rapid rise in TFEE [13]. Honma et al computed the regional TFEE in Japan by employing DEA, a dataset of 47 prefectures in Japan for the period 1993–2003 was constructed [14]. Honma et al analyzed the total-factor energy productivity growth of regions in Japan based upon DEA [15]. Chang et al introduced total-factor energy productivity change index based upon TFEE and decompose it into TFEE change and total-factor energy usage progress, with which he analyzed the situation in China from 2000 to 2004 [16].

2 TFEE of Beijing: 1991-2009

Since DEA is used to analyze to relative efficiency of each DMU, the employment of data series for Beijing only will not help us learn about Beijing's performance as compared with the national average level, though it could reflect the change trend of Beijing's TFEE for the period 1991-2009. Therefore, we use the data on the national average level as a reference.

When taking DEA approach to evaluate the energy efficiency in Beijing, we are concerned if there is redundant energy input for the economic output, so, we adopt input-oriented DEA here, which is based upon Non-parametric method.

Data and variables. In this study, we emphasize on the efficiency of energy input in Beijing, so we do not take undesirable output (like Carbon emissions) into consideration. we take annual energy consumption, labor force & capital investment as input variables and GDP as output variable, with which we inspect the data on total 38 DMUs for Beijing and the national average for the period: 1991-2009.

Annual energy consumption: the data are taken from China Statistical Yearbook 2010 and Beijing Statistical Yearbook 2010.

Labor force: we use "people employed" here. Since such data are recorded as a year-end value in the Statistical Yearbook, we adopt the average value of the current year-end data and its preceding one.

Capital investment: in the form of "Capital Stock". We could not get the data directly from the Statistical Yearbook, so we process the data by way of a consistent saving algorithm. Shan H.J made a calculation of the capital stock for each region in China and the nation itself for the period: 1978-2006, and continued to work out the data for the period: 2007-2009[17]. We make use of his data source: 1991-2009.

Elimination of prices fluctuation: based upon the unchanged prices in 1978, we choose Beijing & the whole nation's GDP as economic output variables. Since China has 31 provinces, municipalities & autonomous regions in total, we get the national average value by dividing the national total with 31. For detailed information, please refer to Table 1 below:

Table 1. Data of input & output variables for Beijing and the national total

time	national total				Beijing			
	capital stock (billion)	Total Employment (Ten thousands)	energy consumption per capita (million tons of standard coal)	GDP (billion)	capital stock (billion)	Total Employment (ten thousands)	energy consumption per capita (million tons of standard coal)	GDP (billion)
1991	17678.60	65120.00	103783.00	11211.44	1346.50	630.55	2871.96	341.41
1992	19514.43	65821.50	109170.00	12808.03	1501.38	641.65	2987.45	379.93
1993	22075.24	66480.00	115993.00	14596.58	1748.76	638.55	3264.63	426.71
1994	25200.94	67131.50	122737.00	16505.92	2114.87	646.05	3385.92	485.14
1995	28753.90	67760.00	131176.00	18309.18	2468.17	664.80	3533.33	543.35
1996	32709.40	68507.50	135192.00	20141.66	2769.30	662.75	3734.52	592.20
1997	36682.67	69385.00	135909.00	22014.24	3086.59	658.00	3719.22	652.04
1998	40872.12	70228.50	136184.00	23738.69	3465.94	639.00	3808.10	713.95
1999	45247.31	71015.50	140569.00	25547.54	3828.12	620.40	3906.61	791.74
2000	49983.04	71739.50	145531.00	27701.53	4214.42	618.95	4144.00	885.20
2001	55263.97	72555.00	150406.00	30000.84	4628.49	624.10	4229.21	988.77
2002	61592.23	73382.50	159431.00	32725.54	5118.94	654.05	4436.13	1102.47
2003	69711.65	74086.00	183792.00	36006.40	5748.20	691.25	4648.17	1224.87
2004	79084.78	74816.00	213456.00	39637.66	6444.18	778.70	5139.56	1397.54
2005	90256.58	75512.50	235997.00	44120.69	7221.53	866.05	5521.94	1567.05
2006	103075.80	76112.50	258676.00	49713.66	8067.29	898.85	5904.10	1770.72
2007	117102.16	76695.00	280508.00	56754.31	9014.08	931.20	6285.04	2027.27
2008	132874.98	77235.00	291448.00	62222.40	9588.42	961.80	6327.10	2211.90
2009	154246.68	77737.50	306647.00	67892.77	10438.10	989.60	6570.34	2437.56

Table 2 below presents the correlation coefficients of the input and output variables. The isotonicity property is satisfied, that an output should not decrease with an increase in an input [14].

Table 2. The correlation coefficients of the input and output variables

Correlation coefficients	Capital Stock	People employed	Annual energy consumption
lActual GDP	0.82	0.11	0.85

Empirical result. We obtain the technical efficiency θ and TFEE of Beijing & the national average level for the period 1991-2009 (Table 3).

Although Beijing is a developed city, Beijing's overall technical efficiencies were much lower than the national average level for the past years: its TFEE was lower too, the input variables did not coordinate with each other on their input amount, and there was a high degree of redundant energy input, while the technical efficiency and TFEE on the national average level remained close to 1. At the other side, the technical efficiency and TFEE of Beijing kept rising for most part of the time during the period 1991-2009, and reach the frontier of relative efficiency in 2009, though most of its economic output was inefficient.(As shown in Fig. 1).

Table 3. The technical efficiency and TFEE of Beijing & the national average level for the period 1991-2009

	the national average				Beijing			
time	θ	best energy input	actual energy input	TFEE	θ	best energy input	actual energy input	TFEE
1991	0.96	2873.96	3347.84	0.86	0.60	1512.04	2871.96	0.53
1992	0.99	3283.23	3521.61	0.93	0.63	1640.65	2987.45	0.55
1993	1.00	3741.71	3741.71	1.00	0.66	1760.91	3264.63	0.54
1994	1.00	3959.26	3959.26	1.00	0.67	1896.73	3385.92	0.56
1995	1.00	4231.48	4231.48	1.00	0.68	2042.16	3533.33	0.58
1996	1.00	4301.56	4361.03	0.99	0.70	2143.25	3734.52	0.57
1997	1.00	4384.16	4384.16	1.00	0.72	2273.08	3719.22	0.61
1998	1.00	4393.03	4393.03	1.00	0.74	2373.79	3808.10	0.62
1999	1.00	4517.03	4534.48	1.00	0.77	2524.10	3906.61	0.65
2000	1.00	4692.35	4694.55	1.00	0.81	2733.48	4144.00	0.66
2001	1.00	4851.81	4851.81	1.00	0.84	2970.81	4229.21	0.70
2002	1.00	5142.94	5142.94	1.00	0.86	3256.26	4436.13	0.73
2003	0.99	5876.78	5928.77	0.99	0.86	3549.45	4648.17	0.76
2004	0.98	6743.16	6885.68	0.98	0.88	4055.93	5139.56	0.79
2005	0.97	7342.45	7612.81	0.96	0.88	4537.13	5521.94	0.82
2006	0.98	8088.54	8344.39	0.97	0.91	5011.13	5904.10	0.85
2007	1.00	9048.65	9048.65	1.00	0.95	5606.36	6285.04	0.89
2008	1.00	9401.55	9401.55	1.00	0.98	6063.00	6327.10	0.96
2009	1.00	9891.84	9891.84	1.00	1.00	6570.34	6570.34	1.00
average	0.99	-	-	0.98	0.80	-	-	0.70

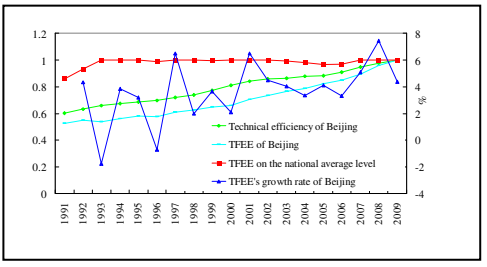

Fig. 1. The technical efficiency, TFEE and TFEE's growth rate of Beijing & the TFEE on the national average level for 1991-2009

3 Influential Factors

Data and factors. Yuan et al stated that the fall of energy intensity in China was caused by efficiency factors instead of structure factors. The main factors effecting energy intensity in China include economy growth, economy structure, energy price, technical advances and energy policy. In single-factor analysis, the lower energy intensity is, the higher the energy efficiency is [18]. Zhang et al applied Tobit regression model to analyze the relationship between TFEE in China and income per capita income, say, GDP per capita. He found a U-shaped relationship exists between TFEE and GDP per capita, which means the energy efficiency first decreases with the increase of GDP per capita, and then increases after a certain level [13].

TFEE could help analyze the energy efficiency under the influence of various input factors, so we believe the factors mentioned in those scholars' studies are possibly the main factors that have driven the improvement of Beijing's TFEE in recent years.

Economy growth: GDP per capita applied here. The GDP per capita of Beijing has been rising in recent years, so we presume a positive relationship exists between Beijing's TFEE and its GDP per capita.

Economy structure: represented by the portion of the tertiary industry. Since the tertiary industry enjoys comparatively lower energy consumption, the increase of its portion in a nation's economy could help reduce the consumption of energy and improve energy efficiency.

Energy price: represented by the purchasing indexes of raw materials, fuel and power. The up-rise of energy price will cause the lower energy consumption and the improvement of energy efficiency.

Technical advances: another driving factor of the improvement of energy efficiency, the advances of technology will enhance the efficiency of energy processing & energy consumption. Hereby, we use the number of active technicians as a replacement for technical advances.

Since energy policy functions by way of a nation's adjustment of industry structure and influence on energy prices, we choose only four factors listed above as the

variables for our research: GDP per capita, the portion of the tertiary industry, the purchasing indexes of raw materials, fuel and power and the number of active technicians.

We applied GRA to study the major factors that affected Beijing's TFEE for the period 1991-2008. Please refer to Table 4 below for details:

Table 4. Beijing's TFEE & its driving factors for 1991-2008

time	TFEE	the proportion of tertiary industry (%)	GDP per capita index (1 in 1978)	Raw materials price index for fuel, power purchase (1 in 1990)	number of scientific and technical personnel (ten thousands)
1991	0.53	43.68	2.49	1.12	22.82
1992	0.55	44.30	2.75	1.15	24.75
1993	0.54	46.59	3.07	1.54	25.28
1994	0.56	48.91	3.45	1.82	24.04
1995	0.58	52.29	3.64	1.95	25.22
1996	0.57	55.86	3.75	1.95	26.56
1997	0.61	58.64	4.15	2.02	27.32
1998	0.62	61.36	4.57	1.98	23.71
1999	0.65	63.20	5.03	1.90	22.96
2000	0.66	64.81	5.37	1.90	26.11
2001	0.70	67.01	5.72	1.91	24.06
2002	0.73	69.12	6.24	1.85	25.73
2003	0.76	68.62	6.76	1.94	27.09
2004	0.79	67.83	7.53	2.21	30.12
2005	0.82	69.65	8.22	2.47	38.32
2006	0.85	71.91	9.02	2.60	38.28
2007	0.89	73.49	10.02	2.73	45.03
2008	0.96	75.36	10.56	3.16	45.01

Grey relational analysis. If the relative variation between two factors is quite consistent during their development process, then the grey relational grade is high [19]. We take Beijing's TFEE as the reference series and influential factors as the comparison series to study the grey relational grade among them. Since these series have different magnitude, we divide the data in each series by its initial data (data for the first year), thus we can obtain five comparable series. As shown in Fig. 2, the change trends of the portion of the tertiary industry and the number of active technicians are quite similar to TFEE's, and the change trends of the purchasing indexes of raw materials, fuel & power and GDP per capita are alike to TFEE's to some degree.

Taking the resolution coefficient as 0.5, we compute the grey relational coefficients of the comparison series to the reference series through related grey relational coefficient formulae. To manifest the relationship between each comparison series and TFEE in the whole system, we compute the average score of the grey relational coefficients for the period 1991-2008 to get the overall grey correlation (Table 5).

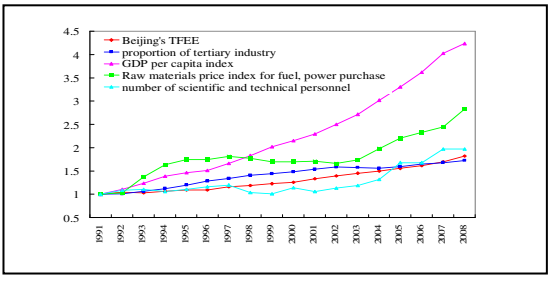

Fig. 2. Normalized data series of Beijing's TFEE & its driving factors for 1991-2008

As shown in Table 5, the portion of the tertiary industry has a high grey relational coefficient to Beijing's TFEE for the whole period: their grey correlation reaches as high as 0.919, and the number of active technicians enjoys a grey correlation of 0.908 with Beijing's TFEE. Therefore, the restructuring of industries & technical advances in Beijing has strongly pushed up the improvement of its TFEE. As for the purchasing indexes of raw materials, fuel & power and GDP per capita, they have a grey correlation of 0.726 & 0.618 with Beijing's TFEE respectively. Thus, the change of energy prices and regional economic development in recent years has certain effects on the improvement of Beijing's TFEE.

Table 5. The grey relational coefficients & grey correlation of the comparison series to TFEE (Beijing, 1991-2008)

time	grey relational coefficient			
	the proportion of tertiary industry	GDP per capita index	Raw materials price index for fuel, power purchase	number of scientific and technical personnel
1991	1.000	1.000	1.000	1.000
1992	0.977	0.951	0.992	0.967
1993	0.966	0.854	0.775	0.935
1994	0.956	0.790	0.680	0.991
1995	0.924	0.770	0.652	0.994
1996	0.865	0.745	0.648	0.943
1997	0.869	0.706	0.652	0.971
1998	0.846	0.651	0.673	0.893
1999	0.846	0.605	0.720	0.846
2000	0.840	0.573	0.731	0.918
2001	0.858	0.557	0.764	0.812
2002	0.865	0.521	0.821	0.820
2003	0.909	0.489	0.809	0.821
2004	0.957	0.442	0.715	0.871
2005	0.973	0.411	0.651	0.911
2006	0.973	0.376	0.628	0.949
2007	0.990	0.342	0.617	0.812
2008	0.927	0.333	0.545	0.888
result	0.919	0.618	0.726	0.908

4 Conclusion

This paper adopts input-oriented DEA method to evaluate Beijing's TFEE from 1991 to 2009 as compared with China's average level. We found that the TFEE in Beijing had kept rising since 1991 even though it remained below the national average level. In addition, we employ GRA to determine the main driving factors of Beijing's TFEE. The primary driving factors are the restructuring of industries & technical advances, and the secondary driving factors are energy price & local economic development.

To adjust the structure of industries, Beijing can increase the portion of the tertiary industry and optimize structure of other industries to reduce redundant input of energy. To make further technical advances, Beijing can put more investment in technical research and import advanced techniques to promote the efficiency of energy production, usage and management. In China, energy prices have limited effect on the promotion of energy efficiency, because the government controls them partially or completely. Therefore, energy prices in China usually remain below the international market level and could not reflect the actual relationship between energy demand & energy supply[20]. To reform the energy-pricing mechanism, we should follow the practices of international market and take further actions to implement policies related with energy. Above measures will help Beijing promote its energy efficiency to the maximum in the future.

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Reliability Analysis on Slope Stability Based on Rainfall-Induced Damage

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Abstract. Rainfall infiltration is an important factor affecting slope stability. However, rainfall-induced damage of rockmass strength is not considered in slope stability analysis in most literatures at present. Therefore, from the point of view that variation of water content leads to damage of rockmass strength, a comprehensive method of damage mechanics and reliability theory is used to analyze slope stability under rainfall. Firstly, the variation features of water content and Young's modulus under rainfall in an iron open-pit mine are studied, the relation between damage variable D and water content is built; Then, the damage model of rockmass strength parameters is made. Finally, the slope's reliability is assessed under different rainfall duration. The results showed that reliability indexes based on rainfall-induced damage of rockmass strength are smaller than that when the damage of rockmass strength is ignored. Therefore, it is necessary to consider rainfall-induced damage in slope stability assessment. The study can provide theoretical evidence for slope stability evaluation and production safety in open pit mines.

Keywords: rainfall infiltration, damage, reliability, slope, water content.

1 Introduction

A large number of cases show that rainfall infiltration is a principal factor impacting slope stability, since almost 90% of landslides were induced by rainfall infiltration in China[1]. At present, slope stability under rainfall has been analyzed in some literatures [2-8], these studies generally believe that hydrostatic pressure and hydrodynamic pressure in rock slopes generated by seepage flow of rainwater will undermine the stress balance of slopes, lead the resistance of the slope to be reduced and the sliding force to increase, which result in landslides. However, rockmass strength reduction induced by rainfall is not considered in most of these literatures. Therefore, from the point of view that variation of water content leads to damage of rockmass strength, the relationship between water content and damage variable D of rockmass is studied, and damage models of rockmass strength parameters are built; At last, a comprehensive method of damage mechanics and reliability theory is used to analyze slope stability under rainfall, the reliability indexes under two conditions that rock damage is considered or not are compared with, the research can provide reference to slope stability evaluation and operation safety of slopes.

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2 Case

Case Introduction. There is an iron open-pit mine in northeast of China, its production capacity of design is 400Mt/a. Strata layers from the new to the old in the mine are respectively the Quaternary system, the Sinian system, the Anshan group and the Times ditch group. A great number of fractures formed by tectonization and intrusion of migmatite become good accesses and gather belt of groundwater. The main recharge of the groundwater is rain, the annual rainfall in the mine is about 700-900 mm, the biggest amount of precipitation is in July, its average rainfall is 206.2mm. With the slope being excavated downward, drainage area, amount of runoff and hydrogeologic conditions are changing constantly. Slope stability becomes the main factor affecting mining production under the co-action of surface water, groundwater, river seepage and specific hydrogeology condition. Therefore, it is urgent to study the damage mechanism of rockmass under rainfall and the stability of slopes to give reference to open pit mining.

Calculation Model and Parameters Selection. The Ⅲ-Ⅲ section of the iron open-pit mine was selected to be studied. Because fractures are intensive and there is no large scale faults in the slope, a continuum model is chosen to analyze seepage character of the slope. The calculation model of the section can be seen in Fig.1. The seepage parameters come from data of ground water in exploration drilling of the slope. As the forming of the slope, the groundwater will be drained, so the water boundary is the medial border and the bottom of the pit when the normal seepage field is analyzed. The mechanical parameters and permeability coefficients are shown in Table 1, rainfall parameters in Table 2[9].

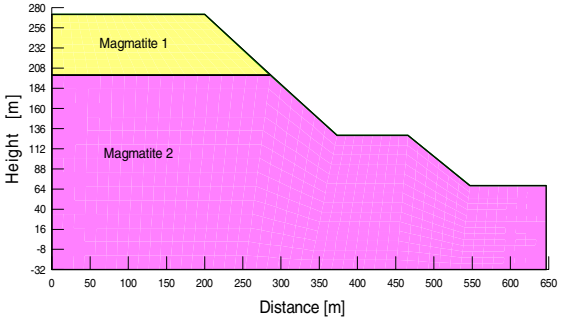

Fig. 1. Calculation model of Ⅲ—Ⅲ section

Table 1. Mechanical parameters of rock mass

Rock Types	Unit weight γ[kN·m^3]	Young's modulus E [Gpa]	Poisson 's ratio ν	Tensile strengt h□σ_t [MPa]	Cohesio n C [kPa]	Friction angle φ [˚]	Permeability coefficient K [m·s^{-1}]
migmatite 1	26	42.582	0.11	6.83	390	21.3	5.41x10^{-8}~4.91x10^{-7}
migmatite 2	26	56.026	0.11	6.83	400	21.4	5.41x10^{-12}~4.91x10^{-9}

Table 2. Amount of precipitation

Time	1h	6h	24h	72h
Amount of precipitation [mm]	33	63	189	252

3 Damage Models of Rockmass Strength in Slopes under Rainfall

The strength of rockmass reduced under rainfall has become a trouble in the stability of rock engineering. The influence of water on rockmass strength is closely related to physical properties, water content, unit weight and stress state of rockmass. Because the variation of water content is obvious and it's influence on rockmass is the biggest water content is used to analyze the slope stability with damaged rockmass strength. Damage variable D of rockmass under rainfall is determined by Young's modulus method from damage mechanics of continuum. Because the variation of Young's modulus is closely related to water content, the damage variable D can also be expressed by water content as follows,

$$D = 1 - \frac{E}{E_0} = 1 - \frac{E(\omega)}{E_0} = D(\omega) \tag{1}$$

Where, $E(\omega)$ is the damage Young's modulus when the water content of rockmass is ω, E_0 is the Young's modulus of dry rock.

According to the theory of Professor Z. J. Chen that rockmass strength decreases with time, the decrease of strength is related to variation of Young's modulus, so damage variables of shear strength parameters C and φ are assumed as same as that of Young's modulus, therefore, shear strength parameters C and φ can be given by,

$$C = (1 - D_c)C_0 = (1 - D(\omega))C_0 \tag{2}$$

$$\varphi = (1 - D_\varphi)\,\varphi_0 = (1 - D(\omega))\varphi_0 \tag{3}$$

Where, C_0 is cohesion of rock mass when it is dry, [Mpa]; φ_0 is the inner friction angle of rockmass when it is dry, [°].

Relationship between Young's Modulus $E(\omega)$ and Water Content ω. The relationship between Young's Modulus $E(\omega)$ and water content ω can be achieved by nonlinear coupled analysis of solid- liquid. It is assumed that the water content of the rock in slope is zero when there is no rain. The relationships of Young's modulus, water content and rain duration of the rockmass in the Ⅲ-Ⅲ section are shown in Table 3.

Table 3. Relationships between Young's modulus, water content and rainfall duration

Rainfall duration [h]	0	24	36	48	72
Water content of migmatite 1 [%]	0	0.8	1.1	1.68	2.1
Water content migmatite 2 [%]	0	0.85	1.13	1.70	2.13
Young's modulus of migmatite 1 [Gpa]	42.582	40.027	37.898	36.621	34.066
Young's modulus of migmatite 2 [Gpa]	56.026	52.664	49.863	48.182	44.821

The relationships between Young's modulus and water content of migmatite 1 (Fig.2) and migmatite 2 (Fig. 3) by linear regressions are given by

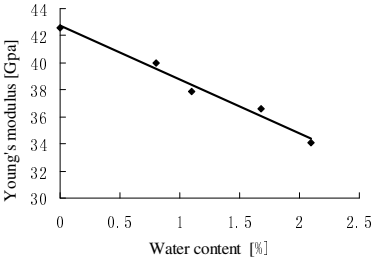

Fig. 2. Relationship between Young's modulus and water content of migmatite 1

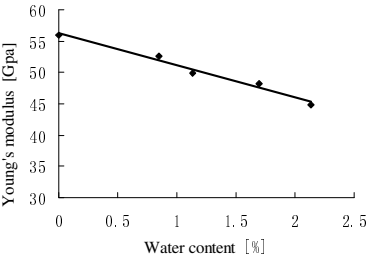

Fig. 3. Relationship between Young's modulus and water content of migmatite 2

$$E_1(\omega) = -3.9640\omega + 42.7420 \tag{4}$$

$$E_2(\omega) = -5.1663\,\omega + 56.3145 \tag{5}$$

The correlation coefficient *r* of migmatite 1 is 0.9860, *r* of migmatite 2 is 0.9846, they are all bigger than 0.8, so the accuracy is good.

Relationship between Damage Variable *D* and Water Content *ω*. When Eq. 4 and Eq. 5 is put into Eq. 1 respectively, damage variables can be given by,

$$D_1(\omega) = 1 - \frac{-3.964\,\omega + 42.742}{42.582} \tag{6}$$

$$D_2(\varpi) = 1 - \frac{-5.1663\,\omega + 56.3145}{56.026} \tag{7}$$

Where, $D_1(\omega)$ is damage variable of migmatite 1; $D_2(\omega)$ is damage variable of migmatite 2.

When Eq. 6 and Eq. 7 is put into Eq. 2 and Eq. 3 respectively, values of cohesion and friction angle in different rainfall duration can be gained as shown in Table 4.

Table 4. Values of cohesion and friction angle of rock layers in different rainfall duration

Rainfall duration	Cohesion of migmatite 1 C_1	friction angle of migmatite 1 φ_1	Cohesion of migmatite 2 C_2	friction angle of migmatite 2 φ_2
0	390	21.3	400	21.4
24 h	362.31	19.5	370.71	19.8
36 h	351.39	18.9	360.4	19.3
48 h	330.33	17.8	339.4	18.2
72 h	315.12	17.0	323.5	17.3

4 Reliability Analysis of Slope Based on Rainfall-Induced Damage of Rockmass

In order to analyze the effect of seepage on rockmass strength and damage of rockmass strength to slope reliability, methods of Monte-Carlo and Monrgenstern-Price are used. Parameters C and φ are assumed to be normal distribution, the standard deviation is assumed to be one tenth of the mean. C and φ are independent. After 10,000 of numerical iteration, reliability indexes of the slope considering rockmass damage considered or not in different rainfall duration can be seen in Fig. 4.

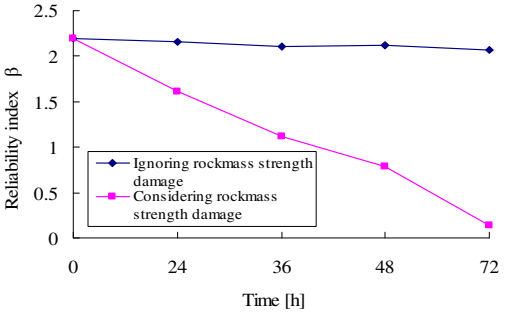

Fig. 4. Reliability indexes in rainfall duration

From Fig. 4, reliability indexes of slope change little during rainfall when rockmass strength damage is ignored. The reliability index is 2.2 under normal conditions. After 72 hours' raining, the value became 2.069. Reliability indexes became lower and lower when rockmass strength damage is considered. The D-value of reliability index become bigger with the duration of rainfall. After 72 hours' raining, the reliability index is just 6.77% of that when damage is ignored. Thus, rockmass strength damage caused by rainfall should not be ignored when slope stability is evaluated.

5 Conclusion

The stability of an open pit mine under rainfall is analyzed by a comprehensive method integrated damage mechanics and reliability theory in this paper, conclusions are drawn as follows:

1. Water content of rockmass increased with rainfall duration, but Young's modulus decreased. The relationship between Young's modulus and water content was negative by linear regression.

2. The equation of damage variable D was derived by Young's modulus method of continuum damage mechanics using water content. Damage characters of internal friction angle φ and cohesion C are also studied.

3. Cohesion and internal friction angle were assumed as random variables to analyze the stability of the slope by using Monrgenstern-Price and Monte-carlo methods. Two conditions that rockmass strength damage considered or not were studied, the results showed that the reliability index considering rockmass strength damage is far below than that ignoring rockmass strength damage. Therefore, rockmass strength damage caused by rainfall must be considered in slope stability evaluation and mining production.

Acknowledgment. This work was financially supported by the key project of National Natural Science Foundation (Number: 51034001).

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NOx Emission Characteristics in a DesiNOx Gned Premixed Burner

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Abstract. Nitrogen oxides (NOx) formed in gas instantaneous water heater combustion systems is a significant pollutant source in the domestic environment. Advances in the science of reactions, mathematical modeling, and increased performance of computer systems have made comprehensive modeling of NOx formation and destruction a valuable tool to provide insights and understanding of the NOx reaction processes in combustion systems. In this approach, the chemical combustion reactions are described by nine species and six steps. The predicted NO level is less than 30 ppm when diameter of round fire holes (d) is 0.6 or 0.7mm, and excess air ratio (α) is 1.3. Our results indicates that the vortex produced between a bunch of the round fire holes and another bunch of the round fire holes results in thermal agglomeration and the elevated value of NO. The areas of vortex regions are decreased with the increase of heat load. The lower temperature is produced in the vortex regions. The reduction of NO concentration under higher heat load is attributed to the lower temperature.

Keywords: PDF methods, NOx formation, premixed burner, thermal intensity, combustion.

1 Introduction

In recent years, domestic environment pollution has reached critical levels which threatens the people's health, deteriorates the environment and damages property and landscape. The reduction of NOx emission from combustion of fossil fuels is one of the most important research subjects for combustion researchers and engineers, and a lot of efforts have been made to development of low emission combustion devices such as furnaces, and home combustion appliances. In addition, recent developments in the fields of high speed computing and chemical kinetics have made it possible to conduct numerical simulations of flames using huge detailed kinetics schemes and NO_x formation mechanisms.

The burner of gas instantaneous water heater is mainly the atmospheric type. The characteristic of atmospheric burner is that the primary mixed air and gas flows out of the fire holes, and the secondary air is offered from the gap of fire hole rows. The flame structure is a typical Bunsen flame. Owing to the local high flame temperature, the emission of nitrogen oxide pollutant is about 100 PPm in gas instantaneous water

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heaters. In order to reduce the emission of nitrogen oxide, a new burner without changing the burner size and mold of original gas instantaneous water heater was developed by the authors. The main aim of this work is to investigate the combustion characteristics and pollutant formation in the designed burner. The optimal geometrical structure is also selected.

2 Design of the Combustor

The fire hole board consists of two parts which are the square fire holes and the round fire hole, as shown in Fig. 1. The significant geometries of part of the fire hole board are listed in Table 1. The burner is operated at 22 kW.

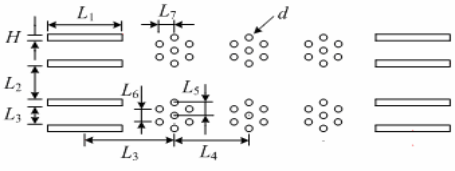


Fig. 1. Part of the fire hole board of burner

Table 1. Geometries of fire hole board (mm)

H	L_1	L_2	L_3	L_4	L_5	L_6	L_7
0.5	5	3	6	5	1	1	1

3 CFD Modeling of the Combustor

The Model Combustors. The combustor modeling has been performed for two different geometries and for nine different cases. The diameter of round fire hole (d) is designed with d=0.6 mm and 0.7mm, and the square fire holes kept constant. The excess air coefficient varies in the rang of 1.1 and 1.3. The standard k–ε model [1] was employed for the modeling of the turbulent flow in the combustors. Owing to the geometry symplex structure arrangement, the part used in combustor modeling is selected as shown in Fig. 2. The height of combustor chamber (z direction) is 50 mm. and the dashed line is the symmetry planes of model. Thermal intensity of burner port(q_s) increases from 2.67 W•mm^{-2} to 15.6 W•mm^{-2} .

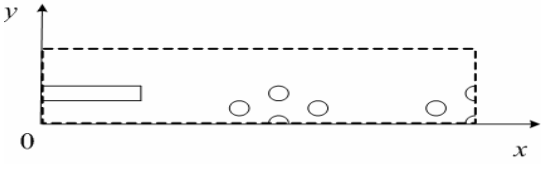


Fig. 2. The modelling part of combustor

The Combustion Model. The PDF method is a powerful tool to investigate turbulent nonreactive and reactive flows. It treats the chemical reaction source term without any assumptions on turbulent fluctuations [1]. Therefore, the PDF method is very attractive for turbulent combustion modeling. In this work, the chemistry is described by the probability density function (PDF) model. The β distribution for the mixture fraction is employed in the spray flamelet model. A detailed discussion about the present PDF method can be found in [2,3]. The radiative heat transfer in the combustors was calculated with the DO radiation model. The numerical calculations adopt a reduced six-step reaction mechanisms[4], and consist of 9 species. Thermal NO_x and prompt NO_x formations are considered as NO_x formation routes.

NOx Post-processing. In most of the combustion cases, NO accounts for about 95% of the total NO_x . Nitrogen oxide (NO_2) and nitrous oxide (N_2O) are less significant components of the total NO_x formation . Therefore, only NO formation is calculated in this work. A NO_x post-processor has been used to predict NO formation from methane combustion and hydrogen–methane composite fuel combustion. In methane and hydrogen–methane composite fuel combustions, the formation of NO can be attributed to two chemical kinetic processes, which are thermal NO_x and prompt NO_x, Thermal NO_x is formed by the oxidation of atmospheric nitrogen at high temperatures. Prompt NO_x is formed by the reactions of intermediate species at the flame front. Indeed, NO is formed via three mechanisms in combustion systems, fuel NO_x, prompt NO_x and thermal NO_x. The detailed introduction can be found in [5, 6]. The following well-known Zeldovich reaction determines the thermal NO:

$$O+N_2 \rightarrow N+NO \tag{1}$$

$$N+O_2 \rightarrow O+NO \tag{2}$$

$$N+OH \rightarrow H+NO \tag{3}$$

The mass transport equation is solved for the NO calculation, taking into account convection, diffusion, production and consumption of NO and related chemical species. The overall thermal NO formation rate can be calculated as

$$\frac{d[NO]}{dt} = \frac{2[O](k_1 k_2 [O_2][N_2] - k_{-1} k_{-2} [NO]^2)}{k_2 [O_2] + k_{-1} [NO]} \tag{4}$$

The prompt NOx formation mechanism was first reported by Fenimore. The prompt NO_x formation is significant in most hydrocarbon fuel combustion conditions, especially low temperature, short residence times and fuel-rich conditions. In the designed burner, the combustion was in oxygen-rich condition. So the thermal NO formation is much more than the prompt NO.

4 Results and Discussion

The model is a three-dimensional burner. The distribution of NO in the combustion chamber and the exhaust gas at various ratio of fuel to air is simulated. The simulation provides more insight of the NO concentration formation and its relation between the maximum flame temperature, flame average temperature and burner exit temperature. Excess air ratio (α) is defined as the supplied air/the theoretical air requirement. The average NO emissions for all cases at the burner exit are shown in Figs.3-4. It is

found that the average NO emissions at exit decrease with the increase of heat load and the maximum NO mole fraction is about 30 ppm when when the diameter of round fire holes is 0.6 or 0.7mm at the case of α=1.3. The NO emission satisfies the demand of gas instantaneous water heater standard (GB 6932－2001).

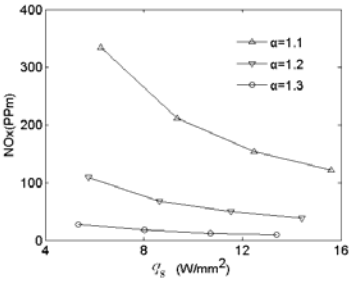


Fig. 3. Effect of thermal intensity of burner port on NO emission with d=0.6

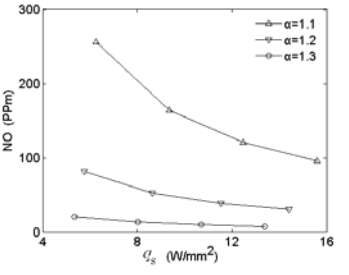


Fig. 4. Effect of thermal intensity of burner port on NO emission with d=0.7

The general features of the flow and combustion characteristics are presented in Figs. 5-6 for the temperature contours and NO contours. The temperature distribution in a vertical plane (y=1 mm) through the burner is shown in Fig. 5 (a) when q_s=5.35 Wmm^{-2}. The temperature reaches its maximum value of 2000 K at the regions between the square fire hole and the round fire hole, as well as between a bunch of the round fire holes and another bunch of the round fire holes.This is attributed to the vortex produced in these regions. Thermal agglomeration in the vortexes results in elevated value of the thermal NO, as shown in Fig. 5 (b). The NO value decreases at the exit of the burner. Fig. 6 indicates that the distribution of temperature and NO mole fraction. The location of maximum values of NO and temperature are the same as shown in Fig. 5. However, the areas of vortex regions for q_s=13.38 Wmm^{-2} is less than that that for q_s=5.35 Wmm^{-2} . It is also found that the temperature and NO mole fraction also decrease in these regions. It is further explained that the increase of heat load results in the increase of velocity and flame height, the decrease of the areas of vortex regions and temperature. It is concluded that NO production is mainly controlled by the temperature of combustion in the cases of α>1.2.

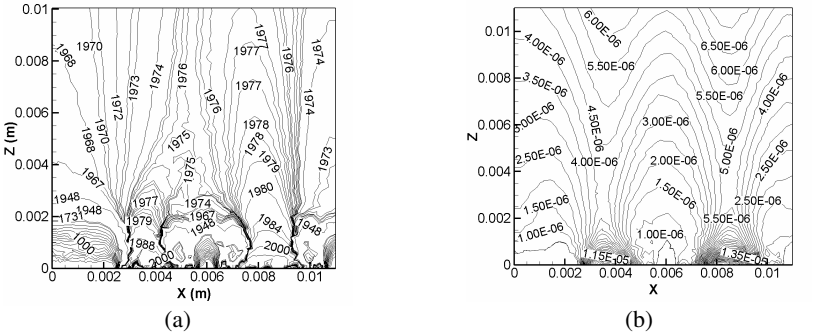
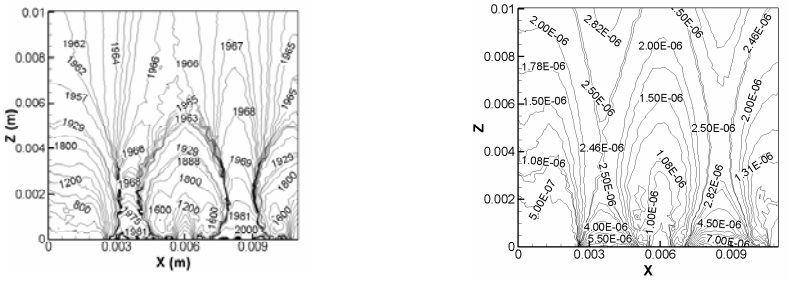


Fig. 5. The distribution of temperature (a) and NO mole fraction (b) at y=1mm and q_s=5.35 Wmm^{-2}



(a) (b)

Fig. 6. The distribution of temperature K (a) and NO mole fraction (b) at y=1mm and q_s=13.38 Wmm^{-2}

5 Conclusions

The characteristic of combustion and NO emission of methane is studied in a designed burner. The main results derived from the investigations are:

The average NO_x emissions at exit decreases with the increase of the heat load. The predicted maximum mole fraction of NO is about 30 ppm for hole diameter d=0.6 or 0.7mm and α=1.3. The vortex produced between two bunches of the round fire holes results in thermal agglomeration and the increase of NO mole fraction. The increase of heat load resulted in the increase of inlet velocity and flame height and the decrease of the vortex region areas and temperature. In the cases of α>1.2, the important NO mechanism is the thermal NO mechanism in combustion of methane. NO production is mainly controlled by the temperature of combustion. The fire hole with d=0.7mm, is a better choice for the designed burner. In order to meet with the fifth class of NO emission in gas instantaneous water heater standard GB 6932－2001, the excess air ratio should be above 1.3.

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Probabilistic Analysis of Gnedenko System with K-Vacations of a Repairman

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Abstract. This paper studies the Gnedenko system attended by a repairman with k-vacations. It is assumed that the life of the operating unit and the standby, and the vacation time of the repairman are all exponential distributions, while the repair time of the unit has a general continuous distribution. By using the supplementary variable method, we obtain the explicit expressions of the steady-state availability and the steady-state failure frequency of the system.

Keywords: supplementary variables approach, multiple adaptive vacations, availability.

1 Introduction

In 1967, Gnedenko studied an *N*-unit series service system with one warm standby unit and one repair facility, and obtained the reliability function and discussed some extreme theorems [1]. In this system, the working unit and standby unit each processed a constant failure rate and arbitrary repair time. The above mentioned system is generally termed as Gnedenko system. By employing the Markov renewal process and Takacs method, Cao analyzed the probability of a Gnedenko system with a replaceable repair facility and gained its availability and failure frequency [2].

According to the classic theory of a Gnedenko system, the repairman always stays in the system and can repair any failed unit immediately. However, in practice the failed units might not be repaired in time and the repairman could leave for vacation or carry out other work when there are no failed units. From this perspective, research into reliability of reparable system with vacation is theoretically and practically necessary. In recent years, some reparable systems with vacation have been studied such as in [3,4].

The standard vacation policies include single vacation policy and multiple vacation policy. Takagi first proposed the concept of a variant vacation, which is a generalization of the multiple and single vacation policies [5]. The maxim number of vacations that the server may take is a random variable. However, the planned vacation process may be interrupted. The server will start a new busy period at the end of a vacation if any arrival occurs. Zhang and Tian named this kind of vacation policy "multiple adaptive vacation policy" [6]. We investigate the Gnedenko system with one repairman and multiple adaptive vacations in this paper. For convenience, the maxim number of vacations is assumed to be "k" and the term "k-vacations" is thus used.

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2 System Model

The model assumptions are as follows:

(1) The system consists of *N* operating units, one warm standby and one repairman.

(2) The operating units and the standby have constant failure rates with the parameters λ and λ_1 respectively when the system is down and the rest operable units no longer fail.

(3) The repair time distribution is generally continuous: $\mu(t)$ and μ are the repair rate function and the mean repair time. We denote the probability density function and distribution function of the repair time by $g(t)$ and $G(t)$ respectively.

(4) The vacation time distribution is exponential with the parameter of θ, and the repairman takes *k*-vacations.

(5) All random variables are mutually independent.

(6) Initially, the system with *N* new units begins to operate and the repairman stays in the system until a failed unit occurs.

(7) Switchover time is negligible and switching is perfect. A repaired unit is as good as a new one.

Let $N(t)$ be the number of failed units at time *t*. When $N(t)$ is positive and the repairman is available, we introduce the elapsed repair time $X(t)$ at time *t* as the supplementary variable. Then the process $\{N(t), X(t), t \geq 0\}$ forms a vector Markov process. We define the possible states of the system as follows:

$$P_{10}(t) = P\left\{N(t) = 0, \bar{v}\right\}, \tag{1}$$

$$P_{0i}(t) = P\left\{N(t) = i, v\right\},\ i = 1, 2, \tag{2}$$

$$P_{00i}(t) = P\left\{N(t) = 0, v_i\right\}, i = 1, 2, \ldots K, \tag{3}$$

$$P_{2i}(t, x)dx = P\left\{N(t) = i, x \leq X(t) < x + dx\right\},\quad i = 1, 2. \tag{4}$$

In the above equations, $\bar{v}$, v and $v_i\ (i = 1, 2.....k)$ represent that the repairman is available, on vacation and on ith vacation respectively.

For the sake of convenience, we introduce the following symbols:

$$a_1(s) = s + \theta, a_2(s) = s + \theta + N\lambda, a_3(s) = s + N\lambda + \lambda_1,$$

$$a_4(s) = s + N\lambda + \lambda_1 + \theta \tag{5}$$

3 System State Equations

By probability arguments, we have the following integro-differential equations:

$$\left[\frac{d}{dt}+a_3(0)\right]P_{10}(t)=P_{00K}(t)\theta, \tag{6}$$

$$\left[\frac{d}{dt}+a_4(0)\right]P_{001}(t)=\int_0^{\infty}P_{21}(t,x)\mu(x)dx, \tag{7}$$

$$\left[\frac{d}{dt}+a_4(0)\right]P_{00i}(t)=P_{00(i-1)}(t)\theta, i=2,3,.....K, \tag{8}$$

$$\left[\frac{d}{dt}+a_2(0)\right]P_{01}(t)=a_3(0)\sum_{i=1}^{K}P_{00i}(t), \tag{9}$$

$$\left[\frac{d}{dt}+\theta\right]P_{02}(t)=P_{01}(t)N\lambda, \tag{10}$$

$$\left[\frac{\partial}{\partial t}+\frac{\partial}{\partial x}+N\lambda+\mu(x)\right]P_{21}(t,x)=0, \tag{11}$$

$$\left[\frac{\partial}{\partial t}+\frac{\partial}{\partial x}+\mu(x)\right]P_{22}(t,x)=P_{21}(t,x)N\lambda. \tag{12}$$

With boundary conditions:

$$P_{21}(t,0)=\int_0^{\infty}P_{22}(t,x)\mu(x)dx+\theta P_{01}(t)+a_3(s)P_{10}(t), \tag{13}$$

$$P_{22}(t,0)=\theta P_{02}(t). \tag{14}$$

And the only non-zero initial condition $P_{10}(0)=1$, we introduce the following symbols:

$$\overline{g}^{*}(s)=1-g^{*}(s),\ \overline{g}^{*}(s+N\lambda)=1-g^{*}(s+N\lambda). \tag{15}$$

4 Steady-State Availability and Failure Frequency

Theorem 1: The steady-state availability of the system is given as follows:

$$A=\left[1+\frac{\overline{g}^{*}(N\lambda)}{N\lambda}\right]P_{21}+g^{*}(N\lambda)\frac{1}{\Delta}\times\left[a_2(0)a_4^{K+1}(0)-a_3(0)\theta^{K+1}-N\lambda a_3(0)a_4^{K}(0)\right] \tag{16}$$

In the above equation, P_{21} is as follows:

$$P_{21} = \frac{L}{\Delta}, \tag{17}$$

$$L = \theta a_2(0) a_3(0) a_4{}^K(0), \tag{18}$$

$$\begin{aligned}\Delta = {} & a_2(0) a_4{}^K(0)\left[g^*(N\lambda) a_4(0) + (1+\mu)\theta a_3(0)\right] + N\lambda\theta\mu a_3(0) g^*(N\lambda) \times \left[a_4{}^K(0) - \theta^K\right] \\ & - a_3(0) a_2(0) \times g^*(N\lambda)\theta^K\end{aligned} \tag{19}$$

Proof: By the system assumptions, we can obtain the availability at time *t*:

$$A(t) = P_{10}(t) + P_{01}(t) + \sum_{i=1}^{K} P_{00i}(t) + \int_0^\infty P_{21}(t,x)\,dx = 1 - P_{02}(t) - \int_0^\infty P_{22}(t,x)\,dx. \tag{20}$$

In the above equation, by applying Laplace transformation, the equation of availability at time *t* is as follows:

$$A^*(s) = \frac{1}{s} - P_{02}{}^*(s) - \int_0^\infty P_{22}{}^*(s,x)\,dx. \tag{21}$$

By taking Laplace transformations of Eqs.6-14 and solving the equations, we can obtain the Laplace transformations of the state probability at time t including $P_{02}{}^*(s)$ and $P_{22}{}^*(s,x)$.By applying the conclusion to the above equation, we can obtain $A^*(s)$, and therefore the steady-state availability can be acquired by combining Laplace transformation theorem $A = \lim_{t\to\infty} A(t) = \lim_{s\to 0} sA^*(s)$ and L'Hospital Rule.

Theorem 2: The steady-state failure frequency is given as follows:

$$M = \left\{ \frac{g^*(N\lambda)\left[a_4{}^K(0) - \theta^K\right]}{a_2(0) a_4{}^K(0)} + \frac{\overline{g}^*(N\lambda)}{N\lambda} \right\} \times N\lambda P_{21}. \tag{22}$$

In the above equation, P_{21} is given by Theorem 1.

Proof: Based on [7], the failure frequency at time *t*:

$$W(t) = N\lambda P_{01}(t) + N\lambda \int_0^\infty P_{21}(t,x)\,dx. \tag{23}$$

By taking Laplace transformations of Eqs.6-14 and solving the equations, we can obtain the Laplace transformations of the state probability at time t including $P_{01}{}^*(s)$ and $P_{21}{}^*(s,x)$. Thus we can obtain $W^*(s)$ by applying Laplace transformation in the

above equation. The steady-state failure frequency of the system can be obtained by combining $M = \lim_{t\to\infty} W(t) = \lim_{s\to 0} sW^*(s)$ and L'Hospital Rule.

5 Conclusion

In this paper, we considered the Gnedenko system with *k*-vacations of a repairman. We assumed that the life of the operating and the standby units, the vacation time of the repairman are all exponential distributions, and the repair time of the unit has a general continuous distribution. By using the supplementary variable method, we have obtained the explicit expressions of the steady-state availability and the steady-state failure frequency of the system.

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Reliability Analysis of Gnedenko System with Multiple Vacations

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Abstract. This paper studies the Gnedenko system attended by a repairman with multiple vacations. It is assumed that the life of the operating unit, the standby and the rest operable units when the system is down and the vacation time of the repairman are all exponential distributions, while the repair time of the unit has a general continuous distribution. By using the supplementary variable method, we obtain the Laplace transformation of the reliability and the explicit expression of the mean time to first failure of the system.

Keywords: supplementary variables approach, multiple vacations, reliability.

1 Introduction

The study of series systems with standby is an important topic in reliability. Gnedenko studied an N-unit series service system with one warm standby unit and one repair facility, and obtained the reliability function and discussed some extreme theorems [1]. By employing the Markov renewal process and Takacs method, Cao analyzed the probability of a Gnedenko system with a replaceable repair facility and gained its availability and failure frequency [2]. The above mentioned system is generally termed as Gnedenko system.

Repairman is one of the essential parts of repairable system, and repairman vacations are useful for the system in which repairman wants to utilize his idle time for different purposes [3]. Vacation concept was linked to reliability theory by Su and Shi [4].The repairman leaves for a vacation or does other work when there are no failed units for repair in system, which can have important influence to performance of system. In recent years, some reparable systems with vacation have been studied such as in [5,6].The classic vacation policies include single vacation policy and multiple vacations policy. In some conditions, the repairman will take another vacation after a vacation, if there are no failed units for repair in system at the moment, which may make more economic benefit compared with single vacation. In this paper, we considered a Gnedenko system with multiple vacations of a repairman.

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2 System Model

The model assumptions are as follows:

(1) The system consists of *N* operating units, one warm standby and one repairman.

(2) The operating units and the standby have constant failure rates with the parameters λ and λ_1 respectively. When the system is down, the rest operable units have constant failure rate with the parameter λ_2.

(3) The repair time distribution is generally continuous: $\mu(t)$ and μ are the repair rate function and the mean repair time. We denote the probability density function and distribution function of the repair time by $g(t)$ and $G(t)$ respectively.

(4) The vacation time distribution is exponential with the parameter of θ, and the repairman takes multiple vacations.

(5) All random variables are mutually independent.

(6) Initially, the system with *N* new units begins to operate and the repairman stays in the system until a failed unit occurs.

(7) Switchover time is negligible and switching is perfect. A repaired unit is as good as a new one.

Let $N(t)$ be the number of failed units at time *t*. When $N(t)$ is positive and the repairman is available, we introduce the elapsed repair time $X(t)$ at time *t* as the supplementary variable. Then the process $\{N(t), X(t), t \geq 0\}$ forms a vector Markov process. We define the possible states of the system as follows:

$$P_{0i}(t) = P\{N(t) = i, v\}, \quad i = 0,1,\ldots,N+1, \tag{1}$$

$$P_{1j}(t) = P\{N(t) = j, x \leq X(t) < x + dx\}, \quad j = 1,2,\ldots,N+1. \tag{2}$$

The *v* above represents that repairman is on vacation.

3 System Reliability and Mean Time to First Failure

Let the system reliability is $R(t)$, the system is down when $N(t) = 2$. In order to attain $R(t)$, let $N(t) = 2$ be the absorbing state of $\{N(t), X(t), t \geq 0\}$, and thus a new stochastic process is defined as $\{\tilde{N}(t), \tilde{X}(t); t \geq 0\}$: $\tilde{N}(t) = i$, if there are *i* failure units in the system at time *t*, where $i = 0,1,2$. When $\tilde{N}(t) = 1$ and the

repairman is at work, let $\tilde{X}(t)$ denote the elapsed repair time of the unit being repaired at time t and $\tilde{X}(t)$ can be ignored when $\tilde{N}(t)=0,2$. Thus $\{\tilde{N}(t),\tilde{X}(t);t\geq 0\}$ is continuous-time generalized Markov process with an absorbing state. Let

$$Q_{00}(t)=P\{\tilde{N}(t)=0,v\}, \tag{3}$$

$$Q_{01}(t)=P\{\tilde{N}(t)=1,v\}, \tag{4}$$

$$Q_{11}(t,x)\,dx=P\{\tilde{N}(t)=1,x\leq\tilde{X}(t)<x+dx\}. \tag{5}$$

Thus the integro-differential equations of probability of each state are as follows:

$$\left[\frac{d}{dt}+N\lambda+\lambda_1+\theta\right]Q_{00}(t)=\int_0^{\infty}Q_{11}(t,x)\mu(x)\,dx, \tag{6}$$

$$\left[\frac{d}{dt}+N\lambda+\theta\right]Q_{01}(t)=Q_{00}(t)(N\lambda+\lambda_1), \tag{7}$$

$$\left[\frac{\partial}{\partial t}+\frac{\partial}{\partial x}+N\lambda+\mu(x)\right]Q_{11}(t,x)=0 \tag{8}$$

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With boundary conditions:

$$Q_{11}(t,0)=\theta Q_{01}(t). \tag{9}$$

Initial conditions are $Q_{00}(0)=1,$ and others are 0.

Theorem 1. The Laplace transformation of the reliability at time *t*:

$$R^*(s)=\frac{(s+N\lambda)(s+\theta+2N\lambda+\lambda_1)+\theta(N\lambda+\lambda_1)\left[1-g^*(s+N\lambda)\right]}{(s+N\lambda)(s+\theta+N\lambda)(s+\theta+N\lambda+\lambda_1)-\theta(s+N\lambda)(N\lambda+\lambda_1)g^*(s+N\lambda)}. \tag{10}$$

Proof. By taking Laplace transformations of Eqs.5-8, we can obtain:

$$[s+N\lambda+\lambda_1+\theta]Q_{00}{}^*(s)=1+\int_0^{\infty}Q_{11}{}^*(s,x)\mu(x)\,dx, \tag{11}$$

$$[s+N\lambda+\theta]Q_{01}{}^*(s)=(N\lambda+\lambda_1)Q_{00}{}^*(s), \tag{12}$$

$$\left[\frac{d}{dx}+s+N\lambda+\mu(x)\right]Q_{11}^{*}(s,x)=0, \tag{13}$$

$$Q_{11}^{*}(s,0)=\theta Q_{01}^{*}(s). \tag{14}$$

By using the theory of linear, ordinary differential equations, we can obtain the solution of the above equations:

$$Q_{00}^{*}(s)=\frac{s+\theta+N\lambda}{(s+\theta+N\lambda)(s+\theta+N\lambda+\lambda_1)-\theta(N\lambda+\lambda_1)g^{*}(s+N\lambda)}, \tag{15}$$

$$Q_{01}^{*}(s)=\frac{N\lambda+\lambda_1}{(s+N\lambda+\lambda_1+\theta)(s+N\lambda+\theta)-\theta(N\lambda+\lambda_1)g^{*}(s+N\lambda)}, \tag{16}$$

$$Q_{11}^{*}(s,x)=\frac{\theta(N\lambda+\lambda_1)\bar{G}(x)e^{-(s+N\lambda)x}}{(s+N\lambda+\lambda_1+\theta)(s+N\lambda+\theta)-\theta(N\lambda+\lambda_1)g^{*}(s+N\lambda)}. \tag{17}$$

By applying the conclusion above to the equation:

$$R^{*}(s)=Q_{00}^{*}(s)+Q_{01}^{*}(s)+\int_0^{\infty}Q_{11}^{*}(s,x)dx, \tag{18}$$

we can obtain $R^{*}(s)$.

Theorem 2. The mean time to first failure (MTTFF) of the system is:

$$MTTFF=\frac{N\lambda(\theta+2N\lambda+\lambda_1)+\theta(N\lambda+\lambda_1)\left[1-g^{*}(N\lambda)\right]}{N\lambda(N\lambda+\theta)(N\lambda+\theta+\lambda_1)-\theta N\lambda(N\lambda+\lambda_1)g^{*}(N\lambda)}. \tag{19}$$

Proof. By applying the conclusion of theorem 1 to the equation of $MTTFF=\int_0^{\infty}R(t)dt=\lim_{s\to 0}R^{*}(s)$, we can obtain *MTTFF*.

4 Conclusion

In this paper, we considered the Gnedenko system with multiple vacations of a repairman. We assumed that the life of the operating, the standby units and the rest operable units when the system is down, and the vacation time of the repairman are all exponential distributions, while the repair time of the unit has a general continuous distribution. By using the supplementary variable method, we have obtained the Laplace transformation of the reliability and the explicit expression of the mean time to first failure of the system.

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A Method for Calculating Heat Energy and Braking Moment of Automobile Electromagnetic Retarder with Skin Effect

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Abstract. The mechanical structure and working principle of automobile electromagnetic retarder is analyzed in this paper to study the impact of temperature rising and skin effect on the performance of electromagnetic retarder. Furthermore, a method of calculating the heat energy and braking moment of automobile electromagnetic retarder is given taking temperature rising and skin effect into consideration. This method helps providing theoretical basis for the optimal design of electromagnetic retarder as it demonstrates the interrelation among design parameters more accurately. The method is proved to be correct by comparing and analyzing the calculation result and test result of DHZ100 electromagnetic retarder.

Keywords: automobile electromagnetic retarder, heat energy, braking moment, skin effect.

1 Introduction

An important approach of assisting the braking system, eddy current brake is used extensively in large automobiles. The travelling speed is increasing along with improvement of road and dynamic performance of automobiles; while for automobiles subject to frequent braking such as public transport bus service, and heavy vehicles like intercity buses and trucks, the friction factor of braking system would decrease and abrasion would increase if the brake load is assumed only by the braking system of the automobile itself. Hence the braking ability may decline and even car accidents may happen because of brake failure caused by frequent braking. Based on electromagnetic induction, eddy current brake is to transfer the kinetic energy into electric energy of eddy current and consume it in the form of heat so that the travelling speed is reduced and the reliability and safety of the automobile is ensured.

Automobile electromagnetic retarder is mainly composed of stator, rotor, and fixation apparatus, etc. The rotor generally consists of the front rotating disk, back rotating disk, and the rotor shaft. Both the rotating disks are round and are generally

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made from ferromagnetic materials like electrical pure iron and low carbon steel with high magnetic properties and low remanence ratio. The stator is rigidly fixed still on the carframe (or the chassis or the shell of the main retarder of the drive axle by fixation apparatus). The working principle is as follows: a magnetic field will be generated when the excitation coil of the electromagnetic retarder is connected to electricity. A loop of magnetic lines of force hence will be built up among the pole of the stator, the air gap, and the front and back rotating disk. According to Len'z law, when the rotor is rotating around the shaft, magnetic flux within the area enclosed by innumerable closed traverse will change periodically, hence eddy current will be generated in the rotating disks. The magnetic field built up by the eddy current in the rotor will give rise to braking moment against the direction of the rotating, thus reduce the speed of the drive shaft (see Fig. 1). When the electromagnetic retarder is working, heat effect generated by eddy current flow in resistive rotors will transfer the braking energy into heat energy, which is dissipated by the wind generated by blades of the disk. Moreover, according to Len'z Law, the induced current produced by the new magnetic field of eddy current in the closed loop will resist the rotation of the disk, thus give rise to the braking moment which reduces the vehicle speed.

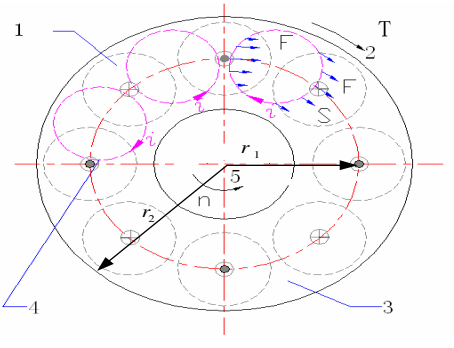

Fig. 1. Braking moment and eddy current of electromagnetic retarder

(1: magnetic pole, 2: eddy current, 3: rotor disk, 4: break moment, 5: direction of rotation)

2 Analysis on the Heat Energy and Braking Moment of Electromagnetic Retarder

2.1 Current Density Amplitude at the Surface of the Rotor Disk

The formula for calculating the current density amplitude at the surface of the rotor disk is as follows:

$$J_{m0} = \sigma E_0 = \sigma B v \tag{1}$$

In this equation, σ is the conductivity of the rotor disk, and B stands for the magnetic flux density at the surface of the disk, while v is the rotating linear velocity at the magnetic pole of the disk.

It is worth noted that tangential components of the current is not taken into account when solving eddy current density in equation 1, rather the current is assumed to be distributed along the axial. In fact, the eddy current distribution is partially closed along the end face, and the rest don't even reach the end surface. Suppose the magnetic conductivity of the rotor disk μ is constant, and taking the axial direction and the tangential components into consideration, the inside radius and outside radius of the disk are defined as r_1 and r_2, the amplitude of tangential components of eddy current density at the surface of the disk should be [4]:

$$J_{m0} = \frac{\sigma \omega_n r_1 B N_P (r_2 - r_1)^2}{N_P{}^2 (r_2 - r_1)^2 + 4\pi^2 r_1^2} Sin \frac{2\pi r_2}{r_2 - r_1} \tag{2}$$

When the number of pole pairs N_P=4, we may derive the following equation from equation 2:

$$J_{m0} = \frac{\sigma \omega_n r_1 B (r_2 - r_1)^2}{4(r_2 - r_1)^2 + \pi^2 r_1^2} Sin \frac{2\pi r_2}{r_2 - r_1} \tag{3}$$

2.2 Magnetic Flux Density Influenced by Skin Effect

During the running of electromagnetic retarder, when the disk is rotating against the shaft, induced electromotive force and eddy current will be generated at the surface and in certain depth of the rotor disk perpendicular to the magnetic lines of force. Impacted by the eddy current magnetic field, the original field is overlaid with the induced eddy current field, so that the eddy current is unevenly distributed along the disk thickness, and is reduced exponentially as it goes deeper. This is known as skin effect of eddy current, which is usually represented by equivalent penetration depth Δh in engineering calculation [5]: $\Delta_h = \sqrt{\frac{2\rho}{\omega_n \mu}}$.

According to the calculation formula of magnetic flux density:

$$B = \frac{\phi}{S_d} \tag{4}$$

B stands for magnetic flux density, ϕ is the magnetic flux influenced by skin effect, and S_d is the area of the rotor disk.

$$\phi = \phi_m - \phi_e \tag{5}$$

ϕ_m is the magnetic flux of excitation coil, ϕ_e is the equivalent magnetic flux generated by induced magnetic field.

$$\phi_m = \frac{\varepsilon_m}{R_m} \tag{6}$$

$\varepsilon_m = NI$ is the magnetic motive force of the excitation soil(N is the number of winding, I is the current of excitation coil), R_m is the magnetic resistance of the magnetic circuit.

$$R_m \approx 2R_{m0} = \frac{2\delta}{\mu S_p} \tag{7}$$

R_{m0} is the air gap magnetic resistance, and δ is the air gap length, while $S_p = \frac{\pi d^2}{4}$ stands for the cross sectional area of the iron core, and d is the diameter of the iron core.

We may further get the following equation from 6 and 7:

$$\phi_m = \frac{NI\mu\pi d^2}{8\delta} \tag{8}$$

The induced electromotive force on the rotor disk ε_e should be [2]:

$$\varepsilon_e = \int_{r_1}^{r_2} v \times B d_l = \frac{\pi n B(r_1 + r_2)}{60} \tag{9}$$

$v = \frac{r_1 + r_2}{2}\omega_n$ is the linear velocity at the magnetic poles of the disk, $\omega_n = \frac{\pi n}{30}$ is the angular velocity of the disk, while n represents the rotating speed of the disk.

We may further get the resistivity of the rotor disk [2]:

$$R_e = \int_{r_1}^{r_2} \frac{\rho}{2\pi\Delta_h l} d_l = \frac{\rho}{2\pi\Delta_h} \ln\frac{r_2}{r_1} \tag{10}$$

$$\text{Thus: } \phi_e = \frac{\varepsilon_e}{2R_e} = \frac{\pi^2 n B \Delta_h (r_1 + r_2)}{30\rho \ln\frac{r_2}{r_1}} \tag{11}$$

$$\phi = \phi_m - \phi_e = \frac{\varepsilon_m}{R_m} - \frac{\varepsilon_e}{2R_e} = \frac{NI\mu\pi d^2}{8\delta} - \frac{\pi^2 n B \Delta_h (r_1 + r_2)}{30\rho \ln\frac{r_2}{r_1}} \tag{12}$$

The following equation can be deduced by putting equation 2 into 4:

$$B = \frac{\phi}{S_d} = \frac{30\rho NI\mu d^2 \ln\frac{r_2}{r_1}}{8\delta(r_1+r_2)[30\rho\ln\frac{r_2}{r_1}(r_2-r_1)+\sqrt{\frac{60\pi n\rho}{\mu}}]}\delta \tag{13}$$

Influenced by the material of the conductor and the temperature of its surrounding environment, the resistivity ρ 与 changes linearly under slight variation of surrounding temperature [6]:

$$\rho = \rho_0[1+\Delta_T\alpha] \tag{14}$$

ρ_0 represents the resistivity of the conductor under , and α is the temperature coefficients of resistivity, while Δ_T is the temperature difference. The relationship between Δ_T and time t and incoming current i is show by the following equation [7]:

$$\Delta_T = 0.046t(500i-8.117) \tag{15}$$

According to equation 21 and 22, the resistivity of the conductor increases along with the increment of time and incoming current.

The heat energy consumed by rotor disk per unit volume is $\rho J_{m0}{}^2$ [8], and the heat energy consumed by the rotor disk P is:

$$P = \pi(r_2{}^2 - r_1{}^2)\cdot\Delta_h\cdot\rho J_{m0}{}^2 \tag{16}$$

We may get the following equation by putting Δ_h and J_{m0} into equation 23:

$$P = (r_1+r_2)\sqrt{\frac{60\pi n}{\mu\rho}}\frac{\pi^2 n r_1{}^2 B^2(r_2-r_1)^5}{900[4(r_2-r_1)^2+\pi^2 r_1{}^2]^2}\sin^2\frac{2\pi r_2}{r_2-r_1} \tag{17}$$

Hence the braking moment *T* is derived:

$$T = \frac{P}{\omega_n} = (r_1+r_2)\sqrt{\frac{\pi n}{15\mu\rho}}\cdot\frac{\pi r_1{}^2 B^2(r_2-r_1)^5}{[4(r_2-r_1)^2+\pi^2 r_1{}^2]^2}\sin^2\frac{2\pi r_2}{r_2-r_1} \tag{18}$$

By putting equation 20, 21, and 22 into equation 24 and 25, the formula for calculating the variation of heat energy and braking moment which are subject to changes of incoming current and time is deduced.

3 Example of Calculating the Braking Moment

DHZ100 electromagnetic retarder is taken as an example in this paper to verify the calculation results. The structure parameters of this retarder are as follows: the inside diameter of rotor disk r_1 =86mm, outside diameter r_2 =178mm, thickness h=16mm, 4 groups of excitation composed of 8 coils with N=400, the diameter of iron core d=70mm, the air gap δ =1.25mm. the braking moment produced by the retarder is calculated by equation 18, and is compared with test results, see Table 1.

Table 1. Theoretical value and experimental value of braking moment of DHZ100 electromagnetic retarder

rotating speed[r/min]	theoretical value [N·m]	experimental value [N·m]
250	611.4	608.6
500	866.3	867.9
750	1061.2	1062.3
800	1096.3	1096.9
1000	1113.2	1032.8

The calculation results in this paper are compared with the calculated value and experimental value in reference 1, see Fig. 2.

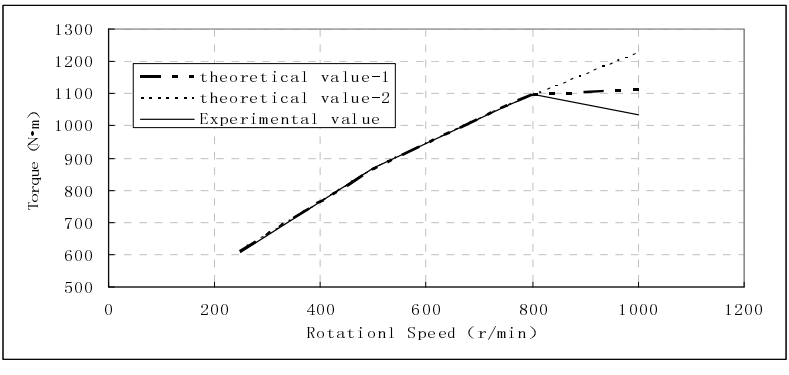

Fig. 2. Comparison of calculated values and experimental values by two different methods

The comparisons in table 1 and fig. 2 demonstrate that the theoretical value of braking moment is approximate to experimental value under low rotating speed; while as the rotating speed is increased to be larger than 1000r/min, which is the limit speed, the theoretical values are larger than experimental values. Nonetheless, the calculated value in this paper is evidently closer to theoretical value than that in reference [1].The increment of rotating speed and temperature will affect the resistivity ρ and demagnetizing effect. This is why the calculation results in this paper are still different from experimental values and is needed to be further studied.

4 Conclusion

Based on the calculation of heat energy and braking moment of automobile electromagnetic retarder under ideal conditions, this paper takes engineering project as a example, and re-calculated the heat energy and braking moment of the retarder taking temperature rising and skin effect into account. The results are more approximate to engineering practices and hence can provide theoretical basis for the improvement of automobile electromagnetic retarder designing.

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Research on the Fabrication of Integrative Insulator Rib for Field Emission Display Panel

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Abstract. With insulation slurry as fabrication material, the integrative insulator rib was developed on the cathode back plane. The integrarive insulator rib was mainly composed of two parts, which was the bottom insulator rib and the top insulator rib, respectively. The high effective screen-printing method was adopted to fabricate the integrative insulator rib. The top insulator rib would reside on the bottom insulator rib, and was arranged on the cathode back plane surface with the bottom insulator rib in orthogonal direction. The bottom insulator rib was parallel with the adjacent cathode indium tin oxide electrodes, but not contacted with them each other. The carbon nanotube was prepared on the cathode indium tin oxide electrodes surface to form the cold cathode with good field emission ability. The fabricated FED panel with integrative insulator rib possessed high image brightness and better field emission property.

Keywords: insulator rib, integrative, cathode back plane, field emission, printing.

1 Introduction

Carbon nanotubes (CNTs) possessed excellent field emission ability and had attracted much attention in the flat-panel display community. Because of their high aspect ratios and small curvature radii, the strong electric-field caused by the applied exterior operation voltage could be formed easily [1-3]. Once the CNTs were used as cold cathode materials, lots of electrons would be emitted from the CNTs cathode surface by the field emission form. Field emission display (FED) with CNTs as field emitters had been considered as a promising technology, and had also been intensively researched in recent years either for its manufacture process or for its fabrication materials [4-6]. The diode type FED panel usually two sets of electrodes, which was the panel cathode and anode, respectively. It was obvisously that the two sets of electrodes must be separated by some insulation object, such as the insulation rib or insulation wall. However, the fabrication of insulation object could not effected the formed panel image. For example, for the anode back plane, the contact area between the insulation object and anode back plane must be small as far as possible. Otherwise, not only the image resolution would be reduced because the insulation object had occupyed large numbers of anode back plane area, but also the exquisite

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panel image would not formed on the anode back plane because of the visible insulation object. The screen-printing was a high effective fabrication process, and had been adopted in the fabrication course for the FED panel [7-9]. In this paper, the insulation slurry was used as fabrication material, and the integrative insulator rib was fabricated with the screen-printing method. The integrative insulator rib was mainly composed of two parts, which included the bottom insulator rib and top insulator rib on the cathode back plane. The CNTs were prepared on the cathode ITO electrode surface to form the field emitters, and the FED panel with CNT cold cathode was fabricated. The detailed fabrication process was also given.

2 Experimental Details

The schematic structure of cathode back plane for the FED panel was illustrated in Fig.1. The cathode back plane was made of common soda-lime glass, which the thickness was approximate 1.8mm. After the precise photolithography process, the indium tin oxide (ITO) film covered on the cathode back plane surface would be divided into many bar cathode ITO electrodes, which would serve for the CNT field emitters. Every bar cathode ITO electrodes was independent, which only would be connected with the peripheral extension line on the cathode back plane. By the extension line, the applied operation voltage could be conducted for the cathode ITO electrodes. The high effective screen-printing method was adopted to prepare the integrative insulator rib. Using insulation slurry as material, the bottom insulator rib was fabricated on the cathode back plane, which would reside on the position between the different bar cathode ITO electrodes. Of course, the formed bottom insulator rib pattern would not cover any bar cathode ITO electrodes. The single bottom insulator rib and the adjacent cathode ITO electrode was parallel each other. The insulation slurry paste would be again printed on the cathode back plane surface to form the top insulator rib. As shown in Fig.1, the bottom insulator rib and the top insulator rib were fabricated in orthogonal directions. Finally, the CNT paste was prepared on the exposed cathode ITO electrodes surface to form the CNT field emitters. The post-treatment process was necessary for improving the field emission property of CNT cold cathode.

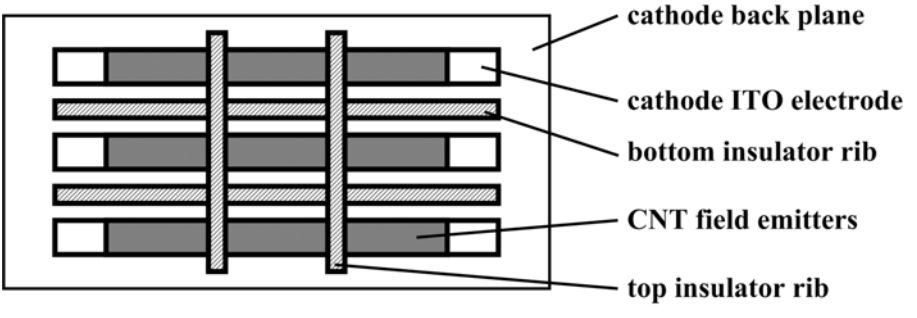

Fig. 1. Schematic structure of cathode back plane

For the anode back plane, the phosphor powder was printed on the anode ITO electrodes surface to form the luminous layer. The panel chamber would be made by the combined cathode back plane and anode back plane, which should be separated by the integrative insulator rib. The total height of integrative insulator rib would be the distance between the cathode and anode back plane. The low-melting glass frit was used to seal the whole panel chamber. After the gas in the panel vacuum was evacuated out, the inner vacuum would be formed because of the sealing for the sintered glass frit, which was necessary for the FED panel.

3 Results and Discussion

FED panel was an electron device, and the cathode back plane and the anode back plane must be separated by some insulation object. On the one hand, the distance between the cathode back plane and the anode back plane was necessary for the FED panel. Seen from the operation principle, the electrons emitted from CNT field emitters would be accelerated by the applied anode voltage. Only with the distance, the flying electron beam could obtain more enough energy to bombard the luminous layer. Otherwise, the prepared phosphor powder on the anode back plane would not be excitated. On the other hand, the panel cathode part was fabricated on the cathode back plane, and the panel anode part was prepared on the anode back plane in the fabrication course. Once the anode and cathode back plane would not be kept apart, the panel cathode ITO electrodes and anode ITO electrodes should contact directly each other, and the short circuit for the whole FED panel would become unavoidable.

To improve the insulation performance between the cathode and anode back plane, the integrative insulator rib was used in this study. The integrative insulator rib was composed of two parts, which were the bottom insulator rib and the top insulator rib, respectively. The bottom insulator rib was made of sintered insulation slurry, which possessed good insulation property. The single bottom insulator rib was bar shape, and the height of all the bottom insulator rib was identical. Many bar bottom insulator rib were aligned to form the bottom insulator rib layer. The one bottom insulator rib was parallel with the adjacent cathode ITO electrodes, but not contacted each other. Because of the non-contacting mode, the edge regularity of cathode ITO electrodes would not be damaged, which was helpful for insuring the better field emission ability of CNT field emitters. Because of the existing of parallel single insulator rib, the cross-electron-emitting of CNT field emitters on the cathode ITO electrode surface would be controlled. On the bottom insulator rib of cathode back plane, the top insulator rib was fabricated with simple screen-printing process. The top insulator rib was also made of the sintered insulation slurry, and was orthogonal arranged with the bottom insulator rib. The under-surface of top insulator rib was flat, which could make it easy to integrate with the bottom insulator rib. However, the top-surface of top insulator rib was pointed, so the contact-area of the top insulator ribs and anode back plane was small, which was beneficial for improving the resolution ratio of whole FED panel.

For simplifying the manufacture process, the same fabrication material, which was the printed insulation slurry, was used for the integrative insulator rib in this study. In fact, the integrative insulator rib would comprise two parts, and the two parts could

also be made with different fabrication material, which was advantageous for the process flexibility. For example, the bottom insulator rib would be prepared using the material with better insulation performance, which could effective prevent from the short-circuit phenomenon between the panel anode and cathode. The top insulator rib could be made with common insulation material, which could reduce the fabrication cost by a large margin.

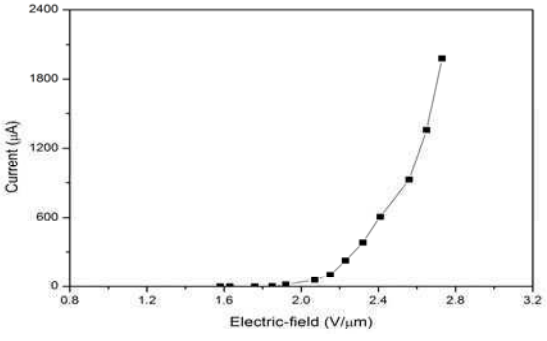

Fig. 2. The field emission curve for the diode FED panel

Fig. 3. The displayed image for the fabricated FED panel with CNT field emitters

The typical field emission curve for the diode FED panel was illustrated in Fig.3. As the formed electric-field between the panel cathode and anode increased, the field emission current would also become larger. And the maximun emission current was approximate 1976μA. It was obvisously that the normal field emission for CNT cold cathode had been conducted although the integrative insulation rib was fabricated on the cathode back plane. The displayed image for the FED panel was showed in Fig.4. The simple numeric character could be displayed with green phosphor powder on the anode back plane, and the FED panel showed high luminous brightness.

4 Conclusion

The insulation slurry was used as the fabrication material of integrative insulator rib, and the simple screen-printing method was also adopted in the fabrication course. So the integrative rib was developed on the cathode back plane, which mainly included the bottom insulator rib part and top insulator rib part. The etched ITO film was

formed with the precise photolithography process, which would be used as the cathode ITO electrodes. The bottom insulator rib was parallel with the cathode ITO electrodes, but was orthogonal with the top insulation rib. Using CNTs as field emission material, the FED panel was fabricated, which possessed high luminous brightness and better field emission property.

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Improvement of Information Rough Communication on Rough Set

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Abstract. The concept of information rough communication based on knowledge base is proposed by Mousavi Amin, Jabedar-Maralani Parviz. In this paper, its limitation is discussed. The concept of information rough communication based on information system is given, and solve the question about the limitation. The associated concepts and theorems are given.

Keywords: information system, rough sets, rough communication, translation sequence.

1 Introduction

Rough sets theory [1,2], proposed by Z. Pawlak, is a new mathematical tool for dealing with vagueness and uncertainty. Rough communication [3], a proper tool for dealing with several information sources, is presented as a new extension of rough sets. When dealing with several sources of information where only one concept is present, each agent has a different language and cannot provide precise communication to others, therefore, it is called rough communication. It is done by defining the approximation of a rough set from one approximation space to another. By doing this, some information or precision of the concept is lost and this will result in a less precise or rougher concept.

Mousavi Amin, Jabedar-Maralani Parviz [3] made the concept of information rough communication based on knowledge base. Through some analysis, the concept of information rough communication based on knowledge base is improper and limited and the concept of information rough communication based on information system is reasonable.

2 Basic Concepts

Definition 1 [1,2]. Let U be the universe set and R be an equivalence relation on U. Pair (U, R) is called knowledge base. If $X \subseteq U$ is an arbitrary set, then two approximations are formally defined as follows

$$\underline{R}(X) = \{x \in U \mid [x]_R \subseteq X\},$$

$$\overline{R}(X) = \{x \in U \mid [x]_R \cap X \neq \Phi\}$$

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Where $[x]_R$ is an equivalence class containing x. $\underline{R}(X), \overline{R}(X)$ is R-lower approximation and R-upper approximation of X.

$$pos_R(X) = \underline{R}(X)$$

is called the R-positive region of X.

$$neg_R(X) = U - \overline{R}(X) = \{x \in U \mid [x]_R \bigcap X = \Phi\}$$

$$= \{x \in U \mid [x]_R \subseteq X^c\}) = \underline{R}(X^c) = pos_R(X^c)$$

is called the R-negative region of X.

Definition 2[3]. Suppose $(U, R_1), (U, R_2)$ are two knowledge bases, they represent the knowledge R_1, R_2 of A_1, A_2, pair $(pos_{R_1}(X), neg_{R_1}(X))$ is the comprehension of information source X based on the knowledge R_1. Let $G_1^+ = pos_{R_1}(X), G_1^- = neg_{R_1}(X) = pos_{R_1}(X^c)$, $\underline{R_2}(G_1^+, G_1^-) = (\underline{R_2}(G_1^+), \underline{R_2}(G_1^-))$ is called lower approximation rough communication of information source X from A_1 to A_2.

Definition 3 [1,2]. Pair $S = (U, A)$ is a information system, where U is a finite non-empty set of objects called universe of discourse and A is a non-finite of attributes such that $a : U \to V_a$ for each $a \in A$. The set V_a is called the value set of a.

Definition 4 [1,2]. Pair $S = (U, A)$ is a information system, $B \subseteq A$, equivalence relation as given below

$$IND(B) = \{(u,v) \mid (u,v) \in U \times U, \forall a \in B(a(u) = a(v))\}$$

Obviously, $(U, IND(B))$ is a knowledge base.

3 Improvement of Information Rough Communication

An example is given for illustrating that definition1 is improper and limited,then improvement of information rough communication is provided.

Suppose a black dog and a white cat in the park are shown through an information system as bellow:

	yell	color
x_1	doggie	black
x_2	mew	white

The concept $\{x_1\}$ is impossible to be transferred from a deaf to a dumb according to common sense. The concept is transferred according to definition1 as follows($\underline{IND(B)}(X)$ is simply called $\underline{B}(X)$).

$$pos_{\{color\}}(\{x_1\}) = \{x_1\},\ \underline{\{yell\}}(pos_{\{color\}})(\{x_1\})) = \{x_1\},$$

$$neg_{\{color\}}(\{x_1\}) = \{x_2\},\ \underline{\{yell\}}(neg_{\{color\}}(\{x_1\})) = \{x_2\}.$$

No information is lost, so definition1 is improper and limited. The concept of information rough communication based on information system is given as follows.

Definition 5. Suppose $(U, A_1), (U, A_2)$ are two information systems. they represent the knowledge $IND(A_1)$, $IND(A_2)$ of A_1, A_2, pair $(pos_{A_1}(X), neg_{A_1}(X))$ is the comprehension of information source X based on the knowledge $IND(A_1)$. Let $G_1^+ = pos_{A_1}(X), G_1^- = neg_{A_1}(X)$, $\underline{A_1 \bigcap A_2}(G_1^+, G_1^-) = (\underline{A_1 \bigcap A_2}(G_1^+), \underline{A_1 \bigcap A_2}(G_1^-))$ is called lower approximation rough communication of information source X from A_1 to A_2.

The operator $\underline{A_1 \bigcap A_2}(G_1^+, G_1^-)$ means that the information described definitely by A_1 can be transferred to A_2 and A_2 only accepts definite information described by common knowledge of A_1 and A_2.

According to the definition, no information is directly communicated between a deaf and a dumb. Then, is information never communicated between a deaf and a dumb? The information is communicated indirectly between them, the definition of information rough communication through translation sequence is given as follows.

Definition 6. Suppose $(U, A_1), (U, A_2), \cdots, (U, A_n)$ are n information systems, $IND(A_1), IND(A_2), \cdots, IND(A_n)$ are the knowledges of $A_1, A_2, \cdots, A_n$ respectively,

$$(G_1^+, G_1^-) = (pos_{A_1}(X), neg_{A_1}(X)),$$
$$(G_i^+, G_i^-) = (\underline{A_{i-1} \bigcap A_i}(G_{i-1}^+), \underline{A_{i-1} \bigcap A_i}(G_{i-1}^-))(i = 2, \cdots, n)$$

is called lower approximation rough communication of information source following $X \to A_1 \to A_2 \to \cdots \to A_n$.

The information is communicated through a normal person between a deaf and a dumb in the example. How is information communication expressed when the information is transferred from many person to one person? The definition is given as follows.

Definition 7. Suppose $(U,A_1),(U,A_2),\cdots,(U,A_n),(U,A)$ are n+1information systems, $IND(A_1),IND(A_2),\cdots,IND(A_n),IND(A)$ are the knowledges of $A_1,A_2,\cdots,A_n,A$ respectively, let $(G_i^+,G_i^-)=(pos_{A_i}(X),\ neg_{A_i}(X))$ $(i=1,2,\cdots,n)$,

$$(G^+,G^-)=(\bigcup_{i=1}^{n}\underline{A\cap A_i}(G_i^+),\bigcup_{i=1}^{n}\underline{A\cap A_i}(G_i^-))$$

is called lower approximation rough communication of information source $X\subseteq U$ from $A_1,A_2,\cdots,A_n$ to A.

What is the relation between the comprehension of information source $X\subseteq U$ based on the knowledge $IND(A)$ and that based on the lower approximation rough communication of information source X from $A_1,A_2,\cdots,A_n$ to A ? The answer is given by theorem as follow.

Theorem. Suppose $(U,A_1),(U,A_2),\cdots,(U,A_n),(U,A)$ are n+1 information systems, $IND(A_1),IND(A_2),\cdots,IND(A_n),IND(A)$ are the knowledges of $A_1,A_2,\cdots,A_n,A$ respectively, then

$$\bigcup_{i=1}^{n}\underline{A\cap A_i}(G_i^+)\subseteq pos_A(X),\ \bigcup_{i=1}^{n}\underline{A\cap A_i}(G_i^-)\subseteq neg_A(X)$$

namely

$$(G^+,G^-)=(\bigcup_{i=1}^{n}\underline{A\cap A_i}(G_i^+),\bigcup_{i=1}^{n}\underline{A\cap A_i}(G_i^-))\subseteq(pos_A(X),neg_A(X))。$$

Proof. $\underline{A\cap A_i}(G_i^+)=\underline{A\cap A_i}(\underline{A_i}(X))=\underline{A\cap A_i}(X)\subseteq\underline{A}(X)=pos_A(X)$

$$\underline{A\cap A_i}(G_i^-)=\underline{A\cap A_i}(neg_{A_i}(X))=\underline{A\cap A_i}(\underline{A_i}X^c)=\underline{A\cap A_i}(X^c)\subseteq\underline{A}(X^c)=neg_A(X)$$

so

$$\bigcup_{i=1}^{n}\underline{A\cap A_i}(G_i^+)\subseteq pos_A(X),\ \bigcup_{i=1}^{n}\underline{A\cap A_i}(G_i^-)\subseteq neg_A(X).$$

As is shown in the theorem that the comprehension of information source based on the own knowledge is more than transferred from others.

4 Conclusions

The concept of information rough communication based on knowledge base is improper and limited through analysis in this paper. The concept of information rough communication based on information system is given. Lastly, the relation between the comprehension of information source based on the own knowledge and that from others and the relation in common sense are consistent.

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Business Strategies Selection of Aviation Passenger Transportation Enterprises Based on High Speed Railway Competition

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Abstract. By analyzing competition as well as market occupation between aviation passenger and railway multiple units, a SWOT matrix is set up to present the aviation passenger market internal advantages and external environment, strategies of aviation passenger transportation enterprises can be found out.

Keywords: High-speed railway, competition, aviation passenger transportation enterprise, market occupation, Strategies.

Introduction

According to "long-term railway network plan" (2008 Revision), high-speed railway program in China shows as follows: Establishing intercity and provincial capital city fast passenger transportation channel, planning “four vertical four horizontal” passenger line .And then, China's aviation industry will face serious impact from the iron.

1 Aviation and High-Speed Rail Passenger Market Competition Analysis

1.1 Aviation Competitive Advantages Analysis

With relatively low price, high speed, small delay and coach comfort environment, especially in terms of energy conservation and emissions reduction, high-speed rail is better. For aviation, the aircraft is undoubtedly the fastest means of transport; its speed advantage outstands in medium-long distance transportation.

The relative competitiveness of them showed as figure 1

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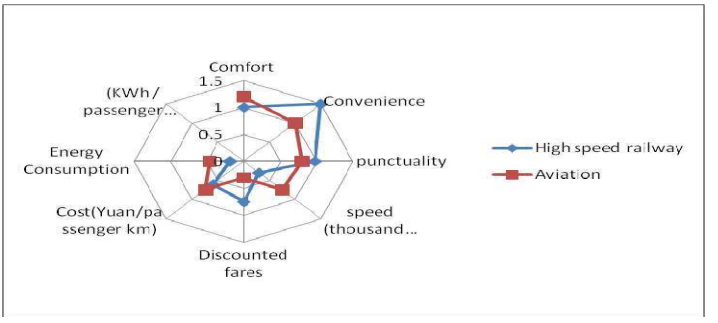

Fig. 1. High Speed Rail and Air competitive comparison diagram

1.2 Impact Analysis of High-Speed Rail on Aviation Market

As shown in the following table1, the air industry is greatly influenced by high-speed rail, leading to 15.7% decline in passenger volume. whereas, with only 7.4% average decline, passenger turnover volume is subject to Smaller impact .the reason for this can be concluded from the statistics about passenger volume and turnover volume, china's air average haul distance is about 1250km, passenger volume is mainly distributed within the 1000km flight sector with it's volume accounts for 60.8% of the total .however, passenger turnover volume is mainly distributed within the 1000~2000km flight sector, and accounts for 67.5% of the whole. high-speed rail advantage is within the 1000km, as a result, air industry dominant position isn't threatened.

Table 1. Impact estimate of the High-Speed Rail on the aviation market under different price

Condition / INDE	high-speed rail first- class price, air full price (base price)	high-speed rail second-class Price, air full price (twenty percent off)
passenger volume	-15.7%	-16.0%
passenger turnover volume	-7.4%	-7.5%

This two transport market distribution can be derived from Fig 2. with over 90% market share ,High-speed rail is in superior position Within 750 km; once expand to 1000km or more, air passenger market share will exceed HSR greatly and reach to 100%.Their competition mainly focus on the distances of 750~1000km, especially 800~900km.Accordingly, it is this basic difference in market location and service quality that determine the competition between the two focuses on the medium short-distance transportation.

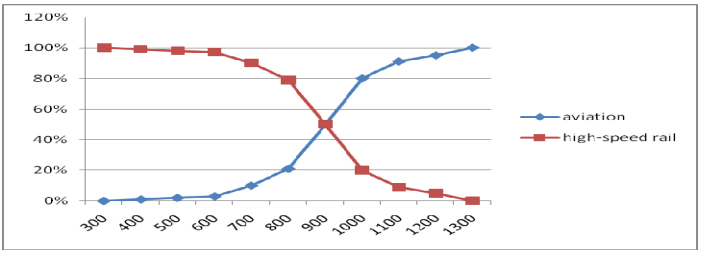

Fig. 2. High Speed Rail and Air market share under different flight distances

2 Air Transport SWOT Analyses

SWOT analysis is a strategy analysis widely used in various industries and enterprises, Combination with the above analysis, Slightly extended we can Summarize the external environment and opportunities, internal strengths and weaknesses of air industry. And then according to different strategy requirements, we can get corresponding business strategies. Reorganize them and fill them in SWOT matrix, air Industry analyses matrix is got as the following table 2.

Table 2. Air passenger industry SWOT matrix

Opportunity/threate Strength/weakn	External opportunities（O）： 1、Developed Line Network ； 2、International requirement increase 3、Bond by geographical environment High-speed rail accessibility is restricted 4、RMB appreciation 5、High-speed rail's high monopoly	External threaten（T）： 1、High-speed rail is high efficiency and 2、High-speed rail is convenient –link 3、higher Price Quality 4、Petroleum product price climbs 5、International enterprises impact
Internal advantages（s）： 1、High speed 2、High security and comfort 3、Flexible ticket endorsement 4、Short construction period, wide operating ranges ,low cost, 5、Mature ticketing network, a variety of ticketing, check-way	Growth Strategy (SO)： 1、Increase flights frequency by taking advantage of he routes accessibility 2、Develop Special lines directly lead to city center and large interchange hub 3、Introduce different levels of ticket fares 4、Meet passenger demand at all levels, expand market share .	diversification strategy（ST）： 1、Expand Ticket Direct Marketing 2、Actively develop the long distance and international market, 3、Enhance cooperation to improve enterprise comprehensive strength 4,Develop new long-haul markets, Operate Intercity Express Air Lines

Table 2. *(Continued)*

Internal weaknesses（w）：	shifting Strategy（WO）	Defensive strategy（WT）
1、Complex operating body and Huge expenditure 2、Poor traffic links 3、lower punctuality 4、Greatly impact by external factor 5、High Energy consumption 6、Low Flight Frequency 7、Time-consuming flight Check In	1、Pursuit of high differences 2、develop regional aviation, and combining with the eastern lines to shape into transit route network hub system 3、Effectively link the ground and air transportation 4、Operate official Charter flights and other aviation services	1、minimize delay rate 2 、Simplify the registration process 3、Adjust air frequency, increase the flight under reasonable cost 5、Improve aircraft performance and capacity, reduce energy consumption 6、 Give the international major airlines related policy supports

3 Air Enterprises Competition Strategies

Facing the impact of high-speed rail, aviation Enterprises should start from their own advantages with taking the specific circumstances of different lines into account, and combined with high-speed rail development trends and prospects to arrange reasonable development strategies.

3.1 Strategy Choice Based on Lines Running Distances

As showed in Figure 2, high -speed Rail replacement rate is 90% or more in the 750 km of passenger routes. Accordingly, airlines should re-locate, push out personalized services, not for profit, but focus on providing transit services, thus it can introduce some "SO" and "ST" strategy to improve the overall air passenger service.

The competition between them heats up in the medium-long lines. The aviation industry has to utilize its advantages to hold on to the existing market share. The air can use some "WT" strategies such as enhancing the integrated hub, improving convenience, accessibility and punctuality, It can also consider using some "WO" strategies, such as develop regional business in regions with large growth in demand but Complicated geographical conditions.

With less lines and trains, high -speed rail replacement rate is 10%in the long – distance routes which hasn't threatened aviation. In this sector, advantages of air give full play. In view of this, aviation enterprises should seize this advantage, and work out long-haul routes planning. The air can appropriately use some "SO" and "ST" strategy to enhance cooperation with relevant departments to improve the response to emergencies and external threats. At the same time, adjust and optimize the domestic and international scale to release internal pressure.

3.2 Strategy Choice Based on Lines Running Sector

China's southeastern coastal as well as northeast Committee city centered on Beijing are the place where aviation and high-wire network concentrated, in these areas, some "ST" or "WT" strategies should be used to adjust short-range capacity configuration distributed in eastern and central regions to strengthen the capacity arrangements for

long-haul routes In terms of the large volume between hub airports, some “fast lane" model should be actively carried out to achieve free to "pick to go."

Some remote western city which is restricted by geographical, economic and cultural conditions, has opened very few rail passenger line, which cannot meet passenger demands .By taking some diversification strategy, the air can provide diversified services and improve service quality, hence, it will hold on to the existing customers.

3.3 Strategy Choice Based on Air Passenger Connection

Of all the passenger transport in China, air is the worst in connection .Other than long waiting time, large part of reasons for consumers are willing to choose high-speed rail as their travel mode is that the airport is often built in the suburbs far from the city, causing inconvenience connection. According to statistics, among the passengers shift from the aviation to high iron, 80% are due to such reasons. As a result, the air should speed up the comprehensive stations planning, and set a variety of large-scale direct line reaching to the city center or the hubs to enhance the airport connection ability. Some "WO" and "WT" strategy can be applied to withstand high-speed rail competition

4 Conclusion

High-speed rail’s advantages are outstanding in convenience, punctuality and environmental, what’s more, with the further development of high-speed rail construction; its advantages will be more evident in some of China's economically developed cities. Faced with this pressure, through SWOT matrix the author focuses on analyzing the operating differences between the aviation and high-speed rail passenger service, from these we can sum up that in the competition with high-speed rail, aviation enterprises should focus development on providing more differentiated services and developing new products and services for passenger traffic. Basing on the new strategies and ideas, the air should transform ideas and shake off difficulties to advance its sustained and healthy development.

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Discussion on the Routing Layout of Regional Comprehensive Transportation Corridors

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Abstract. To plan the routing layout of regional CTC (comprehensive transportation corridors) reasonably, firstly, transport nodes selection, calculation of nodes' importance and the hierarchical policy are taken as the foundation. Then explore the routing preliminarily with the method of Minimum Spanning Trees and with an aim that the corridors cover important nodes and entrance nodes. Finally, the adjustment of regional CTC routing layout is perfected with various factors.

Keywords: Comprehensive transportation corridors, routing layout, transport nodes, Minimum Spanning Trees.

1 Introduction

Comprehensive transportation corridors are important and convenient narrow oblong composed of routes with two or more transport modes linking different regions, which are backbones of the comprehensive transport network and undertake the most or all regional transporting business with characteristics such as large transport capacity, mass passenger and freight volume, advanced technology, etc [1] Regional CTC are large-scale corridors which take administration area or economic area as boundary in the whole country and have functions including connect major nodes in the region, ensure local coherence and global coherence, guarantee connectivity of corridors with external passageways.

In terms of the layout forms, CTC are described as a series of urban nodes and links to fulfill traffic demand by connecting those urban nodes via diverse transport lines [2]. About the routing layout of regional CTC, this paper take transport nodes selection, calculation of nodes' importance and the hierarchical policy as the foundation, then apply the method of Minimum Spanning Trees to conduct and adjust the layout.

2 Determine Nodes of CTC

2.1 Transport Nodes Selection

Transport nodes are junctions of routes which could be cities and towns in the region or important traffic nodes in cities or centrostigma of traffic demand [3]. Usually, the

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connection between corresponding transport nodes form corridors, that is, compose the spatial layout of transportation network. Thus, the selection of transport nodes plays an important role in rational layout and effective utilization of CTC. The paper thinks that central cities and cities above the county level in the region should be considered as well as the traffic hinge, distributing centres, station ports, airports.

2.2 Nodes' Importance Calculation

The nodes' importance describes the relative important degree of a node and reflects its traffic demands and weightiness in the comprehensive transport network. Usually nodes' importance is used in nodes selection. There are various factors such as politic, economy, industry and culture relating to nodes' importance. A number of interrelated indexes are used to represent these factors. This paper applies principal component analysis (PCA) to calculate the nodes' importance so that it can cover the indexes' information completely, eliminate the mutual influences between these indexes, and make sure the result more objective. PCA is a mathematical transformation method which use dimension reduction to transform multiple original indexes to few principal components [4]. The steps below outline the process that takes PCA calculating the nodes' importance.

1. Select relevant indexes, and collect required data.
2. Standardize the original indexes as a Z – matrix, and solve its correlation coefficient matrix as an R – matrix.
3. Calculate the Characteristic Equation of R – matrix, and solve its characteristic roots (λ_j) and eigenvectors(b_j).
4. Determine the optimal m value through the contribution rate of some characteristic roots in the correlation coefficient matrix reached 85%.

$$\frac{\sum_{j=1}^{m} \lambda_j}{\sum_{j=1}^{p} \lambda_j} \geq 0.85$$

Then decide principal components and the expression Uj base on relative contributions.

$$U_j = \sum_{j=1}^{m} b_j Z_j$$

5. So the linearity weighted formula can be obtained: $W_j = \sum_{j=1}^{m} \partial_j U_j$

The relative contribution of the first j principal components is $\partial_j = \frac{\lambda_j}{\sum_{j=1}^{m} \lambda_j}$

3 Nodes Hierarchical Clustering

Base on calculated nodes' importance above, cluster analysis method is used for hierarchy dividing in order to ensure main controlling point of CTC. Cluster analysis

method uses multivariate analysis in mathematics and metric tool of Euclidean distance to classify samples into similar sets which has its typical features, and displays similarity in inner elements and diversity between sets [5]. The following diagram is built according to systematic cluster analysis method.

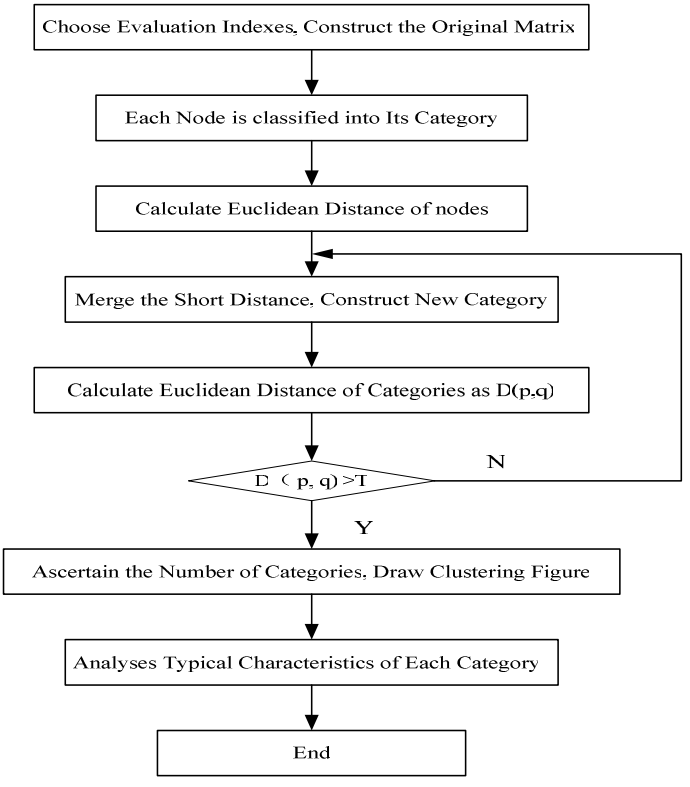

Fig. 1. Cluster Analysis Process

Nodes selection and nodes' importance calculation have great influence on routing layout of regional CTC with the method of Minimum Spanning Trees. For the sake of guaranteeing nodes selection and layering accurate, the paper classifies nodes as three kinds of important node, less important node and general node.

4 Routing Layout of Regional CTC

4.1 Routing Layout Idea of Regional CTC

At present time the layout methods of CTC include nodes importance method, traffic location method, associated method of important degree-traffic area location that are based on nodes' importance calculation, traffic location analysis, road section significance calculation which tend to cause interruption in corridors and conduct

layout by a way of manual intervention. In this paper the method of Minimum Spanning Trees will be introduced into line layout, which will guarantee more theoretical method adoption, the connectivity within corridors, and thus avoid the analysis on traffic lines and the calculation about road importance as well as simplify the routing layout process of CTC. Base on the result of nodes hierarchical clustering, the routing layout idea of CTC is showed as follows:

1. Take the important node, less important node from nodes hierarchical clustering with the entrance nodes of corridors in objective planning region under the planning of higher authorities as selected nodes.
2. Find out the Minimum spanning Tree which covers all selected nodes, and link every entrance nodes with the nearest nodes on the Minimum spanning Tree.
3. Link all selected nodes on the Minimum spanning Tree and relevant entrance nodes, and sign them as the basic regional CTC.
4. Adjust and perfect the layout according to regional character, corridors' function, relevant planning of higher authorities and so on.

The routing layout process of CTC is showed as follows:

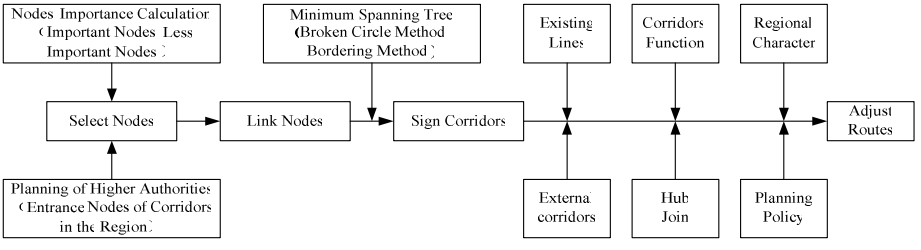

Fig. 2. Routing Layout Process of CTC

5 Routing Layout Adjustment of Regional CTC

For the indexes of nodes can not fully reflect future conditions, adjustment of the routing layout is important after preliminary layout. Adjustments are made in some aspects as follows:

1) Utilize existing lines especially some high-grade highways so as to reduce construction investment and meanwhile also discover the defects of existing lines and make improvement.
2) Consider regional features mainly such as the natural geographical conditions and ethnic customs.
3) Function orientation is brought forward after analyses the basic function of the regional CTC in order to find the specific direction of corridors.
4) Ensure the cohesion of corridors both in exterior or edge and large scale transportation junction in the region with planned CTC through adjustment.
5) Adjust the routing layout with a more deep understanding about the government's intention and planning policy as well as the effects on transport.

6 Conclusion

This paper makes the nodes' importance calculation and classification, and applies Minimum Spanning Tree idea to fulfill a primary layout and adjusts the layout with various factors. Base on the frequently-used method, the advantages of this paper is that conduct routing layout of regional CTC more theoretical, and simplify the layout process with new idea. Undoubtedly, this method also has some disadvantages as its over-reliance on nodes selection and nodes' importance calculation. If improper nodes are selected, great impacts will be brought out. So some improvements should be made in the future.

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Image Monitor System Based on Windows Mobile OS

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Abstract. It has been affected for a long time in Image Monitor system, as the transmission speed and the performance of mobile phone restricted. The paper provides an Image Monitor system based on Windows Mobile OS which can send the images shot by a USB camera from the server-side to the mobile phone of client-side and analyses the soft ware in both sides which can meet the requirements of the application in remote monitoring. As the outcome shows, the system has a good real-time performance and the images can be displayed distinctly on the mobile phone.

Keywords: RMON, Image Monitor, 3G.

0 Introductions

It has been applied more and more widely with the development of the 3rd mobile communication technology. But the development of the mobile monitoring technology with the terminal of mobile phone or other mobile facility is slow relatively as a result of the limit in tradition network and performance of mobile phone. Mobile monitoring technology will certainly turn into a hot application in 3G business and its terminal will breakthrough the intrinsic limit in space relative to that consisting of fixed computer.

In the context of the widely commercial using of 3G network and the popularize of smart phone, Mobile monitoring technology will have broad prospect and value. For instance, it can be adopted in the armamentarium for monitoring the patient, old and children as more and more people are working in other place. Image monitoring system in mobile phone can meet the request of instantaneity and image definition as a result of 3G network which overcomes the disadvantage of the tradition network in network bandwidth.

This paper provides a complete application solution of remote monitoring basing on Windows Mobile OS and taking the advantage of 3G network that can send the images constantly collecting by a camera to the mobile phone.

1 Hardware Design

1.1 Structure of the System

A complete image monitoring system can be divided into 3 parts: front side, server-side and client side. Front side: It adopts a camera for taking photos; server-side: It's

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set up with a common PC or server being open all the time which is waiting for the requests of each terminal and can be used for querying the current images; client side: It needs a mobile phone installing Windows Mobile OS so as to scan the images, locale examining and configure the front side [1].

1.2 Functions of the System

a. User can cast off the limitation of time and geography to monitor the images with only a mobile phone installing Windows Mobile OS.
b. It can easily achieve the function such as snapshot of monitory point with the system structure of client side-server side.
c. Server side sends the images to client side with the protocol of UDP/IP.

2 Software Design

It adopts .Net Framework v3.0 and .NET Compact Framework v2.0 as the design platform and Visual Studio 2008, ActiveSync 4.5, Windows Mobile 6.5 Professional Developer Tool Kit and Windows Mobile 6 Professional Images as the development platform.

It includes a software system of server side and client side. System uses a client/server mode that creates UDP-Client network service on server side, listen specific port and start the service to send data; creates UDP-Client network service on client side and then send the IP address and port number to server side with UDP packet. Client side start UDP-Client network service when login and then connect to server that begins to receive data if connecting succeed. Fig2 shows the communication process between server side and client side.

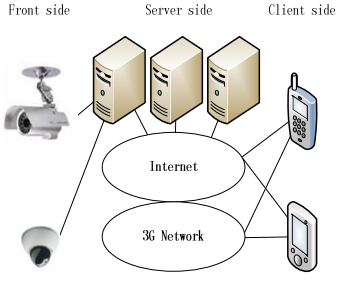

Fig. 1. Structure of the system

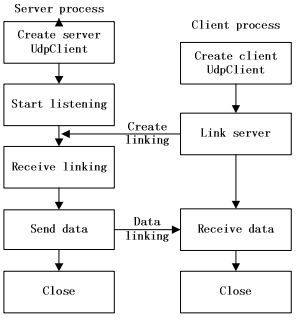

Fig. 2. Communication process between server side and client side

2.1 Server Side Design

It adopts Windows Image Acquisition and 2 class libraries WIAlib and WIAVIDEOLib on server side. When program starts, it creates WIA Manager Object and search for the WIA video facility to initialization. If fails, it will prompt no camera facility. If

succeeds, it will create WIA video RVC with the ID searched by WIA Manager and start the UDP-Client network service for monitoring the specific port to end the initialization. It will begin the process of snapshot , cramping the images into a jpeg one with the resolution ratio of 212×159 and send the images to client side at 1 frame/500ms once received the IP and port of client side before client side disconnects. The images are sent by server side and also can be demanded by client side. Fig3 shows the process of image collecting.

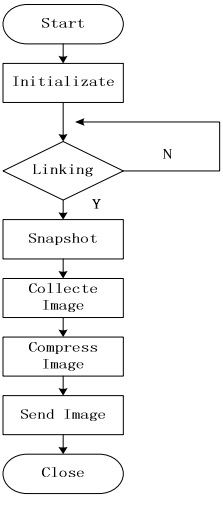

Fig. 3. Image collecting process

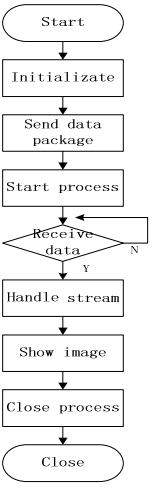

Fig. 4. Flow chat of client side

2.2 Client Side Design

Client side includes a mobile phone installing Windows Mobile OS. It displays the images receiving from server side after connecting to server and do monitor through 3G network. It develops on .NET Compact Framework platform and realized by C#.

It creates a main thread after initialization and sends client side packet including IP address and port number to server. It also creates an assistant thread for receiving packet and is controlled by OS to run with the main thread simultaneously by means of parallel mode [2].Main thread displays the receiving image data after disposing the packet sent from server. Assistant thread is prepared to receive the packets form server and send them to main thread for disposing [3]. Flow chat as below:

2.3 Network Data Transmission

It's adopting the network transmission protocol of UDP (User Datagram protocol) which was a fine choice as a result of its characteristic that it doesn't confirm whether the packets have been received so it will not affect the global data even if there are some packets lost in transmission. Moreover, UDP protocol will improve users'

experience owing to it economizes in network resource and high speed in data disposing [4].

3 Demonstrate and Performance Analysis

3.1 Simulation Platform

Simulation platform tools are: Visual Studio 2008、Virtual Machine Network Driver for Microsoft Device Emulator, Windows Mobile 6 Professional Images.

Network environment should be configured before simulation. Parameter as below: Local Area Connection Properties: virtual Machine Network service; CHS Windows Mobile 6 Professional Emulator Properties: Transmission: TCP link transmission; Network: packet project procedure mini-port (network card of local area connection); Network address of Simulator OS: 192.168.16.4; Subnet mask: 255.255.255.0; Default gateway: 192.168.16.3.

3.2 Test Result

3.2.1 Server Side and Client Side

Fig5 shows the server side interface. Toolbar includes: Run, Pause, Snap, Send, Save, Transfer, Stop. Right window shows the video information captured by camera. Left window shows the images waiting for transmission. Bottom window shows some important information such as server status, server status and so on.

Fig6 shows the client side interface. Main window shows the images received. Left key is used as menu function that sends orders of receiving and configuration. Right key is used for exiting.

Fig. 5. Server side interface

Fig. 6. Client side

3.2.2 Test Indicate

It has a stable state and fine Real-time performance when server side and client side structured. Client side displays the monitoring images receiving from server side. User can check them on a mobile phone anytime and take solutions once exception occurred. The resolution ratio of the image in Fig5 is 212×159 JPEG. It can be confirmed from Fig6 that images in server side and mobile phone accordant well corresponding to the exceptive result.

4 Summary

This design proposal achieves an image monitor system based on Windows Mobile OS which completes configuration of user information and receiving of their query request. It also achieves the aim of remote monitor through captures images of the monitor place and gives orders to client side by control software installing in PC.

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Investigation of a Patch Antenna Based on I-Shaped Left-Handed Material

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Abstract. Left-handed Material (LHM) is an artificial material. It has negative permittivity and negative permeability simultaneously and has attracted great attention these years. LHM has a lot of abnormal characteristics different from these conventional natural materials. This paper investigates a patch antenna based on I-shaped left-handed material by using the method of Finite Difference Time Domain (FDTD). The results show that there exists a wave resonance state at 2.96 GHz, where the real part of the permittivity and permeability are all negative; its refraction index is –1. The effect has largely enhanced the electromagnetic wave's resonance intensity, and has improved the localized extent of electromagnetic energy obviously in such LHM structure, resulting in a higher antenna gain, a lower return loss, a wider bandwidth and a better improvement of the antenna's characteristics. Due to these advantages, the application of patch antennas can be extended to the fields such as mobile communication, satellite communication, aviation, etc.

Keywords: Left-handed Material (LHM), Patch Antenna, Return Loss, Gain.

0 Introduction

The concept of "photonic crystals" was put forward by E.Yablonovitch [1] and S.John in 1987, it is a periodic structure in the space, and the internal propagating characteristic of electromagnetic waves in this structure is similar to the propagating of the electrons in semiconductor crystals, so they are called "electromagnetic crystals" as well, when EM waves are transmitted in the photonic crystal, EM waves in a frequency range called "forbidden frequency range" or "stopband" will be forbidden to propagate. In 1989, Yablonovitch and Gmitte created a photonic crystal structure consisted of 9 layers' cinnamene plate firstly, which includes 8000 atoms, furthermore, they found a forbidden band over 2GHz around 6.5GHz [2].For its specialty, the photonic crystals were already used in microwave circuits, antennas [3], etc.

In the nature, dielectric permittivity ε_r and magnetic permeability μ_r of all the materials are positive and they are also known as Right-Handed Material (RHM), because the electric vector, magnetic vector, and wave vector of an electromagnetic wave in such a medium will be form left-handed rule. However, the negative permittivity and negative permeability can be artificially made of materials, which are known as left-handed media or left-handed materials (LHM). This kind of media,

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which also referred to as left-handed materials (LHM) or Double Negative Material(DNG) by Veselago in 1968[4], has recently attracted much attention due to its experimental verification in 2000 by using negative-refraction material fabricated with periodical patterns composed of a unit split-ring resonator and a conducting wire [5]. A lot of efforts have been made to investigate the interesting optical and electromagnetic properties, phenomena, effects of wave propagation and applications in such materials.

The paper employs FDTD method to analyze the patch antenna based on I-shaped left-handed materials, and its performance parameters are attained by simulation; On the other hand, the method of NRW is also used to extract the effective permittivity and permeability of the medium from its S parameters. Then the left-handed patch antenna and the other conventional referenced patch antenna are compared, finding that it has a lower return loss and a higher gain.

1 Computing Model of the Photonic Crystal Antenna

Among these techniques used for patch antenna's simulation, FDTD [6] is usually chosen to calculate the meta-material patch antenna for its advantages. The FDTD method discretizes the two Maxwell curl equations directly in time and spatial domains, and get a second-order centered difference equation group in Yee form.

$$\frac{\partial \vec{\mathrm{H}}}{\partial \mathrm{t}} = -\frac{1}{\mu}\nabla \times \vec{E} \tag{1}$$

$$\frac{\partial \vec{\mathrm{E}}}{\partial \mathrm{t}} = \frac{1}{\varepsilon}[\nabla \times \vec{H} - \sigma_{\iota}\vec{E}] \tag{2}$$

When the initial field distribution and boundary conditions are specified, the voltage corresponding to electric field and the current concerned with magnetic field can be obtained by using the FDTD method. The antenna's S-parameters can also be calculated by correctly applying a Fourier transform, so the computation can be finished in time domain. FDTD computation can get not only the field distribution in the computing domain in any time, but also the time-changed waveform in any point in the domain. Based on these discussions, we can attain the following work:

(1) Study electromagnetic waves' propagation in the analyzed structure in some chosen sequential time.

(2) Obtain the antenna's characteristic parameters such as S-parameters and input impedance in wide bandwidth by calculating the point in time domain.

(3) Estimate the antenna's resonant frequency.

(4) Calculating results including frequency characteristics and field distribution in one frequency in frequency domain can be obtained by Fourier transform, and both the Near-Zone field at resonant frequency and electricity distribution on the patch's surface, together with the antenna's radiation patterns and the corresponding gain can also be attained.

In order to simulate electromagnetic waves' propagation from the photonic crystal antenna in finite mesh space but infinite physical vacuum, special processing is

needed for the mesh boundary, so a method called "Absorbing boundary condition" is used to avoid the reflection caused by boundary's truncation. The paper takes the Perfectly Matched Layer (PML) used commonly nowadays ; PML uses a layer of loss medium to surround the computing domain, when the medium's parameters are proper, it can absorb the outer directed waves in any frequency and any incidence angles. We employ 5-layers PML, and when the pulse comes into the domain, an absorbing plane is set in every 4-5 steps to avoid the second reflection in excitation plane and non-convergence.

We take the Gauss pulse as the excitation source for its smoothness in the time domain, and the bandwidth is easy to choose. The electric field Ez vector under the micro strip on the excitation plane is:

$$Ez(t) = \exp[-\frac{(t-t_0)^2}{T^2}] \tag{3}$$

The parameters are: $T = 40\Delta t$, $t_0 = 110\Delta t$ where Δt , t_0 and T are time increment step, time delay, and half-width Gauss pulse. Its frequency ranges from 0 to 14.1GHz. 4000 time steps are chosen. The active microwave photonic crystal antenna structure is calculated by the FDTD numerical method.

The geometry structure of the left-handed patch antenna is shown in figure1, the left-handed material is fabricated by etching periodic I-shaped metal patches in the substrate. The substrate's dimension is: 360mm×360mm×8mm, and the relative permittivity is 10. The length of the upper and lower rectangular hole is 320mm, while the center strip is 278mm, the width of these strips are all 16mm, which constitute a large I-shaped structure. on both sides of the large-I are two symmetric rows of smaller I-hole, and the length of every little I-shaped hole is 16mm, while the width is 4mm (as shown in figure 2). A patch of 26mm×16mm is etched on the substrate, the excitation source is Gaussian discrete source, fed by a micro strip which width is 4.7mm.

The referenced conventional patch antenna without left-handed material is shown in figure 3, the relative permittivity of the substrate is 10, the substrate's dimension is 360mm×360mm×8mm, a patch of 26mm×16mm is etched on the substrate, the excitation source is Gaussian discrete source, fed by a micro strip whose width is 4.7mm.

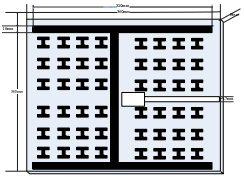


Fig. 1. I-LHM patch antenna

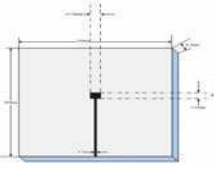


Fig. 2. Referenced conventional patch antenna

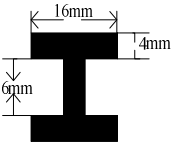
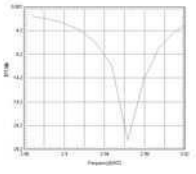


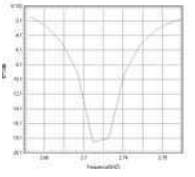
Fig. 3. Little I-shaped hole

2 Simulation Results and Analysis

By simulating these patch antennas, the return loss (s11), gain, VSWR and Reflection Coefficient are shown in figure 4, figure 5, figure 6 and figure 7.

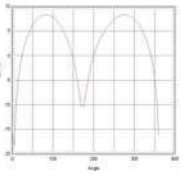


a) I-LHM

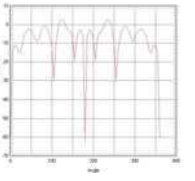


b) Referenced conventional

Fig. 4. Return loss (S11) of the simulated antennas



a) I-LHM

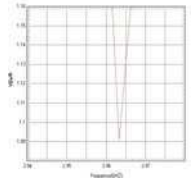


b) Referenced conventional

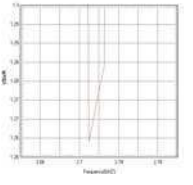
Fig. 5. Radiation patterns of two antennas

It can be seen that the left-handed patch antenna has a better return loss (S11) compared to the conventional patch antenna with -8.58dB reduced in figure 4.

In the antennas' radiation patterns figure 5, we can find that the conventional antenna's maximum gain is 3.64996dB, while the PBG one is 8.58076dB, 4.93dB improved. It shows that the left-handed material can improve patch antennas' gain obviously.

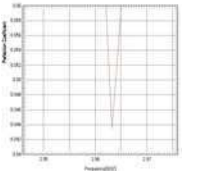


a) I-LHM

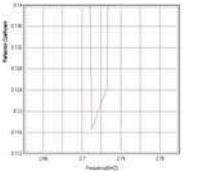


b) Referenced conventional

Fig. 6. VSWR of two antennas



a) I-LHM



b)Referenced conventional

Fig. 7. Reflection Coefficient of two antennas

In the antennas' radiation patterns figure 6 and figure 7, we can find that the conventional antenna's VSWR is 1.26402, while the PBG one is 1.09075, 0.17 reduced and closer to 1, while the reflection coefficient also fell 0.073, closer to 0, showing that the effect of the left-handed material is better than conventional antenna.

The simulated results are summed up as in table 1.

Table 1. Parameters of antennas with and without the LHM

Return loss （S11）	Bandwidth （S11=-10dB）	VSWR （voltage standing wave ratio）	Reflection Coefficient	Maximum gain	
I-shaped left-handed patch antenna	-27.2491dB (2.96GHz)	1.62%	1.09075	0.0434	8.58076dB
Referenced conventional antenna	-18.6648dB (2.70GHz)	1.522%	1.26402	0.116617	3.64996dB

It can be easily found that the patch antenna presents lower return loss and higher gain by adding the left-handed material. This is clear from the following theoretical point of view:

After adding left-handed material into the substrate in the patch antenna, electromagnetic (photonic) band gap will be formed, and electromagnetic waves in the band frequency range will be bound and unable to spread in any direction, using photonic band gap crystals effect, can inhibit the spread along the basement floor media SAW, thus, it will reduce the absorption of electromagnetic wave antenna substrate to increase the reflection of electromagnetic wave energy to the free space. All these advantages can reduce return loss of the antenna and increase the gain .The physical principle is shown in figure 8 intuitively.

Facts show that novel antennas based on photonic crystals have many unique properties; applications of photonic crystal antenna in communication in the future will achieve greater development. At abroad have developed a variety of photonic crystal antenna, the antenna with the photonic crystal has played an important role in laying a good foundation of investigating novel antenna for photonic crystal applications in many fields.

Notomi has ever lucubrated and explained different ways to attain equivalent negative refraction index in 2-D photonic crystal [12].As a matter of periodic distributing in left-handed materials or photonic crystals. Bloch wave and surface wave's resonance would be produced for the electromagnetic wave's Bragg dispersion at a frequency. We have studied resonance effect in triangle structure whose effective refraction coefficient is -1, thus, we calculated the S parameters (s11 and s21) of the medium used for the photonic crystal patch antenna, and then the medium's effective permittivity and permeability were extracted by the method of

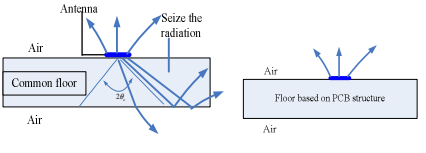


Fig. 8. Effect of photonic crystal band antenna substrate

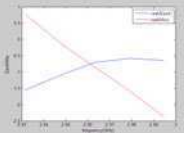


Fig. 9. Effective permittivity

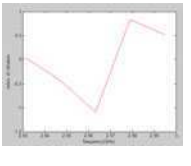


Fig. 10. Refraction of I-LHM surface wave suppression of the physical image and permeability of I-LHM

NRW [8]. S21 is calculated by adding micro strip feeder on the left of the patch[13]. The calculated result in figure 9 and figure 10 apparently showed that permittivity is -1, and effective permeability is -1 at the frequency of 2.96GHz, which would enhance the resonance effect at the resonance frequency, and improve the localized intensity of the electromagnetic energy by such left-handed materials. Due to these factors, the antenna can present a higher gain and a lower return loss.

3 Conclusion

According to the simulations, we find that the left-handed materials proposed in the paper will produce an electromagnetic resonance state at 2.96 GHz. Its effective permittivity and permeability are all negative, and its refraction index is –1. The effect has enhanced the wave's resonance intensity greatly, and improved the localized intensity of the electromagnetic energy in such structure. The LHM patch antenna presents a lower return loss, a wider bandwidth and a higher gain, so the radiation energy coupling into the free space is improved, and the radiation energy emitted into the free space increases; Further more, the signal-to-noise ratio increases and the performance is improved correspondingly.

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Evaluation System for Carbon Finance Development in China

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Abstract. Aiming to build a carbon finance evaluation system, we choose indicators based on the analysis of influential factors of carbon finance, obtain index weight through fussy analytic hierarchy process, and take data from China for empirical study. After Comparison with the international general level and three representative developed countries, namely America, England and Japan, we consider it urgent for China to build a thorough carbon financial service system.

Keywords: carbon finance, evaluation index system, fussy AHP, empirical study.

1 Introduction

With increasing environmental protection consciousness, carbon finance has been undergoing a rocket progress in recent decades, and global carbon trade volume was predicted to be $150 billion in 2012. Take China for example, there was a drop by 14.38% in carbon intensity and a jump by 37% in total energy consumption from 2005 to 2009 [1,2]. Annual carbon emissions growth approximately takes up the worlds' half, and the control of energy demand and carbon emissions has become a tough mission, which makes the development of carbon finance imperative in China.

2 Evaluation Index System for Carbon Finance

To build a national evaluation index system for carbon finance contributes to its quantitative investigation. Here we endeavor to build this system with reference to international experience.

2.1 Influential Factors Analysis

The factors involved in carbon finance growth can be explored from the following perspectives:

(a) Industrial background: The evolvement of carbon finance is greatly influenced by the economic and financial environment. A country's economic level is often

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measured from the output perspective. For example, GDP can depict a country's overall strength, the disposable income of residents is related to people's lives, international trade volume reflects foreign economic relations and inflation rate is the projection of price level. As for finance, the total funding from global markets reflects financing capability, profitability of the banking industry can be a reflection of financial sector's stable revenue, the proportion of private loans to GDP demonstrates its contribution to national economic development, and such ratios as current ratio and deposit-loans ratio are symbols of financial stability. In addition, the proportion of institutional investors holding the stock and trading stock value separately reveal the structure and size of the securities industry.

(b)Market construction: As carbon finance is an emerging industry, priority comes to market construction, meaning deepening financial development and improving carbon financial service system. In general, financial development can be measured in two ways: financial efficiency and financial innovation. Financial efficiency means how good the financial system has been enhanced in mobilizing savings, allocating funds, etc. Song Hanguang (2011) reckons that the financial system's ability to mobilize savings can be evaluated from the following indices: (1) increase in deposit / (GDP-final consumption), showing the ability to mobilize the whole society savings; (2) increase in savings per capita/ disposable income, reflecting the ability to mobilize private savings; (3) increase in loans/ increase in deposit, revealing the transformation capacity of savings to investment [3]. With I and V representing fixed assets stock and value added of an industry, Jeffrey Wurgler (2000) creates the equation for an industry's capital allocation efficiency η [4]:

$$\ln \frac{I_{i,t}}{I_{i,t-1}} = \alpha + \eta \ln \frac{V_{i,t}}{V_{i,t-1}} + \varepsilon_{i,t} \tag{1}$$

In view of financial instruments working as media for carbon finance, financial innovation can be measured by the trade volume growth of stocks, bonds, funds, options and futures.

(c)Business development: From this point, carbon trade volume reflects industrial scale, prices of EUA and CER show its development potential, while annual carbon emission reduction and low-carbon index (CLCI) is a comprehensive survey of to what extent the objective is achieved. What's more, business cannot operate without the support of relevant regulations, such as green credits, carbon disclosure, low-carbon products standards, carbon taxes and carbon emission limits.

(d)Infrastructure: Development of any industry cannot be separated from infrastructure, and for the sake of reducing carbon emissions, technology and energy efficiency should also be considered, such as technologies related to clean coal, renewable energy, high-performance power storage, eco-design, clean production, energy-saving, carbon capture and storage, and new automobiles [5]. Regarding energy efficiency, apart from production, process and consumption of energy, carbon intensity (CO2/GDP) and carbon energy consumption capacity (CO2/TPES) also stand out.

2.2 Framework of Index System

Based on the foregoing factors, we can build the indicator framework, as shown in table 1.

Table 1. Evaluation index result for carbon finance in China

Target layer(A)	Criterion layer(B)	Index layer(C)	value	Direction	weight
	B1.Economic development 0.1860	1.GDP per capita(USD)	430.5	+	0.0235
		2.Tertiary industry(% of GDP)	43.36	+	0.0426
		3.Disposable income of urban 4.residents(USD)	2515.3	+	0.0312
		4.Net income of rural residents(USD)	754.7	+	0.0312
		5.Foreign trade volume(billion USD)	22063	+	0.0287
		6.Inflation rate	-0.007	+	0.0288
	B2.Financial environment 0.2230	1.Finance, value added value 2.(% of tertiary industry)	12.0	+	0.0317
		2.Total domestic and foreign 3. financing(billion USD)	1514.1	+	0.0309
		3.Capital-asset ratio of bank	0.061	+	0.0201
		4.Profitability ratio of bank asset	0.009	+	0.0238
		5.Growth of proportion of 6.private loans in GDP	0.227	+	0.0214
		6.Deposit to loans ratio	0.669	+	0.0223
		7.Liquidity ratio	0.464	+	0.0212
		8.Proportion of stock trade 9.value in GDP	1.574	+	0.0279
		9.Ratio of institute investors 10.holding stock	0.7	+	0.0237
	B3.Financial efficiency 0.0658	1.Motivation of society's saving	0.744	+	0.0108
		2.Motivation of private saving	0.182	+	0.0095
		3.Saving's transformation 4.to investment	0.731	+	0.0192
		4.Capital allocation efficiency	0.602	+	0.0263
	B4.Financial instruments 0.0439	1.Growth of stock value	1.01	+	0.0093
		2.Growth of trade volume 3.of debts	0.401	+	0.0087
		3.Growth of trade volume 4.of options	-0.231	+	0.0082
		4.Growth of trade volume 5.of futures	0.815	+	0.0086
		5.Growth of trade volume 6.of investment funds	0.758	+	0.0091
The development	B5.Carbon financial	1.Carbon trade volume 2.(million ton)	7592	+	0.0241
		2.Carbon turnover 3.(million USD)	138695	+	0.0239

Table 1. (*continued*)

level of carbon finance	Business 0.1652	3.Price prediction for 4.EUA(EUR)	[35,48]	-	0.0182
		4.Price prediction for 5.CER(EUR)	[12,20]	-	0.0182
		5.Proportion of CDM amount	0.397	+	0.0201
		6.Growth of CDM amount	0.197	+	0.0187
		7.Proportion of annual emission 8. reduction	0.608	+	0.0207
		8.CLCI	2.65	+	0.0213
	B6.Energy efficiency 0.1257	1.Energy processing efficiency	0.72	+	0.0151
		2.Energy production coefficient	0.59	+	0.0151
		3.Energy consumption coefficient	0.57	+	0.0151
		4.Electricity consumption per 5.capita(kwh)	2471	-	0.0155
		5.Carbon emissions(million ton)	6550	-	0.0169
		6.Carbon emission per capita(ton)	4.92	-	0.0164
		7.Carbon intensity(kg CO2/2000USD)	2.30	-	0.0158
		8.Carbon energy consumption 9.capacity(ton/toe)	3.07	-	0.0158
	B7.Science and technology 0.1063	1.Proportion of R&D in GDP	0.017	+	0.0225
		2.Clean coal's high-efficiency 3.use tech.	0.12	+	0.0102
		3.Renewable energy tech.	0.13	+	0.0104
		4.High-performance power 5.storage tech.	0.09	+	0.0105
		5.Clean production tech.	0.13	+	0.0102
		6.Intelligent energy-saving tech.	0.08	+	0.0106
		7.Eco-design tech.	0.10	+	0.0105
		8.Carbon capture and storage 9. tech.	0.09	+	0.0113
		9.New automobiles tech.	0.10	+	0.0101
	B8.Policy and regulation 0.0841	1.Sophistication of policy	0.18	+	0.0165
		2.Ratio of green credits	0.10	+	0.0175
		3.Carbon disclosure	0.10	+	0.0163
		4.Standards for carbon products	0.16	+	0.0166
		5.Entrance limits to high emission 6. industries	0.12	+	0.0172

Note: Energy efficiency takes 2008 data, except the first three indicators; "total domestic and foreign financing" data is from 2010.

3 Empirical Study

Through the collection of the latest data from China and the world, we have found out that not every index has data for 2009. Thus, 2008 and 2010 data are also used (seeing the note). Data in technology and policies refers to previous results [5]. Table 1 shows the evaluation results in China.

3.1 Weight Calculation Based on FAHP

Based on fussy analytic hierarchy process (FAHP), we use Matlab Software to get the weight for each index, as is listed in table 1. Calculation steps are as follows [6]:

I. Build the priority matrix

$$f_{ij} = \begin{cases} 1, c(i) > c(j) \\ 0.5, c(i) < c(j) \\ 0, c(i) = c(j) \end{cases} \tag{2}$$

c(*i*)and c(j) are separately the relative importance of f_i and f_j.

II. Transform the priority matrix $F = (f_{ij})_{m\times n}$ into fuzzy consistent matrix

$$Q = (q_{ij})_{m\times n}$$

$$q = \sum_{j=1}^{m} f_{ij} \quad i = 1,2,\ldots,\text{m} \tag{3}$$

$$q_{ij} = \frac{q_i - q_j}{2m} + 0.5 \tag{4}$$

III. Use the line normalization to get weight vector

The sum of each row (excluding self-comparison) and the total sum of non-diagonal elements:

$$l_i = \sum_{j=1}^{m} q_{ij} - 0.5 \quad i = 1,2,\ldots,\text{m} \tag{5}$$

$$\sum_i l_i = m(m-1)/2 \tag{6}$$

Weight of each index can be obtained through normalization on l_i:

$$W_i = \frac{l_i}{\sum_i l_i} = \frac{2l_i}{m(m-1)} \tag{7}$$

3.2 Data Comparison

To find out the gap in the development of carbon finance between China and the rest of the world, we take 2009 data (except those beginning with 08 for 2008) from the world, the United States, the United Kingdom and Japan for comparison. Some related index data is listed in Table 2.

Table 2. Global data comparison

Index	China	World	United States	United Kingdom	Japan
GDP per capita (USD)	3744	--	48436	35165	39727
GDP growth (%)	9.1	-1.9	-2.4	-4.9	-5.2
Inflation rate (%)	-0.6	2.7	1.7	1.4	-0.9
R&D expenditure (% of GDP)	1.49	2.21	2.67	1.84	3.45
Legal right strength index (0-10)	6	5	8	9	7
Credit information depth index (0-6)	4	3	6	6	6
Bank capital to asset ratio (%)	6.1	9	9.3	4.4	3.6
Stock traded, total value (% of GDP)	179.7	141.9	327.8	156.5	82.7
Stock traded, turnover ratio (%)	229.6	176.2	348.6	146.4	128.8
08 Carbon emission (million ton)	6550	29381	5595.92	--	1151.14
08 Carbon emission per capita (ton)	4.92	4.39	18.38	8.32	9.02
08 CO2/GDP (kg CO2/2000 USD)	2.3	0.73	0.48	0.29	0.22
08 CO2/TPES (ton/toe)	3.07	2.4	2.45	2.45	2.32
08 Electricity consumption per capita (kwh)	2471	2782	13647	6067	8072

From the data above, carbon finance in China is suffering the following problems: First, the financial market is not mature enough to promote the development of carbon finance. Development of futures and options are still in early stages, and there's a long way to go for China to catch up with the developed countries in stock market, with American proportion of stock trade value to GDP doubling that of China. In addition, loans on CDM cannot satisfy the need of carbon trade and low capital-asset ratio implies high risk. Second, there is no national carbon trade system and lack of relative information, which results in high trade cost and low-price transactions. Third, China is undergoing high pressure in emission reduction, for such negative indices as carbon intensity and carbon energy consumption capacity obviously higher than the world. And China invest a little in technology research, say 1.49% of the GDP, lower than the world level(2.21%), not to speak the 2.67% figure of America.

Fourth, policies and regulations are in shortage, such as no carbon tax, small scope of green credits and low legal strength index.

4 Conclusions and Suggestions

To address these problems, we can make effort from the following four aspects:

Firstly, build a complete carbon finance service system, with banks providing green loans and carbon fund, carbon exchange offering carbon forwards, futures and options and carbon insurances paying risky policies [7]. Secondly, the relevant departments should develop uniform product standards and trade rules, gradually improve market structure and size, and try its utmost to build China's international carbon trading market to strengthen its voice in carbon pricing. Thirdly, reinforce technical self-development by integrating existing technologies for wide application [8], and optimize industrial structure, including the first industry developing ecological agriculture, the second industry promoting renewable energies, and the tertiary industry building high-tech industry [9]. Fourthly, the government improves the incentive and restraint mechanisms, including both such rewards as tax breaks and interest subsidies and such punishments as penalties and industry limits.

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The Development of EPS Exterior Wall Thermal Insulation System and Discussion of Engineering Quality

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Abstract. China's building energy efficiency an important topic in the construction industry. Construction of the external supporting structure of the heat loss of a larger structure of the external retaining wall and up a large share. Therefore, the building wall insulation system reform and the development of the wall construction of energy-saving technologies is one of the most important aspect of this article the status of their development through the analysis of materials and construction from the proposed two EPS Exterior Insulation affect the quality of the project factors and improvement measures.

Keywords: energy conservation, EPS wall insulation, the improvement measures.

0 Introduction

Building energy conservation is a main content of national environmental protection and energy saving policy, which is an important part of implementing the sustainable development of national economy. In 1995, Ministry of Construction promulgated the "City Detailed Rules for Implementation of Building Energy Conservation" and other documents, in which 《<Heating on residential architecture> of Design Standards for Civil Building Energy Conservation》 JGJ26-95 was set as mandatory standard. According to the article 76 《Management Regulations for Civil Building Energy Conservation》 issued by Ministry of Construction on Oct. 1st 2000, the projects would not be approved if they could not complied with Energy Conservation Standards. Under the guidance of these policies, regulations, standards and mandatory provisions, the energy conservation work in residential construction deepened unceasingly. Energy-saving standards were enhanced unceasingly. Many new energy conservation technologies and materials were introduced and developed for residential building. But current level of building energy conservation in China, is still far below the developed countries. In our country, energy consumption per unit area of building is three times to five times to the similar climate developed countries. In the northern cold area, building heating energy consumption have been over 20% of the whole local society energy consumption. And most heating energy comes from thermal power generation and coal-fired boiler which seriously pollutes the environment. Therefore new building envelop and energy-saving combine tightly and building energy-saving has become the urgent task. To achieve this objective, building envelop should be thermal insulated.

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1 Development Status

EPS exterior wall and facing system occurred during the last energy crisis in the end of 1970s, firstly applied to commercial building and then civil building. Today, this system accounted for 17.0% used in commercial building and 3.5% used in civil building. The application in civil building is now making a annual growth of 17% to 18%. This system is multi-layer composite of exterior wall thermal insulation system can be used in both civil building and commercial building. It includes the following several parts: main part is made of polystyrene foamed plastic insulation board, generally 1 to 4 inches thick, fixed to the exterior wall by synthetic binder or mechanical approach. Intermediate part is lasting waterproof polymer mortar base. This base is mainly used to insulation board with glass fabric network to enhance and convey the force. Outside part is beautiful durable surface layer. In order to prevent fading or cracking, covering material generally adopts acrylic acid polymer coating technology. This coating has a variety of colors and textures to be selected, with good durability and corrosion resistant capability. In the United State, value R of thermal insulated hollow wall made by glass fiber is from 6 to 15, and it is 25 highest by using EPS exterior wall and facing system. Comparing with the traditional brick-wood exterior wall structure, EPS exterior wall and facing system can reduce the air infiltration by 55%. Meanwhile this system provides many choices for design. It is possible to design the parts matched up arch, column, beam, corner and decoration by CAD. The effects of energy conservation, sound insulation and impermeability are incomparable with the normal wall materials.

Thus with the deepening implementation of building energy conservation policy in China, EPS exterior wall thermal insulation technology will get a promotion and popularity. But for the reasons of improper material selection or lax construction quality control, some EPS exterior wall thermal insulation get to crack and drop off after a period from construction finish. Rain will permeate EPS board from crack making the conductivity factor increase which makes the effects of heat preservation get worse. When the crack is big, water possibly permeates into room and causes a serious consequences. Therefore strengthen EPS exterior insulation engineering quality control is urgently needed. Analysed by author, the reasons of EPS exterior wall thermal insulation cracking could be two: one is improper material selection; the other is lax quality control of staff training and construction process. In order to ensure construction quality of EPS exterior insulation, it must take a series of effective measures according to these two aspects.

2 Influence Factors and the Improvement Measures

2.1 The Quality Control of Raw Materials

Exterior insulation engineering involved the materials mainly consist of all sorts of plank, polymer mortar, alkali-resistant fiberglass mesh and wall coating materials, etc. These materials significantly influence the engineering quality of exterior wall thermal insulation.

2.1.1 Selection of EPS Board

At present polystyrene board is mostly used. It has two forms: foaming polystyrene board (EPS) and extruded board (XPS). According to national industrial standard 《Exterior Insulation Engineering Procedures》, EPS is selected.

EPS board is foamable flame-retardant polystyrene foam board which plays a key role in effectiveness of EPS exterior wall thermal insulation. according to national design standard of residential building energy conservation. The thickness of EPS board is determined by calculation on local heat transfer coefficient, type and thickness of exterior wall. To ensure dimensional stabilization EPS board must be stored for 42 days at normal temperature or 5 days in steam curing conditions at 60℃ to complete drying process. If use prematurely, EPS board will be shrink for the volatile of water and gas which is leading to the crack at the edges of two boards. At present most EPS companies limit production to market ability, meanwhile construction organization generally need it urgently. This contradiction leads manufacturer to shorten the storage period of EPS board which results in hidden danger of wall cracking. Therefor construction organization must order EPS as early as possible to store it enough time. For urgent usage, it is possible to ask manufacturer to cure EPS board with steam to prevent it from crack by shrinkage. In addition, EPS must satisfy the bibulous rate, the oxygen index, size deviation and etc requirements.

2.1.2 Polymer Mortar

Polymer mortar used in EPS exterior wall thermal insulation engineering is generally classified into 2 sorts: one-component and bicomponent ones. Bicomponent mortar is made by mixing polymer glue, cement and sand at jobe site, which is low-price. But its quality is hard to control for the fineness degree, particle grading, especially indax of silt content of sand is hard to reach standard requirement; too many kinds of polymer glue, variable qualities of glue; and the measurment of all sorts of materials could possiblly be inaccurate. All above factors will significantly effect construction quality. The worse is completely failed in performance requirement for preparing mortar by gel 107 or 801. One-component polymer mortar is a kind of polymer dry mortar made by redispersible polymer powder, cement, quartz, thickener, water-saving agent and etc in factory. It can be made into polymer mortar at job site just by watering in proportion and stiring. Polymer dry mortar as the technical and service comprehensive products is more expensive than bicomponent ploymer mortar. But one-component polymer mortar has very good development prospect for its superiority of speeding EPS exterior insulation engineering up, lowing environmental contamination and stable quality. However, for market competitive, some manufacturer reduce the amount of redispersible polymer powder to lower price, which causes its performance couldn't satisfy the requirement. Therefore the quality inspection is indispensable before usage.

2.1.3 Alkali-Resistant Fiberglass Mesh

Alkali-resistant fiberglass mesh is used to ensure the wholeness of EPS exterior insulation and prevent the protective layer from cracking. Cement is harmful to fiberglass mesh for its strongly alkaline, so that, the fiberglass mesh must be alkali-resistant and its performance index must meet standards to ensure the service life of EPS exterior insulation more than 25 years. At the moment, this market is disordered. In order to lower

price, most projects adopt normal alkali glass fiber mesh with alkali-resistant coating, what is more, some projects adopt normal alkali glass fiber mesh only. It will be very harmful to cause the wall getting crack after several years for the bad quality of normal alkali glass fiber mesh. Therefore it must apply alkali-resistant fiberglass mesh meeting performance standards to ensure the quality of EPS exterior insulation.

2.1.4 Exterior Wall Coating Materials

Exterior wall coating materials is the appearance of EPS exterior insulation. The engineering quality of exterior insulation all depends on it. EPS exterior insulation cracking caused by the issues of materials and engineering will result in coating crack. Inorder to reduce the coating crack, it had better use elastic coatings, for the microcrack on the surface of EPS exterior insulation can be covered by the usage. And elastic coatings have strong capability of plastic deformation to ensure the coatings will not crack with wall microcracking.

2.2 Quality Control in Engineering Process

2.2.1 Strengthen the Training for Construction Staff

Construction of EPS exterior insulation is not a very technical work, and skilled plasterer can do it very well only by training for a short period. But it is a very careful work, the staff must be very responsible. Staff not only need to have trainings on skills but also on responsabilities before construction to make them fully understand what harm is likely to be caused by not following the normal operating rules.

2.2.2 Strict Quality Control on Construction

Quality control in construction should be strict in several aspects blow:

1. Accurate mixing proportion; well mixed polymer mortar used up within the prescribed period; congealing polymer mortar is forbidden to use for it is easily to result in crack on protective layer.
2. EPS polymer mortar bond points on metope are uniform distribution; paste area meets requirements which can prevent EPS board from loosing or falling off.
3. When pasting EPS board, making sure the dimensions is standard, shape is squared, no apparent crack between bords to prevent surface layer from cracking at slab joint.
4. Strictly inspect the metope after pasting and polish if not flat.
5. In construction of protective layer, alkali-resistant fiberglass mesh must be overlaped following the specified length; polymer mortar layer thin and even as possible as necessary; it must strictly apply strengthened fiberglass mesh at window's corner part according to requirements. In practical: the most common reasons of EPS exterior insulation cracking are fiberglass mesh overlaped non-standard, protective layer is locally too thick or no strengthened fiberglass mesh at the necessary parts.
6. Don't construct in the sunshine at summer midday nor in the condition of negative temperature, otherwise, it easily causes exterior insulation cracking.
7. Coating must stay behind protective layer drying to standard water ratio to prevent coating layer from cracking with the shrink metope. In the meantime to prevent coating bubbling caused by swell of water and air in high temperature season.

3 Conclusion

At present technologies on exterior wall thermal insulation develop very quickly in our country, which are the key point of energy conservation. The development of external wall thermal insulation technology and innovation of energy-saving material are inseparable. Energy conservation must based on the development of new energy-saving materials and enough insulation materials. The development of energy-saving materials could play a role only by combining with exterior wall thermal insulation technologies. The superiorities of exterior wall thermal insulation technologies get growing concern for the innovation of energy-saving materials. Therefore it must strengthen the development and application of new energy-saving materials, at the same time, popularized exterior wall thermal insulation technologies to realize building energy conservation. EPS exterior wall thermal insulation technology is the mostly used wall energy-saving technology. It is difficult to control the qualities by this technique for many factors influence the qualities. The reasons of exertior insulation cracking and the improvement on it mentioned in this paper is a meaningful guidance to engineering practice.

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Analysis of the Factors Influence on Urban Economic Development Based on Interpretative Structural Model

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Abstract. In this paper, taking the urban economic development system as the research object, the urban economic development influence factors are analyzed and the layered structure diagram and transport chain of factors are constructed with the interpretative structure model (ISM). The results show that the factors influence on urban economic development are not only the well-know basic economic indicators, such as local financial revenue and consumer, but also some quality indicators of city life, such as education and environment.

Keywords: urban economic development, interpretative structure model, influence factors.

1 Introduction

With urbanization advancement in china, the research of Chinese economic development should be made not just at the national level, but need to analysis the subdivision part, city. To study the urban economic development can help us understand the economic situation better, and also for city planning and social development. To study urban economic development status must make clear the influence factors of urban economic development and the relationship between them first.

ISM is a system analysis method designed by J.N. Warfield during 1971-1973 for analysis of structure model of complex system. The application of ISM is quite extensive. At present, the model is mostly used to analyze influence factors and stratification, such as power system model and power load forecasting model. But in the economic field, the relevant literature is relatively less. And the application of this model in the field of urban economic research is almost none.

2 The Steps of Constructing ISM

Sort system structure factors and determine the factor sets, as Eq.(1)

$$N = \left\{ r_i \middle| (i = 1, 2, \cdots, n) \right\} \cdot \tag{1}$$

Build the consciousness model. Judgement whether there is a direct binary relation between any two of the factors in the set. The direct binary relation can be expressed as Eq.(2)

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$$a_{ij} = \begin{cases} 0 & (factor\ i\ doesn't\ affect\ factor\ j) \\ 1 & (factor\ i\ affects\ factor\ j) \end{cases} . \tag{2}$$

The sum of all direct binary relationship constitutes the adjacency matrix A.According to the matrix properties, calculate the reachability matrix by Eq.(3),

$$(A+I) \neq (A+I)^2 \neq \cdots \neq (A+I)^m = (A+I)^{m+1} = M , \tag{3}$$

Eq.(3) meets boolean algebra algorithms. I is the unit matrix. The essence of this algorithm is to plus A and I, and make the result square until the products are all equal. Then the equal product is the reachability matrix.

Class division is to divide different factors into different level. Collection of the factors which are influenced by factor r_i defines as a reachability set. The collection of the factors which influence factor r_i defines as a leading set. If the leading set contains the reachability set, then r_i is the highest level factor. All the factors which meet the conditions are the same class, L_1. By analogy, can get different class, L_2, L_3... . After class division, express the hierarchical structure of the system with the form of digraph. Then according to layered structure diagram, get the risk transmission chain.

3 Influence Factors System of Urban Economic Development Based on ISM

3.1 Influence Factors of Urban Economic Development

To analyze the influence factors of urban economic development first should be clearly how to measure the level of economic development. Here choose GDP. It is well known that GDP has four different components, including consumer, private investment, government spending and net exports. While the national economy is constituted by three industries. Therefore the influence factors of urban economic development can be search from four different direction of three industries. Through the data collection and analysis, this paper ultimately summary 26 main influence factors: (1) GDP (economic development situation of urban society); (2) the first industry GDP; (3) the second industry GDP; (4) the third industry GDP; (5) environmental factors (environment including land, air, etc.); (6) water security; (7) urban population; (8) agricultural policy; (9) fixed assets investment; (10) technology investment; (11) geographical position; (12) inports and exports; (13) house prices; (14) energy factors (energy consumption and utilization); (15) environmental policy (energy conservation and emission reduction etc.); (16) urban population quality (degree of accepting education); (17) infrastructure (building roads, etc.); (18) industrial GDP; (19) construction production value; (20) financial product investment; (21) local financial revenue; (22) local financial expenditure; (23) residents income; (24) residents consumer; (25) labor employment; (26) humanistic resources (the construction condition of tourist attractions and entertainment facilities).

3.2 Consciousness Model of Factors Influence on Urban Economic Development

Make sure the risk factors that are directly influenced by each factor. The result is shown in table 1. And then establish a directed relationship between each factor and a consciousness model, this is the basis of establishing the adjacency matrix.

Table 1. Influence factors of urban economics development

factor	directly influence factors	factor	directly influence factors
1	—	14	18
2	1	15	5,6,14
3	1	16	10,25
4	1	17	4,12,19
5	2,12	18	3
6	2,12,18	19	3
7	12,19,25	20	4
8	9	21	22
9	2,18	22	4,17,18,19
10	4,18	23	24
11	12,14,26	24	2,4,18,19
12	2,4,18	25	23
13	24	26	4

3.3 Adjacency Matrix and Reachability Matrix of Influence Factors

According to table 1 and Eq.(2), the adjacency matrix A can be got by calculated. Then using MATLAB program and Eq.(3), after three times boolean matrix calculations, the reachability matrix M can be received. According to class division principle, the model of factors system is divided into seven layers. In order from top to bottom is:

$$L_1=\{1\};L_2=\{2,3,4\};L_3=\{18,19,20,26\};L_4=\{9,10,12,14,24\};$$

$$L_5=\{5,6,8,11,13,17,23\};L_6=\{15,22,25\};L_7=\{7,16,21\}.$$

3.4 Layered Structure Diagram of Urban Economic Development

According to the calculations above, the layered structure diagram of urban economic development can be drawn as shown in figure 1. 26 influence factors have three classes: ultimate factor, source factors and process factors. GDP (1) is the factor which reflects urban economic development status, so it is the ultimate factor. Process factors are the intermediate link, they can influence on the final factor through upper process factors, and also can directly influence on the final factor. Source factors are the basis impact, including urban population (22), urban population quality (16), local financial revenue (21), environmental policy (15), agricultural policy (8), urban geographical position (11), house prices (13), and financial product investment (20).

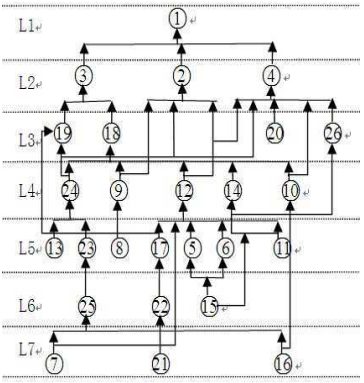

Fig. 1. Layered structure diagram

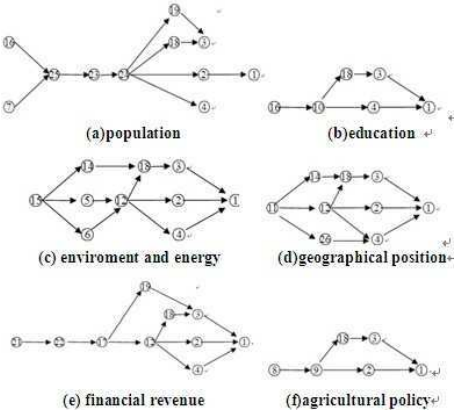

Fig. 2. Influence transport chain

According to strcture position, the source factors can be divided into several categories: first is residents consumer caused by population factor and house prices, and financial expenditure, namely government spending; second is private investment, such as financial product investment and fixed asset investment guided by agricultural policy, from which we can obviously see the composition of GDP; In addition, there are some other factors, such as invariant urban geographical position, also playing a important role. As well as the environment, a vital objective factor, is making conditionality influence on the development of urban, even the country. These source factors each form different transmission chains, eventually influence on urban economic development, as shown in figure 2. The upper factors as social economic development representation, can intuitive identify economic development condition, while the lower factors as urban economic development internal cause.

4 Summary

Through the analysis based on ISM, it can be obtained that the influence factors are no only these known basis indexs which characterize city economic development. Nowaday china is vigorously advocating sustainable development. So those factors that relate with the quality of city life, such as the environment and energy factors, geographical location and education policy city life quality, are also playing a more and more fundamental impact on urban economic development.

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Oil Price Forecast Based on Integrated Forecasting Method during the 12th Five Years Development Strategies

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Abstract. With analysis of the factors influence on oil prices, using integrated forecasting method which combines growth rate method with multiple regression linear method, this paper forecasts the prices of crude oil and petroleum products. Considering the risk factors, use high, medium and low schemes to increase the prediction accuracy. It shows that chinese oil prices predicted will be obviously rise during the 12th five year development strategies. And crude oil price will rise slightly lower than product price.

Keywords: influence factors, oil price forecast, integrated forecasting method.

1 Introduction

To predict chinese oil prices, first of all should make clear the factors that influence on our oil prices. By oil pricing mechanism, we can know these main influence factors.

Undoubtedly, international crude oil prices is the most important factor influence on our oil prices. Whether crude oil prices or petroleum products prices all link with the international market. And the factors influence on international crude oil prices include: supply and demand relation of the market, international political situation, futures market speculation, exchange rate of dollar, gold prices, and some other factors can't be measure, such as social, economic, military and natural interaction, all these constitute the risk factors of oil price.

For crude oil price, the decisive factor is international crude oil prices. But the price of products is different. Its price includes not only the decisive factor, crude oil price, but also includes processing cost, transportation cost, refinery profits and taxes. These can also affect the price of oil as factors. But they are pricinged by the government that wants to make the benefits of refining enterprise and consumer, society and economy balance. And once set, the prices will not be changed in the short term. So its influence ability is less than crude oil price. Even some of the costs are influenced by the price of crude oil.

2 Oil Price Forecasting Model

2.1 Growth Rate Forecasting Model

Growth rate method is a method that depanding on the annual growth rate and some special factors to determine future growth rate, and assume the future price of oil will

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increase with this growth rate. According to the historical growth rate fluctuations, low scheme and high scheme respectively reduce and increase some proportion of the growth rate of medium scheme.

Oil price growth rate calculation formula is shown as Eq. (1)

$$v = \sqrt{\frac{p_{o_{0n}}}{p_{o_{00}}}} - 1 \qquad (n = 0,1,2,...)' \tag{1}$$

where v is the annual growth rate of oil prices, P_{O00} denotes the base price, and P_{O0n} is the oil price interval n years with the base price. And to forecast future oil prices,it should change Eq.(1) into another form, as Eq.(2)

$$p_{o_{0n}} = p_{o_{00}}(1+v)^n \qquad (n = 0,1,2,...). \tag{2}$$

2.2 Multiple Regression Linear Model

Multiple regressions are an extension of linear regression involving more that one predictable variable. The model based on multiple regressions is here known as multiple regression linear model (MRLM). MRLM attempts to model the relationship between two or more explanatory variables and a response variable by fitting linear equation to observed data. Every value of the independent variable x is associated with a value of the dependent variable y. The population regression line for p explanatory variables $x_1,x_2,\ldots,x_p$ is defined to be as Eq.(3)

$$Y = c_0 + c_1 x_1 + c_2 x_2 + \cdots + c_p x_p + \varepsilon,\ \varepsilon \sim N(0,\sigma^2), \tag{3}$$

where $x_1,x_2,\ldots,x_p$ represent the parameters or attributes of the data sets under investigation and the response Y is the class value for a particular instance in the data set. $c_1,c_2,\ldots,c_p$ are the independent variable regression coefficients, and ε is called residual or surplus item, normal distribution. σ^2 is an unknown parameter irrelevant with $x_1,x_2,\ldots,x_p$.

The input and output relationship of the data ($x_{i1},x_{i2},\ldots,x_{ip}$, y_i) can be expressed in multiple regression linear model in the following manner as Eq.(4)

$$\begin{cases} y_1 = \beta_0 + \beta_1 x_{11} + \beta_2 x_{12} + \cdots + \beta_p x_{1p} + \varepsilon_1 \\ y_2 = \beta_0 + \beta_1 x_{21} + \beta_2 x_{22} + \cdots + \beta_p x_{2p} + \varepsilon_2 \\ \cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots \\ y_n = \beta_0 + \beta_1 x_{n1} + \beta_2 x_{n2} + \cdots + \beta_p x_{np} + \varepsilon_n \end{cases} \tag{4}$$

Where $\varepsilon_1, \varepsilon_2,\ldots, \varepsilon_n$ are mutual independence, $\varepsilon_i \sim N(0, \sigma^2)$, $i=1,2,\ldots,n$. This model called multiple linear regression mathematics model.

2.3 Integrated Forecasting Method

Integrated forecasting method is a method that integrate all results forecasted by different methods to make a comprehensive forecasting. The weight of each forecasting mathod is determined based on expert advice or prediction error size.

$$SQR = \sum_{i=1}^{n} (y_i - x_i)^2 , \tag{5}$$

Where SQR is the squared residuals, y_i denotes the forecasting price, and x_i denotes the real one.

3 Crude Oil Price Forecast during the 12th Five Years Development Strategies

3.1 Crude Oil Price Forecast Based on Growth Rate Forecasting Model

Taking Daqing crude oil price as a domestic crude oil price forecasted object, and according to the analysis of the crude oil price over years, primarily determine to make 13% growth rate for high scheme, 12% for medium scheme, and 11% for low scheme. The prediction result is shown in table 1.

Table 1. Crude oil price forecasting value based on grownth rate model [US$/toe]

year	high scheme	medium scheme	low scheme
2011	534.22	2011	534.22
2012	603.67	2012	603.67
2013	682.15	2013	682.15
2014	770.83	2014	770.83
2015	871.04	2015	871.04

3.2 Crude Oil Price Forecast Based on Multiple Regression Linear Model

Using Eviews6.0 to do unit root test and granger causality test on each affecting factor, finally choose oil consumption, international crude oil price, international coal price, domestic coal price, and the dollar index as main factors.

Considering the oil price risk factors, in order to improve prediction accuracy, set high scheme, medium scheme and low scheme, three schemes. high scheme and low scheme are based on medium scheme and fluctuate 0.5% up and down, the prediction is shown in table 2.

Table 2. Crude oil price forecasting value based on MRLM [US$/toe]

year	high scheme	medium scheme	low scheme
2011	616.67	613.61	610.54
2012	651.76	648.52	645.27
2013	688.84	685.41	681.99
2014	728.03	724.41	720.79
2015	769.45	765.63	761.80

3.3 Crude Oil Price Forecast Based on Multiple Regression Linear Model

By compared with real value, multiple regression model is more accurate than growth rate model, so using integrated forecasting method, the final forecast result is shown in table 3.

Table 3. Crude oil price forecasting value based on integrated forecasting model [US$/toe]

year	high scheme	medium scheme	low scheme
2011	615.85	612.72	609.59
2012	651.28	647.91	644.54
2013	688.77	685.14	681.52
2014	728.46	724.54	720.63
2015	770.47	766.23	762.01

3.4 Petroleum Products Price Forecast during the 12th Five Years Development Strategies

Using integrated forecasting method, after unit conversion, the result is the domestic refined oil market price, as shown in table 4.

Table 4. Forecasting value based on integrated forecasting method [CNY/liter]

year	97# gasoline forecast price			0# diesel forecast price		
	high scheme	medium scheme	low scheme	high scheme	medium scheme	low scheme
2011	7.99	7.95	7.90	6.63	6.60	6.56
2012	9.23	9.18	9.13	7.80	7.77	7.72
2013	10.67	10.59	10.53	9.19	9.15	9.09
2014	12.31	12.23	12.16	10.82	10.76	10.69
2015	14.22	14.12	14.03	12.73	12.67	12.58

4 Summary

No matter crude oil price or petroleum products price will rise during the 12^{th} five years stratrgies, and crude oil price will rise slightly lower than products price. But considering the strong demand of oil and shortage of resources, the government will take some regulation measures to stable price. So for oil price forecast, in the short term, should avoid the risk that oil price and current price superposition increase caused by such as political crisis; in the long term, China should complete energy pricing mechanism, establish a long-term mechanism of energy saving, gradually reduce the dependence on oil. Meanwhile, steadily establish oil futures market, improve our international status in market pricing, and effectively avoid the loss caused by price fluctuation.

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Experimental Researches of Factors Affecting Bubbling Humidification

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Abstract. It's obtained by experiments that air is easily to be humidified to the saturated state by bubbling humidification on single stage sieve plate. The higher the humidifying temperature is, the more the humidification capacity is. If humidifying temperature increased by 10℃, the humidification capacity would be increased by about 80%. The lower the water level is, the less the air flowing resistance and the blower energy consumption are. Under the condition of no water leaking on sieve plate, the larger the sieve hole diameter is, the lower the pressure drop of air is, and the less the blower energy consumption is.

Keywords: bubbling, humidification, experiment, influence factors.

0 Introductions

Humidification is one of the main processes in humidification-dehumidification (HD) desalination. Now, the main method to humidify air is single stage [1] or multistage spraying humidification [2, 3], sometimes honeycombs which is made of papers are used to be mass transfer mediums to enhance the efficiency of humidification [4]. S.A.EI-Agouz, etc. [5] firstly put an air pipe with holes in seawater to humidify air by bubbling. The experiments indicated that its humidifying rate is as same as the multistage spraying one [6,7].

In this paper, the measurements of bubbling humidification test-bed with single sieve plate is improved, based on it, the sieve plates with different opening hole rates are experimented in order to obtain more perfect experimental results.

1 Experiment System

The experiment system of bubbling humidification is consisted of blower, air heater, bubbling humidifier with single-stage sieve plate, and measuring instruments, etc, which are shown in Fig.1.

During the operation, air is conveyed by blower from the bottom of the sieve plate into the seawater on it, when the air passes through the holes and the level of seawater, it's humidified by bubbling. The humidified air is discharged from the top of humidifier, and then went into the dehumidifier. Electric heaters are used to heat air and seawater instead of solar air heater and solar seawater heater.

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2 Main Factors Affecting Humidification

2.1 Influences of Air Flow Rate

When other parameters are constant, the air volume flow rate M_v is changed to obtain the relationship of each parameter with M_v.

Experiment conditions are that the inner diameter of humidifier is d_0=2mm, the distance of near holes is t=12mm, the number of holes is n=217, the ambient temperature, relative humidity and pressure are t_0=15.09℃, φ_0 =35.2%, p_0=98.1kPa separately.

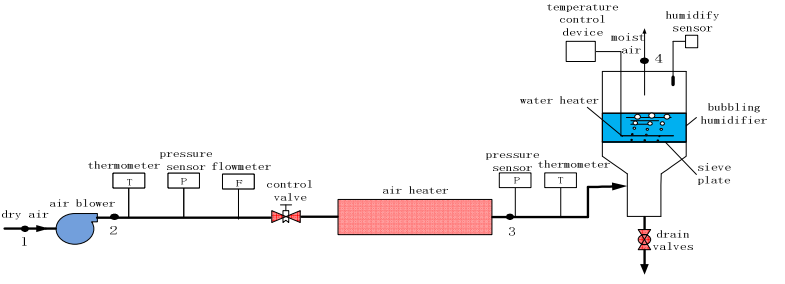

Fig. 1. Experiment system of bubbling humidification

Supposing the water temperature in humidifier t_w equals to the temperature of air in the inlet of humidifier t_1, which is 40℃. Experiments are done when initial water level are H=1cm and 3cm respectively. Using freshwater instead of seawater. The experiment results are shown:

(1)When M_v is increased, air relative humidity in the outlet of humidifier remains 100%.

(2)When H is unchanged, the total pressure drop of air flowing through pipes and humidifier would be increased with Mv increased. As the air flow control valve is opened gradually, the local resistance of valve is reduced, and M_v is increased.

(3)When M_v is unchanged, the lower H is, the less the total pressure drop of air is.

The experimental data are shown in Fig.2.

2.2 Influences of Humidifying Temperature

The aim of the experiments is to obtain the relationships of each parameter changed with T_w. In the experiments, d_0=2mm, n=91, s =18mm. H=1cm, t_W =t_1, t_0=12.8℃, φ_0=33.1%, p_0=97.8kPa. M_v=18m^3/h. The sieve holes are arranged as regular triangle. The experimental data are shown in Table 1, in which v_2—air flow rate in the outlet of blower, m/s.

The total humidifying capacity of air is:

$$m = M_0(d_4 - d_0)\,. \tag{1}$$

Here, m—total humidifying capacity of air, g/s; M_0—air mass flow rate, kg/s; d_4—the absolute humidity of air in the outlet of humidifier, g/kg (dry); d_0 —the absolute humidity of ambient, g/kg(dry), it is 3.127 g/kg(dry) by looking up psychrometric chart according to t_0 and p_0. When sieve plate area is 0.0307m^2, the calculation results are shown in Table 2.

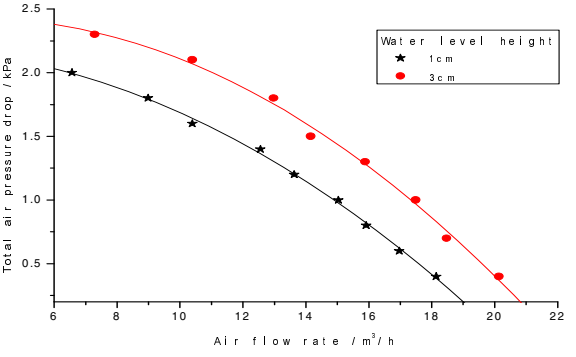

Fig. 2. Total air pressure drops changed with air flow rate

Table 1. Experiment results changed with t_w

t_w=t_1 /℃	30	40	50	60
t_2 /℃	26.4	27.2	28.2	29.2
P_2 /kPa	98.20	98.30	98.35	98.40
P_3 /kPa	97.90	97.90	97.90	97.90
ΔP /kPa	0.4	0.5	0.55	0.6
v_2 /(m/s)	5.60	5.63	5.65	5.67
φ_1 /%	100	100	100	100

Table 2. Relations of t_w and m

T_w=t_1 /℃	30	40	50	60
ρ_2 /(kg/m^3)	1.142	1.14	1.14	1.13
M_{2V} /(m^3/h)	18.29	18.39	18.46	18.52
M_0 /(g/s)	5.80	5.82	5.83	5.83
d_4 /(g/kg)	28.2	50. 8	89.9	159.2
m /(g/h)	524	999	1820	3279

In Table 2, m is increased with t_w increased. As t_w is increased from 40℃ to50℃, and from 50℃ to 60℃, m is increased by about 80% separately. If t_w is extended to 70℃, it is obtained that m would be 5.67kg/h. That means t_w is one of the main factors affecting humidification.

2.3 Influences of Water Level

If T_0 =12.3℃, φ_0=32.8%, P_0=98.4kPa, d_0=2mm, n=91, t_w=t_1=40℃, and H is changed from 2cm to16cm, other parameters are shown in Table 3.

Supposing the pressure of air in the outlet of humidifier is equal to ambient pressure. When H is changed, the air pressure drop and air flow rate in humidifier are calculated by:

$$\Delta P_H = P_3 - P_0 . \tag{2}$$

Here, ΔP_H—the air pressure drop in humidifier, kPa; P_3—the air pressure in the inlet of humidifier, kPa.

$$M_{2V} = \pi r_a^2 v_2 . \tag{3}$$

In above equation, r_a—inner radius of air pipes, taking 0.017m.

The experiment relations of ΔP_H and M_{2V} changed with H are shown in Fig.3.

Table 3. Experimental data under different water levels

H/cm	2	4	6	8	10	12	14	16
P_3/ kPa	98.75	98.90	99.15	99.35	99.50	99.70	99.90	100.10
v /(m/s)	4.65	4.52	4.19	3.87	3.65	3.39	3.02	2.56

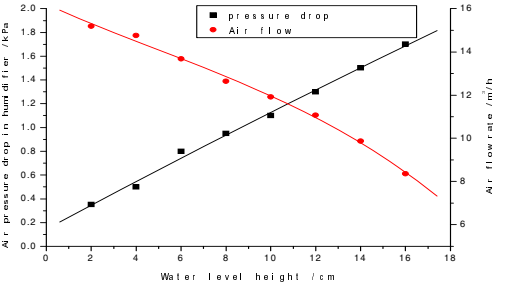

Fig. 3. Influence of water level

It shows that under above experimental conditions, as H is changed from 2cm to 16cm, the relative humidity of humidified air is reached 100%. Even though H is reduced to 1cm, the air is humidified to saturated humidity state, and there is no water leaking on the sieve plate. When H is increased, ΔP_H would be increased, while M_{2v} would be reduced. When H is changed from 2cm to 16cm, ΔP_H is 1.35kPa. So the

lower H is, the less the air resistance is, the more M_{2v} is, and the better the economy of freshwater production is. Therefore, under the condition that no water is leaked and the air is humidified saturated, H should be as lower as possible.

2.4 Influence of Sieve Hole Open Rate

As T_0=14.99℃, p_0=98.1 kPa, φ_0=34.7%, t_w=t_1=40℃, d_0=2mm, n=91 and 217, taking π=1.12% and 2.52%, H=1cm and 3cm separately, it's known from experiments that when M_v is changed from 6m^3/h to 18m^3/h, air is humidified to saturated state, and there is no water leaking. The total pressure drop of air would be reduced as M_v and hole open rate increased. The experiment results are shown in Fig.4 and Tab. 4. The blower energy consumption would be increased as M_v increased. When hole open rate is increased, the air resistance would be decreased, and blower energy consumption would be decreased.

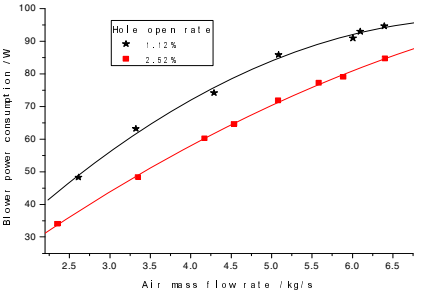

Fig. 4. Blower energy consumption changed with M_v

Table 4. Air pressure drop in humidifier changed with H and π /kPa

H /cm	1	3	5	7
π =1.12%	0.4	0.55	0.7	0.85
π =2.52%	0.25	0.4	0.5	—

Table 5. Air pressure drop in humidifier changed with H and d_0 /kPa

H /cm	1	3	5	7	9
d_0=1 mm	1.55	1.65	1.65	1.75	1.8
d_0=2 mm	0.4	0.55	0.7	0.85	—

2.5 Influences of Sieve Diameter

Under d_0=1mm, 2mm, n=91, t_w=t_1=40℃, the experiments indicate that air can be humidified to saturated state, and there is no water leaking. The experiment results are shown in Table.5. It's known that the air pressure drop in humidifier would be reduced with increasing of sieve diameter, and increased with increasing of H.

3 Conclusions

Sieve plates having different number and diameter of holes are used in experiments to study the factors affecting humidification, air pressure drop, and blower energy consumption. The conclusions are:

1. In the experimental range, air is easily to be saturated state by humidifying in single stage sieve plate.
2. When M_v and H are unchanged, the higher the t_w is, the more the humidifying capacity is. If t_w is increased from 40℃ to 60℃, humidifying capacity would be increased by 80% as t_w increased by 10℃.
3. When t_w is unchanged, if H is changed from 2cm to 16cm, the relative humidity of humidified air remains 100%. The lower H is, the less the air resistance is, the less the blower energy consumption is, the less the electric needed to produce unit freshwater is.
4. When there is no water leaking, the larger the sieve hole diameter is, the more the open rate of holes is, the less the air pressure drop in humidifier is, so the less the blower energy consumption is.

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Strategic Research on the Implementation Structure about Mass Customization

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Abstract. This paper focuses on studying mass customization from the perspective of strategy instead of manufacturing and technology model. Whether to use mass customization and the ways of strategic planning and implementation are discussed completely. This paper also quotes SWOT as the synthetic evaluation tool. Finally, the strategic structure about mass customization is addressed as a key point.

Keywords: Mass customization, SWOT, Strategic Implementation structure.

Introduction

In today's fast-paced competition of the market environment, to create strategic advantage increasingly more important. The company who has no strategic advantage will face the risk of being out of market competition. Mass customization, because of its strength and sustainability, is not only a production model, but also increase the long-term strategy for the enterprise. Many internationally known companies such as HP, Toyota, Motorola and so on use the use mass customization strategies to enhance the core competitiveness of enterprises. Most researches for mass customization now are from the angel of technical, organization and marketing which at the same time from a strategic point of view of the system is almost a blank. Therefore, this paper from a strategic point of view, systematic analysis that mass customization as a rule of competitive strategy, in order to provide help for enterprises to make strategic decisions and build strategic advantage.

1 The Mass Customization Formulation Stage of Strategy

1.1 The Proposal of Problems

With the time of knowledge economy era of globalization, the enterprise's external environment is full of business complexity and uncertainty. Consumer demand is growing more personalized and diversified. Consumer preferences and purchasing behavior and even the corresponding reaction of competitors is more difficult to predict and master. Industry competition environment is more intense and also the

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product life cycle is shorter. More and more companies recognize that only through mass customization strategy can implement low-cost operation and build the core competitiveness of enterprises so that enterprises would in a dominant position in the fierce competition. As a result, for those who are trying to make their own products or services to gain competitive advantage in an increasingly crowded market through maverick, whether to implement mass customization strategies and how to implement mass customization strategy has become a serious problem.

1.2 Internal and External Environment Analysis

This paper will draw on the SWOT analysis to comprehensive evaluation of enterprise's own business environment and its ability so that enterprises can conclude whether to planning and implement the strategy of mass customization. The computer industry is a typical industry to implement mass customization, the following use SWOT matrix to analysis a computer company's internal and external environmental. The external opportunities and threats and the main elements of the main internal strengths, weaknesses to-one correspondence, in-depth understanding of business mass customization, shown in table 1.

Table 1. SWOT analysis of a matrix of computer companies

		Opportunity		Threat	Correlation	
		Customer demand for customized products	The suitability of the supply chain	Competitor's strategy	+	-
Advantages S	For the degree of product customization	+	+	-	2	1
	The ability to obtain customer information	+	+	-	2	1
	Flexible manufacturing system	+	+	0	2	0
Disdvantages W	Organizational Structure	+	-	0	1	1
	Ability to manage integration	+	+	-	2	1
Correlation	+	5	4	0		
	-	0	1	3		

Note: "+" indicates positive relationship between the two elements of the corresponding conditions on the implementation of mass customization business is good; "-" indicates negative correlation, that is, the relationship between the two elements of the corresponding implementation of mass customization of business is detrimental to ; "0" indicates not relevant. Finally, the horizontal and vertical "+","-"," 0 "respectively summed, and fill the form at right and below.

Evaluation by SWOT matrix can be seen that the company implemented most of the major factors for mass customization higher scores, indicating that the company is appropriate with the strategy of mass customization. The result matches the fact that the computer industry is suitable for mass customization is consistent. Customers have the needs of customization and at the same time products are suitable for custom, and the ability to obtain customized information and management integration all of which are the key to successful implementation of mass customization. The ability of enterprises in these areas constitutes the implementation of the basic conditions for mass customization strategies.

2 Implement the Overall Strategic Framework of Mass Customization

With the internal capacity of enterprises and external relations based on common elements, and in mass customization based on the SWOT analysis, then combined with supply chain management in the manufacturing model, this paper presents the overall strategic framework for mass customization, shown in Figure 1.

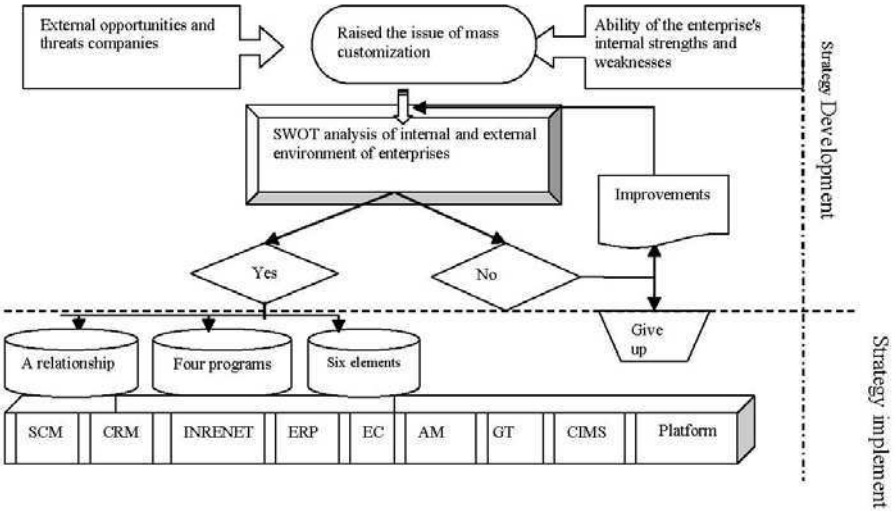

Fig. 1. The overall framework of mass customization strategy

3 Implementation Framework for Mass Customization Based on the Strategic Perspective

In order to make mass customization rise to a long-term strategy for the enterprise, one should to strategic operations from the overall height. Shown in figure 2. From "a relationship, the four plans, the six elements" can fully and orderly explain the process of implementation of the strategy of mass customization.

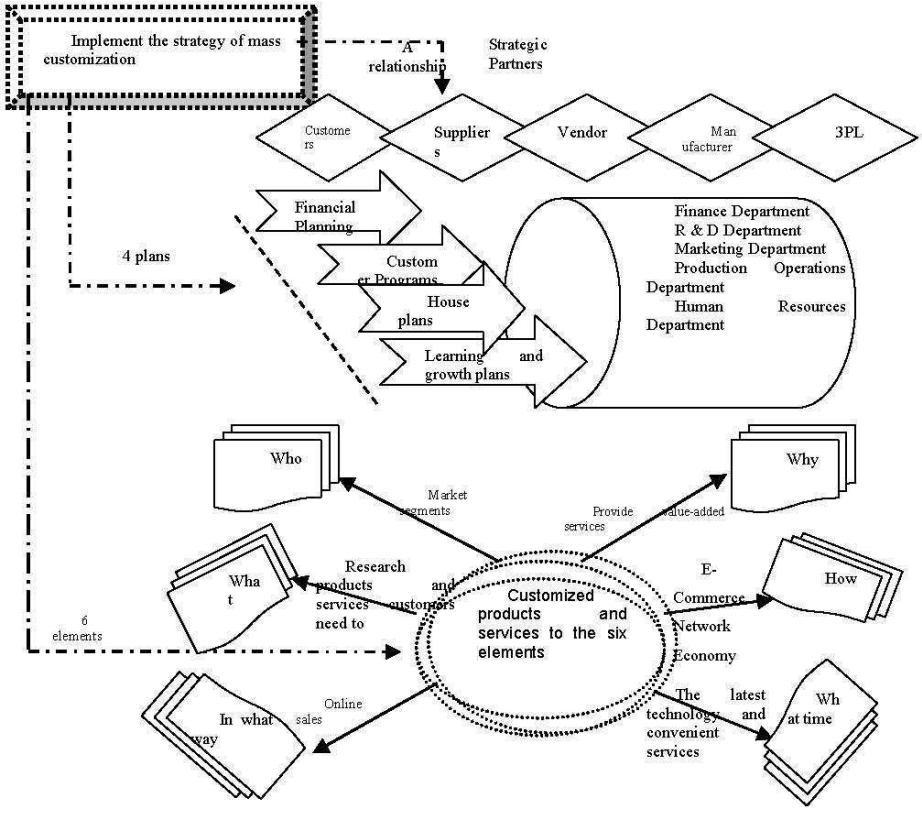

Fig. 2. The implementation of the strategic framework for mass customization

3.1 A Supply Chain of Partnership Based on Strategic

A supply chain of partnership based on strategic can create a common vision and increase the actual production capacity and actual value. Then through the intimate, close, sharing and mutual trust to achieve logistics, capital flow, information flow and exchange of knowledge flows, ultimately reduce transaction costs between enterprises and then timely and accurate customized to the individual needs of customers products.

3.2 Four Integrated Planning System

Enterprise to implement mass customization strategy, should systematically implemented in its "four in one plan" namely financial program, customer program, internal program and learning and growth program. Financial program, mainly from the perspective of financial strategy in order to analysis the growth strategy and the production costs strategy of mass customization. Customer program is mainly from the R & D and marketing plans to consider the product leadership, customer intimacy and operational excellence strategy. Internal control program requires organizations to

master the business processes and specific activities, which are support to the customer value orientation, mainly corporate culture and production operation strategy. Learning and growth program is to determine requires for operational activities in achieving a high level of customer relations and good physical assets, and starting from human resource strategy to build learning organizations.

3.2.1
Through the collection and analysis of custom from the customer, raw material supply to transportation, processing, production, distribution, sales and after-sales service and other aspects of cost information. Scientific calculates if the costs of the implementation of mass customization can afford custom and the profitability of enterprise, enhance the ability of financial decision making.

3.2.2
Establish a web-based fast marketing system that marketing staff make full use of modern marketing approach with customers to achieve the "zero distance". And provide a communication platform for enterprises and customers, in which way consumers can participate in R & D product design, allowing real response to customer needs.

3.2.3
Agile Manufacturing (AM), to achieve mass customization "push" and "pull" mode of production combination. Take the basis of Group Technology (GT) and through modular product design to achieve mass production. At the same time , create more variety, small batch, similar to the production of short-term water system of flexible production units (FMC), to achieve large-scale customized and to meet customer rapid changes needs.

3.2.4
Formation of a flat organization structure, training high quality staff. Mass customization enterprises require high efficiency, low cost to responsive to customer demand for diversified and personalized. So enterprise should form a learning organizational structure which has the basis of enterprise information, and rapid response to customer demand for quick customization, network and modular. The staff of this organization is a knowledge-based, multi-skilled team with cooperation and teamwork.

4 Conclusion

Mass customization is considered as the competitive edge in the 21st century. In this regard, enterprises in our country should try to research on mass customization production enterprise competition early, and make corresponding countermeasures. Under these conditions, if the enterprise is now necessary to implement mass customization or not and how to implement, should be based on the specific situation of enterprises and from a strategic grasp for a high degree of system. Only in this way, companies can gain a competitive competition in the market the initiative and create strategic relative advantage to make enterprise remain invincible.

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Numerical Simulations and Comparisons of Air Bubbling Process through Single Hole

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Abstract. VOF and Eulerian model in the software of Fluent are separately used in two-dimensional simulation calculations for air bubbling in water by single hole. The simulation results are compared with experiment photos by high-speed camera, it's obtained that gravity should be considered in using VOF model; at lower air speed, VOF model is more accurate to simulate the bubble formation, separation, upward motion and coalescence; the simulation results of Eulerian model have an obviously difference with the experimental ones at lower air speed, but it's suitable to simulate bubbling process for air at higher speed.

Keywords: bubbling, VOF, Eulerian, numerical simulation, single hole.

0 Introductions

Gas-liquid bubbling column is widely used in many fields such as chemical engineering, environmental engineering and biochemical engineering for its simple structure, low cost and low power consumption, high efficiency of heat and mass transfer, and simple operation.

A large number of experiments and numerical simulations have been carried out by many researchers [1] for the complex flow state of gas-liquid phases in the actual bubbling column. However, the simulation results by Computational Fluid Dynamics (CFD) are different from actual situation because of the difference in using models, setting boundary and stress conditions. Therefore, the numerical simulation method should be further studied and improved. The software of Fluent is used in this paper to simulate the process of air bubbling process by single hole, and the results are compared with the experimental ones in order to identify the correct simulation method.

1 Calculation Models

There are three models in Fluent to calculate gas-liquid two flows, which are VOF model, Mixture model and Eulerian model. VOF model is a surface tracking method under fixed Eulerian grids. It can be used when the interface of one or more mutually incompatible fluid is needed. Eulerian model is the most complex multi-phase model in Fluent. It solves each phase by using n momentum equations and continuity

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equations. Eulerian model can be used for bubbling column, particle suspension and fluidized bed.

VOF and Eulerian model are used to simulate and compare the process of air bubbling in water by single hole in the paper. The heat transfer between air and water are neglected in calculation.

1.1 VOF Model

VOF model is tracing the interface between different phases and solving continuity equations of the volume ratio of one or more phases. For the phase q, the equation is:

$$\frac{\partial \alpha_q}{\partial t} + \vec{v} \cdot \nabla \alpha_q = \frac{S_{\alpha_q}}{\rho_q}. \tag{1}$$

Here, α_q —the volume ratio of the phase q; v—velocity; t—time; ρ_q—the density of the phase q; S_{α_q} —Source item.

The properties appeared in the transport equation are determined by partial phases in each control volume. Usually, volume ratio is expressed as the following form:

$$\rho = \sum \alpha_q \rho_q . \tag{2}$$

Momentum equation depends on the volume ratio of all phases represented by ρ and μ. It only needs to solve a single momentum equation in the whole region. The velocity field which is as a result is shared by each phase. The momentum equation is as follow：

$$\frac{\partial}{\partial t}(\rho \vec{v}) + \nabla \cdot (\rho \vec{v} \vec{v}) = -\nabla p + \nabla \cdot [\mu (\nabla \vec{v} + \nabla \vec{v}^T)] + \rho \vec{g} + \vec{F} \tag{3}$$

1.2 Eulerian Model

Eulerian model describes the changes of flow parameters by transient average value. When mass and heat transfer between phases are not considered, the flowing control equation can be simplified as following form:

Mass conservation equation is:

$$\frac{\partial \alpha_i}{\partial t} + \nabla \cdot (\alpha_i U_i) = 0 . \tag{4}$$

Momentum conservation equation is:

$$\frac{\partial \alpha_i \rho_i U_i}{\partial t} + \nabla \cdot (\alpha_i \rho_i U_i U_i) = -\alpha_i \cdot \nabla p_i + \nabla \cdot (\alpha_i \tau_i) + F_i + \alpha_i \rho_i g \tag{5}$$

In the equations, α_k—phase holdup; ρ_k—phase density; μ_k—phase viscosity; u_k—phase velocity; $F_{g,l}$—interaction force between gas and liquid; g—gravity acceleration.

2 Meshing and Discrete Solution

The diameter of sieve hole is 1mm, the cylinder diameter is 20mm and its height is 200mm. The single-hole model is established by non-uniform structured grid and partial density is increased. The first grid near the wall and center on the horizontal are separately 0.5mm and 0.2mm. The grids are increased by the ratio of 1.2, and which in vertical direction are uniform as 2mm. The local grids near the hole are amplified as shown Fig.1.

The independence of grids is very important in the simulation and it directly affect the errors of calculation results [2]. Three sets of grids which are 5 million, 6 million and 10 million are calculated for one same parameter. The simulation results shows that results obtained by different numbers of grids are consistent, and the errors are less than 1%. So it's considered that the simulation results are independent with the numbers of grids.

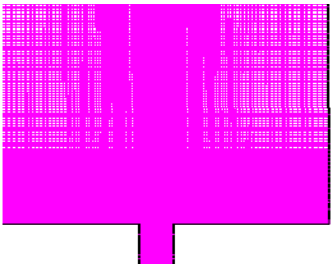
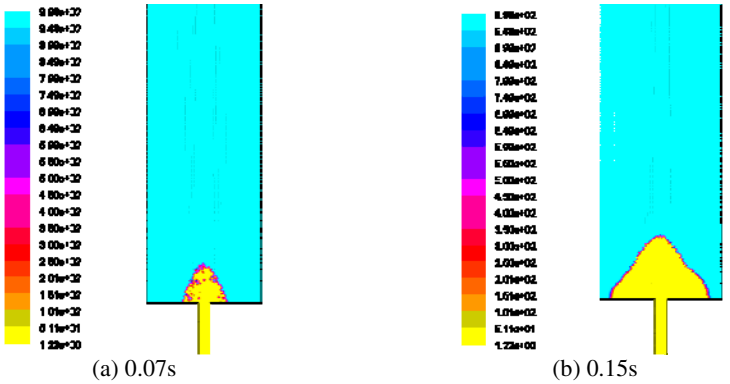


Fig. 1. Local grids near the hole

The initial conditions of simulation for air bubbling process by single hole are set as follows: the velocity of air inlet are 0.05m/s and 0.2m/s. The outlet pressure above the liquid layer is local atmospheric pressure. The initial velocity of liquid is set as 0 for the liquid in the humidifier is at rest at the beginning. The bubble diameter is regard as a single diameter in Eulerian model and the drag coefficient is depended on the bubble diameter. The wall of humidifier is non-slip. In VOF model, velocity inlet and pressure outlet are set, and the effect of surface tension is considered by the setting the surface tension coefficient. The variables of each equation are in the discrete form. Solver used pressure-velocity coupling method and the simple algorithm. Relaxation factors used the default values of the software. Residuals of each variable are set to 1×10^{-3}.

3 The Effect of Gravity on VOF Model

It's assumed no gravity at first when the VOF model is used to simulate the bubbling process through single hole. When the air inlet velocity is 0.2m/s and the gravity is not considered, the cloud charts of volume fraction at 0.07s and 0.15s are shown in Fig.2. It's found from the calculation results that the bubble attached to the hole and can't separate. It's illustrated that gravity is a factor must be considered for the simulation of the bubble formation, separation, upward motion and coalescence.

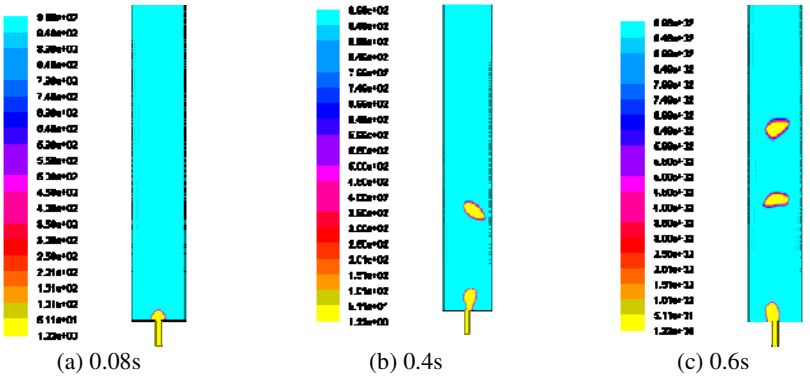


(a) 0.07s (b) 0.15s

Fig. 2. Simulation results of VOF model without gravity

4 Simulation Results Comparisons between VOF Model and Eulerian Model

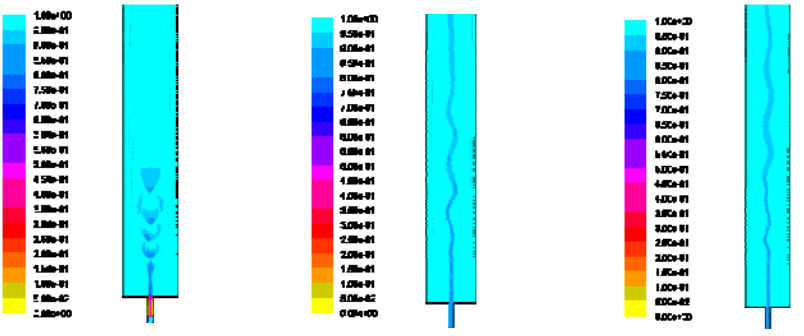
When u=0.05m/s, the calculation result pictures of VOF model and Eulerian model at the same time are shown in Fig.3 and Fig.4. The calculation results of VOF model show that surface tension is a leading factor at low air velocity. The diameter of



(a) 0.08s (b) 0.4s (c) 0.6s

Fig. 3. Simulation results of VOF model

bubble is small and uniform. The bubbles arise almost straightly. The coalescence and broken of bubble didn't occur, which is similar to the experimental results shown in Fig.5. Bubble appeared in a short time at the beginning of the simulation of Eulerian model (Fig.4(a)), and the simulation results became S shape quickly, which is obviously different from the experiment ones. It's illustrated that Eulerian model is not applicable to simulate the bubbling process when the two phases have not mixed at low air velocity.



(a) 0.08s (b) 0.4s (c) 0.6s

Fig. 4. Simulation results of Eulerian model

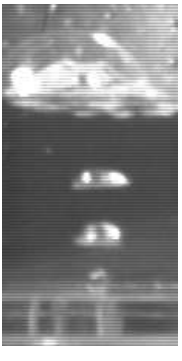
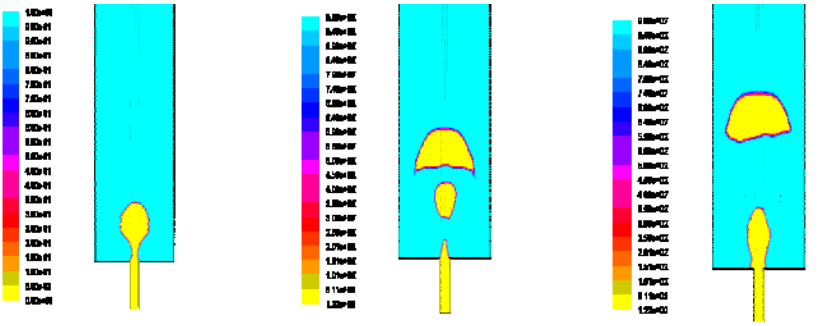


Fig. 5. Experimental picture at low air velocity

When u=0.2m/s, the bubble formation, separation, upward motion and coalescence simulated by VOF model are shown in Fig.6 clearly and they are similar to the experimental pictures (Fig.7). Compared with Fig.3, u in Fig.6 is increased and the near bubbles in the front and after are closer. The second bubble got into the wake region of the front one, and suffered less drag, so it fast approached the front one and they collided and coalesced.



(a)0.07s (b)0.12s (c)0.17s

Fig. 6. Simulation results of VOF model

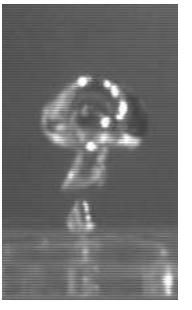
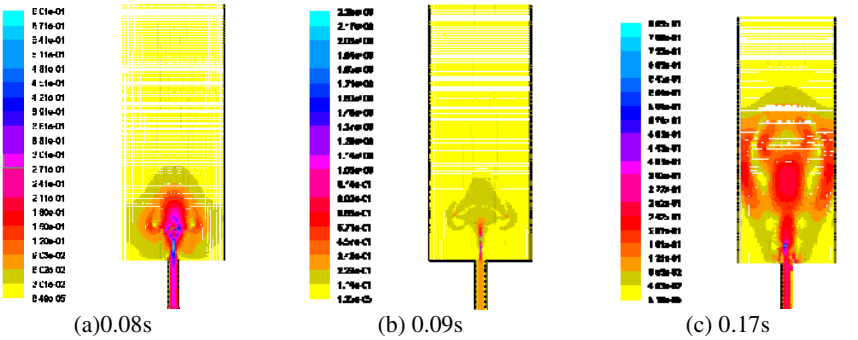


Fig. 7. Experimental picture of coalescence

When u=0.2m/s, the velocity vector clouds charts of VOF model are shown in Fig.8. It can be seen from Fig.8 (b) that the velocity field is not uniform. Under the influence of the wake region of the first bubble, vortexes appeared on the right and left sides of the second bubble, and the bubble has not completely separate from the hole and it is still being filled air in it.



(a)0.08s (b) 0.09s (c) 0.17s

Fig. 8. Velocity vector clouds charts of VOF model

Literatures [3, 4] used Eulerian model to simulate the bubbling process at turbulent state and found that air is in the S shape when it is bubbled in the water. It's as same as the phenomenon observed in the experiments; it means that the simulation results are correct.

5 Conclusions

1. Gravity should be considered in numerical simulation by VOF model; otherwise the bubble would be attached to the hole and can't be separated.

2. VOF model is more accurate to simulate the bubble formation, separation, upward motion and coalescence at low air velocity and the result is similar to the experimental ones.

3. The simulation results of Eulerian model are obviously different from the experimental ones when the two phases have not mixed at low air velocity. While at high air velocity, the phenomenon in the experiment is almost consistent with the simulation results by Eulerian model in literatures, which means Eulerian model is suitable to be used in higher air velocity.

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Literature Review of New Industry Development Research Based on Patent

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Abstract. This paper bases on the theory of industrial ecology, uses the method of social network analysis and bibliometrics, uses the statistical and visualization tools and get help from datas of patent databases and statistic yearbooks. This paper finds the evolution law between patent and new industry through the changes of patent quantity, quality and structure, in the hope of guiding the develop of related industries, especially strategic new industry.

Keywords: Industrial Ecology, New Industry, Technology, Patent, Co-evolution.

1 Introduction

The formation and development of new industries has its own internal logic and rules, this logic and laws is the mechanism of formation and development of emerging industry, it is concentrated expression of the formation and development of new industries in the motivation, path, and influence factors. Emerging industry represents the new requirements of the market economic system overall output and the new direction of industrial structure conversion, but also represents a new level of science and technology industry, industry itself is in the formative stages of the life cycle, is new force to promote the evolution of industrial structure.

The interaction evolution between new industries and patent to knowledge economy and emerging industries in China maintain sustained high speed development is very important. Collaboration between development of new industries patent and economic growth in the efficiency improvement is the future of our country to enhance the level of new industries development, and the key to boost economic toward intensive, knowledge-intensive development.

2 Research Status of Emerging Industry

2.1 The Concept of Emerging Industries

(1) From the perspective of industry life cycle

Emerging industry is the industry which in the growth stage of industry life cycle stage, is newly formed or re-formation industry, which is due to technological innovation, changes in relationship between relative costs, emergence of new consumer demand, or other economic or social changes formation or re-formed industry [1].

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(2) From the perspective of economic development

Analysis report of China's economic hotspots defined strategic emerging industries as related to national economy social development and upgrading of industrial structure, with a comprehensive, long-term, oriented and dynamic, four major characteristics industry. First, with a strategic position in national economy, have a significant and long-term effects on economic social development and national security; Second, strategic emerging industry is focused on the future, must have the possibility of becoming the country's future economic development pillar industry [2].

(3) From the technical point of view

New industries is resulting from new technological breakthroughs, products or services innovative, which may be a new invention relys on the new technology different from the traditional techniques format a series of industries, it is also known as high-tech technology industry [3].

(4) From the perspective of market demand

From the market demand point of view, the emerging industry is due to the new generation of consumer demand or social changes, leaving new product or service upgraded to possible and viable business opportunities, which led to new industries, is demand driving for products, service, technology, even arising from management innovation[4].

2.2 The Formation Pattern of New Industry

First, the new industry life. The formation of new industries is not conceived in the original industry, and not attached to the existing industries, but with a relatively independent manner from bud to form. The growth of this industry results in breakthrough advances of science and technology, generally germinated in laboratory.

Second, the industrial division. Industrial division refers to the budding new industry by fully developed, emerged new technologies, new processes, new products, then separated from the original industry, broken down into a separate new industry process.

Third, the industry derived. The way of industry derived is due to the development of an industry, led to another related industry, supporting the new industries generated.

Fourth, industrial integration. Industrial integration exists in modern science and technology industry, point to different industries or different sectors in the same industry within mutual penetration, cross, and ultimately integration, and gradually form new industries's dynamic development process.

2.3 The Research Method of New Industries

2.3.1 Correlational Research Based on Ecology

ZHANG Yan-hui studied the relationship between ecological community succession and the industrial structure upgrading, pointed out that community succession is the phenomenon of community replaced in turn, the community succession is a process with law and direction, the regional industrial structure composition is similar to the natural ecological communities, industrial structure is in the constantly evolving, upgrading process, the industry development and industrial structure upgrading has also been influenced and changed the regional economic and social environment, so

as to provide the basis environment for a new round of the industrial structure upgrade[5].

Huang Lucheng and Li Jiang, applied population ecology and evolutionary biology theory to technological innovation, put forward the concept of technology stocks and explains the level relationship between the technical community , technique population and single technology (technology integration body); patented technology stocks density, birth and death rates; age structure and structure of spatial distribution; The number of patent technique population basic growth law, at last use patented technology population evolution chart depicts the evolution of populations [6].

Zhao Jin and Liu Yanping recognized industry cluster with the characteristics of ecological communities, embedded in the enterprise ecosystem, among enterprises in the cluster business, in cluster firms populations, as well as between industry clusters and external environment, have multi-level synergy evolution, also used central cluster analysis methods to determine the stability of ecosystem [7].

2.3.2 Research on Industry and Patent

The quantity and quality of patent applications is one important indicator of measure a region independent innovation and IPR protection level. Patent analysis can analyzed strategy from national level, simulation specific emerging technologies, is valuable for technology development planning. Changes and evolutionary trends in the number of patents has a significant population characteristics, and with the same characters of emerging technologies and emerging new industries, patent development promote knowledge growth, knowledge growth promote economic growth, which is the main reason for emerging industries rapidly becoming countries leading industrial in knowledge economy era.

Fu Changqing, Yan Xianglin point out that patent information reflects the country's development goals and the use of enterprise technology strategy, integrated all patent information of enterprises in the country, can reflect the overall industrial development of the country and the corresponding state of technology. Through analysis and master on these patent information, compared with national situation, can obtained relatively clear understanding of national industrial development [8].

Shi Yizhong listed the number of patent applications and the correlation coefficient index of industries in the text, used patent applications for the main line of technology activities, used quantitative method revealed the objective relationship exists among different technologies, technology and industries, technology development and industrial policy [9]. Xiong Xiaoqin used international car manufacturers as the research object, introduced the patent map analysis method to the layout of vendors study, drawing patent map, draw on valuable conclusions and recommendations to automotive enterprise in China [10].

2.3.3 The Relationship between Industry and Technology

R. Phaal, E. O'Sullivan, C. Farrukh and D. Probert, who believe that technological revolution has stimulated the formation of new industries and business models appear. This paper presents a preliminary framework for mapping the emerging industry, based on the road map principles and 20 pilot case studies of the phenomenon and form observed, proposed a framework to draw new industry.Garud and Rappa proposed three levels of industry evolution: macro level, micro level and the level of

co-evolution [11]. Suarez made the three stages of emerging industries: from science to technology stage; from the technical to the application stage; from application to the market stage [12].

3 Prospects

In this paper, through mining new industries and related patented technology statistical data, use bibliometrics and scientific knowledge Atlas method of social network analysis to comprehensive analysis. Through literature research, theory and methods review, documentation and data mining, patent software mapping analysis, synergy analysis, and empirical analysis of these six chapters for further introduction on patents and new industries law of evolution and development.

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Combined Forecast for Wind Power Short-Term Load Based on Gray Neural Network Trained by Particle Swarm Optimization

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Abstract. The accurate wind power load forecasting has important significance for power production, power network safe operation and national economy. By comprehensively analyzes the advantages and disadvantages of various forecasting method, combining grey forecast and neural network training by particle swarm optimization, this paper establishes combined forecast model based on gray neural network trained by particle swarm optimization and applies it into short-term load forecasting of wind power. Empirical analysis shows that this method is science and practical.

Keywords: grey forecasting, particle swarm optimization, neural networks, wind power, load forecasting.

1 Introduction

The accurate power load forecasting has important significance for power production, power network safe operation and national economy [1-3]. For many years, the load forecast is always the hot, previous research in this field has made some achievements. The traditional forecasting methods, such as time sequence method, regression analysis and pattern recognition method, have their flaws [4, 5].

Grey forecasting method looks for system change rule through the correlation analysis and the original data generation treatment [6, 7]. Then generate strong regularity of data sequence, establish corresponding differential equation model and forecast future development trend. The traditional BP neural network has better nonlinear and self-learning ability. However it often appeared some disadvantages, such as easy oscillations, slow convergence speed and difficult to determine the number of hidden neurons. Particle swarm optimization is used to train neural network parameters to optimize network. Then the BP neural network parameters automatically optimize [8, 9]. Using the grey forecasting results as neural network's input value, the paper established combination forecast model for power short-term load based on gray neural network trained by particle swarm optimization, compiled language optimization calculation program based on Mat lab and VC++, and used the model into the short-term load forecasting system of wind power plant. The results show that this method can accelerate the network learning speed, improve load forecasting accuracy and strengthen BP generalization ability.

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2 Organization of the Text

Neural Network. The BP neural network is a kind of typical feed forward network. It is mainly composed by the input, hidden and output layer, each layer achieving complete connection. The input signal inputs from the input layer node, in turn passes through each hidden nodes, and then spreads to the output node.

The BP neural network learning process is composed of information positive dissemination and error back-propagation. In positive spread process, input data from the input layer is handled in hidden layer to output layer, and each layer neuron state affects only the next layer neurons state. If the expected output is not got in the output layer, reverse to back-propagation. At this time, error signal spreads to input from the output layer and adjusts weights between different layers and bias value between each neuron. With error signal smaller, after repeated iteration, the error is less than the allowable value and network training ends.

For any neuron i, its input and output relationship may be described as:

$$Y_i = f(\sum_{j=1}^{N} w_{ij} x_j + \theta_i) \tag{1}$$

connected to first i neurons, θ_i is the threshold value of neurons. f(x) is transfer function, generally taking Sigmoid function, such as:

$$f(x) = \frac{1}{1+e^{-x}} \tag{2}$$

Particle Swarm Optimization Algorithm. PSO is inspired by flock foraging behavior, and put forward to solve optimization problems.In a D dimension of target search space, N particles compose of a community, $x_i = (x_{i1}, x_{i2},\ldots, x_{id})$, namely the position of particle i in the D dimension of target search space. Each particle position x is a potential solutions. Put x into a target function, the adaptive value can be calculated. According to the size of adaptive value, x can be measured whether of optimal solution required. The "flying" speed of particle i is also a D dimension vector, noting for $v_i = (v_{i1}, v_{i2},..., v_{id})$. The optimal location searched by particles i through h iterations is $P_i = (P_{i1}, P_{i2},\ldots, P_{id})$, the optimal location searched by particle swarm is $P_{igd} = (P_{i1},P_{i2},\ldots,P_{id})$. The basic formula is as follows:

$$v_{id}^{(k+1)} = w_{il}^{(k)} + c_1 r_1^{(k)}(P_{id}^{(k)} - x_{id}^{(k)}) + c_2 r_2^{(k)}(P_{gd}^{(k)} - x_{id}^{(k)}), \; x_{id}^{(k+1)} = x_{id}^{(k)} + v_{id}^{(k+1)} \tag{3}$$

Where: c_1, c_2 are accelerated coefficients respectively adjust the most large step flying toward global best particles and the individual best particle. r_1, r_2 are random number between 0 and 1. Generally speaking, when the fitness value of optimum position particle swarm searched so far meet prespecified minimum fitness threshold, Algorithm iterative terminated.

3 Particle Swarm Optimization Neural Network

Optimization Strategy. Basic thoughts of PSO training BP neural network: Each weight and threshold of BP network is encoded to each component of particle position, that meaning each particle represents a specific BP network structure. The basic process of optimized algorithm: Random generation initial particle swarm. For each particle, each component of current position corresponding to the weight of BP network, form BP network. Using of samples, train composed BP network. Calculate mean-square error, $Err(x_i) = \frac{1}{N}\sum_{k=1}^{c}(y_{ik} - t_{ik})^2$, c is output terminal count, y_{ik} is k output value of particle i, t_{ik} is expectation. By Fitness function $f(x) = \frac{1}{1+Err}$, calculate the fitness value of each particle. According to the maximum principle, evaluate all individuals of particle swarm, find the best particle, compare the fitness of best particles with all fitness, and determine current Pbest and Gbest. So circulates, until fitness value meet the requirements or reach maximum iterating times, the algorithm end. The whole algorithm ended, the BP network to predict can be got.

Realization of PSO-FBP Hybrid Optimization Algorithm. Take grey forecast results as input data, determine neurons number of neural network's input, hidden and output layer. Determine particle swarm particle number n and dimension D. The dimension D of each particle equals the total number of weights and threshold, namely, each particle represents a group of weights and threshold. Then the position and velocity of particle swarm is respectively a n×D matrix. Particle swarm position matrix is representative of n sets of different weights and threshold. Randomly initialize the position and velocity matrix of particle swarm. For each particle corresponding neural network training, input training samples, calculated mean square error from training set as the fitness of particles. If the fitness of individual particle superiors the optimal position's, set optimal location as the particle position. Update speed and position of particles. If the iteration times greater than maximum iterating times or global optimal position is less than the fitness training session set fitness error, and otherwise, returned to continue to training. If the iteration number is greater than maximum iterating number or global optimal position fitness is less than set fitness error, training ends. Otherwise, return to continue to training. Local meticulous searches, meet the required accuracy of convergence. When network weight training is completed, take the optimal weight as BP network weight and forecast short-term power load.

The Empirical Analysis. In this paper, load data from1 July 2009 to 5 September 2009 of a wind power plant is taken as research object. Train the first 72, test the following 20, and forest the last 4. Because daily variation law and fluctuations are different in one day, the paper enrolls representative 14:00 this moment to do the forecast analysis. Input features include a quarter of an hour or two load, one day before or two load, the day before a week load, output feature being the moment load.

Firstly, the grey forecasting method is used to predict various input characteristic value, as BP neural network's input values. Then particle swarm optimization neural network is used to error analysis and forecast.

Figure 2 is iterative process of fitness function value in PSO - FBP hybrid calculation. At first function value is higher and rapid declining. Eighty times later, fitness value gradually stable and gradually close to zero. Fitness function is mean square error of actual output and target output, the smaller fitness value, the closer between real value and predictive value. So PSO - FBP network identification accuracy is high.

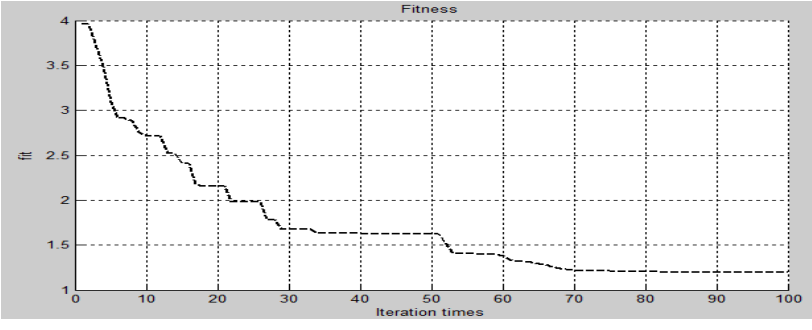

Fig. 2. Fitness function values change processes

In order to further evaluate PSO - FBP model, this paper adopts traditional grey prediction and the BP neural network model to forest power load, and compares the results of three methods. Figure 3 and figure 4 show predictive value relative error got by grey prediction, the BP neural network model and PSO - FBP network model. We can see from the graphs that prediction accuracy of PSO - FBP network model is higher than the gray prediction and traditional BP method. We can also see from this example that PSO-FBP neural network model is feasible and practical in power grid short-term load prediction.

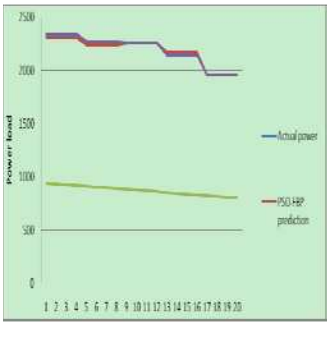

Fig. 3. The actual and forecasted power load

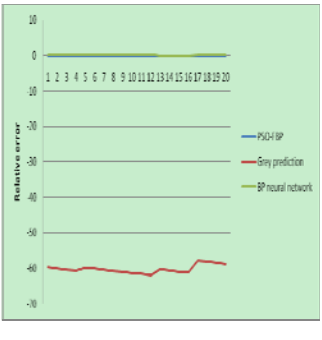

Fig. 4. The relative error of power load forecast

4 Summary

This paper analyzes the traditional power load forecasting methods and shortcomings, puts forward a combination forecast model for wind power short-term load based on gray neural network trained by particle swarm optimization. Calculate connection weight vectors and threshold of BP neural network by PSO algorithm, work out optimal particle right vector of each iteration and actual output value, finally reach fitness function of particle i. Train neural network by PSO - BP algorithm to realize the parameters optimization. Forecast input characteristics by grey method as BP neural network's input values. We can get the combination forecast model for power short-term load based on gray neural network trained by particle swarm optimization and apply to wind power load forecasting. Example analysis shows that: Compared to grey forecasting method and traditional BP algorithm, this model studied has advantages including fast convergence and high prediction precision, and overcomes shortcomings such as easily into local minimum points of BP neural network and traditional particle swarm optimization method. The method improves the BP network generalization ability. It has good prediction ability in the power system short-term load forecasting and improves prediction accuracy, which provides a scientific and effective method for wind short-term load forecasting in our country.

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The Research Based on the Integration of Logistics of Industrial Clusters

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Abstract. Based on the current development of industrial cluster, this paper puts forward the concept of industrial cluster logistics, and further analysis the problems of cluster logistics development, aiming at these problems, this paper points out the feasibility to carry out the strategy of integrated logistics as the solution to the problems, and puts forward several modes of the industrial integrated logistics cluster operation , and based on this building structural systems of integrated logistics industry cluster.

Keywords: Industry clusters, Integrated logistics, Cluster logistics, 3PL.

Introduction

The 21st century economic development is the era of industrial cluster domination. Industrial cluster is not only constitutes the basic space framework of economy in the world today, but also usually it is the competitiveness of a national or regional. Modern logistics fields also gradually obtain the attention of the domestic and foreign economic fields and academic. In the industrial cluster, high frequency of cluster enterprise business flow activities to the logistics capability put forward higher request. How to coordinate the industry cluster internal logistics operations, will directly or indirectly affect the competitive ability of industrial clusters and the development of regional economic.

1 The Related Elaboration about the Integration of Industrial Cluster and Integration of Logistics

Simply said, the industrial cluster is agglomeration phenomenon of enterprise with similar or related activities gather in certain areas. In the process of cluster formation follows the frequent complex link based on some value chain; it's often realized with logistics as a link. After the formation of industrial cluster, cluster enterprise divider between enterprises strengthens ceaselessly. Enterprises contact directionality is more and more strong, the development of cluster enterprise logistics toward the direction of local supply chain integration to derivate.

Logistics integration refers to production, supply and sales of raw materials, semi-finished products and finished goods combined into an organic whole, realize circulation and production of ties. In the industrial cluster is realized in upstream to

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downstream enterprise of logistics enterprise integration, realize the integration of from manufacturers, suppliers, distributors , retailers and other logistics service provider in the logistics level for the integration of the entire supply chain coordination, in order to provide the guarantee for the effective cohesion and operation of the whole supply chain.

2 The Relationship of Integrated Logistics and Industrial Analysis

2.1 Integration of Logistics Provide Bbasic Guarantee for the Development of Industrial Cluster

Industrial cluster as a big regional system, the collaboration of upstream associated enterprises and downstream associated enterprises produces a large number of logistics related activities to provide fertile soil for the development of logistics. The rapid development of industry cluster, also contributed to the improvement and integration of the system including logistics infrastructure network and logistics elements, provided the material basis for the regional logistics development.

The spatial aggregation and specialization of industrial clusters enhance the competitiveness of cluster enterprise, collective procurement; common sales, efficient information transfer and the clusters culture based on the common background, and greatly reduce costs and risks of the logistics transaction.

In short, the industrial cluster development is the platform and base of the logistics operation, logistics organic embedded each link of cluster supply chain is the guarantee of the development and evolution of industrial cluster.

3 The Necessity and Feasibility of Implementation Integrated Logistics Industry Cluster

3.1 The Necessity of Implementation of Integrated Logistics Industry Cluster

The development of industry clusters in our country exist some problems ,for example, logistics services are not perfect, the lack of cluster enterprise longitudinal cooperation and so on, which seriously affected the healthy operation of cluster economic, the measures of clusters of integrated logistics management operation implementation can effectively solve the problems. Besides industry cluster in the form of integration of logistics operation can promote the development of cluster economic and the process of cluster economic integration.

3.2 The Feasibility of the Implementation of Integrated Logistics on the Industrial Cluster Environment

From the theory and the realistic development of industrial cluster, we can summarize the inherent attributes of industrial cluster: First, a cluster has the feature of geographic concentration; Second, the industry body form cluster which belongs to a certain special industrial field, it's interrelated; Third, industrial cluster have strong local relation; Forth, among the cluster enterprises exist some development network.

The cluster inherent properties and the application of logistics information technology and supply chain management method indicate the possibility of implementation the integrated logistics in the industry cluster. .

4 The Construction of Cluster Integrated Logistics System

The integration Logistics is the inevitable result that logistics develop to the mature stage. The building needs mutual combination of various factors. Specific for a industrial cluster, it need take actions that suit that circumstances according to the type of industrial cluster, the development model, members of the organization structure, logistics development, customer types and demand factors

4.1 The Construction Factor of Cluster Integrated Logistics

From the theory and the realistic development of industrial cluster, we can summarize the inherent attributes of industrial cluster: First, a cluster has the feature of geographic concentration; Second, the industry body form cluster which belongs to a certain special industrial field, it's interrelated; Third, industrial cluster have strong local relation; Forth, among the cluster enterprises exist some development network. The cluster inherent properties and the application of logistics information technology and supply chain management method indicate the possibility of implementation the integrated logistics in the industry cluster.

4.2 The Operation Modes of Cluster Integrated Logistics

Industry cluster logistics is leaded by the small and medium-sized enterprises logistics in essence. a cluster is usually one or a handful of core enterprise. The mostly rest is small and medium-sized enterprises to service or produce parts for it, logistics activities scale of these enterprise is small, logistics activity frequently and logistics direction single, and the logistics development has formed the scale hardly, and the management thoughts of a few small and medium-sized enterprise managers fall behind, among enterprises there are conflicts of interest and competing, difficulty in forming the integrated logistics development. So achieving clustering integrated logistics, within a cluster of small and medium-sized enterprises logistics all large unified, and to form integrated logistics are priority of building cluster integrated logistics.

4.2.1 The Single Outsourcing Logistics Model

A single logistics outsourcing model refers to the small and medium-sized enterprises within the industrial clusters with individual enterprise for unit by signing contracts, delivering logistics business to the third party logistics to operate on the certain period, the third party logistics enterprise with its professional, contracting and information sharing advantages for small and medium-sized enterprises provides logistics services to meet their requirements.

4.2.2 Established 3PL Cooperation Mode

The 3PL cooperation mode, namely the multiple enterprise with similar logistic business cooperate with each other to crosswise integrate, through many a little makes a mickle, to integrate between own logistics department and multiple enterprise logistics departments, or single or multiple enterprise logistics department with a third-party logistics enterprises established space integration, to build the third party logistics enterprise as a specialized enterprise to service for the cluster, by joint investment or cooperation.

4.2.3 Logistics Overall Outsourcing Model

This model is social logistics development to a higher degree of a pattern, on condition that logistics developed to a higher degree , small and medium-sized enterprises within a cluster, combined, outsourced his own logistics business overall, delivery to the third party logistics enterprise specializing in all the business, the enterprises are focused on its core business.

4.2.4 Logistics Park/Logistics Center Unified Operation Management Mode

The construction of logistics park provides the foundation to structure of this kind of mode, logistics park amass some logistics enterprise of different function and logistics facilities of different types, small and medium-sized enterprises in a cluster deliver itself all logistics business to logistics park, logistics park provide logistics services of integration to the enterprise with its scale, specialization, function .

4.3 The Analysis of Integrated Logistics System Structure within a Cluster

The above several modes are according to different types of industrial cluster to construct the logistics of different patterns. Though each mode has certain difference in operation, but it is inter-link and interconnected, it is smile about inside structural system.

As follows in figure 1, it can clearly show the internal structure of integrated logistics system (this chart for example with a single type, logistics only activates in a single supply chain). Oval in figure said the indispensable platforms of integrated logistics building: faith network platform and logistics information platform. This is the prerequisite to realize the integration of logistics. Within a cluster enterprise general can be divided into suppliers, manufacturers and distributors, they have a lot of logistics information and logistics activities, logistics information will be Shared by platform to transmit between logistics enterprises effectively, the logistics activity be operated integrated by 3PL, logistics park or logistics center, responsible for the goods has been passed to the hand from suppliers to customers, and by recycling logistics, retuned logistics has been delivered the problems of goods to marketers, producers, until supplier, realized the integrated operation by forward and reverse logistics, forming logistics chain that attached to supply chain in a cluster. Service institution provide the necessary basic services to ensure logistics information transmission effectively, logistics activity operation effective, integrated logistics culture root planted, logistics facilities or logistics equipment construction and maintenance. Remarks: S: suppliers CE: core enterprise D: distributors C:customer

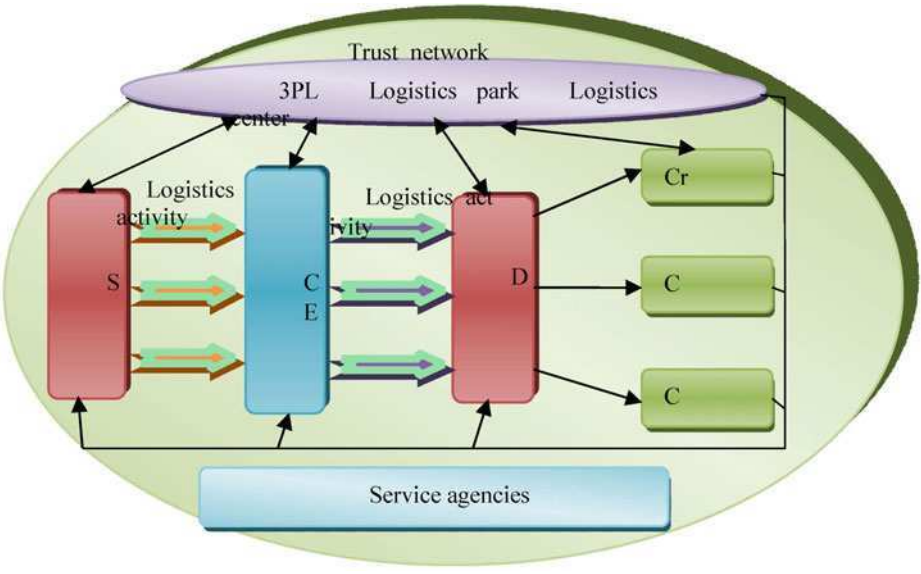

Fig. 1. Integrated logistics system structure in a cluster

5 Summary

The current situation of industrial clusters in China, the development of integrated logistics is far from mature stage, the concept between enterprises within a cluster of win-win haven't reach the degree to develop modern logistics, so the development and in-depth of integrated logistics not only need the progress of management concept between enterprise, but also need maturity of the whole society logistic environment. But with the further accumulation and amplification of the industry cluster and the further development of social logistics, integration of industrial cluster internal logistics will be mature soon.

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The Research on the Demand Model of After-Sales Service Supply Chain

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Abstract. The market competition has got into the era of winning service, the status and role of after-sales service supply chain are becoming increasingly apparent .In this paper , we introduce the definition of after-sales service supply chain and obtain its demand model through the analysis of occurrence mechanism, characteristics and the influence factors; we do hope to provide reference to other relevant research on after-sales service supply chain.

Keywords: After-sales Service Supply Chain, Occurrence Mechanisms, Demand Factors, Demand Model.

Introduction

After-sales service is an important method of transmitting service value to users and improving customer loyalty [1]. With the introduction of advanced manufacturing technology and scientific management methods, the extent to which internal values of the enterprises, whose internal managements are rather standard, can be promoted are relatively limitted. In this paper the After-sale service supply chain is studied, not only to enrich supply chain management theory, but to be of guiding significance for the development of enterprises, which has certain theoretical significance and practical values.

1 The Connotation of After-Sales Service Supply Chain

The foreign studies involving After-sales service supply chain theory were started, from the earliest 1960s, by the spare part inventory problem. It was until 1980s that the references focused mostly on after-sales service resources reserve, namely service spare parts. In 2006, Kim and Cohen officially proposed their concept of After-sales Service Supply Chain[3], and some other scholars used "Service Parts Supply Chain".

This paper argues that after-sales service supply chain refers to a whole function nets chain structure which combines supplier, manufacturer and final consumer consisting of enterprise through the control of information flow, logistics, cash flow, starting from distributing products, managing the spare parts and maintenance

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products, to after-sales service supplier delivering service to the hands of customers. After-sales service supply chain mainly researches demand mode, resource allocation, predicting users' demand for its services and meeting the needs of different users, etc.

2 The Occurrence Mechanism of After-Sales Service Supply Chain

2.1 Competition Focus Changes

As the times progress, enterprise has been the mainstay of market competition, while competition object is constantly changing. The market competition is no longer a single competition among enterprises, but the competition between supply chains, and therefore the after-sale service supply chain proposed live up to requirements of object changes in competition.

2.2 Total Quality Management Theory Consummation

Product quality eventually depends on the product quality and after-sales service. The increasingly furious market competition leads to a comprehensive quality management thoughts transforming into the after-sales service management. To some extent, after-sales service supply chain was put forward in the total quality management theory consummation.

2.3 Customer Demand Changes

Product after-sale service stage is the purpose of production as well as the reflection (embodiment) of product value and use value. After-sales service is the precondition for the product to realize its value and customers have gradually turned to focus on products' after-sales service.

3 After-Sales Service Supply Chain Characteristics

After-sales service supply chain doesn't have only generality of all service supply chain, but also have its own characteristics and mainly performed in the following aspects: Reverse characteristics, Demand uncertainty ,Service passivity, Service continuity, Content complexity.

4 Demand Factors Analysis Influenced After-Sales Service Supply Chain

On one hand, enterprise hope through perfect the after-sale service supply chain to solve the problem that product encounter in the process of realizing its value and to enhance the competitive advantage of enterprises; on the other hand, consumers expect enterprises to improve the level of meeting consumer needs with perfected after-sale service system. In order to make a better understanding of the demand mode

of after-sales service supply chain, this paper focuses on analyzing the influence factors of the demand.

4.1 Production Aspect

First, product quality defects caused in design and manufacturing stages will be a fatal attack to enterprises, resulting in recalling product which is the most economic severe losses activity among provided after-sales service. Second, different product type determines the key use people and also affect choosing different after-sales service suppliers.

4.2 Use Environmental Aspect

For different users,it has different using environment. Operating environment and operating frequency also have great different influence on different users. Which generally has an effect on after-sales service demands by affectting product physical abrasion. In certain cases this difference has a more significant effect on the demand of after-sales service.

4.3 After-Sales Service Provider Aspect

After-sales service suppliers mainly adopt two forms, enterprise self-built and outsource it to agent. First, the enterprise provides after-sales service itself. Enterprise has a very professional level of its own products in terms of whether structure or manufacturing technology. Second, the agent offer after-sale service. Some enterprise in order to enhance their core competitiveness will choose outsourcing service.

4.4 Relationship of Demand Source and Factors

After-sales service demand mainly comes from three aspects, products quality defect, breakdown maintenance and check and repair. The three aspects and demand factors are closely linked, as is shown in figure 4. after-sales service caused by poduct itself mainly involving in product defects at design and manufacturing stages. At this point, demand strength is determined by product type and product function importance. Product breakdown maintenance is usually determined by after-sales supplier service ability. The products daily maintenance mainly determined by product using environment and the degree of its demand strength ups to operating personnel quality, operating environment and operating frequency.

5 The Demand Model of After-Sales Service Supply Chain

Demand mode is determined by customer needs. After-sales service supply chain's unique demand source requires their unique demand model, whose demand originates from a time when the product functional obstacle occurs, for the product is put together by various spare parts, from this perspective, its product fault period is in accord with "tub curve" theory [10]. Therefore demand mode of after-sales service supply chain is jointly determined by the three aspects. In fault early obstacle period,

product factors in dominant position, , demand derives from product quality, which determines the type of the detection leading decision models, the relations between three demand modes and deciding factors are shown in chart 1. Three models concrete analysis is as follows.

5.1 Detection Leading Demand Mode

Detection leading demand mode refers to in the product initial operation period, users, to reduce possibilities of product failure caused by quality problems, produce a strict test on product quality dominant demand mode. This period of time is very short. According to complexity, durability and other product characteristics, it is generally 7 to 15 days or so. In running-in period, elements of product are dominant factors. Failures are often caused by product defects. once failure occurs, it is to be a sign that the product will be recalled by users. On one hand, from the user's perspective, product recall will directly responsible for its lack of demand for product function and will indirectly effect on enterprise credit; On the other hand, from the enterprises' point of view, product recalls will have serious effects on economy and image of enterprises. Therefore, this period reflects users' strong demand characteristics of testing and controlling over the manufacturer's product quality.

5.2 Guide Leading Demand Mode

Guide leading demand mode refers to in the normal operation stage, users to prolong the normal running-in period, producing to guide the users themselves to learn to operate inspection and maintenance dominant demand mode. This is a priod when product failure occasionally occurs, for the failure is caused by imroer maintenance, false operations and other environmental factors. The source demand of after-sales service is mainly daily repair work, to increase product availability, delay wear. Then product many in occasional fault period, the fault is because of bad maintenance and operating error caused by the use of environmental factors such as the demand of after-sales service, the source is mainly daily repair work, to increase product availability, delay wear. This period by the length is the normal life decision products. The user needs to fully made use of expression in the use of the products and prolong the service life of value in use process, and learning to the maintenance and maintenance knowledge, accept after-sales service supplier guidance behavior.

5.3 Service Leading Demand Mode

Service leading demand mode refers to in the failure period, users to demand for functional restoration of products resulting from the dominant role of after-sales service dominant demand mode. During this period, the demand source from the products functional restoration is the breakdown maintenance, while the user's demand is mainly after-sales service product maintenance services. Because the product's long-term use, various spare parts have received a lot of wear, product failure rates rising sharply. Then it is after-sales service supplier factors that dominate. The after-sales service supplier service capability is the main influencing factors on its demand.

It's worth noticing that each kind of mode needs source, demand factors and demand strength. Each is not completely isolated, but connected to determine its demand mode, so they are mutual infiltration and closely linked.6 Conclusion.

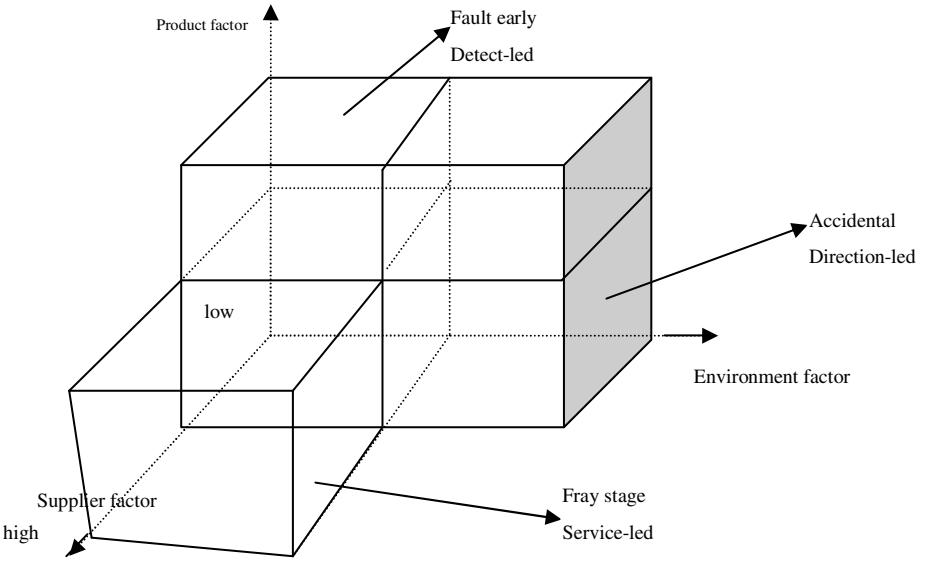

Chart 1. Fault-stage-based after-sales service supply chain demand mode&factor relationship three-dimensional chart

6 Conclusion

After-sales service supply chain management is an integral part of enterprises' supply chain management activities. The proposition of the concept of After-sales service supply chain is adapted to the transformation of competitions between enterprises, virtually the competitions between supply chains, and is also the outcomes of development of the supply chain theory at present phase. Development and perfection of After-sales service supply chain theory necessarily serve as guidance for enterprises, economic and social development.

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2. This paper formally approved for social science development research topic "The investigation and research on logistics supply and demand situation in Hebei NO.201005014" in Hebei province.

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Brief Introduction of Calorimetry

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Abstract. Calorimetry is an important method of biological analysis. Calorimetry is widely used in chemical reaction and the measuring method of biochemical reactions. The main advantage of calorimetry is that it needn't sophisticated equipment, and it can measure tiny energy changes. As a kind of measurement methods, calorimetry can be widely used in life science, clinical medicine, pharmacology, biotechnology, ecology, environmental science and many other areas. This page briefly introduces the measuring principle of calorimetry, and the method of calorimetry. At last, this page prospects the quantity method and the development direction of calorimetry.

Keywords: calorimetry, fermentation, heat balance.

1 Introduction

Chemical reactions and biochemical reactions are accompanied by a series of thermal effects, and these thermal effects have some relevance with changes between the reactants. The subject that is based on measurements of the rate of the temperature changes or the heat changes of chemical, biochemical and biological processes to determine component contents is called Analytical Calorimetry, and the work using this way of heat method to deal with the problem is called Calorimetric Analysis. [1]

As we all know, the heat divergence is a widespread biological phenomenon, and measuring the rate of heat production of biological processes has become a powerful tool. Because there are only a few sensors in the laboratory, and heat method can be used in the industry without complex equipments, so calorimetry should be rapid development in the future. In the past fifteen years, small-scale calorimeter has made great progress in the laboratory. It has a great role is that it can be used in the detection and the control of biological processes. [2]

2 The Value of Calorimetry

Many chemical reaction process is exothermic process, the reaction calorimetry is an effective way through measuring the relevant parameters of the heat balance (such as temperature, flow rate) to online calculate the heat of reactions. Through the heat of reaction can further calculate the reaction rate, conversion rate and other process

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parameters. The reaction of the state can be observed for the control of the reactor, optimization of the basic conditions. [3]

I. Marison et al [4] think that with accuracy improving, calorimetry can also be applied to heat production even more the laboratory system's heats smaller than heats of mixing, pH control, and gas's effect, which involves animal cell culture, anaerobic digestion, microbial or weak endothermic reaction, and it's heat between 50 ~ 300mW / L.

Now the amount of biological processes used in the thermal system is mainly divided into two categories: one is the micro-calorimeter; one is the large or medium-sized calorimeter. The former's volume general is in the 1-100ml, heat production between 10-200W. The latter is similar as the standard laboratory reactor, it's minimum volume about 1L, and generally require less accuracy.

3 The Application of Calorimetry

Calorimetry is an important bio-thermo-chemical method for all levels of biological systems: molecules, organelles, tissues and organs, individuals and ecosystems and so on. Microcalorimetry technology as a high sensitivity and automation of analytical techniques [5,6] has been widely used in life science, clinical medicine, pharmacology, biotechnology [7,8], ecology, environmental science and many other areas. Application of microcalorimetry has been carried out in many areas of biology, extensive research and has made important progress in many areas.

Ho Ji uses LKB-2277 bioactivity detection system to study the influence factors of the thermal spectrum of bacterial growth, and such research get information by analysis the thermal spectrum of bacterial growth. He found that measure temperature, measurement method and the medium had a significant effect on the thermal spectrum.

BHA van Kleeff used calorimetry in the batch fermentation of Saccharomyces cerevisiae CBS 8066 to control the glucose's feeding in the cultivation liquid. In actual production, feed rate is known. In the feed, bending curve shows that the exponential glucose feeding rate depends on the yeast growth rate; smooth curves indicate the steady growth of glucose depends on the characteristics of the fermentation tank (oxygen delivery and cooling systems). If the fermentation of glucose concentration increases more than the theoretical value, it had to make a correction. However, the concentration of glucose in the industrial production line can not be determined, therefore, the excess glucose testing is necessary to indirectly through other features, such as the formation of ethanol or high respiratory quotient, these two features are easily detected in the fermentation tank emissions . However, due to the transfer process, detection is always delayed. Because the detection lag in time, so the gas analysis can only be used to slow the control conditions. [9]

T.W.Randolph integrates calorimetry with heat balance and enthalpy balance, and uses it in controlling the feed of fermentation to get quantitative information about the fluid. Feed with its improved algorithm can get high cell yield and reduces the production of alcohol by-products. In the particular feed that it only has carbon source without nitrogen source, the biomass calculated by the fermentation heat is correspond with the biomass measured. When the control algorithm in the coefficient

is less than the maximum specific growth rate, even if the emergency event occurs in the feed, the control can be stable. [10]

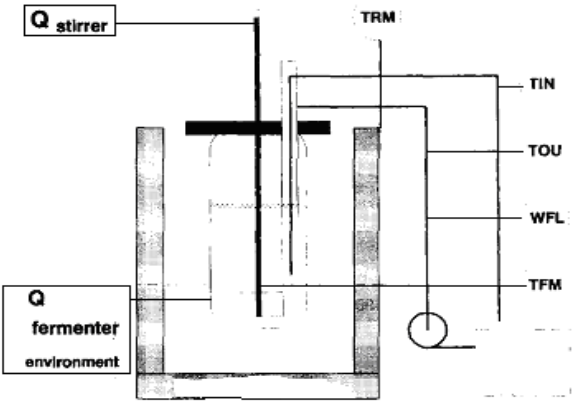

Fig. 1. Diagram of the fermentation tank in the intermittent fermentation

Online measurement of reaction heat is expensive, so in most microbiology laboratories, there aren't these possess inside. Therefore, Bastiaan HA van Kleeff. found a method applied in the laboratory fermenter inside, and it can measure just a little heat changes. In this approach, all the heat passed in and out of fermentation parameters were measured. These measurements combined with the basic knowledge of the heat flow and equipment characteristic parameters can make online measured for heat of the fermentation reaction. There are tubular heat exchangers (heat pipes) in the fermentation reaction to control the tube temperature of the solution. It can measure stream flow of liquid flowing in the heat pipe, it's temperature, and the temperature of the fermentation tank. [11]

BHA van Kleeff [9] makes Saccharomyces cerevisiae CBS 8066 in intermittent fermentation as an example. In order to match the motion in the feed of glucose (due to changes in feed composition or the pump fails), a fast control method is necessary. Fermentation is carried out based on the measurement of heat, and heat measurements only measure the temperature, so they can respond quickly, completely independent on the gas analysis.

4 The Principles and Methods of Calorimetry

A well-known difficult in heat measurement is how to measure without depending on the heat generated by biological response (such as mixing heat). The way to solve this difficulty (zero offset) is not through the control channels on the measurement of heat itself, but on the time differential on it.

Figure 1, BHA van Kleeff et al [9] to establish the heat balance equation for the fermentation tank

$$Bioheat = \frac{dTFM}{dt} \bullet HeatCapacity - (TIN - TOU) \bullet WFL - Q_{Background} \quad (1)$$

In this formula, Bioheat is the fermentation heat, $dTFM / dt$ is the temperature change, $HeatCapacity$ is the specific heat of fermentation tanks, TIN is the inlet temperature, TOU is the outlet temperature, WFL is the multiplied of liquid flow and the specific heat, $Q_{Background}$ is outside shed heat.

For such a system, as shown in Figure 2, the heat balance of industrial reactor as follows:

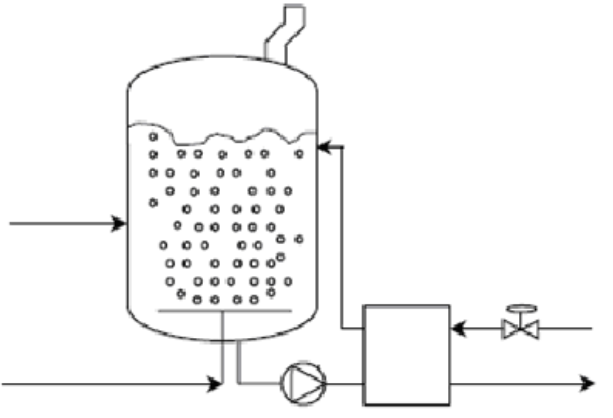

Fig. 2. Mustafa Türker's Industrial reactor

$$\begin{aligned} \rho c_{p,\mathrm{b}} \frac{\mathrm{d}(VT)}{\mathrm{d}t} &= q_{\mathrm{feed}} + q_{\mathrm{metabolic}} + q_{\mathrm{mechanic}} + q_{\mathrm{exchanger}} \\ &\quad + q_{\mathrm{surface}} + q_{\mathrm{evaporation}} + q_{\mathrm{radiation}} \\ &\quad + q_{\mathrm{acid}} + q_{\mathrm{CO_2}} \end{aligned} \quad (2)$$

The accumulation of the heat is in the left of the equation and in the right of the equation are feed heat, fermentation heat, mechanical agitation heat, exchange heat, heat outlet in air, liquid radiant heat, acid counteract heat and heat outlet in CO_2.

Cooney and his collaborators have been getting a new method in laboratory reactor, which they called "discontinuous method (Discontinuous method) ". In this method, the cooling system must be stopped from time to time, so that the temperature of the solution in the medium increased. Establish the total energy conservation equation of the bioreactor to get the temperature - time curve, and obtained the rate of energy production from the slope. [12]

In online calorimetry experiments, the baseline is very important to get the correct amount of heat value. Generally speaking, when the initial baseline and the final baseline value is not the same time, it usually re-draws a baseline after the end of the experiment, and assuming the change of the base linear is linear relationship or a curve of the complex equation. However, the change of the baseline will occur at any time in experiments. An ideal experiment is that online measurement of heat and online baseline correcting at the same time.

5 Summary

Current the development of calorimetry is still very fast, but because of the difficulty of the experiment, published experimental data is inadequate. Thus for industrial-scale also need to do a lot of calorimetry data to support it, and it need to do a lot of improvements and optimizations to make it widely applied.

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A Study of the Website Performance of Xiamen Star Grade Hotels Based on the EMICA Model

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Abstract. Interactivity is the most dominant character which distinguishes the on-line marketing from the traditional marketing. It's a very important factor to determine the validity of the hotels' on-line marketing. This paper uses the extended Model of Internet Commerce Adoption (EMICA) to evaluate the website performance of star grade hotels in Xiamen. The model highlights the utility of using interactivity to measure the relative maturity of hotel websites. The results showed that star grade hotels in Xiamen were not utilizing the Internet to its full potential. Suggestions and recommendations are also provided based on the findings of this research.

Keywords: EMICA model, On-line Marketing, Interactivity, Xiamen Star Grade Hotel.

1 Introduction

According to iResearch, in 2010 the market scale of Chinese on-line travel booking is 6.16 billion RMB, increased by 58.4% compared with the 3.89 billion RMB in 2009 over the same period of time. The trend of increasing in the future remains. Hotels must own an excellent website if they want to make profit in an on-line booking market, and how to evaluate a website is the issue that needs to be explored.

"Interactivity" refers to the direct two-way communication between business to costumer (B2C), or business to business (B2B). With the increasing popularity of different, personalized and perceptual consumption, interactive marketing attracts costumers to actively participate in the whole production process. This not only enables enterprises to gain economies of scale in mass production, but also enables their products to meet unique needs of individual customers and in the meanwhile, to meet popular and personalized needs, and thus maximizes customers' degree of satisfaction from their products.

Hotel industry in Xiamen is representative and highly developed. Taking interactivity as the starting point, this paper employs a relatively mature model-EMICA (The Extended Model of Internet Commerce Adoption) model to assess the interactivity of Xiamen star hotels' websites, so as to have a comprehensive grasp of their development and provide some useful information for their future development.

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2 Methodology

2.1 Sampling Procedure

For the purpose of this study, the star-rated hotels published on Jan. fourth, 2001 in Xiamen official tourism bureau website are used as sampling frame. Out of the 71 star grade hotels, 32 are high level (above four stars) and 39 middle- and-low level (below three stars). Among the 34 with hotel websites, 24 are the high level ones, while the others in the middle-and-low end. We select a sample of 10 hotel websites in the high level sector and 10 in the middle-and-low sector (mainly three stars).

2.2 Instrument—EMICA Model

Commercial website development typically begins simply and evolves over time with the addition more functionality and complexity as firms gain experience with Internet technologies. From the perspective of technology, physical networks and hardware structure are improved due to the rapid information technology advancement. From the perspective of commercial application, the incessant development in applications has given rise to the sophistication of operation system and application software. Those improvements are evidenced by its transition from a static web page to a dynamic information system and from simple and limited interactivity to complex and personalized one.

The EMICA (The Extended Model of Commerce Adoption) is based on this concept, measuring the development of the website by its interactivity. It consists of three stages, incorporating three levels of website development--web-based promotion, provision of information and services, and transaction processing.

Promotion is the initial stage of web development, offering the company's basic information on line, which is like a self statement of the company. The second stage sees the improvement of interactivity, within which three levels are identified. More detailed information about the products and services as well as the links to other websites are provided for the consumers. Besides, it is characterized with on-line help for users, including interactive maps, traffic maps and site-search engines etc. In addition, the interactivity is completed with services comprising of FAQs, multimedia applications, discussion forum, and email newsletter etc. The third stage identified in the EMICA model is where the website has a functional maturity which permits on-line transactions. This stage enables companies to provide service such as online order, follow-up, online payment and interactivity with suppliers.

Doolin et al identified 14 Levels in assessing the interactivity of tourism organization websites. Given that hotels and travel agencies belong to tourism industry and share a similar operation principle, we adopt the modified Levels put forward by Derong Lin et al in assessing the travel agencies in China to evaluate the hotel websites. According to the model, a site needed to display functionality up to at least Level 4 to be classified as Stage 2 of EMICA. Sites reaching level7 functionality were classified as Stage 2, Layer 2, and those reaching Level 10 functionality were classified as Stage 2, Layer 3. To be classified as Stage 3 of EMICA, a site required functionality at Level 12. The classification of the 13 Levels of the development of sites are shown in Table 1.

Table 1. The classification of the 13 Levels of the development of sites

Stage 3-processing		Target 13:Services after payment
		Target 12:Secure online payment
Stage 2 -provision	Layer 3-high interactivity	Target11: Advanced value-added features (Order form inquiry multi-language support, member lands, multimedia, chat rooms and discussion forums)
		Target 10: Online bookings
	Layer 2-medium interactivity	Target 9: Searchable databases for hotel rooms under different inquiry condition
		Target 8: Online customer support (FAQs, site map, site-search engine)
		Target7: Interactive value-added features (Currency Converter, interactive maps, downloadable materials, special offers, member's privileges, guest books)
	Layer 1-low interactivity	Target 6: Multiple value-added features (key facts, maps, location, news, photo gallery, promotion)
		Target 5: Product catalogs (hotel rooms, dining, meeting, shopping, fitness, entertainment)
		Target 4: Systematic links to further information
Stage1 -promotion	Layer 2—rich information	Target 3: Description for the hotel
		Target 2: Images
	Layer 1-basic information	Target 1: Contact detail

According to Derong LIN, Zongqing ZHOU, Xiaolin Guo (2009).

2.3 Data Analysis

Evaluation results of 20 Xiamen hotel websites according to EMICA model are as Table 2:

Table 2. Evaluating current situation of interactivity of the 20 Xiamen star grade hotels

The layer and stage of the EMICA model	The number of sites	Percentage
Stage 3	2	10
Stage 2, Layer 3	9	45
Stage 2, Layer 2	5	25
Stage 2, Layer 1	3	15
Stage 1, Layer 2	1	5
Stage 1, Layer 1	0	0
total	20	100

Respective evaluation data of top-end hotels and low and middle end ones are in Table 2 and 3:

Table 3. Evaluating current situation of interactivity of the 10 Xiamen high star hotels

The layer and stage of the EMICA model	The number of sites	Percentage
Stage 3	2	20
Stage 2, Layer 3	7	70
Stage 2, Layer 2	1	10
Stage 2, Layer 1	0	0
Stage 1, Layer 2	0	0
Stage 1, Layer 1	0	0
total	10	100

Table 4. Evaluating current situation of interactivity of the 10 Xiamen mid-and low-star hotels

The layer and stage of the EMICA model	The number of sites	Percentage
Stage 3	0	0
Stage 2, Layer 3	2	20
Stage 2, Layer 2	4	40
Stage 2, Layer 1	3	30
Stage 1, Layer 2	1	10
Stage 1, Layer 1	0	0
total	10	100

3 Conclusion

3.1 Data Analysis

According to figure 2-1, only 5% of the hotel websites stay in Stage 1 (the stage of company promotion). The majority of the remaining websites are in Stage 2 (the stage of providing products and services). And a small number of the hotel websites reach Stage 3 (the stage of transaction). Among those hotel websites in Stage 2, the majority reach Layer 3 (high interactivity) or Layer 2 (medium interactivity).

85% of the hotel websites stay in Stage 2. Among these 17 websites, 15 sites offer online booking (Index 10) and the ratio is 88.24% (15/17). 6 out of 15 websites do not reach the third level. The reason is that they lack Level 9, or Level 8, 9, or Level 7, 8, 9. But they all reach Level 1-6, and up to 94.12% of the websites reach these 6 levels.

Comparing the data of luxury hotels with that of middle-and-low grade ones (see Figure 2-2 and Figure 2-3), we draw the conclusion that the interactivity of luxury hotel websites is higher. All the websites of luxury hotels reach Layer 2 of Stage 2 (medium interactivity), and the ratio is 100%; while websites that reach Stage 3 are still rare. As for the middle-and-low grade hotel websites, they mainly stay in the first or second layer in Stage 2, even in Stage 1; no sites reach Stage 3.

In summary, the interactivity of hotel network marketing in Xiamen is medium or lower on the whole. There is a big gap between luxury hotels and middle-and-low grade ones.

3.2 Analyzing the Function of the Websites

(1) The hotel websites mainly focus on advertisement, but now they begin to pay attention to the interaction with consumers.

Many websites still emphasize hotel information and its service. Instead of encouraging the consumers and potential consumers to check in and increasing their buying motives, this kind of websites can only help consumers know the hotels better.

FAQS (Frequently Asked Questions) has long been considered as a good way to communicate with the customers. Among these 20 hotel websites, none provides such a list. But 12 websites (60%) to some degree reach Level 8 (online customer service) in that they provide the email addresses (they promise to reply as soon as possible) of some departments (like the house keeping department), site maps, website search engines, etc. E-mail contact helps to learn consumers' consumption tendency and habits.

(2) The websites mainly contain static information, but they also provide dynamic information through site links.

From the perspective of website contents, there are two types of information. One is static information, the other is dynamic information. Static information includes general knowledge, hotel business, city maps, etc; this kind of information does not need frequent updates. While dynamic information includes room price, exchange rate, weather forecast, etc; and needs to be updated frequently. Currently, the established hotel websites mainly focus on static and one-sided introduction of hotel business. Many hotels' information of discount promotions has not been updated for a long time.

However, a number of the hotel websites provide dynamic information through hyperlinks. For instance, "exchange rate" is linked to the webpage of related banks; "weather forecast" is linked to the webpage of local weather bureau; and "local scenic spot" is linked to related tourism websites. This is a good experiment.

(3) The technique of website expression is too simple.

Multimedia is a major feature of network marketing. The network can give the audiences more sensory experiences than other means of mass media. Although some hotels have already realized the value of multimedia in network marketing, their websites still only provide photos of hotel rooms and interior design, or small flash animations. They seldom offer services like video images, audio introduction and virtual visit. Besides, none of the 20 hotel websites has online download services, which is inconvenient for consumers to gain hotel information.

(4) No website search engines.

Only 5 out of the 20 hotel websites (25%) provide website search engines. In the absence of the search engines, it is difficult for consumers to find what they need among a wealth of information.

(5) Luxury hotels do not provide multi-language support.

Surveys show that 8 hotel websites provide bilingual (Chinese and English) web pages. But for luxury hotels, it is far from enough. Since Xiamen receives a large number of tourists from Japan and Korean each year, it is also very important to provide Japanese, Korean web pages. Luxury hotels should meet the challenge of globalization.

(6) It is difficult for hotel websites to reach Stage 3.

At present, only 2 hotels in Xiamen reach Stage 3 (the stage of transaction). Though these two websites meet the requirement of online payment (Level 12), they do not provide after-sale services (Level 13). This illustrates that hotels in Xiamen still lacks highly interactive websites.

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Conceptual Design of a Service Level Agreement Management System

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Abstract. Due to customer demand, market competition and technological development of multiple background, SLA (Service Level Agreement) is playing more and more important roles in telecommunications industry. In this paper, we give an overall system implementation method, architecture, technology roadmap and outline design of each module to guide the detailed design and development. This work can be used by the implementation of SLA system and referred by related researched in service management domain.

Keywords: service level agreement, information management, business management.

1 Introduction

In china, the reform of the telecommunications industry will put telecommunication companies into the global market, and the companies must face a more competitive environment [1]. In several forms of competition, such as product competition, quality competition, price competition, and many other means of competition, quality competition has appeared increasingly important. Due to customer demand, market competition and technological development of multiple background, SLA (Service Level Agreement, Service Level Agreement) came into being. SLA is a service supporting the two sides negotiating through a formal agreement [2,3], it agreed quality of service targets and service responsibilities of both parties is to serve the parties to achieve and maintain a particular quality of service and consultation to develop a set of related goals and processes.

In this paper, we use EAI/BPM technology enables the implementation of the traditional complex SLA process becomes simple and easy to modify. Therefore, both the current development of SLA system can be technically advanced, but also to the way ahead in the implementation of industry competitors. The project was developed end-to-end SLA-based service quality management system. The system includes the core functionality SLA, SLA-related business process integration of two major parts. Due to space limitations, this paper will concentrate on the core functions of SLA implementation.

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2 The Overall Goal of SLA System

The project's overall function is to achieve end to end SLA-based service quality management system. In order to achieve the end to end management system, we apply BPM approaches to business process integration. At present, most operators of SLA processing module has not yet realized, and thus unable to process integration. Therefore, this project will use the JAVA platform, first to achieve SLA management system applications. The application system will have the following characteristics:

(1) Easy to be integrated: SLA implementation involves many aspects of OSS systems, regardless of external data collection or send messages to other systems, specific to different operators, all will be greatly different. System implementation depends on the construction according to the specific situation of operators designed to OSS implementation plan, so the system must be fully adjustable, easy integration and modification.

(2) Conform to standard. The project is one of a lot of OSS applications and processes. For existing systems with the operator to achieve maximum integration, and long-term information technology in business process improvements and improved, it should follow a uniform standard. The TMF's NGOSS standards are referred in the business development.

(3) Both economy and feasibility are both considered.

3 Information Model

In this section, we build the information model of SLA system by UML class diagram. Entities participating in an agreement take on a number of roles. These roles include: 1)Agreement owners, those entities who have entered into an agreement, such as a customer and a service provider; 2) Agreement contacts; those entities who

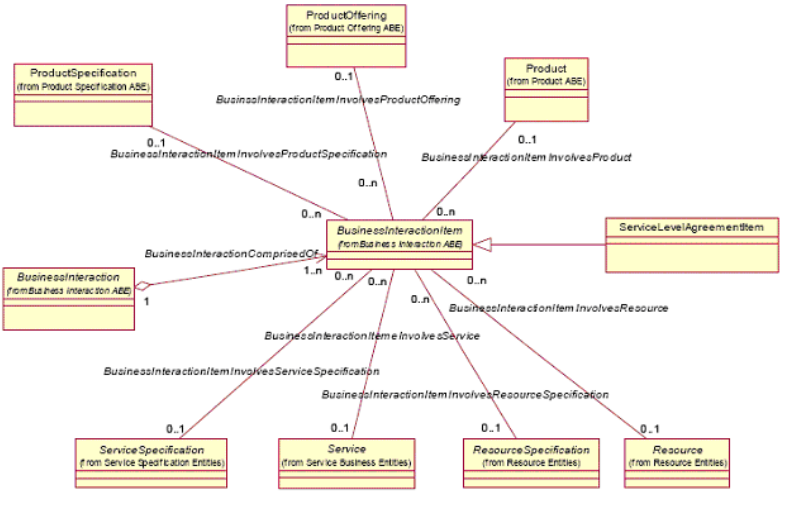

Fig. 1. Entities inherited relationships

help with the administration of the agreement, such as emergency contacts, help desk contacts, and so forth; 3) Agreement authorizers; those entities who are responsible for the approval of the agreement. Agreement owners and Agreement contacts information are inherited from the Business Interaction business entity, Business Interaction Role. The three roles and their derivatives become enumerated values for the interaction role attribute that characterizes the Business Interaction Role business entity. For example, role values could include owner, emergency contact, authorizer, and so forth. The core classes and their relationships are shown in Fig.1.

4 Architecture of System Operation

The applications of SLA mainly including:

(1) Web applications: Some functions should be executed in distributed manner, such as the definition and modification of templates, product management, the definition of services, the management of resources required in services, the negotiation and sale of services, and so forth. These functions are all be designed and programmed in Web Server, and realized by JSP and Servlet technologies.

(2) Background applications: In background applications, the main functions are data collection and data processing, which must be realized in multi-thread with the network programming technologies, such as Socket.

(3) Interface service: The main function is the implementation of all the passive reception of messages, such as accepting and storing the actual status of resources, information disclosure and start receiving the follow-up treatment, the performance of the external system voluntarily submit data service resources to achieve data acquisition functions. The function is realized by using WebSevice.

(4) EAI/BPM: The application connector is development according to special application programming interfaces of the existing applications, which is responsible to manage and control the communications between SLA system and other application. The data exchange is used to finish the Heterogeneous data conversion. The SLA Business process management is employed to start and monitor the business process of SLA.

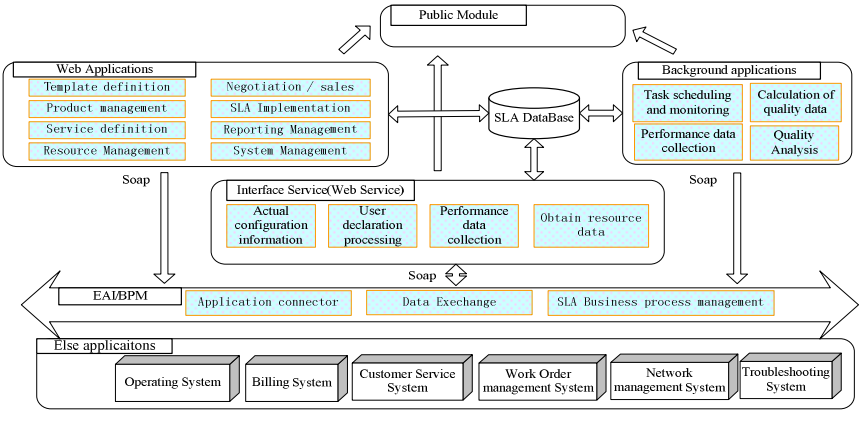

Fig. 2. System Architecture

5 Business Process Model

There are lots of business processes in SLA system, all of which should be analyzed and designed before the implementation of it. We adopt activity diagram of UML technologies to describe and define these processes. In this section, due to limited space, we only introduce the process of obtaining synchronous resource data, as shown in Fig.3. The steps are dedicated as follows:

(1) Firstly, users send a data synchronization request in the service resource interfaces;
(2) The request is further send to the service interfaces, which transform the message to external applications;
(3) External system return the data updating tag to the service interface.
(4) The interface service program receives data updates tag will forward it to the service resource management module;
(5) Rresource management services to determine whether there is a need for data synchronization
(6) If there is no need for data synchronization, the end of the process; if found to have the updated resource data service, the service resource management module sends out a data synchronization request;
(7) Interface service program requests sent to external system data synchronization;
(8) Synchronous data system to accept external requests, and returns the data service resources
(9) External interface service program will return to service resource data resource management module;
(10) Service resource management module to filter the returned data, formatting and other data processing operations

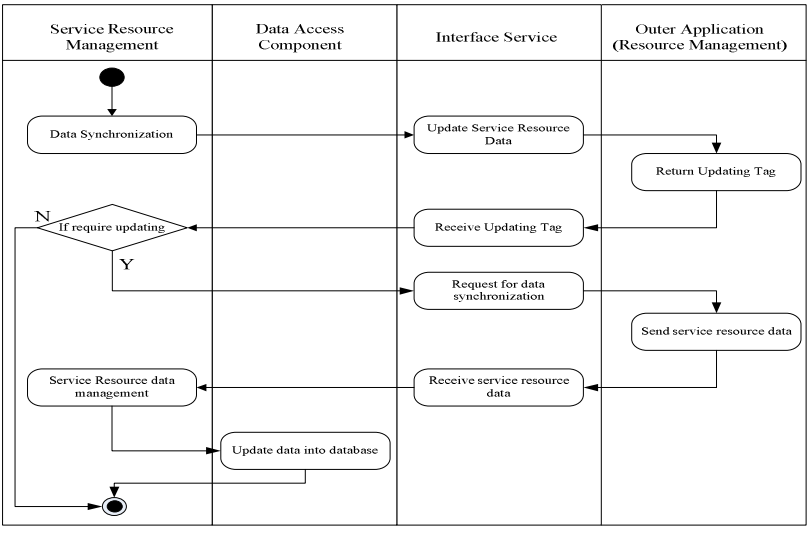

Fig. 3. Obtaining synchronous resource data

(11) Data processing operation is completed call the database component, the data update to the database
(12) The process is completed.

6 Summary

SLA covers three aspects: technical indicators and measurement services; Services offense penalties; services, communication between the two rules. SLA development process is very complex, and OSS market is still not mature SLA solutions but regulate the telecommunications industry has been basically formed SLA development, operators are in various facilities and services to support SLA. Therefore, the market prospects are very promising, and telecommunications operators SLA application in the technical background and business background are in place. In this paper, we the information model, including entity relationship model, Operating system software structure , and business process model are build by using UML related tools. This work will be referred by the implementation of SLA information system or the SLA business process management.

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Study on Business Process Management of Telecom

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Abstract. A business process management based dynamic enterprise application integration (EAI) facilitates application reusability and flexible business process re-engineering. It supported dynamic interoperation between heterogeneous workflow systems. In this paper, we introduce the function and application of the business process management in telecoms. We introduce the current status of studies, and present the core function of business process management. Finally, a case example is used to illustrate the implementation process of business process management in telecoms.

Keywords: Business process management, Enterprise application integration, Information system.

1 Introduction

With the booming business globalisation and commoditisation, enterprises tend to be more dependent on business process management (BPM) to keep their business processes in control [1]. Such globalization trend highly urges the dynamic collaborations among organizations. The business processes of different organizations are correspondingly required to be integrated seamlessly to adapt to the continuously changing business conditions, and to stay competitive in the global market. Though current business process technologies have achieved a certain level, there is still a large room between the available supports and the requirements from real collaboration scenarios. Especially in a loosely coupled collaboration environment, many non-functional yet crucial aspects, such as privacy and security, reliability and flexibility, scalability and agility, process validation, QoS guarantees, etc., are with an outstanding lack of sufficient supports [2]. This gap in turn poses an obstacle to further advancements and wider application of business process technologies [3, 4]. Therefore, more academic research, facilitating infrastructures, protocols and standards are being expected to shift current BPM for supporting collaborative business processes.

In recent years, previous efforts target at the primitive aspects of business process collaboration management, such as universal business process specification languages, system infrastructures and communication protocols across heterogeneous platforms, such asWS-BPEL [5], Some business process languages, like WS-BPEL

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and Business Process Modelling Notation (BPMN) [6], have been proposed and are being adopted as industry standards. The work on contracting have ever discussed how to help human analysts interpret user requirements and convey them to business process modeling[7].

In this presentation, we introduce a supporting system of business process management method in telecom. The supporting system is defined as business ware for telecom(BW), which supporting the definition, management, monitoring and analysis of enterprise business process in telecom.

2 Core Function of BW

Business Process Management. One of the core objectives of enterprise application integration (EAI) is the business process management. The business process management should be implemented from the abstract to the concrete, and should embrace enough flexibility so as to be easily created and facilitate changing. According the characteristics of telecom, BW applies the graphical modeling tool of JBPM to build the business process model, which can be convenient to be defined and edited in web page. The main functions including:

(1) Process State Management, which can be used to pursue, store and show the states of each step in a special business process, and response intelligently.
(2) Integrated work flow management, which combines the information automation management and manual management. In the business process management, people's participation is also important, and the wisdom of persons can be excited in the BW.
(3) Synchronous integration and asynchronous integration. They are realized by message broker. The message broker technology reduces this complexity. The main idea is to reduce the number of interfaces and thereby make it easier to support them. If one of the applications changes format, only one connection has to be changed: the one to the message broker. The message broker also makes coordination between different applications easier, that is to forward a message from one application to another. Furthermore, the message broker can decide to what application a message should be sent depending on the content of the message.
(4) Automatic Data Processing, exception and error management.
(5) Transaction mechanism to commit or rollback a series of activities in a business process.
(6) Supporting Nested and Parallel modeling. A multi-user graphical modeling environment and shared component repository enable quick mixing and matching of components to build, modify and expand integration solutions. Components may be hierarchically nested within other components to further abstract and simplify complex projects into a series of easier-to-manage subsystems.
(7) Design-time repository of reusable sub-processes
(8) Adaptable business processes that monitor real-time metrics themselves automatically according to pre-defined rules

BW has taken a top-down, business process-centric approach to integration. It enables a company to scale from solving the simplest process problems to the most complex, today and well into the future. The platform's industry-leading BPM capabilities enable a company to focus on what it needs its business process to accomplish, rather than what its integration tool can do.

Business Analysis and Monitoring. The Business Analysis and Monitoring (BAM) capabilities of the business process management platform give users unprecedented visibility over strategic processes, with real-time and historical process data analysis. Line of business executives can easily configure, track, and analyze their own real-time key performance indicators, gaining immediate, actionable business insight that previously may have taken days, weeks, or months to compile and analyze across the fragmented process. Capture the big picture, then drill-down on a single data object, such as an order or claim, to understand complete status of a particular item across all systems involved in the process. Zoom in on cross-process metrics with real-time analysis to determine which processes are creating bottlenecks or which customer is most profitable. Monitor service-level agreements. All users can easily personalize the information they want to receive and how it is presented: graphically on the Web; through proactive alerts to e-mail, cell phones, and pagers.

(1) For telecoms, the BAM should be performed according to the standard business process defined in eTom to find out the joint among business processes. Since the business analysis and monitoring is achieved on the foundation of integration of application and data, the analysis of business should provide the requirements to the implementation of application integration and data exchanging. The business analysis and monitoring of telecoms can be realized according to the following steps:
(2) Creating the map relationships between applications and eTom model;
(3) Building the standard business process flow which is to be integrated and managed based on the eTom.
(4) Specializing the Mapping between the current business process and standard eTom process, and comparing them;
(5) Analyzing the interfaces involving the relationships among applications, which is used as the foundation of development and configurations of application connectors.

Analyzing the data schemes involving the relationships among applications, which are used as the foundation of exchanging messages among different applications.

3 Case Analysis

We illustrate the implementations of business process management system by typical examples. In China Mobile Communication Liaoning Company, the existing legacy IMF (Internet Management Framework) system consists of three major components: IMF CRM, IMF Provisioning, and IMF Billing. In this sense it represents an integrated BSS/OSS environment for data related services. To replace the entire IMF functionality it was deemed necessary to properly align each of the stated components with appropriate systems in the future NGOSS environment: one that is designed to

be firmly anchored in TMF frameworks. By having followed the guidelines and recommendations laid out in the TMF Telecommunications Applications Map (TAM) the BSS and OSS systems in the new environment have become well defined and clearly delineated. Going forward, it is necessary to migrate the functionality of the IMF CRM module into the Donat CRM system. The same applies to the data and processes currently supported by the IMF Billing component. Its functionality will be migrated into the existing Geneva billing system. Finally, it will be necessary to implement the order management and provisioning functionality of IMF using the new BPM and Service Catalog systems. Decisions have already been taken to use Telcordia Expediter and Telcordia Dynamic Service Catalog for this purpose.
In the following sections, we analyze the implementations of the processes of order management.

The process of order management. A streamlined order management process is the critical link between several functions distributed among different departments, these are:

(1) customer service system
(2) Trouble shoot system
(3) Work Order System
(4) Billing System

According to the definition in eTom, the whole business process can be analyzed and dedicated as Fig.1.

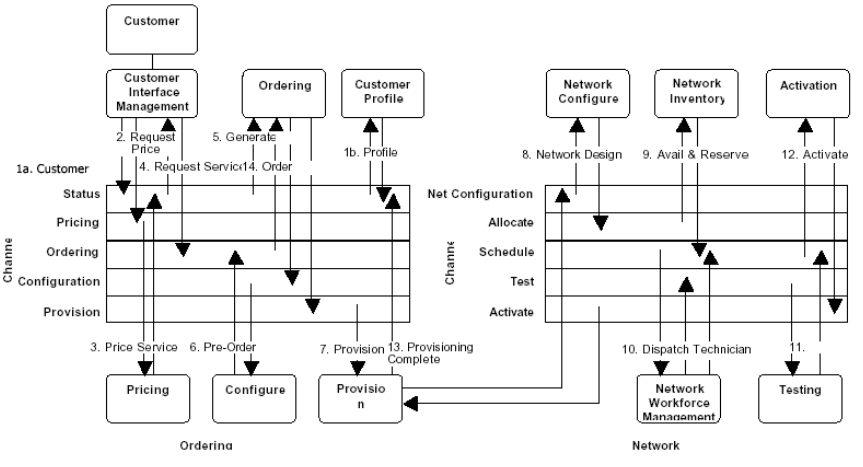

Fig. 1. The business process model of order management

The process will be executed according to the following steps:

(1) A customer call the customer service center, customer service personnel access to customer information;
(2) The customer asked the price of a product;

(3) Depending on different products or services, the pricing systems give the appropriate quote;
(4) The customer decides to purchase it;
(5) The order management system receives the order and start the order management process;
(6) The order management system needs to configure the customer's specific requirements;
(7) The information is sent to the Pre-order system;
(8) The network design tool configure the contents of the service required;
(9) At the same time, relevant information is passed to the associated equipment to prepare for the completion of the order
(10) If necessary, the relevant information is sent to the work order system to the appropriate technical staff to do the construction;
(11) Then, the system will be automatically tested.

Finally, BPM will inform billing system the results to start charging fees, and notify the customers.

Operation analysis and monitoring. Business analysis and monitoring, as shown in Fig.2 provides the real-time analysis (RTA, Real-Time Analysis) capabilities, which is used to collect, analyze and respond to real-time process information and related business metrics, as shown in Fig.2. RTA provides process feedback data to help business managers to optimize business process operations. The Web-based interfaces of business process management platform is switched to the monitor mode, where the chart shows the current process data in real time, analyze the bottleneck of the process handling and accurate positioning customers and orders. Thus, there is purpose to adjust the business process, when the problem occurred in the small to solve the problem, to avoid the risk of business operations, while increasing the company's rapid response capability.

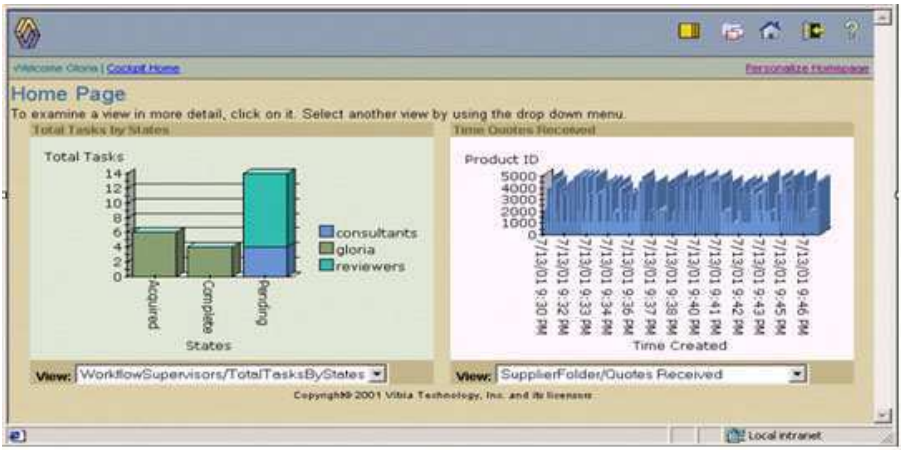

Fig. 2. Interfaces of analysis and monitoring

The business process analysis and monitoring can be based on Real-time data in Real-time access to business intelligence analysis. See above, the analysis found that treatment of a process where the real customers, orders where the bottleneck where the business process, which combines the multi-system, Multi-functional rapid business insight.

4 Summary

In modern telecom, the business process management expands across both departments' and organizational boundaries, and thereby should support organizations to coordinate the flow of information among departments and organizations and link their business processes. With collaborative business processes, organizations can create dynamic and flexible collaborations to synergic ally adapt to the changing conditions, and stay competitive in the global market. Due to its significant potential and value, business processes are becoming an important issue of business process management in telecom, and attracts lots of attention and efforts from both academic and industry sides. This presentation provides an information solution to sport the business process management of telecom, and it is illustrated by an example. Although there are lots technologies which are impossible to be dedicated in detail, we believe that this work have some reference to the research and applications in this field in the future.

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The Research of Construction Ontology-Based Material Management System in e-Commerce

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Abstract. Ontologies are formal, explicit specifications of shared conceptual-izations of a given domain of discourse. The goal of materials management is to provide an unbroken chain of components for production to manufacture goods on time for the customer base. This paper attempts to propose a framework to improve and upgrade the effectiveness of E-C materials management by ontology construction algorithms. Our approach consists of a methodology that aids actors in understanding information generated from multiple construction participants. This paper presents using ontology to build materials management system in e-commerce. The experimental results have shown our suggested materials management system will increase precision and performance.

Keywords: material management system, e-commerce, ontology.

1 Introduction

The major challenge that materials managers face is maintaining a consistent flow of materials for production. Materials management plans and designs for the delivery, distribution, storage, collection, and removal of occupant-generated streams of materials and services. It has a deep and wide industrial connections from petroleum and gas refinery, chemical materials, man-made fiber, clothing, plastic, synthetic rubber, fertilizer, cleaner, and other industries. But this field is still being discussed today. The knowledge formalization part is again subdivided into two layers, namely the definition of a domain specific knowledge ontology and, based hereon, the definition of design rules. Many applications in modern information technology utilize ontological background knowledge. The availability of materials may greatly influence the schedule in projects with a *fast track* or very tight time schedule: sufficient time for obtaining the necessary materials must be allowed.

The major issues that all materials managers face are incorrect bills of materials, inaccurate cycle counts, un-reported scrap, shipping errors, receiving errors, and production reporting errors. The web services execution environment supports common B2B and B2C (Business to Consumer) scenarios, acting as an information system representing the central point of a hub-and-spoke architecture [1]. The performance of a design project is, therefore, not only a function of the expertise of the individual experts, but also how well they work together. Natural language interfaces are an interesting option to interact with mobile devices due to their limited input and output functionality. This interoperability problem was the main topic of the

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W3C Multimedia Semantics Incubator Group (MMSem) in which the authors have actively participated within the photo use case.

Materials managers have strived to determine how to manage these issues in the business sectors of manufacturing since the beginning of the industrial revolution. As a result, a B2B system is built using the existing standards cited above by overcoming their limits and sharing their different advantages. This means that, if items A and B are complementary, the more an item is being consumed, the more B item will be consumed. As a result, companies are now implementing knowledge management processes and its supporting technologies. Knowledge management systems (KMS) are a class of IS developed to support and enhance the organizational processes of knowledge creation, storage/retrieval, transfer and application. WSMX tackles and addresses the requirements occurring in B2B and B2C collaborations, serving as a reference implementation for WSMO. Most information retrieval systems are based on the premise that users know the keywords for searching subjects. Ontology based systems is more powerful if it is required to accommodate the growth of domain knowledge with time. This study attempts to propose a framework to improve and upgrade the effectiveness of E-C by ontology construction algorithms. The paper probes into building e-business domain ontology in order to constructing the ontology model of e-commerce material management system, and to suffice the needs of theory and application in E-commerce recommendation system. An effective materials management plan also means a more holistic approach to managing vehicle use and emissions, solid waste, hazardous waste, recycling, and utility services.

2 The Application of Ontology Model in Constructing Material Management System

Materials management can deal with campus planning and building design for the movement of materials, or with logistics that deal with the tangible components of a supply chain. Ontologies have shown to be the right answer to the structuring and modelling problems arising in Knowledge Management. RDF is recommended by W3C and can deal with the lack of standard to reuse or integrate existing ontology. This method consists of two agencies. One is knowledge agency with three agents supporting knowledge management process. The other is application agency with three agents supporting knowledge application.

Materials management is part of logistics and refers to the location and movement of the physical items or products. The domain ontology plays a central role as a resource structuring the learning content[2]. Aimed at developing a methodology for building real applicable ontology-based management information systems, this work tackles the above mentioned problems from a perspective based on exploiting the different ways users ask for information in the domain. In particular, for $x \in X$ and $m \in M$, denote xIm to express that an object x is in a relation I with an attribute m. Let G be a set of objects and M be a set of fuzzy or crisp attributes. $\forall g_1, g_2 \in G$, one can define τ as follows, we define Eq. 1.

$$W_{jk}^{new} = \begin{cases} L/(L-1+n), & \text{if } h_{ik} = 1 \\ 0, & \text{if } h_{ik} = 0 \end{cases} \qquad W_{ij} = \frac{f_{ij}}{\sum_{k=1}^{m} f_{kj}} \tag{1}$$

$$W_{kj}^{new} = (1-\alpha) W_{kj}^{old} + \alpha D_j$$

Eq. 1 express that where *Kj* represents jth keyword and *fij* is the number of occurances of *Kj* in Question *Qi*, *fi* is the total number of occurrences of *Kj* in the FAQ database. Ontology building is a task that pertains to ontology engineers, an emerging expert profile that requires the expertise of knowledge engineers (KEs) and domain experts (DEs).

Materials management is important in large manufacturing and distribution environments, where there are multiple parts, locations, and significant money invested in these items. In knowledge engineering, ontologies are typically offered as the means to support development of a shared understanding.

Materials systems based on a service-oriented architecture which are able to integrate different functionalities and to offer a virtual component model that abstracts from the peculiarity of specific implementations, seem to be a very appealing solution. Shrinkage is a general materials management term used to describe the loss of materials once they have reached the companies property. The pedagogical agents can use SOAP, XML and HTTP to communicate over a network. For any subset $X \subseteq U$, the β lower approximation of X with respect to f is defined as Eq. 2.

$$R^I(x)=\{y\in\Delta^I|\langle x,y\rangle\in R^I\},\ R^{\sim}(x)=\{y\in\Delta^I|\langle x,y\rangle\in R^{\sim}\} \tag{2}$$

The operational model of knowledge integration for enterprise collaboration includes three mapping layers: the enterprise collaboration lifecycle layer, the system operational layer, and the mechanism operational layer. For instance, $\langle\{dr\}, \{or, r, dr\}\rangle$ is more specific than $\langle\{or, r, dr\}, \{or, r, dr\}\rangle$ (is a specialization of $\langle\{or, r, dr\}, \{or, r, dr\}\rangle$), $\langle\{or, r, dr\}, \{or, r, dr\}\rangle$ is more general than $\langle\{dr\}, \{or, r, dr\}\rangle$ (is a generalization of $\langle\{dr\}, \{or, r, dr\}\rangle$).

Materials is generally measured by accomplishing on time delivery to the customer, on time delivery from the supply base, attaining a freight budget, inventory shrink management, and inventory accuracy. It is the most important that the methods which we adopt are distinct when searching concepts and relationship between concepts in domain.

The paper proposes an application of ontology, in the sense of the Semantic Web, for development of computing with words based systems capable of performing operations on propositions including their semantics[3]. A Bill of Materials (BOM) is a product structure that lists the parts and components that constitute the product in the context of an assembly, kit, or model. It contains one or more Products, Services, or BOMs. That is to say, rough description logic RDLAC is a rough extension of classical description logic ALC. The main motivation to adopt ontology for terminology extraction is that, we want to make use of the background knowledge and words' semantic relationships compiled in ontology to capture the semantic features of terminologies in documents.

The Materials Management system based on ontology construction algorithms:

BEGIN

Input the semantic relation set $SRS = \{SR_{IO1}, SR_{IO2}, \ldots, SR_{IOK}\}$.

Initialize the context information set $CIS = \varphi$.

Initialize $i = 1$

DO UNTIL ($i > K$)

Infer the context information CI_{IOi} between SR_{IOi} and CR_{IOi} by the fuzzy inference engine.

Add CI_{IOi} to *CIS* set.

increment *i*

for (all l ∈L(Fgs)) do

if (SimBetweenNodes (r, l) > Threshold)

then do

number*n* ← the group number of l;

list.add(n);

/*Add the selected Friend Group number to list. */

endif

for (all groupNum ∈list) do

groupInstances = getGroupInstances(groupNum, Ord)

Instances Result_list

DO UNTIL ($i > K$)

The Materials Management component of the company open source ERP business solutions software addresses a broad range of issues around your material inventory: products, price lists, inventory receipts, shipments, movements, and counts within a company, its organizations, as well as to and from suppliers and customers. According to feedbacks, Agent is automatically in charge of the formation and modification of concept, and analyzes the information which users browsed through, then search information according to the revised concept. The flowchart as Fig.1.

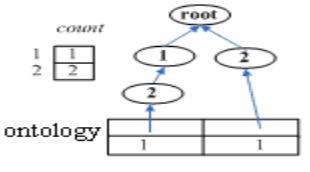

Fig. 1. Materials Management system based on ontology

Materials represent a major expense in construction, so minimizing *procurement* or *purchase* costs presents important opportunities for reducing costs. The aim of ontology is to obtain, describe and express the knowledge of related domain. Protégé is an open-source development environment for ontologies and knowledge-based systems. Protégé OWL Plugin has a user-friendly environment for editing and visualizing OWL classes and properties [4]. Ontologies play a key role in information retrieval from nomadic objects, Internet and heterogeneous data sources. The ontology presents a common model of the world and is shared between all parts, while the instances, the actual items described are generally kept in local stores. The idea of automatic question answering system is same for information retrieval which has become a well known research area in computer and information sciences.

3 Building Ontology-Based Materials Management System in e-Commerce

Materials management is not just a concern during the monitoring stage in which construction is taking place. Our system runs on a Windows XP-based PC with an Intel Pentium 4 CPU at 2.6 GHz and 512 MB RAM. The system was developed using Java on Java SDK 1.4.2 platform. Then semantic web services technology has been introduced, technology that we envisage will allow flexible integration and automation of business processes within and between enterprises.

This organizational materials management problem is analogous to inventory control in any organization facing continuing demand for particular items. Figure. 2 describes the drawing of materials management system in e-commerce based on ontology. The algorithm can adapt its connectivity within the small world network structure. Similarly, the algorithm can also be applied to other network structures by the self-adapting policy.

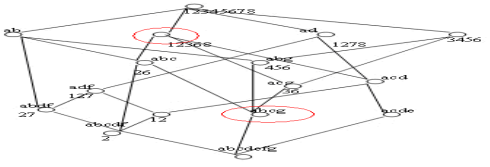

Fig. 2. The ontology-based materials management system in e-commerce

4 Summary

Materials management is an important element in project planning and control. The paper put forward constructing ontology-based materials management system in order to constructing the ontology model of e-commerce system, and to suffice the needs of theory and application in e-commerce recommendation system. The research results were tested on a case study that demonstrated the feasibility and applicability of the proposed semantics and modeling rules for medium size projects. The experimental results have shown our suggested information system will increase precision and performance. With a materials requirement system, much of the detailed record keeping is automated and project managers are alerted to purchasing requirements.

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The Development of the Material Management System Based on Ontology and Fuzzy Cognitive Map

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Abstract. Fuzzy cognitive map is a knowledge-based methodology suitable to model complex systems and handle information from an abstract point of view. Materials management is an important element in project planning and control. As the foundation of the semantic web, ontology is a formal, explicit specification of a shared conceptual model. The main contribution of this paper is presenting applying fuzzy cognitive maps theory and ontology to construct materials management system. The experiment shows the CPU Time in the attribute numbers, indicating that ontology is superior to fuzzy cognitive map in building materials management system.

Keywords: material management system, Fuzzy Cognitive Map, domain ontology.

1 Introduction

Material handling, which includes procurement, inventory, shop fabrication and field servicing, requires special attention for cost reduction. Materials management can deal with campus planning and building design for the movement of materials, or with logistics that deal with the tangible components of a supply chain. Users tend to put personal longings and feelings into their avatars by combining a number of props. In order to solve this problem, semantic web technique – OWL and OWL-S, which are innovative for data discovery and service discovery respectively, have been adopted. Worldwide the conventional energy sources are rapidly depleting, while population growth, increased expectations and means, and scientific and technological developments have dramatically increased the global demand for energy in its various forms [1]. The concept of sustainability combines the needs of present and future generations and takes the interdependencies of economic activities and ecological status into account.

Even worse, materials may deteriorate during storage or be stolen unless special care is taken. For example, electrical equipment often must be stored in waterproof locations. Second, delays and extra expenses may be incurred if materials required for particular activities are not available. In addition, a Fuzzy Cognitive Map (FCM) is proposed for modelling Critical Success Factors (CSFs). FCM is a knowledge-based methodology suitable to model complex systems and handle information from an

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abstract point of view. It is to describe the concept in formalization of symbol from extent and intent, and then realize the semantic information which can be understood by computer. It is to extract all connotative concepts and connections between them from formal context according to the binary relationship so as to form a hierarchical structure of concept. In this information-exploding era, the user expects to spend short time retrieving really useful information rather than spending plenty of time and ending up with lots of garbage information. The FCMs constitute an attractive knowledge-based method, combining the robust properties of fuzzy logic and neural networks.

Materials management is also a problem at the organization level if central purchasing and inventory control is used for standard items. In this case, the various projects undertaken by the organization would present requests to the central purchasing group. A fuzzy cognitive map (FCM), fuzzified version of cognitive maps has been introduced. The paper probes into building domain materials management system based on ontology and fuzzy cognitive maps in order to constructing the ontology model of e-commerce recommendation system, and to suffice the needs of theory and application in E-commerce recommendation system. Our focus is on integrating the two types of preferences, which represents our novel contribution to recommendation systems. The experimental results show that the proposed approach can effectively recommend a travel route matched with the tourist's requirements.

2 The Materials Management System Based on Ontology

The availability of materials may greatly influence the schedule in projects with a fast track or very tight time schedule: sufficient time for obtaining the necessary materials must be allowed. In some case, more expensive suppliers or shippers may be employed to save time. Ontologies provide interpretation to the contents of the Semantic Web data. Specifically, ontologies define and relate concepts used to describe the web data, which are nothing but instances to the concepts in ontologies.

Materials management is also a problem at the organization level if central purchasing and inventory control is used for standard items. For this, it is necessary to link WSDL elements with semantic models, such as ontologies. The description of business processes is an important first step in the development of information systems that are intended to support and implement these processes. According to the goal of ontology, the pivotal problem of ontology constructing is to find the concepts and relationship among concepts after confirming the field, but these are connotative in the brain or store the file of this field in actual life. For a specific data instance, its semantic view in the ontology not only includes the components that it instantiates, but also any other components whose changes implicitly affect the instantiated components based on the implication analysis presented. X and Y denote the non-empty subsets of U.

The main sources of information for feedback and control of material procurement are requisitions, bids and quotations, purchase orders and subcontracts, shipping and receiving documents, and invoices. The complement, intersection and union set operations are performed by a negation function, a t-norm function (typically, the minimum) and t-conorm function (typically, the maximum) respectively. In particular,

the notion of adjunction between a fuzzy conjunction operator and a fuzzy implication operator on a complete lattice is introduced. The correspondence between a fuzzy covering and a fuzzy relation is analyzed.

A large component of materials management is ensuring that parts and materials used in the supply chain meet minimum requirements by performing quality assurance (QA). Therefore, the system mixes TF-IDF with Entropy to define the weight of the key terms. The weights of the key terms show in formula (1).

$$W(T_i) = (TF\_IDF_i + E(T_i))/2 \tag{1}$$

The materials for delivery to and from a construction site may be broadly classified as: (1) bulk materials, (2) standard off-the-shelf materials, and (3) fabricated members or units. In the case that a conjunction * and an implication → form an adjunction, the pair (*,→) is called an adjunction and → is called the adjunctional implication of *. In the following, we first give the definitions of dispensable attribute and indispensable attribute in the concept lattices. The ontology for relationships between news and financial instruments comprises four parts, each of them is presented by one figure as equation 2.

$$A_i^{(k+1)} = J\left(A_i^{(k)} - \sum_{j \neq i, j=1}^{N} A_j^{(k)} \cdot e_{ij}\right) \tag{2}$$

This aspect of material management is most important in heavily automated industries, since failure rates due to faulty parts can slow or even stop production lines, throwing off timetables for production goals. A defuzzified number is usually represented by the centroid of gravity (COG), which can be determined using the moment of area method defined as $COG=(\int_X x\mu_B(x)dx/\int_X \mu_B(x)dx)$, where $\mu_B(x)$ is the aggregated value of the fuzzy variable B over the universe of discourse Z. The change brings the sentence form in line with the semantics of concept subsumption in formal ontologies. From ontology to be evaluated, we extract a number of such sets of three concepts and construct S1 and S2 sentences that are, according to the formal ontology as follows.

Step 1: Based on the results from Step 1, only the concept “mold product design” meets the requirement that concept name similarity must be $\geqslant$0.8 with essential information similarity $\geqslant$0.5, therefore, this concept is put into the Vector A matrix;

Step 2: Materials mangers are rarely responsible for the direct management of quality issues concerning the supply chain or the customer. A separate quality function generally deals with all issues concerning the correctness of the parts to the finished product and the final product.

Step 3: The reduction of attributes is to eliminate some irrelevant or redundant attributes without decreasing the quality of approximation of an information system as the original set of attributes.

Materials managers have strived to determine how to manage these issues in the business sectors of manufacturing since the beginning of the industrial revolution. Knowledge management approaches are generally divided into personalization approaches that focus on human resources and communication, and codification approaches that emphasize the collection and organization of knowledge.

3 Using Fuzzy Cognitive Maps (FCM) Approach to Building the Material Management System

Materials management plans and designs for the delivery, distribution, storage, collection, and removal of occupant-generated streams of materials and services. Successful avatar design depends on the well-organized integration of avatar props to improve users' self-images and satisfaction. However, previous avatar design studies have not discussed a possible combination of props to enhance users' self-images and satisfaction. In an application environment, the notion of a concept is used as a generic mechanism to deal with a group of related objects and to associate a meaningful label with such a group [2]. In this study, certain features were added to the classical FCM concept value calculation algorithm: these include influence possibility, influence duration, dynamic influence value-changing, and influence permanence. An X is placed in the ith row and jth column to indicate that $(g_i, m_j) \in I$. For a set of objects $A \subseteq G$, $\beta(A)$ is defined as the set of features shared by all objects in A. That is following equation 3.

$$f(x) = \frac{1}{1 + e^{-cx}} \tag{3}$$

Bulk materials refer to materials in their natural or semi-processed state, such as earthwork to be excavated, wet concrete mix, etc. which are usually encountered in large quantities in construction. Cognitive mapping techniques, an essence of FCM to formulate hidden knowledge about the target domain, are aimed at externalizing the subjective knowledge of an individual so that they can be examined not only by himself but also by other individuals and groups.

Decisions about material procurement may also be required during the initial planning and scheduling stages. The value Ai of each concept Ci is calculated by collecting–aggregating the influence of the interconnected concepts to the specific one, by applying the following rule as equation 4.

$$T(C1,C5)=\max\{I1(C1,C5),I2(C1,C5),I3(C1,C5)\}=\text{much} \tag{4}$$

Applications of FCMs have been developed in some industrial sectors: associated to simulations in order to present different future perspectives and thus decide possible alternatives[3]. The main obstacle in recommending a combination of props is the existence of causal relationships among the props that should be dealt with properly in the process of the avatar design.

Step1: This organizational materials management problem is analogous to inventory control in any organization facing continuing demand for particular items.

Step2: Cognitive mapping is a qualitative technique designed to identify cause and effect as well as to explain causal links.

Step3: The presence of a non-zero value in a cell of T indicates that a direct or indirect relationship exists between the relevant elements within the cognitive map.

The effective materials management plan builds from and enhances an institutional master plan by filling in the gaps and producing an environmentally responsible and efficient outcome. Concept lattices provide better foundation for knowledge

processing, such as association rule discovery, intelligent search engine, semantic Web and natural language processing. There are mainly three elements for modeling causal relationships for a real world problem, the cause, the effect, and the cause–effect relationship. Cognitive maps model the causal relationships between concepts without describing how strong the relationship is.

4 Development Materials Management System Based on Ontology and Fuzzy Cognitive Maps

There are no standards for materials management that are practiced from company to company. Most companies use ERP systems such as SAP, Oracle, BPCS, MAPICS, and other systems to manage materials control. The system utilizes the Jena package to output the results of the RDF format [4]. In this paper, we apply the theory of ontology and fuzzy cognitive maps to automatically construct the materials management system and to match up the binary relation matrix of documents and terms to express the independence, intersection and inheritance between different concepts to form the concept relationship of ontology. The primary content of this dissertation is to apply fuzzy cognitive maps to obtain all connotative concepts and hierarchy of them automatically from the designated data, which is not under the influence of developer. The major issues that all materials managers face are incorrect bills of materials, inaccurate cycle counts, un-reported scrap, shipping errors, receiving errors, and production reporting errors.

In general it stands for states, variables, events, actions, goals, values, trends of the system which is modeled as an FCM. Our system runs on a Windows XP-based PC with an Intel Pentium 4 CPU at 2.8 GHz. The system is developed using Java on Java SDK 1.4.2 platform.

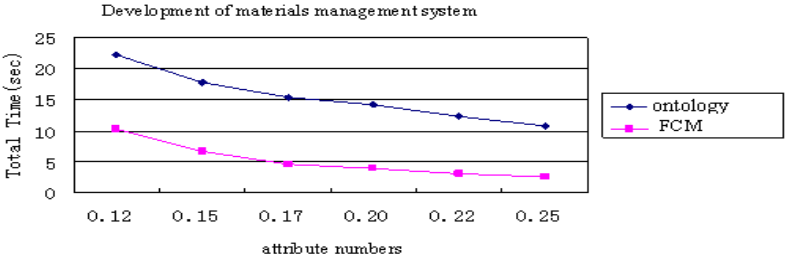

Fig. 1. Development of materials management system compared result of FCM and ontology

Fig. 1 describes the development of material management system based on fuzzy cognitive maps and ontology. Materials management is not just a concern during the monitoring stage in which construction is taking place. The experiments show the CPU Time in the attribute numbers, indicating that ontology is superior to FCM in building the material management system.

5 Summary

FCM is used to model and analyze the radiotherapy process and they successfully used for decision-making in radiation therapy planning systems. The primary content of this dissertation is to apply fuzzy cognitive maps and ontology to obtain all connotative concepts and hierarchy of material management automatically. Finally, we provide some experiments to demonstrate the feasibility of the proposed algorithm.

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Optimize the Length of Temporary House in Post-disaster Transitional Settlement after Wenchuan Earthquake in China

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Abstract. Basing on the house layout of Happy Homeland, a typical transitional settlement with high building density after Wenchuan earthquake, the relation between the length of prefab house and air flow field was studied by using CFD. The CFD simulation result showed that when the length direction of house paralleled the summer prevailing wind direction, the longest house of 12 standard rooms would realize a best summer outdoor wind field to improve the thermal environment of settlement, and the high outdoor wind velocity would be avoided in winter as well. Additionally, although the summer indoor natural would be worst, it would be easily remedied by a household fan.

Keywords: transitional settlement, post-disaster, prefab house, thermal environment, outdoor wind velocity, indoor ventilation, CFD simulation.

1 Introduction

After the magnitude 8.0 Wenchuan earthquake, the Chinese government must face the difficult problem that providing more than one million temporary houses for about 5 millions displaced people within 3 and a half months [1,2]. Single-story prefab houses made of expandable polystyrene (EPS) sandwich prefab boards were chosen as temporary houses, for they might be more safe and economic than the multi-story under the menace of the frequent aftershocks. Meanwhile, limited by scanty construction lands, these prefab houses were parallel to each other, and the spacing between houses was reduced as much as possible. Therefore, a large amount of high building density (HBD) transitional settlements appeared in earthquake-stricken, and the construction and management mode of transitional settlement would be a prototype for Chinese future disaster relief work in the densely populated areas. However, undoubtedly, the high building density would lead to some universal problems about safety, environment and psychology, etc [3]. So, it is necessary to improve the living environment of HBD settlement.

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Our former summer field measurement on Happy Homeland, one typical large scale HBD settlement in Dujiangyan, showed that the average wind velocity inside settlement was 39.5% of that outside, and the mean air temperature inside settlement was 2.1℃ higher than that outside [4]. Additionally, previous study about prefab house made of EPS showed that under natural ventilation condition, the difference between indoor air temperature and outdoor air temperature could reach 1.3℃ in summer, and the temperature of roof inside surface could be even high up to 43.6℃, 8.4℃ higher than outdoor air temperature [5]. As can be inferred, the outdoor and indoor thermal environment of HBD settlement was uncomfortable in summer, and there was a micro-scale heat island effect inside this settlement: the high building density obstructed the outside air with lower temperature to flow through this settlement, and then the heats accumulated inside settlement and houses were hard to be exhausted. So it is necessary to enhance the summer regional wind velocity and indoor ventilation of HBD settlement, and to make outside colder air transfer more heat inside settlement, finally to improve the indoor and outdoor thermal environment inside settlement. Seeing that the high building density is unavoidable, to optimize the building layout will be the best way to improve regional wind velocity inside settlement.

To set out houses by rows and columns was adopted in most of the post-earthquake transitional settlement, for it is the most reasonable layout mode to maximize the plot ratio in a given construction land. If the spacing between houses is minimized, the dimensions of house will be the most important influence factors on regional air flow. This study will focus on the variation of outdoor wind velocity and indoor air change per hour with the length of house, basing on the layout of Happy Homeland: every house consisted of several standard rooms arranged in a row or line. The number of standard rooms within one house and the width of standard room would determine the length of house. If the spacing between houses and the area of construction land are constant, a longer house would accommodate more homeless people as well. The purpose of this study is to find out the optimal length of house, which could not only maximize the capacity of population, but also maximize the wind velocity in order to improve the thermal environment of HBD settlement.

2 CFD Simulations

Cases. Similarly to the houses in Happy Homeland, every house in this study had gable roof, and the dimensions of standard room were defined as 5.4m (length) × 3.6m (width). The plane and section of one standard room was shown in Fig.1, there were one door in the front wall and two windows respectively in the front and back wall.

Taking emergency evacuation into consideration, the maximum length of house was defined as 45m, according to the design norm of fire system of civil buildings [6]. So the maximum number of standard rooms within one house was 12, Therefore, 9 cases were simulated in total, with the number of standard rooms composed one house increasing from 4 to 12. The dimensions of these 9 cases were shown in Table 1. Every case consisted of 6 lines×2 rows houses (12 houses in total), which were located in the middle of the simulation domain. The layout of these 12 houses

was similar to that of Happy Homeland, and the spaces between houses in 9 cases had no difference. Fig.2 showed the layout of case-4. The spaces between lines were defined as passages and those between rows as streets. The passage with 7m width and the street with 7m width formed the main roads and firebreaks in settlement. The passages with 3.5m width formed the entrance passages, and the passages with 1.5m width formed the necessary spaces between the back windows of two adjacent houses.

Table 1. The dimensions of 9 cases and the simulation conditions

	Q (m^3)	A (m^2)	M	*Simulation conditions*
case-4	125.8×207.4×16	47.4×35.8	4	1. Doors and windows are all opened, and the direction of air inflow is parallel to passages(O-PA) 2. Doors and windows are all closed, and the direction of air inflow is parallel to passages(C-PA) 3. Doors and windows are all opened, and the direction of air inflow is perpendicular to passages (O-PE) 4. Doors and windows are all closed, and the direction of air inflow is perpendicular to passages (C-PE)
case-5	133.0×207.4×16	47.4×43.0	5	
case-6	140.2×207.4×16	47.4×50.2	6	
case-7	147.4×207.4×16	47.4×57.4	7	
case-8	154.6×207.4×16	47.4×64.6	8	
case-9	161.8×207.4×16	47.4×71.8	9	
case-10	169.0×207.4×16	47.4×79.0	10	
case-11	176.2×207.4×16	47.4×86.2	11	
case-12	183.4×207.4×16	47.4×93.4	12	

"Q" presents the volume of simulation domain; "A" presents the plane dimension of 12 houses was equal to a×b, which were marked in Fig.2b;"M" presents the number of standard rooms in one house.

Boundary conditions. The CFD simulations used three-dimensional double-precision solver and the standard k-e turbulent flow model. The fluid was assumed to be incompressible, and the boundary conditions were defined as velocity-inlet and pressure-outlet. The law of exponent in vertical distribution of horizontal wind velocity (Eq. 1) was applied to define the air inflow velocity [7]. The wind velocity measured in weather station (V_{met}) was 1.2m/s at 10m height above ground (h_{met}), according to the summer average wind velocity of Dujiangyan in 2008 and 2009. The atmospheric boundary thicknesses of weather station (δ_{met}) and stimulation case (δ) were defined as 270m and 370m respectively. The atmospheric boundary indexes of weather station (a_{met}) and stimulation case (a) were 0.14 and 0.22 respectively [7].

$$V_h = V_{met}(\frac{\delta_{met}}{h_{met}})^{a_{met}}(\frac{h}{\delta})^{a} \tag{1}$$

3 Results of CFD Simulations

Every case was simulated in four conditions shown in Table 1. The distributions of wind velocity at the height of 1.5m in case-4 were shown in Fig.2. It was indicated from Fig.2c that when the direction of air inflow was perpendicular to passages, the four houses on line-1 and line-6 had the extreme indoor ventilations, as well as the passage between line-1 and line-2 had the extreme wind velocity. So in the 9 cases, the average air volumes of the 8 houses on line-2, line-3, line-4 and line-5 were

extracted from the simulation results, and then the mean air change of the 8 houses (N) could be calculated, which was regarded as the mean air change of case. Additionally, the mean wind velocity of passages marked with $P_{1.5}$, $P_{3.5}$ and P_7 in Fig.2a (V) was extracted, which was defined as the mean outdoor velocity of case. Fig.3 reflected the mean air changes of the 8 houses and the mean wind velocities of the 3 passages in the 9 cases.

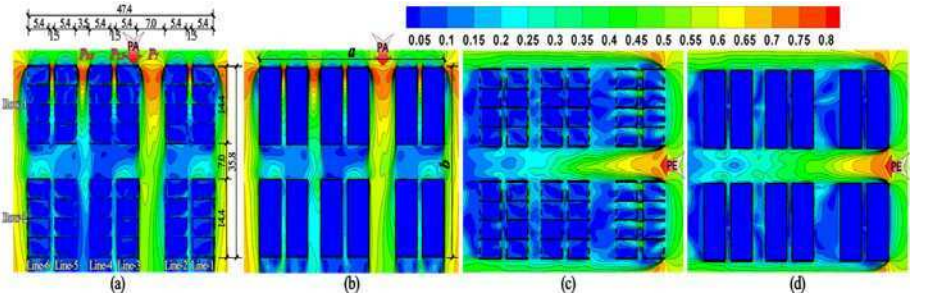

Fig. 2. Distributions of the Wind Velocities at Height of 1.5m in Cases

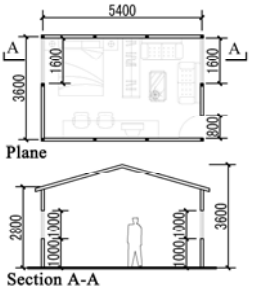

Fig. 1. Plane and section of standard room

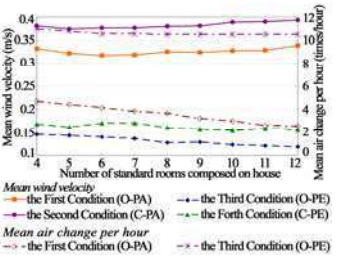

Fig. 3. The N and V of 9 Cases

It could be seen from Fig.3 that: (1) no matter how long the house was, Vs of 9 cases were higher when the direction of air inflow was parallel to passages than that was perpendicular to passages. So in reality, the passages should try to parallel the direction of the summer prevailing wind in reality, in order to create a better wind environment in settlement; (2) the highest Vs of 9 cases were all appeared when the direction of air inflow was parallel to passages, and the doors and windows were all closed. Because the situation that doors and windows were closed would only practically appear in winter, the winter prevailing wind direction paralleling passages should be avoided. And this could be directly realized by paralleling passages to the summer prevailing wind direction, due to the prevailing wind direction in summer always differs with that in winter in China; (3) when the direction of air inflow was parallel to passages, and the doors and windows were all opened, the outdoor mean wind velocity was the lowest when the house consisted of 6 standard rooms, and the longest house of 12 standard rooms would realize a highest outdoor mean wind

velocity. This result indicated that if the layout was reasonable, an outdoor high wind velocity would not be inconsistent with a high building density.

Additionally, Fig.3 showed that: (1) *N*s of 9 cases were at least 6times/hour larger when the direction of air inflow was perpendicular to passages than that was parallel to passages. So if the passages paralleled to the summer prevailing wind direction, the optimum indoor natural ventilation would not be realized; (2) when the direction of air inflow was parallel to passages, the *N* would decrease with the increasing of the number of standard rooms in one house: the *N* of the longest house was smaller than the house consisted of 4 rooms by 2.19times/hour. Additionally, the *N* of the longest house when the direction of air inflow was parallel to passages was 7.97times/hour smaller than the *N* of the house consisted of 4 rooms when the direction of air inflow was perpendicular to passages. The results above showed that contrary to the mean outdoor wind velocity, the mean indoor natural ventilation of case was the worst in the condition that the house consisted of the maximum rooms of 12, and passages were parallel to the prevailing wind direction. But this kind of condition is still the best one to improve the thermal environment of settlement, for the key to improve the thermal environment inside settlement is to promote outside colder air flow through settlement, so as to decrease the regional air temperature inside settlement. Otherwise, even the best indoor natural ventilation would not effectively decrease indoor air temperature and improve indoor thermal environment. The defect of indoor natural ventilation would be easily remedied by mechanical ventilation, for the air change per hour could be at least increased 15.4times/hour with the help of an household fan, according to the criterion of A.C. electric fans and regulators [8] (the volume of a standard room was 62.2m^3).

4 Conclusion

The key to improve the thermal environment in settlement is to promote outside colder air flow through settlement. In order to enhance the outdoor wind velocity inside settlement in summer, decrease that in winter, and settle much more affected families, the passages should try to parallel to the summer prevailing wind direction, and the longest house of 12 standard rooms should try to be adopted, on the other hand, the house consists of 6 standard room should be avoided. Additionally, when the passages are parallel to the summer prevailing wind direction, although the air change per hour of the longest house is lower than that of other house by 7.97times/hour in maximum, it would easily remedy by a household fan.

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Gallopin System in a Polluted Environment

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Abstract. This paper concentrates on studying the long time behavior of a consumer in Gallopin resource-consumer system, located in a polluted environment. Sufficient criteria for weak persistence or extinction of the consumer are obtained.

Keywords: Gallopin system, Persistence, Extinction.

1 Introduction

In recent years, some investigations have been carried out to study the effects of toxicant on a single species population. A deterministic modelling approach to the problem of assessing the effects of a population on an ecological system was proposed by Hallam and his co-workers. Ma et al.[1] studied a simple Gallopin resources-consumer model, and the threshold between persistence in the mean and extinction was obtained. The organism's uptake of toxicant from the environment and egestion of toxicant into the environment was considered. Buonomo et al. [2] modified the model of Hallam et al., and obtained an insight into the effects of the toxicants on the population by mainly using numerical approaches. Srinivasu [3] modified the model of Hallam by considering the effects of the toxicant in the environment on the population.

Motivated by above considerations, we will discuss the survival analysis for Gallopin resource- consumer system in a polluted environment. Assuming that a born organism takes with it a quantity of internal toxicant, and the amount of toxicant stored in the living organisms which die is drifted into the environment. What's more, we also consider the effects of the toxicant in the environment on the population. Let x(t) be the population biomass at time t ; a(t)be the quantity of the resources at time t; $C_e(t)$ be the toxicant concentration of the environment at time t; and $C_0(t)$ be the toxicant concentration in a body at time t. We will study their relationships and try to give some sufficient criteria under which the consumer population in a polluted environment will be weakly persistent or go to extinction.

Following from Gallopin [4], Ma [1] and Srinivasu [3], we assume that a single species model of Gallopin resource-consumer system in a polluted environment is derived as following (M_0):

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$$\frac{dx(t)}{dt} = x(t)(r_0(t) - \alpha(t)C_0(t) - \beta(t)C_e(t) - b(t)\omega(t)e^{-\frac{n(t)a(t)}{x(t)}}), \tag{1}$$

$$\frac{da(t)}{dt} = f(t) - \omega(t)x(t)(1 - e^{-\frac{n(t)a(t)}{x(t)}}), \tag{2}$$

$$\frac{dC_0(t)}{dt} = k(t)C_e(t) - (g(t) + m(t) + b_0(t) - b(t)\omega(t)e^{-\frac{n(t)a(t)}{x(t)}})C_0(t), \tag{3}$$

$$\frac{dC_e(t)}{dt} = -k_1(t)C_e(t)x(t) + (g_1(t) + d_1(t) + \alpha_1(t)C_0(t) + \beta_1(t)C_e(t))x(t)C_0(t) - h(t)C_e(t) + u(t). \tag{4}$$

All the coefficients are positive, bounded and continuous functions on $[0, +\infty)$, u(t) represents the exogenous input rate of toxicant to the environment. The initial values are $x(0) = x_0 > 0, a(0) = a_0 > 0, C_e(0) \geq 0, 0 \leq C_0(0) < D$, here $0 < D < 1$ is the maximum internal toxicant concentration the consumer population can bear.

2 Main Results

For an arbitrary function $p(t)$, let $p^l = \inf\ p(t) \leq \sup\ p(t) = p^u$.

Lemma 2.1. The field $\{(x(t), a(t), C_0(t), C_e(t)):\ x(t) > 0, a(t) > 0,\ C_0(t) > 0,\ C_e(t) > 0\}$ is an invariant set with respect to model (M_0).

Theorem 2.1. For model (M_0), if $r_0^l - \frac{\alpha^u k^u u^u}{h^l(g^l + m^l + b_0^l)} - \frac{\beta^u u^u}{h^l} > 0$ and $C_0(t)<D$ for all $t>0$, then the population x(t) will be weakly persistent.

Proof. If the conclusion is false, i.e. $\lim_{t\to+\infty} x(t) = 0$, there will be a contradiction.

Taylor's theorem enables us to write $e^{-\frac{n(t)a(t)}{x(t)}} \geq 1 - \frac{n(t)a(t)}{x(t)}$, then from Eq. (2)

$$\frac{da(t)}{dt} \geq f(t) - \omega(t)x(t)(1 - (1 - \frac{n(t)a(t)}{x(t)})) \geq f^l - \omega^u n^u a(t), t \geq t_1$$

then we can obtain $\alpha^l \geq \frac{f^l}{\omega^u n^u} > 0$. Combining with $n^l > 0$ and the assumption

$$\lim_{t\to+\infty} x(t) = 0, \text{ we have } e^{-\frac{n(t)a(t)}{x(t)}} \to 0, \text{as } t\to+\infty. \tag{5}$$

From Eq. (4), we have the estimate $\frac{dC_e(t)}{dt} + h^l C_e(t) < u^u,\ t > t_2$.

Multiplying $e^{(h^l - \varepsilon_2)t}$ on both sides of the last inequality, we have

$$(e^{h^l t}C_e(t))' < e^{h^l t}u^u,\ \ t > t_2.$$

Integrating the above inequality from t_2 to t, we have

$$C_e(t)e^{h^l t} < C_e(t_2)e^{h^l t_2} + \int_{t_2}^{t} e^{h^l s}u^u ds = C_e(t_2)e^{h^l t_2} + \frac{u^u}{h^l}(e^{h^l t} - e^{h^l t_2}),\ t > t_2.$$

Dividing both sides of the last inequality by $e^{h^l t}$, it leads to

$$C_e(t) \le C_e(t_2)e^{h^l(t_2 - t)} + \frac{u^u}{h^l}(1 - e^{h^l(t_2 - t)}),\ t > t_2.$$

We take the upper limit on both sides of the last inequality, we can obtain $\limsup_{t\to\infty} C_e(t) \le \frac{u^u}{h^l}$.

From Eq. (3) we have

$$\frac{dC_0(t)}{dt} \le k^u \frac{u^u}{h^l} - (g^l + m^l + b_0^l)C_0(t),\ t > t_3.$$

Then a standard comparison theorem gives

$$\limsup_{t\to\infty} C_0(t) \le \frac{k^u u^u}{h^l(g^l + m^l + b_0^l)}.$$

From Eq. (1), we have

$$\frac{dx(t)}{dt} \ge x(t)(r_0^l - \frac{\alpha^u k^u u^u}{h^l(g^l + m^l + b_0^l)} - \frac{\beta^u u^u}{h^l}),\ t > t_4. \tag{6}$$

Since $\xi := r_0^l - \frac{\alpha^u k^u u^u}{h^l(g^l + m^l + b_0^l)} - \frac{\beta^u u^u}{h^l} > 0$.

Then from inequality (6) we can get $\frac{dx(t)}{dt} \ge \xi x(t), (t > t_4)$ .Integrating on both sides of the last inequality from t_4 to t, we have

$$x(t) \ge x(t_4)e^{\xi(t - t_4)}, (t > t_4).$$

We know $x(t_4) > 0$ according to Lemma 2.1, so $x(t) \to +\infty$ when $t \to +\infty$ .This is a contradiction with the assumption $\lim_{t\to+\infty} x(t) = 0$,so the conclusion of the theorem is true.

Theorem 2.2. For model (M_0), if $r_0^u - \frac{\alpha^l k^l u^l}{(k_1^u M_x + h^u)(g^u + m^u + b_0^u)} - \frac{\beta^l u^l}{k_1^u M_x + h^u} < 0$, and $\int_0^{+\infty} f(t)dt < +\infty$, $b^l\omega^l - r_0^u > 0$, then the population will go to extinction.

Proof. Eq. (2) means that $\frac{da(t)}{dt} \le f(t)$, then

$$a(t) \le a_0 + \int_0^t f(s)ds \le a_0 + \int_0^{+\infty} f(t)dt := M_a.$$

Eq. (1) implies that

$$\frac{dx(t)}{dt} \le x(t)(r_0(t) - b(t)\omega(t)(1 - \frac{n(t)a(t)}{x(t)}))$$

$$= b(t)n(t)\omega(t)a(t) - (b(t)\omega(t) - r_0(t))x(t) \le b^u n^u \omega^u M_a - (b^l \omega^l - r_0^u)x(t).$$

Then a standard comparison theorem gives $\limsup_{t\to+\infty} x(t) \le \frac{b^u n^u \omega^u}{b^l \omega^l - r_0^u} M_a := M_x$.

From Eq. (4) we have $\frac{dC_e(t)}{dt} \ge -(k_1^u M_x + h^u)C_e(t) + u^l$ .Using a standard comparison the theorem we obtain $\liminf_{t\to+\infty} C_e(t) \ge \frac{u^l}{k_1^u M_x + h^u}$.

From Eq. (3) we get $\frac{dC_0(t)}{dt} \ge \frac{k^l u^l}{k_1^l M_x + h^u} - (g^u + m^u + b_0^u)C_0(t)$.

Using a standard comparison theorem again, we have

$$C_0(t) \ge \frac{k^l u^l}{(k_1^l M_x + h^u)(g^u + m^u + b_0^u)} + (C_0(t_3) - \frac{k^l u^l}{(k_1^l M_x + h^u)(g^u + m^u + b_0^u)})e^{-(g^u + m^u + b_0^u)(t - t_3)}.$$

We take the lower limit on both sides of the above inequality,

$$\liminf_{t\to+\infty} C_0(t) \ge \frac{k^l u^l}{(k_1^u M_x + h^u)(g^u + m^u + b_0^u)}.$$

From Eq. (2), we have

$$\frac{dx}{dt} \le x(t)(r_0(t) - \alpha(t)C_0(t) - \beta(t)C_e(t)) \le x(t)(r_0^u - \frac{\alpha^l k^l u^l}{(k_1^l M_x + h^u)(g^u + m^u + b_0^u)} - \frac{\beta^l u^l}{k_1^l M_x + h^u}).$$

Since $\eta := r_0^u - \frac{\alpha^l k^l u^l}{(k_1^l M_x + h^u)(g^u + m^u + b_0^u)} - \frac{\beta^l u^l}{k_1^l M_x + h^u} < 0$.

Then $\frac{dx}{dt} \le \eta x$,a standard comparison theorem gives $x(t) \le x(t_4)e^{\eta(t - t_0)}$. And so $x(t) \to 0$,as $t \to +\infty$.

This completes the proof of the theorem.

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Forecast Study of Temperature of Shanghai Base on Energy Consuming Analysis

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Abstract. Based on the statistical data from National Bureau of Statistical of China, this paper shows the correlationship between the energy consumption of the provinces and temperature of corresponding capitals. After that Shanghai is researched as an example, and an forecast of Shanghai's temperature after 20 years is draw out on condition that the energy consumption of this city keeps the same increasing rate as the average value of the last 6 years up to 2008. And then it is shown that industry and traffic make up the main part of Shanghai's energy consumption. Thus, it is educed as a conclusion that the future achievement on the recycle of industrial residual heat and energy and on the control of traffic energy consumption will be the effective approach to slow the total energy use increment and thus slow the temperature ascent.

Keywords: energy consumption, temperature, artificial heat release, correlationship, forecast, recycle of industrial residual heat and energy.

1 Introduction

The global warming has caught unprecedented attention through a series of phenomena. For example, the sea level has been rising in the last 40years with the thaw of the glacier and the shrinkage of ice sheet in the arctic cycle[1], the globle temperature has moving up at a accelerating speed for the last 100 years, and is at the highest point of all the past 1000 years[2]. The meteorological data show that this temperature rising is also happening in China even more obviously. The corresponding studies [3-7] show that the damage of natural and social environment have been caused by the warming weather and will be magnified with the further rise of the temperature. So it becomes more and more important to develop the research of the reason and control method against temperature rising.

2 The Artificial Heat Release (AHR) is an Important Reason Leading to Warming Weather Besides CO2

There have been several explanation about the climate warming before such as solar activity variety, plate motion, heat release, and the emission of green house gas(GHG) to which CO2 contribute the main part. And now the CO2 theory is known

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as the primary reason and the only consideration to control the climate warming in Intergovernmental Panel on Climate Change (IPCC).

The CO2 viewpoint was first brought out at the end of 19th century by Chamberlin[8], and was demonstrated by ice core pick up from the Vostok station of Antarctic, which told the similar evolvement pattern between temperature and the CO2 concentration in the past 420 thousand years[9].

However, some evidence shows that the CO2 theory is not fit for the temperature foreseeing study on the cities in our country. For instance, the global average CO2 concentration have been rising since the year 1881[10] while the widely temperature ascent of most cities in China started from around 1978. It suggests that there is some other important mechanism which leads to local climate warming.

During the past 30 years, the energy consumption of many provinces in China has increased a lot. while, the temperature of their capitals are in an similar situation, and there is widely correlationship between them[11]. According to the statistic rule system the value of artificial heat release (AHR) can be considered nearly equal to energy consumption. Therefore there is correlationship between AHR and temperature, too.

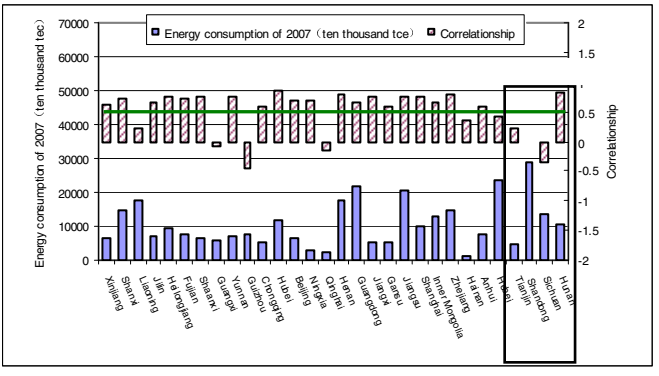

Fig. 1. The correlationship between the energy consumption of the 30 provinces and municipalitys of China and the annual mean temperature of the corresponding capitals

Figure1 shows the correlationship between the energy consumption of provinces and the temperature of corresponding capital in the 30 years from 1978 to 2007. The year sample size of all provinces is equal to or smaller than 30 because of the loss of some part of the data, and is bigger than 10 except for the four provinces in the frame on the right side in the figure.

To be honest, it is not the best choice to study the temperature of the provinces respectively. First, there are great difference of area, geography, population, and industry structure etc. among the province. Second, the effect of energy consumption not only localizes in the district itself but also spread to the area nearby. However, the meaning of this statistics study is still clear after the result of the whole country shows up. It is that the great majority of the provinces and municipalities show strong positive correlaionship between energy consumption and temperature except few districts of which the data has too many blanks.

To be more noticeable, the recent temperature rise of the province capitals in China, cities with widely energy consumption ascending, is much larger than the

global mean value and the Northern Hemisphere mean value[12, 13]. It suggests that the artificial heat release (AHR) from the energy consumption plays an important role in the warming of climate especially of the local climate. If we only take the effect of CO2 in account and neglect the AHR, the long term forecast of city temperature in our country will be lacking in accuracy. Consequently the policies and efforts which are only based on the CO2 consideration will probably lead to failure in mitigating the temperature, and cause unnecessary expense for the city development.

For the reason told above, this paper focuses on the the effect of AHR from the energy consumption to the city temperature evolution. As the most modern and typical energy consuming city, Shanghai has good data of energy and temperature observation. So in the following text, the corresponding situation of Shanghai will be studied in detail as a model.

3 Data Source and Research Method

This paper choose the data of year 1985-2009 to analyse for the data of these years are of intactness and have the fine subdivisions of the energy consumption. The energy consumption are gained from the data publicized by the national bureau of statistic of China[14-16]. The meteorological data come from the data set of the annual mean value of Chinese international exchange surface station which are collected by China meteorological administration with corresponding standards [17, 18].

According to the energy statistics rule, the energy consumption comprise terminal consumption, expense in conversion process, and the loss. In view of that most of the former two item will finally turn to the heat release and the loss is so less that can be neglected, this paper considers the value of energy consumption to be the artificial heat release.

4 The Temperature Forecast Study of Shanghai

The Relationship between the Energy Consumption and Temperature of Shangha. The temperature of Shanghai has been ascending with the energy consumption enhancement as same as most cities in China. The relation between temperature and energy consumption of Shanghai in the year1985~2009 is shown as figure2

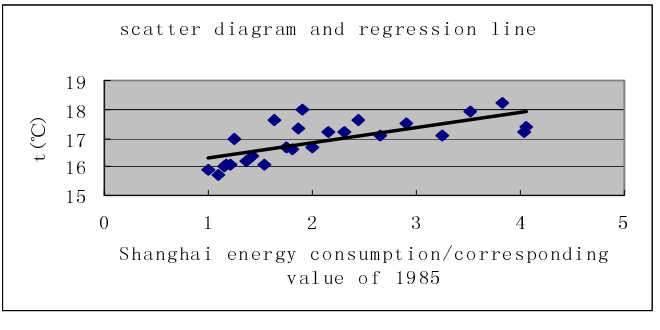

Fig. 2. Scatter diagram and linear regression line of the relation between energy consumption and temperature of Shanghai

Through figure2 the correlationship can be seen clearly. The pearson correlation coefficient equals 0.695 after calculation, the two parameter show strong positive correlationship. Upon that, we make the linear regression of figure2 to find out the quantitive connection between the energy consumption and the temperature of Shanghai. The equation we get is:

$$\phi(\xi)=0.4854*\xi+15.87 \quad (1)$$

In (1) ξ denotes the normalized energy consumption (the energy consumption over the corresponding value of 1985), while ϕ denotes the temperature forecast. The root mean square of the temperature difference between the regression line and the year samples is 0.500℃, while the span of the regression line is 1.58℃, and the span of the samples is 2.5℃. So 0.500℃ is a small number by comparison, and the regression line has relatively good use.(the root mean square temperature difference over the regression line span equals 0.316.)

Based on equation (1) and the estimation of the energy consumption development the future Shanghai temperature can be forecasted now.

Analysis of Energy Consumption Structure of Shanghai. Let's have a look at the development of Shanghai energy consumption and its structure in figure3.

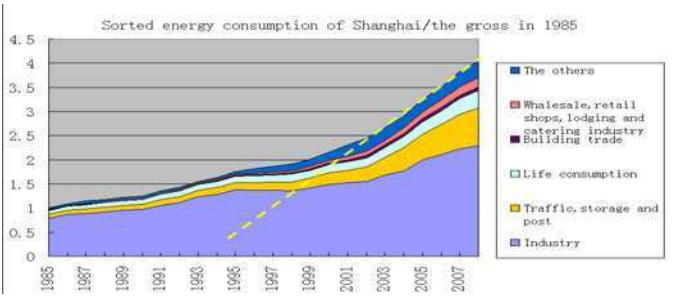

Fig. 3.

It could be seen that the energy consumption of industry contributes the main part of the gross and is still increasing in a considerable speed. In the next place is item of traffic, storage and post which are increasing even more rapidly. The proportion of this item to the gross has grown from 7.9% of the year 1985 to 19.3% of 2008.

The Forecast of the Temperature of Shanghai. Through figure3 we can see that the energy consumption of Shanghai has been increasing in a nearly constant speed for the past 6 years before 2008. Now we take the average of the past 6 years rising speed of the total and the sorted energy consumption. If the energy consumption of Shanghai keeps increasing in the future 20 years at this average speeds, as shown in figure4, the normalized energy consumption will be up to 9.35.

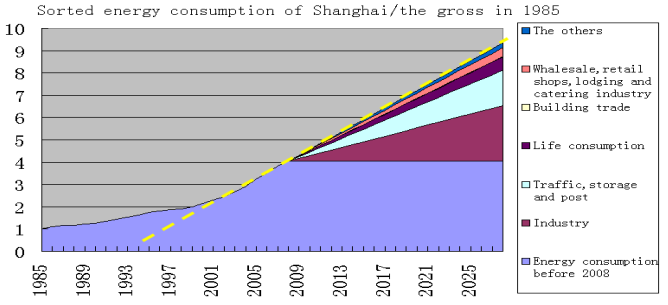

Fig. 4. Increment estimate of sorted energy consumption of Shanghai

If the energy consumption increases like figure4, the annual mean temperature of Shanghai will ascends up to 20.41 ℃ according to equation(1) which is 2.57℃ higher than 2009.

From figure4 we can see that the main part of the energy consumption increment is in industry while the value of traffic, storage and post is also no little. So let's look further into the subdivisions of industry and draw figure5.

In figure5, the part of ferrous metal smelting and rolling contributes 23% of the total energy consumption of industry. In the ferrous metal industry the smelting temperature is around 1500℃, and the surface temperature of most equipment and casting is no less than 300℃. If we can recycle the residual heat and energy to generate electric power the energy consumed in power generation would be reduced greatly.

According to investigation of 20 typical steel corporation on their situation of residual heat and energy recycling, the average recycling rate is 25.8% while the corresponding value in developed country is above 90%, for example Nippon steel corporation of Japan has achieved 92%[19]. Furthermore, most of the other parts of industry in China also have a low efficiency in heat use which is quantitively from10% to 35%[20].

The situation above shows that there is huge development space for the recycling of industry residual heat and energy.

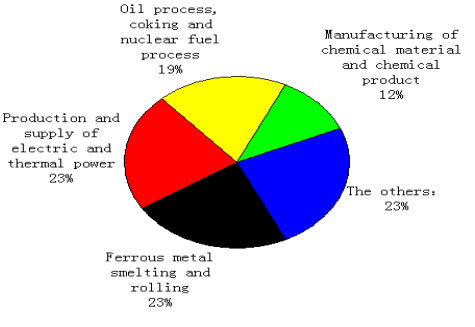

Fig. 5. The structure of industry energy consumption of Shanghai 2008

The Energy Saving Expection and the Resulting Temperature Forecast in 20 Years. If the industry residual heat and energy recycling rate of shanghai can be enhanced 50% from the existing level, in other words, if half of the industry energy consumption in figure5 can be recycled at 2028, the estimation of energy consumption will get large reduction. At the same time if the parts of traffic life consumption and tertiary industry can be reduced by half through the control and optimization, the future energy consumption in 2028 will be the situation as in figure6.

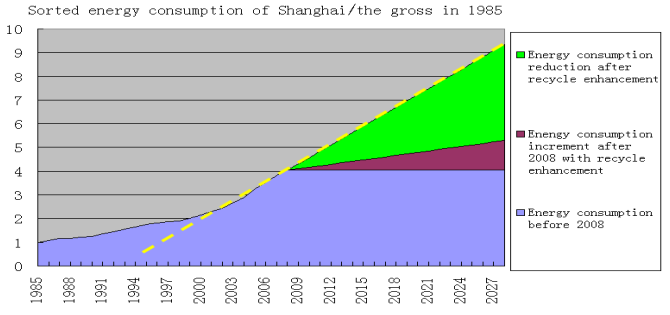

Fig. 6.

In that case the normalized energy consumption will only increase by 1.25 and consequently the temperature will only rise by 0.60℃ with the avoidance of 1.97℃ temperature rise.

Discussion about the Energy Saving Method. Because the industry contributes the main part of the total energy consumption of Shanghai, the recycling of the industry energy use should be the key to the energy saving.

First, power generation from the high quality residual heat must be developed with the encouraging policy of the electricity trade with State Grid.

Second, a mass of industry residual heat under 300℃ is used merely in warming the buildings in the factory and supplying the hot water to resident nearby. There is a huge gap of energy quality between the residual heat source and the requirement[20]. The existing direct use leads to badly waste. If the supply network of heat and cold with respective temperature standard can be paved in the new city zone, it will be very helpful to the residual heat recycling and utilizing. The recycled residual heat and energy can warm the circulating water to 130℃ which is piped to communities to drive heat pump to supply heating in winter[20],and in summer the residual heat and energy can produce the cooling energy and transports it with highly effective latent heat material[21] to the consumption end. Consequently a great lot of energy used by air conditioners for warming or cooling and used for heating bath water will be effectively saved. Furthermore, the residual heat can be used in other sectors, such as agriculture, with the standard thermal supply network.

The last term is about the control of increasing traffic energy consumption. On one hand, the development of public transport and the restriction of private car can save the energy use and mitigate the traffic jam and consequently gain the further energy

saving; on the other hand, the development of electric traffic in company with residual heat recycle in power plant will save the energy use a lot, too. As to the existing bus on service, the alteration to recycle the exhaust heat is recommended.

Conclusion, Suggest and Expectation. In this paper, we have studied the correlationship between the energy consumption and the temperature of Shanghai, and the equation of this relation is gave out.

On the basis of this equation, this paper forecast that if Shanghai keep the existing structure and increment speed of energy consumption the future temperature after 20 years will go up 2.57℃ higher than 2009.

If the estimate net energy consumption of industry, tertiary industry and resident use can be reduced by half through the effective control and upgrade for energy saving, the temperature forecasted of 2028 will be higher by only 0.60℃ than 2009.

To match the central heating and central cooling, the latent heat material needs development to boost the effect of energy transportation.

Although the study in this paper is focused on Shanghai, the conclusion is also or even more fit for the northern cities because of the existing pipe network

As the follow-up work, my next paper will discuss the residual energy recycle of industry and transportation in a thermal mechanics view so that the space of energy saving can be quantified further.

Acknowledgment. The reference room of national bureau of statistics of China and the energy statistics department in Shanghai bureau of statistics are acknowledged for the very useful data support.

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Blockboard Defect Detection Based on Wavelet Transform and Mathematical Morphology

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Abstract. In order to implement automatic detection of blockboard, X-ray nondestructive detecting system is used to obtain blockboard X-ray images. An image processing method based on multi-scale wavelets decomposition and mathematical morphology is proposed in this paper. The method uses wavelet transform to suppress the interference information. Then edge detection method based on mathematical morphology of multi-structure elements is constructed by weighting method of morphological operation. The results show that the method performs well in noise-suppression and edge detection. This method is very effective to detect the defects of blockboard.

Keywords: X-ray Image, Wavelet Transform, Mathematical Morphology, Multi-structure Element.

1 Introduction

Wood-based panel is the mainstream of home decoration nowadays. There are many different kinds of wood-based panel, the most common of which are: blockboard, plywood, wood veneer, fiber board and so on[1]. Blockboard is widely used in furniture-making, interior decoration and other fields. It has the merits of small bulk density, easy processing, and deformation resistance. Compared with fiber board and shaving board, blockboard performance is closer to natural wood, and easier to be accepted by consumers. Because of technical problems and irresponsible manufacturer, quality of blockboard varies considerably. Some properties, such as bond quality, uniformity degree or situations of filler, may be not meeting the requirements. Moreover, environment factors let the used wood accrue various defects in their growth process. So it is necessary to detect the defects of blockboard to raise the utilization rate.

Traditional detecting often uses artificial test which is labor-intensive and brings about raw material waste. Most importantly, the detection efficiency is low. Now scholars use digital image processing techniques to analyze characteristics of wood and woodwork defect images. Detection method using a computer instead of manual inspection can achieve automatic detection and location of defects in target object. X-ray image technique has been applied in the field of nondestructive testing in recent decades. By this method, an image of target object can be acquired by a nondestructive detection image system. Along with the gradual development and improvement of wavelet transform and mathematical morphology, their applications in digital image processing become more and more widespread nowadays. This paper

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provides a new defect inspection method based on wavelet transform and mathematical morphology to realize automatic detection and recognition of blockboard defects.

2 Fast Wavelet Transform of Image

Wavelet analysis is a perfect integration of functional analysis, Fourier analysis, harmonic analysis and numerical analysis. It is a further development of Fourier analysis theory. Fourier analysis is a good tool for frequency analysis, but it only provides global frequency information, which is independent of time. Wavelet transform provides both time and scale information of signals and is well adapted for finding the location and spatial distribution of singularities[2].

Based on pyramid image decomposition and reconstruction algorithms, Mallet proposed a fast decomposition and reconstruction algorithm of wavelet transform[3]. It decomposes a 2D image using two one-dimensional decomposing filters and reconstructs image using two one-dimensional reconstructing filters exactly. Let $H_{r,m} = h_{r-2m}$, $G_{k,m} = g_{k-2m}$ and introduce infinite matrix $H_r = (H_{k_1,m_1})$, $H_c = (H_{k_2,m_2})$, $G_r = (G_{k_1,m_1})$ and $G_c = (H_{k_2,m_2})$, where *H* and *G* are two one-dimensional mirror filter operators. Their subscript "r" and "c" respectively denote the row and column operation of matrix. Then Mallet algorithm of two-dimensional image can be expressed at the scale of $j-1$ as follows:

$$\begin{cases} C_j = H_r H_c C_{j-1} \\ D_j^1 = H_r G_c C_{j-1} \\ D_j^2 = G_r H_c C_{j-1} \\ D_j^3 = G_r G_c C_{j-1} \end{cases} \quad (j = 0, -1, \cdots, -J) \tag{1}$$

C_j is low-frequency components(approximate images) of original image C_{j-1} at the resolution scale of 2^j. D_j^1, D_j^2, D_j^3 respectively correspond to high frequency components(detail images) of vertical, horizontal and diagonal directions. The corresponding Mallet reconstruction algorithm of two-dimensional image can be described as:

$$C_{j-1} = H_r^* H_c^* C_j^* + H_r^* G_c^* D_j^1 + G_r^* H_c^* D_j^2 + G_r^* G_c^* D_j^3, \quad j = -J, -J+1, \cdots, -1. \tag{2}$$

Where H^* and G^* are respective conjugated turn matrixes of H and G. Arithmetic operator of $H_c H_r$ properly stands for a two-dimensional low pass filter. Mallet wavelet decomposition algorithm decomposes any 2D image $f(x, y) \in L^2(R)$ into low-frequency parts at the resolution scale of 2^{-N} and high-frequency part at the resolution scale of $2^{-j}(-1 \le j \le N)$. Then all above several parts can reconstruct original image exactly by using this reconstruction algorithm.

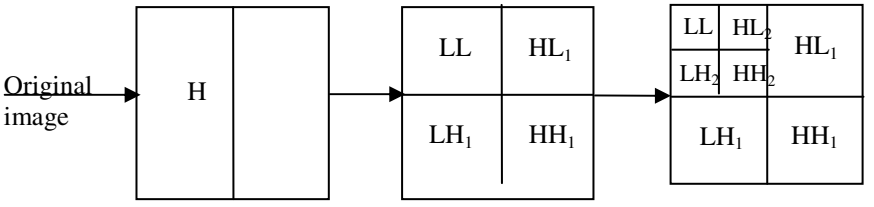

Fig. 1. Structure diagram of two-dimensional wavelet transform decomposition.

Fig.1 is the structure diagram of two-dimensional wavelet transform decomposition. Where, L is low-frequency part, and H is high-frequency parts. LL shows the approximate image which contains the most information of original image. LH, HL, HH respectively preserve vertical edge details, horizontal edge details, and diagonal details. The diagonal details are influenced by noise greatly.

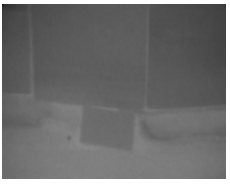

Fig. 2. The Original X-ray image

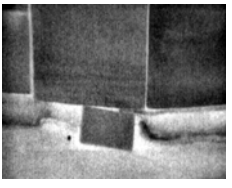

Fig. 3. Image after pre-processing

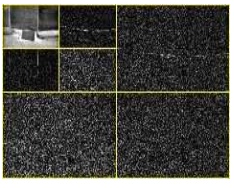

Fig. 4. The Wavelet decomposition result

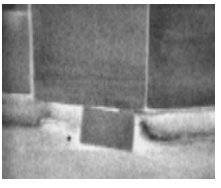

Fig. 5. The reconstructed image

Experiment Results of Wavelet Transform. Fig.2 is a blockboard image collected by X-ray nondestructive detection imaging system. The image is fuzzy, low contrast and the gray scale distribution is uneven. Some preprocessing steps, such as gray-scale transformation and histogram equalization, were performed on the image, and the result is shown in Fig.3. The result of the X-ray image after wavelet decomposition is shown in Fig. 4. By analysis, it's found that the defects have mainly been reflected in the approximate image, while the impurities, noises and some other interference information have mostly been included in the high frequency details section. Therefore, we reconstructed the approximation sub-bands of wavelet transform by abandoning high-frequency detail sub-bands. Then we can find that the reconstructed image not only doesn't lose the main outline of the defects, but also effectively suppress the interference information and enhance the image defects. Fig.5 is the reconstructed image. It's obvious that the interference information such as wood grain, impurities and noises, has been remarkably weakened. The reconstructed image retains the main defects features of the original image, which provides favorable conditions for the follow-up accurate detection of the defects.

3 Morphological Morphology and Defect Edge Extraction

Basic Theory of Mathematical Morphology. Mathematical morphology is a versatile and powerful image analysis technique for extracting useful image

components with respect to representation and description of regions, such as boundaries, size, area, shape, or connectivity in segmentation-oriented image processing. Morphological operators are widely used in image processing and analysis[4].

Basic ideas of mathematical morphology are to measure and extract corresponding shape using structure element which have specific figuration to realize the image of analyzing and identification. Let $f(x, y)$ denotes a grey-scale two dimensional image, $B(s,t)$ denotes structure element. The basic mathematical morphological operators are dilation and erosion, derived from these, opening and closing operations are also defined.

Erosion:

$$(f \Theta B)(x, y) = \min\{f(x+s, y+t) - B(s,t) \mid (x+s, y+t) \in D_f; (s,t) \in D_B\} \tag{3}$$

Dilation:

$$(f \oplus B)(x, y) = \max\{f(x-s, y-t) + B(i, j) \mid (x-s, y-t) \in D_f; (s,t) \in D_B\}. \tag{4}$$

$$\text{Opening: } f \circ B = (f \Theta B) \oplus B. \tag{5}$$

$$\text{Closing: } f \bullet B = (f \oplus B) \Theta B. \tag{6}$$

Dilation and erosion can be combined to achieve a variety of effects. For example, subtracting an eroded image from its dilated version produces a "morphological gradient", which is a measure of local gray-level variation in the image[5].

$$E(x, y) = f(x, y) \oplus B(x, y) - f(x, y) \Theta B(x, y). \tag{7}$$

Using the morphological gradient algorithm can obtain more continuous edge than traditional edge detection methods.

Multi-structure Element. For mathematical morphology, one most important concept is structure element, the choice of which directly affects edge detection results. Different structure elements can be used to extract different image characteristics. There are many kinds of structure element, such as disk, square, diamond and so on. In order to obtain better detection results, it is necessary to adjust the structure elements according to the image features. Traditional edge detection methods by mathematical morphology often select only one single structure element, so that image edges whose shapes are different from structure element are smoothed. The advantages of multi-structure element are accurately detecting different types of edges and effectively restraining noise.

Based on the characteristics of image, select structure elements $B_i (i = 1, 2, \cdots n)$ first. Let $a_i (i = 1, 2, ..., n)$ be weight coefficient. Then multi-structure Element edge detection operator can be constructed.

$$E = \sum_{i=1}^{n} a_i E_i(x, y) \text{ and } E_i(x, y) = f \oplus B_i - f \Theta B_i \ (i = 1, 2, ..., n) \tag{8}$$

Select a_i according to the following algorithm:

(1) Calculate the mean value of the images which are filtered by opening-closing and closing-opening algorithm respectively.

$$f_i(x, y) = (f \circ B_i \bullet B_i + f \bullet B_i \circ B_i)/2 . \tag{9}$$

(2) Calculate image variance $\Delta_i^2 = \left| f - f_i \right|^2$ at different size and weight value $a_i = \Delta_{l-i}^2 / \sum_{i=k}^{l} \Delta_i^2$. The weight value depends on proportion of image variance in different size, which can reflect principle of selecting large, small structuring element weight value.

Edge Extraction Experiments. Fig.6 is the edge image of the proposed method. It can be shown that the edges are consistent with the subjective vision. The anti-interference ability of the operator is strong, and the detected edges are more integrated and continuous. From the figure, we can find that the blockboard is not up to standard. Not only do the raw materials have some defects, such as knot, but also the adhesive bonding technology and filler is in poor quantity. Compared with traditional edge operators, the result is actually conducive to recognize the defects of blockboard. The detecting result of using traditional operator is shown in Fig.7. It is obvious that the result is distorted. Fig.8 and Fig.9 are respectively an original wood x-ray image and the corresponding processing result. It shows that the method we proposed also applies to wood defects detecting.

Fig. 6. Multi-structure element

Fig. 7. Traditional operator

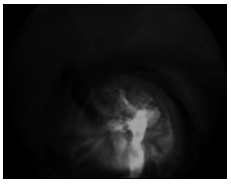

Fig. 8. An x-ray wood image

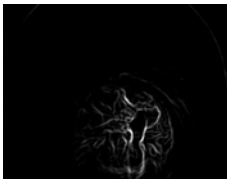

Fig. 9. Processing result of Fig. 8

4 Conclusions

In this paper, we use wavelet transform and morphology to automatically detect blockboard in x-ray image, and extend the method to detect wood defects. The proposed method is very efficient for locating defects in blockboard. It is more efficient and faster than other existing methods for the computation of such operations. Defects of blockboard are easy to identify through the processing results, which are significantly better than those of traditional methods. This paper provides a new method for wood and wood-based production nondestructive testing and image processing. In spite of the good results obtained, a few points remain to be studied in

depth in order to ensure the validity of the processing method and to take into consideration all the factors which may effect processing results.

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Study on the Optimization of Courses Systems Based on Innovative Personnel Training Mode

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Abstract. According to the university's features of running school, the requirement of cultivating innovation talents and the current teaching situation of universities, this thesis probes the assumption of putting stratified teaching model and teaching reform into practice in some majors and the adjustment of train of thought on course design, points out the relative reform of training model of students, and further proposes the suggestions and solutions about how to manage student affairs, which will promote universities' teaching reform and development during the 12th Five-Year plan, improve the teaching qualities and the abilities of managing student affairs, and also have great significance to the development of students' personalities.

Keywords: innovation talents, training model, stratified teaching, student affairs.

1 Introduction

The furious market competition which has been changing deeply requests higher and new quality of subject of educational enterprise in our country. One of the solutions to content the challenge is teaching with layers, which is a necessity not only to the need of higher education reform but also to promote the internationalization of higher education and the cultivation of innovation qualified persons. In this paper, several problems are analyzed in detail and then some suggestions to perform teaching with layers are proposed in order to make student to master professional knowledge and enhance their competitive ability. In compliance with the principle of "teaching students in accordance with their aptitude and guide them by personality" set up by Ministry of Education [1], to spread the system of teaching at levels focuses on those subjects: to build and improve the diversity of teaching platform, to promote the quality of education in universities and the teaching reform regarding more on development of campus students, to harmonize the specialization and individuation and so forth.

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2 Reforming Programs

The system for performing teaching with layers is complex, involving teaching idea and goals, course offered, teaching material and managements both in teachers and students and so on. What's utmost important is the changes in teaching idea, which indeed convey the destination of improving academic ability and take students as the subject of learning. Realizing student demands and teaching goals is teacher's responsibility in this teaching form. Moreover, teachers should change their roles in classroom frequently and only teach marrows in lectures but guarantee plenty of practice. In traditional classroom teaching, a highlight problem—the content is beyond the capability of a poor student and does not satisfy a good student, can be resolved basically.

3 Implement Teaching with Layers and Classified Management

Program in English Teaching with Layers. In April 2009, based on summarizing the10-year experience in English teaching comprehensively and investigating in all directions, the implementing regulations for English-teaching reform were accomplished in China University of Geoscience(CUG). It has been enacted in undergraduate English-teaching reform and practice from autumn 2009. After registering, the freshmen participate in the classified examination organized by CUG, and then they are divided into three ranks A (advanced class), B (intermediate), C (basic class) according to the weighted average of English grades in college entrance examination and classified examination. There are some differences in course arrangement, for class A aiming at English major, it emphasizes accelerating teaching speed and add more extensive profound content in teaching, for class B aiming at non-English majors, it stressed a moderate speed and systematically operation in teaching, for class C, the teaching speed is slower to reinforce basic abilities, because its target is the art students art, the athletic and national minority. To the examination, students at different levels would check in different bank of examination question. In recent years, the passing rate of CET-4 in CUG has kept 10% higher than the average level in the key universities. Moreover, as the comprehensive ability to applying English is boosted gradually, students display a splendid performance in many English competitions: more than 20 students become the outstanding winner, one first prize, one second prize and two third prizes are gained in National English Debating Competition, one second prize and three third prizes in National English speech competition, four third prizes in provincial English speech competition.

Adjustment in Segmental Academic Course. Since the year 2010, the quadrennial modification in undergraduate teaching program was launched, in order to adapt academic course program in layering teaching to the development and academic adjustment. The specific operation as follow:

1 Three Classes ABC in " Foundation of Geology" teaching

Class A: the total class hour is 136, including 82 teaching hours and 54 practical hours.

Practice teaching bases**:** Two weeks for geology fieldwork around the outskirt of WuHan and 4 weeks for practical teaching in ZiGui practice teaching bases.

This course which is related to every hard-core in the geological sciences, can provided students with the basic theory and research method of geological sciences and the current situation, foremost development and future direction in geological sciences. Students are capable of making geology drawing, analyzing the geological phenomenon and are more prepared to learn academic knowledge and conduct fieldwork through this course.

Class B: the total class hour is 80, including 82 theoretical teaching hours and 54 experiment hours.

Practice teaching bases: Two weeks for geology fieldwork around the outskirt of WuHan and 2 weeks for practical teaching in Beidaihe practice teaching bases.

This course is prepared to those majors like Resources and Urban and Rural Planning, environmental engineering, geotechnical engineering, road and bridges engineering and so on. In this course, students can master geological theory, basic knowledge and elementary ability, analyzing and judging the geological phenomenon and read geological information,

Class C: The total class hour is 40, including 30 theoretical teaching hours and 10 experiment hours.

Practice teaching bases: one week for geology fieldwork around the outskirt of WuHan.

This course is a professional course but most important geological course for engineering, environment major and so forth. In this course, basic theory and researching method concerning geological science are involved, and students thinking ability for geology are cultivated [2].

2 Plans concerning Layering Teaching in "Surveying " and "Practice Teaching of Surveying"

At present, the course of surveying are divided in four classes and offered in 8 faculties: Faculty of Environmental Study, Faculty of Earth Sciences, Faculty of Resources, Faculty of Engineering, Faculty of Mechanical & Electronic Information, School of Computer Computer , Faculty of Material Science & Chemistry Engineering, Faculty of Information Engineering and Faculty of Economy and Management, amount to 28 professions. The ability to combine relevant theory, technology, and method with professional knowledge is applicable requirement for non-geomatics -Engineering major students. GPS as a portion of "3S" in geomatics, has been by geosciences students in teaching practical base of Beidaihe, Zhoukoudian, Zigui and so on when they perform practical works, for instance, geological charting, fixing point in map. Taking this significant influence of GPS, the fundamental theory and exercise of GPS will be added in the teaching content.

Reform in Method and Model of Teaching. The reform regard to model of teaching is always the important part in teaching reform, because in the traditional style, the central in classroom is the teacher but not students, their enthusiasm can not be leveraged. "The new teaching model, which converted the simplex classroom teaching to student-leading and teacher-assistant model", is dependent largely on Modern Information Technology, especially the network techniques which can conquer limitations of learning time and place[3]. Given the application of computers

and multimedia teaching, a platform of independent learning has been established in our university to take full advantage of student spare time, which adequately demonstrates the principle of "combining the classroom teaching with independent learning openly". It draws much support from school of foreign language: using the existing multi-media and F.M. devices to play English movies regularly and diverse English listening comprehensions, which forms a second classroom for students to largely display the combination of the first classroom and the second one. Further, it demands that teachers should embody distinctive individual charming as well as teaching art or skill to perform the principle of "practical, intellectual and enjoying teaching". Therefore, the central subject of teaching transformed from teachers to students, and more attention is played to cultivate the ability to apply and self-directed learning.

4 Effect Analyses of Layering Teaching

Benefits in Encouraging Individual Development of Innovatory Talent. In traditional classroom teaching, the unitary standard and compromising teaching goals directly lead to a highlight problem that the content in classroom is beyond the capability of a poor student but not satisfied for a good student, moreover student's enthusiasm to learn is egregious subdued [4]. But in the model of teaching at levels, students with divers abilities are eligible to their own teaching goals which are built relying on their competence. Because different teaching program, content and teaching speed are established respectively, to stimulate students to transfer learning pressures to learning power, and then achieve a few personal progresses.

Encouragement in Enhancing Students Learning. In the layering teaching, not only every student would burden the urgent demand to learn, to advance gradually, and to join in a higher class, but also teacher initiative of teaching are increased. Because in this new teaching model, student different foundation and capability are taken into consideration and students participate in classroom teaching energetically, so that teacher can pay sustained attention to the content, without thinking the layout of teaching.

5 Conclusion

In summary, the layering teaching is an inevitable result of deepened teaching reform, a prerequisite for teaching students in accordance of their aptitude and improving teaching quality. In the form of teaching at levels, to achieve the quality-oriented education and student proper development conveys its basic aim and to cultivate student individual ability displays its ultimate purpose, which both comply with the requirement of academic teaching development. Provided that the idea of teaching students depend on their aptitude, pondering on teaching frequently and keeping reform and innovation is persisted in practically, and students developments are regarded as the essence of university blossoming, the educational reform in our university would make a substantive progress and more professional talents with creative spirit and practical ability would be incubated and perform splendidly in stinting market competition.

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The Study in Characteristics of SMB and HML's Non-system Risk Factors in the Fama and French Three-Factor Model

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Abstract. This article thinks that SMB and HML of the Fama & French Three-factor Model are non-systematic risk factors in the micro level. And in this paper, fixed DVI was adopted to calculate the fixed portfolio price index, form the Fama & French Three-factor Model and test the statistical significance of SMB and HML from different portfolios. Come to conclusions that SMB and HML are significant non-systematic risk factors only in part of portfolios and so on.

Keywords: SMB, HML, DVI, Fama & French Three-factor Model.

1 Introduction

Based on Markowitz's Portfolio Theory, Sharpe (1964), Lintner (1965)], and Mossin (1966) put forward CAPM independently. CAPM takes the market premium as the only risk factor of changes in securities' rates of return of. But it thinks the non-systematic risk caused by other factors is due to the intercept and residuals.

Fama and French (1992) proposed that ME and BE/ME can explain the differences in cross-section of average rates of return. Fama and French (1993) first proposed the Fama & French Three-factor Model. They thought there were other characteristic factors which could reflect the risk of securities beside the β in CAPM. So they took ME as the size premium factor and BE/ME as the value premium factor. Then they imported them into CAPM and formed the Fama & French Three-factor Model, consisting of the market premium factor, size premium factor and value premium factor. Fama and French (1995) linked the size premium factor and BE/ME premium factor with the profitability of listed companies. They took the rate of return as a measure and proved the relationship between the rate of return on investment and the size and BE/ME of the company. This provided theoretical support for the Fama & French Three-factor Model.

The market premium factor reflects the systematic risk of the whole stock market in the macro level. So it is a common risk factor of all securities of the stock market. But the size premium and value premium, belonging to the non-systemic risk of

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securities, reflect the characteristics in the micro level of the stock market. The Fama & French Three-factor Model is based on CAPM. So, when the non-systematic risk factors- the size premium and value premium- is imported, it no longer continues to have characteristics of the uniform pricing model for the entire market. They attempted to improve the Fama & French Three-factor Model by studying process of the dynamic balancing and the relationship between the size premium and value premium. From the perspective of Migration, Fama and French (2007) pointed out that the negative size premium caused by the relatively low average rates of return and greater flexible strategy of large companies often offset some value premium and reduced the value premium level of the entire market. And it happened in the process of the small companies which had significant positive returns turning into large companies. Fama and French (2008) also pointed out that there were internal relations between the size premium and value premium. But they never distinguished the size premium, value premium and the market premium of CAPM from the basic characteristics of risk.

This article believes that the size premium and value premium, linked with individual characteristics of specific securities, are risk factors in the micro level instead of common market risk factors. And the size premium and value premium of securities, having different sizes and BE / ME, have different elasticity and obviously different statistical significance. So, based on the two micro-level risk factors, take use of empirical methods to divide the companies into 6 portfolios, having typical characteristics in the size premium and value premium. Then build the dynamic Fama & French Three-factor Model on the basis of time series and test the statistical significance of the size premium and value premium in different portfolios. This article chooses the data of listed companies in Shanghai Stock Exchange from December 2001 to December 2009 to form the empirical sample. To make dynamic adjustments in the rate of return index of portfolios, use the fixed DVI, proposed by Vikash Bora Ramiah and Sinclair Davidson (2007). This is to ensure the comparability and consistency in time series on the basis of the rate of return index on portfolios. At last, form the dynamic model by six portfolios which are got from cross-group, based on the two risk factors- the size premium and value premium, and do some empirical researches on the effectiveness of the Fama & French Three-factor Model in different portfolios.

2 Calculation and Adjustments of Portfolios Price Index

First, calculate the company size according to their everyday's closing price and the share capital in current financial statements, and calculate BE/ME according to the owner's equities in current financial statements and everyday's closing price. Then divide all samples into the large-scale group B and small-scale group S, according to the company size. We also divide them into groups of high BE/ME- H, groups of medium BE/ME- M and groups of low BE/ME- L. Six portfolios- BH, BM, BL, SH, SM and SL- will get after the cross-group according to the company size and BE/ME. Since each portfolio is built up with a large amount of listed companies, we need to calculate the price index of all the listed companies in each portfolio- I_{BH}、I_{BM}、I_{BL}、I_{SH}、I_{SM} and I_{SL}, in order to reflect the integrated change of a portfolio's market price.

Since the samples of six portfolios will change with time, there will be relevant changes in the composition and weighted structure of the price index of portfolios. And it will also affect the value besides the price changes. Therefore, take use of DVI to eliminate the impact to the portfolio price index caused by sample changes. DVI, proposed by Ramiah, Vikash, and Sinclair Davidson, takes use of Laspeyre Index and takes the base period as the period of weights. But in the face of listed companies increasing their investment or other things, making the amount of stock issuance change, Laspeyre index will lead to the result of deviating from the actual market situation and the wrong DVI value, if we don't fix the weights. So take Peasche Index which takes the reporting period as the weights to fix DVI. This will eliminate the impact.

In the Fama & French Three-factor Model, the two non-systematic risk factors- the company size premium factor and the BE/ME premium factor is expressed by SMB and HML. After calculating I_{BH}, I_{BL}, I_{BL}, I_{SH}, I_{SM} and I_{SL}, we can take use of the rates of return of all portfolios and the first-order logarithmic difference of the index to calculate the time-series data of six groups of portfolios' rates of return- R_{BH}, R_{BM}, R_{BL}, R_{SH}, R_{SM} and R_{SL}. Then we can calculate SMB and HML in the Fama & French Three-factor Model. SMB is the simple average rates of return difference between portfolios with small-scale rates of return - SH, SM and SL, and portfolios with large-scale rates of return- BH, BM and BL.

$$SMB = \left[\left(R_{SH} + R_{SM} + R_{SL}\right) - \left(R_{BH} + R_{BM} + R_{BL}\right)\right]/3 \tag{1}$$

HML is the average rates of return difference between the groups of high BE/ME- BH and SH, and the groups of low BE/ME- BL and SL.

$$HML = \left[\left(R_{SH} + R_{BH}\right) - \left(R_{SL} + R_{BL}\right)\right]/2 \cdot \tag{2}$$

3 Time-series Analysis of Portfolios in the Fama & French Three-Factor Model

In order to carry out some empirical research in micro-level non-systematic characteristics of SMB and HML in the model, we take six portfolios- BH, BM, BL, SH, SM and SL as our research objects to form the time-series Fama & French Three-factor Model of portfolios.

$$RPF_{\mathrm{i,t}} = \alpha_{\mathrm{i,t}} + \mathrm{b_i} RMF_t + \mathrm{s_i} SMB_t + \mathrm{h_i} HML_t + \varepsilon_{\mathrm{i,t}} \tag{3}$$

In equation (3), i is the category of portfolios. t means time. R_f means Risk-free Rate and is the monthly rate of return, converted by Compound Interest from the three-month time deposit rate announced by People's Bank of China. $RPF_i = R_{\mathrm{i}} - R_{\mathrm{f}}$ is the risk premium of type i. R_i means its return of rate. R_m means portfolios' return of rate and is the first-order logarithmic difference of

Shanghai Composite Index. $RMF = R_m - R_f$ is the risk premium of portfolios. And ε_i is the residual. According to equation (3), we take the portfolio risk premium reflected by the portfolio return of rate R_{BHF}, R_{BMF}, R_{BLF}, R_{SHF}, R_{SMF} and R_{SLF} as the explained variables and also take RMF, SMB and HML as explanatory variables, to fit the time-series Fama & French Three-factor Model. Table 1 is the parameter estimates and T Test's P Value of the 6 portfolios' regression model.

Table 1. The Parameter Estimates and Significance Test

estimate	R_{BHF}	R_{BMF}	R_{BLF}	R_{SHF}	R_{SMF}	R_{SLF}
α	-0.003	0.002	-0.003	-0.001	-0.001	-0.002
	(0.424)	(0.627)	(0.555)	(0.784)	(0.854)	(0.669)
b	1.089***	1.040***	1.025***	1.008***	1.075***	1.072***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
s	0.269	0.377*	0.396*	1. 479***	1.211***	1.351***
	(0.150)	(0.068)	(0.071)	(0.000)	(0.000)	(0.000)
h	0.045	-0.722***	-1.185***	-0.213	-0.668***	-0.982***
	(0.767)	(0.000)	(0.000)	(0.249)	(0.000)	(0.000)

The values in Parentheses is T Test's P Values and express the significance in 0.01, 0.05 and 0.1 by ***, ** and *.

We can obtain the following conclusions from Table 1.

All regression constant α have a very small absolute value. Their P Values are greater than 40% and all of them are not significant. This means there are no excess returns which can be explained by RMF, SMB and HML in the model of the 6 portfolios. The Fama & French Three-factor Model comprehensively explains the source of risk premium from the perspective of the systematic risk and non-system risk.

b, the regression coefficients, of RMF have little difference between the six types of portfolios and are all slightly larger than 1. And their P Values are all less than 0.0005 which is very significant. It means, although market risk factor RMF is not the only factor affecting the portfolios' rates of return, it is still the common significant motivation of highly consistent rates of return. It proves that RMF has the characteristic of the macro-level systematic risk factor.

The regression coefficients s of SMB shows significantly different in portfolios having different company size. The values of large company portfolios are small and all less than 0.4. But the values of small company portfolios show distinctive forward premium characteristics and are large and greater than 1.2. The T Test values of large company portfolios are also not very significant. But all the P Values of all small company portfolios are very significant and less than 0.0005. It means SMB is one of the significant premium factors of small-scale company portfolios' risk premium. It has a prominent micro-level non-systematic risk characteristic.

The regression coefficients of HML- h, has significantly difference between portfolios of different BE/ME. The P Values of BH and SH, having high BE/ME, is larger than 0.2. This is not significant. But the T Test values of the other four

portfolios with medium and low BE/ME is very significant and negative. It means HML is only the significant price factor of medium and low BE/ME portfolios. And if the BE/ME is lower, the portfolio's rates of return will be lower too. The BE/ME risk premium can only significantly existent in portfolios of medium and low BE/ME. HML has a distinctive micro-level non-systematic risk characteristic.

4 Conclusions

The three risk factors in the Fama & French Three-factor Model- RMF, SMB and HML, should be divided into the market premium factor RMF, belonging to the systematic risk factor in the macro level, and the company size premium factor SMB and the BE/ME premium factor HML belonging to the non-systematic risk factors in the micro level. The effectiveness of the model comes from that it not only include the systematic risk factor RMF in the macro level, but also add the non-systematic risk factors SMB and HML in the micro level. So it can effectively explain non-systematic risk premium which existent in the form of the regression constant and residual and is ignored in CAPM. And the effectiveness is decided by the significance of SMB and HML.

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Efficiency Analysis of the Government Supervising Firms Pollution Control

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Abstract. Pollution control, as a public good, tends to "free riding" behavior in the course of its private supply and is not easy to achieve the optimal level of social needs. So the regulation of government to pollution control is necessary. In practice, the efficiency of pollution control is low. In this paper, we explore the factors that cause the low efficiency. An incomplete information dynamic game and a complete information static game for government supervising firms' pollution control are constructed. In the model, some factors such as the efficiency of supervision, the strength of punishment and the publication of information are involved in. The conclusions would have some theory references for environmental management.

Keywords: environmental management, efficiency analysis, pollution control, game theory.

1 Introduction

Firms and the public produce pollution in the production and living, which leads to the deterioration of the environment. So they have an obligation to handle the pollution brought by them. Pollution control, as a public goods, is non-competitive and non-exclusive, which tends to have a "free riding" in the course of its private supplies and is not easy to achieve the optimal level of social needs. So the regulation of government to pollution control is necessary [1]. For public goods, Groves and Ledyard brought out that Pareto effective configuration can be achieved by using "mechanism" process under the Nash equilibrium. This mechanism allows participants to pursue their own interests and free riding [2]. Then many scholars are devoted to this research field [3-6]. In general, on the issue of pollution control, the interests between the government and firm are opposed diametrically. Government tries to control the pollution, while the firms try to hide from treating pollutants. But there exist many reasons or collusion phenomenon between firms and local government for the local interest and their own interests, which leads to the weak supervision for the environment issues.

In this paper a complete information static game and an incomplete information dynamic game are constructed to discus the efficiency that government supervises the firm's to control pollution. In the model, the influence of the efficiency of supervision, the strength of punishment and the publication of information to the behavior of firm controlling pollution are analyzed.

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2 Models and Its Solution

Incomplete information dynamic game model for government supervising firms
The government plays a role of regulation. He manages firms and the public to comply with environmental standard in the process of production of pollution.

Now we describe the model of government supervising firms to control pollution. The partners of game are sewage firm and government (or environmental protection departments). The government's strategy is active supervision and negative supervision. Polluter's strategy for pollution control is to take positive or negative attitude. Basic assumptions of the model are:

1) $T=\{C_1,C_2\}$ denotes the type of sewage firm, C_1 means it takes the passive investment management strategy for the sewage. C_2 means it comply with government regulations that take active investment management strategies. It obviously has $C_1<C_2$. The sewage firm knows his type, namely, the value of T, while the government knows its Probability distribution: $P\{T=C_1\}=p$, $P\{T=C_2\}=1-p$.

2) Polluters have to declare the case of pollution control to the government. It is assumed that the government will study the sewage pollution control investment as a measure of corporate governance standards for pollution. Let $M=\{m_1,m_2\}$ be the signal space of firm, in which $M=m_1$ means the pollution control investment declared is C_1 and $M=m_2$ means the investment is C_2.

3) The regulation policies taken by government are two forms that are denoted $K=\{k_1,k_2\}$. k_1 denotes the policies cost of that government just listen to the declaration by polluter and have no the further checks, which called negative regulatory cost. k_2 denotes the policies cost of that government not only listens to the declaration by polluter but also have the further due diligence investigation, which is called active regulatory cost. It is obvious of $k_1<k_2$. If the government takes a negative control, the polluter will not be detected low-input and high reporting.

4) It is obviously that it must have $M=m_2$ when $T=C_2$. The reason is that the polluter wouldn't declare low investment in this case.

5) Polluter acts first, to declare his investment in pollution control. Then the government acts. He chooses the way of supervision according to the declaration of the emission firms. If polluter is found low investment, but declared truthfully businesses to invest, then it is ordered additional input C_2-C_1; If found low input and high input false, it will be imposed a fine $F=QX$, except make it an additional investment outside. Among them, Q ($0\le Q\le 1$) means regulatory efficiency and X is the penalty amount, which shows the intensity of government regulation. The government also makes the fine F as their income. If the polluter puts in low investment of handling pollution and is not found, it will save the investment cost C_2-C_1. Assuming the government does not undertake the responsibility for dereliction of duty. The payoff matrix of game is the following.

Table 1. Payoff matrix of incomplete information game for government supervising polluter

	Government / polluter	Negative supervision	Active supervision
$T=C_1$	Declare $M=m_1$	$-(C_2-C_1)$, $-k_1$	$-(C_2-C_1)$, $-k_2$
	Declare $M=m_2$	0, $-k_1$	$-(C_2-C_1)-QX$, $QX-k_2$
$T=C_2$	Declare $M=m_2$	0, $-k_1$	0, $-k_2$

For the convenience, let $U_i(C_j,m_t,k_i)$ denotes the player's payoff function. So the payoff function of above game is:

$$U_1(C_1,m_1,k_1)=-(C_2-C_1),\ U_2(C_1,m_1,k_1)=-k_1,\ U_1(C_1,m_1,k_2)=-(C_2-C_1),$$
$$U_2(C_1,m_1,k_2)=-k_2$$

$$U_1(C_1,m_2,k_1)=0,\ U_2(C_1,m_2,k_1)=-k_1,\ U_1(C_1,m_2,k_2)=-(C_2-C_1)-QX,$$
$$U_2(C_1,m_2,k_2)=QX-k_2,$$

$$U_1(C_2,m_2,k_1)=0,\ U_2(C_2,m_2,k_1)=-k_1,\ U_1(C_2,m_2,k_2)=0,\ U_2(C_2,m_2,k_2)=-k_2.$$

By Harsanyi transformation, we induce a virtual participant N, called Nature. N selects the type of polluter.

Proposition: I) when $Q\le\frac{k_2-k_1}{pX}$,the Separating strategy $[(m_1,m_2),(k_1,k_1),p\in(0.1)]$ is not subgame perfect Bayesian Nash Equilibrium, while Pooling strategy $[(m_2,m_2),(k_1,k_1),p\in(0.1)]$ is a subgame perfect Bayesian Nash Equilibrium;

II)When $Q>\frac{k_2-k_1}{pX}$, polluter will use separating strategy and pooling strategy alternately.

Proof: polluter has two declare strategy in the model. One is the separating strategy, namely $M(T)=\begin{cases}m_1, & if\ T=C_1\\ m_2, & if\ T=C_2\end{cases}$. The other is the pooling strategy, namely $M(T)=\begin{cases}m_2, & if\ T=C_1\\ m_2, & if\ T=C_2\end{cases}$.

I) When polluter takes separating strategy (m_1,m_2), the government infers that

$$p(C_1\mid m_1)=p(C_2\mid m_2)=1,\ p(C_1\mid m_2)=p(C_2\mid m_1)=0.$$

So the select of government is $\max_{k_i} \sum_{C_j} U_2(C_j, m_t, k_i) p(C_j \mid m_t)$. When $M = m_1$, we have

$$\max_{k_i} \sum_{C_j} U_2(C_j, m_t, k_i) p(C_j \mid m_t) = \max_{k_i} U_2(C_1, m_1, k_i)$$
$$= \max\{U_2(C_1, m_1, k_1), U_2(C_1, m_1, k_2)\} = \max\{-k_1, -k_2\} = -k_1.$$

Then we get $K^*(m_1) = k_1$; When $M = m_2$, we have

$$\max_{k_i} \sum_{C_j} U_2(C_j, m_t, k_i) p(C_j \mid m_t) = \max_{k_i} U_2(C_2, m_2, k_i)$$
$$= \max\{U_2(C_2, m_2, k_1), U_2(C_2, m_2, k_2)\} = \max\{-k_1, -k_2\} = -k_1.$$

Then we get $K^*(m_2) = k_1$; So the optimal strategy of government is $K^*(M) = \{k_1, k_1\}$.

If the government selects the strategy of $K^*(M) = \{k_1, k_1\}$, then the selection of polluter is $\max_{m_t} U_1(C_j, m_t, K^*(m))$. When $T = C_1$, we have that

$$\max_{m_t} U_1(C_1, m_t, k_1) = \max\{U_1(C_1, m_1, k_1), U_1(C_1, m_2, k_1)\} = \max\{-(C_2 - C_1),\ 0\} = 0.$$

Then we obtain that $M^*(C_1) = m_2$; When $T = C_2$, it must have $M^*(C_2) = m_2$, namely the strategy of polluter is $M^*(T) = \{m_2, m_2\}$.

From above derivation, we can see that the separating strategy $[(m_1, m_2), (k_1, k_1), p \in (0.1)]$ is not subgame perfect Bayesian Nash Equilibrium.

ii) The firm takes the pooling strategy (m_2, m_2). So the government refers that $p(C_1 \mid m_2) = p$, $p(C_2 \mid m_2) = 1 - p$, $p(C_1 \mid m_1) = 1$, $p(C_2 \mid m_1) = 0$. So the choice of government is

$\max_{k_i} \sum_{C_j} U_2(C_j, m_t, k_i) p(C_j \mid m_t)$. When $M = m_1$, we have that

$$\max_{k_i} \sum_{C_j} U_2(C_j, m_t, k_i) p(C_j \mid m_t) = \max_{k_i} U_2(C_1, m_1, k_i)$$
$$= \max\{U_2(C_1, m_1, k_1), U_2(C_1, m_1, k_2)\} = \max\{-k_1, -k_2\} = -k_1.$$

Then we get $K^*(m_1) = k_1$; When $M = m_2$, we have that

$$\max_{k_i} \sum_{C_j} U_2(C_j, m_t, k_i) p(C_j \mid m_t) = \max_{k_i} \{U_2(C_1, m_2, k_i) p + U_2(C_2, m_2, k_i)(1 - p)\}$$
$$= \max_{i} \{U_2(C_1, m_2, k_1) p + U_2(C_2, m_2, k_1)(1 - p),$$
$$U_2(C_1, m_2, k_2) p + U_2(C_2, m_2, k_2)(1 - p)\}$$

$$= \max\{-k_1 p - k_1(1-p), (QX - k_2)p - k_2(1-p)\} = \max\{-k_1, QXp - k_2\}$$

$$= \begin{cases} -k_1, & if \ -k_1 > QXp - k_2 \\ -QXp - k_2, & if \ -k_1 < QXp - k_2 \end{cases}.$$

Then we get $K^*(m_2) = = \begin{cases} k_1, & if \ -k_1 > QXp - k_2 \\ k_2, & if \ -k_1 < QXp - k_2 \end{cases}$.

Thus the pooling strategy $[(m_2, m_2), (k_1, k_1), p \in (0.1)]$ is a subgame perfect Bayesian Nash Equilibrium when $QXp \le k_2 - k_1$.

With a completely similar proof, II) is established.

The proof is end.

From the outcomes of incomplete information dynamic model, it can be seen that:

1) When the efficiency of government regulation is low, the punishment will not have any incentive. In this case the firm always takes a negative and misrepresented its pollution control costs, and the government takes a negative form of regulation.

2) When the efficiency of government regulation increase, namely $Q > \frac{k_2 - k_1}{pX}$, the situation is improved significantly. The firm will use truthful and false reporting alternately, while the government will use the active and negative regulation alternately as well. These will improve pollution condition significantly.

Complete information game model for government supervising firms

Under complete information, we assume that there has no the process of representation and other assumptions are the same assumptions of model I. Assume that the government does not undertake the responsibility for the supervision. In this case the payoff matrix is the following.

Table 2. Payoff Matrix Of Complete Information Game for Government Supervising Pollter

Government / polluter	Negative supervision(γ)	Active supervision($1-\gamma$)
Negative control（θ）	$C_2 - C_1$， $-k_1$	$-QX$， $QX - k_2$
Active control（$1-\theta$）	0， $-k_1$	0， $-k_2$

In the model θ is the probability of the polluter taking the strategy of negative pollution control and γ is the probability of government taking negative supervision. The expected utility of government and firm are:

$U_P(\theta,\gamma) = (C_2 - C_1)\ \theta\gamma - QX\ \theta(1-\gamma)$, $U_G(\theta,\gamma) = -k_1\ \theta\gamma + (QX - k_2)\ \theta(1-\gamma) - k_1\ (1-\theta)\gamma - k_2\ (1-\theta)\ (1-\gamma)$.

Derivate the above two formulas for γ and θ, we get the optimal first-order conditions:

$$\frac{\partial U_P}{\partial \theta} = (C_2 - C_1)\ \gamma - QX\ (1-\gamma) = 0,\ \frac{\partial U_G}{\partial \gamma} = -k_1\ \theta - (QX - k_2)\ \theta - k_1\ (1-\theta) + k_2\ (1-\theta) = 0$$

Thus the Nash equilibrium is

$$\gamma^* = \frac{QX}{QX + C_2 - C_1} = 1 - \frac{C_2 - C_1}{QX + C_2 - C_1},\ \theta^* = \frac{k_2 - k_1}{QX}$$

The equilibrium of the game shows that when the estimated probability of the government's negative regulation is high, namely $\gamma \in (\frac{QX}{QX + C_2 - C_1}, 1]$, the optimal choice of the polluter is a negative pollution control. When the estimated probability of the government's negative regulation is low, namely $\gamma \in [0, \frac{QX}{QX + C_2 - C_1})$, the optimal choice of the polluter is an active pollution control. For the government, if he estimates the probability of negative pollution control for polluter is $\theta \in (\frac{k_2 - k_1}{QX}, 1]$, his choice is active supervision; On the contrary, if he estimates the probability of negative pollution control is $\theta \in [0, \frac{k_2 - k_1}{QX})$, his choice would be negative supervision.

Also we can see that the attitude of polluter controlling pollution is decided by how much he knows about the information of government's supervision. This is related to $k_2 - k_1$ and the punish strength and the efficiency QX. On the one hand, if the cost difference $k_2 - k_1$ in different ways of government supervision is large, then the probability of polluter negative pollution control will increase. The reason is that he knows the large difference $k_2 - k_1$ will increase the difficulty of choice. On the other hand, the supervision efficiency and the strength for government would hinder the polluter from negative pollution control effectively. The larger the regulation efficiency and the bigger the strength, the fewer negative polluter there have. So the government should increase the strength of punishment and improve manage efficiency.

3 Conclusion

The supervision strategy of government is influenced by the cost of pollution control of polluter. If there is no more much difference between negative and active pollution control, the probability of negative supervision for government will increase. Because the government knows that in this case the polluters are reluctant to risk to take

passive attitude for pollution control, which may be found and be punished. This conclusion is consistent with the environmental management in practice.

By the comparative analysis of above two game models, we can conclude that in incomplete information, the equilibrium of polluter is $(\frac{k_2 - k_1}{pQX}, 1 - \frac{k_2 - k_1}{pQX})$. That is to say the polluter takes the negative pollution control in probability $\theta = \frac{k_2 - k_1}{pQX}$. Compared with the complete information, the probability of negative pollution control is bigger. So the incomplete information causes the negative pollution control more likely.

In order to eliminate this aspect of interference, the government would input costs and reveal the related information of polluter through various channels. These will transform the private information into common knowledge, namely transform incomplete information game into complete information game.

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Construction of Riemann-Theta Function Solutions for Benjamin-Ono Equation Based on Symbolic Computation

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Abstract. In this paper, Benjamin-Ono equation, one of the most important equations in mathematical physics, is studied. With the aid of symbolic computation system Mathematica, theta function solutions for Benjamin-Ono equation are constructed by the auxiliary equation method.

Keywords: Riemann-Theta Function Solutions, Benjamin-Ono Equation, Symbolic Computation.

1 Introduction

Most Waves in Real-Life do not travel with a permanent profile, that is, dispersion continuously changes the profile of the wave. Since most media are dispersive, they cause waves to change form (disperse). For example, waves on the surface of water. Physicists had long believed that it was impossible to observe such special waves of permanent wave form in any dispersive medium. The Benjamin-Ono equation, developed in [1-3], is one of the most important equations in mathematical physics, It is a widely-studied dispersive equation, and much is known about solutions for the Benjamin-Ono equation.

There are many mathematical models described by nonlinear partial differential equation(NLPDE), especially some basic equations in physics and mechanics. To investigate the exact solutions for these NLPDE plays an important role in the study of nonlinear physical phenomena. In recent years, direct search for exact solutions to NLPDE has become more and more attractive partly due to the availability of computer symbolic systems like Maple or Mathematica which allows us to perform some complicated and tedious algebraic calculation on computer, and helps us to find new exact solutions to NLPDE, such as Homogeneous balance method[4], tanh-function method, sine-cosine method, Jacobi elliptic functions method, F-expansion method[5-7] and so on. In this paper, we apply auxiliary equation method[6] to seek exact theta function solutions for Benjamin-Ono equation:

$$u_{tt} + 2pu_{xt} + p^2 u_{xx} + r(u^2)_{xx} - su^{(4)} = 0 \tag{1}$$

by taking full advantages of elliptic equation:

$$F'(x) = A + BF^2(x) + CF^4(x) \tag{2}$$

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2 Method of Solution

For the elliptic equation (1), the following fact is needed to realize the aim of this paper.

Proposition. If we take
$C=-A=-\vartheta_2^2(0)\vartheta_4^2(0)$ and $B=\vartheta_2^2(0)-\vartheta_4^2(0)$, then $F(z)=\vartheta_1(z)/\vartheta_3(z)$
satisfies the elliptic equation (2), where theta functions are defined as following

$$\vartheta[\begin{pmatrix}\varepsilon\\ \varepsilon'\end{pmatrix}](z|\tau)=\sum_{n=-\infty}^{\infty}\exp\{\pi i\tau(n+\frac{\varepsilon}{2})^2+2(n+\frac{\varepsilon}{2})(z+\frac{\varepsilon'}{2})\}$$

$$\vartheta_i(z)\triangleq\vartheta_i(z|\tau)=\vartheta[\varepsilon_i](z|\tau),\varepsilon_1=\begin{bmatrix}1\\1\end{bmatrix},\varepsilon_2=\begin{bmatrix}1\\0\end{bmatrix},\varepsilon_3=\begin{bmatrix}0\\0\end{bmatrix},\varepsilon_4=\begin{bmatrix}0\\1\end{bmatrix} \tag{3}$$

In the following, we seek traveling wave solution in the formal solution for the equation (1)

$$u(\xi)=a_0+\sum_{i=1}^{N}a_iF^n(\xi)\qquad(a_N\neq 0) \tag{4}$$

by taking $u(x_1;x_2;\cdots;x_l;t)=u(\xi),\xi=x_1+k_2x_2+\cdots+k_lx_l+\lambda_t.$ (5)

where $k_1,k_2,\cdots,k_l,\lambda$ are constants to be determined, and a_i,A,B,C are constants to be determined, $F(\xi)$ satisfies elliptic equation (2) .

The main steps are listed in the following:

Step 1: Inserting (4) into (1) yields an ODE for $u(\xi):P(u;u';u'';\cdots)=0$ (6)

Step 2: Determine N by considering the homogeneous balance between the governing nonlinear term(s) and highest order derivatives of $u(\xi)$ in (6).

Step 3: Substituting (4) into (6), and using (2), and then the left-hand side of (6) can be converted into a finite series in $F^k(\xi)(k=0,1,\cdots,M)$.

Step 4: Equating each coefficient of $F^k(\xi)$ to zero yields a system of algebraic equations for $a_i(i=0,1,\cdots,N)$.

Step 5: Solving the system of algebraic equations, with the aid of Mathematica or Maple, a_i,k_i,λ can be expressed by A, B, C (or the coefficients of ODE (6)).

Step 6: Substituting these results into (4), we can obtain the general form of travelling wave solutions to equation (1).

Step 7: From propositon, we can give theta function solutions for equation (1).

3 Exact Theta Function Solutions

In this section, we will make use of the auxiliary equation method and symbolic computation to find the exact solutions to the Benjamin-Ono equation.

We assume that (1) has travelling wave solution in the form

$$u(x,t)=U(\xi),\quad \xi=\rho x+\omega t \tag{7}$$

Substituting (7) into (1), then Eq. (1) is transformed into the following form:

$$U''(\omega^2+2p\rho\omega+p^2\rho^2)+r\rho^2(U^2)''-s\rho^4U^{(4)}=0 \tag{8}$$

According to step 2 in section 2, by balancing $U^{(4)}(\xi)$ and $U(\xi)U'(\xi)$ in Eq. (8), we obtain $n=2$, and suppose that Eq. (8) has the following solutions:

$$U(\xi)=a_0+a_1F(\xi)+a_2F^2(\xi), \tag{9}$$

Substituting (9) along with Eq.(2) into (8) yields a polynomial equation in $F(\xi)$. Setting their coefficients to zero yields a set of algebraic equations for unknown parameters a_0,a_1,a_2,ω.

$$2r\rho^2a_1^2b_0+2p^2\rho^2a_2b_0+4p\rho\omega a_2b_0+2\omega^2a_2b_0+4r\rho^2a_0a_2b_0-8s\rho^4a_2b_0b_2=0$$
$$12r\rho^2a_1a_2b_0+p^2\rho^2a_1b_2+2p\rho\omega a_1b_2+\omega^2a_1b_2+2r\rho^2a_0a_1b_2$$
$$-s\rho^4a_1b_2{}^2-12s\rho^4a_1b_0b_4=0$$
$$12r\rho^2a_2^2b_0+4r\rho^2a_1^2b_2+4p^2\rho^2a_2b_2+8p\rho\omega a_2b_2+4\omega^2a_2b_2+8r\rho^2a_0a_2b_2$$
$$-16s\rho^4a_2b_2{}^2-72s\rho^4a_2b_0b_4=0$$
$$18r\rho^2a_1a_2b_2+2p^2\rho^2a_1b_4+4p\rho\omega a_1b_4+2\omega^2a_1b_4+4r\rho^2a_0a_1b_4-20s\rho^4a_1b_2b_4=0$$
$$16r\rho^2a_2^2b_2+6r\rho^2a_1^2b_4+6p^2\rho^2a_2b_4+12p\rho\omega a_2b_4+6\omega^2a_2b_4+12r\rho^2a_0a_2b_4$$
$$-120s\rho^4a_2b_2b_4=0$$
$$24r\rho^2a_1a_2b_4-24s\rho^4a_1b_4{}^2=0$$
$$20r\rho^2a_2^2b_4-120s\rho^4a_2b_4{}^2=0$$

Solving these equations, we can get the following solutions:

$$a_0=\frac{-p^2\rho^2-2p\rho\omega-\omega^2+4s\rho^4B}{2r\rho^2},a_1=0,a_2=\frac{6s\rho^2C}{r} \tag{10}$$

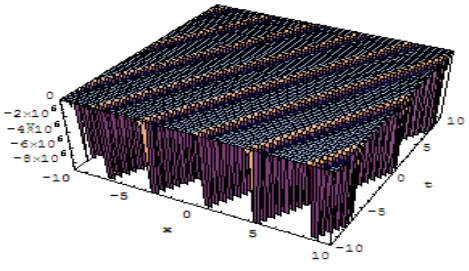
And a_0,A,B,C are arbitrary constants. The traveling wave solution of the Benjamin-Ono equation are given by $U(\xi)=a_0+a_1F(\xi)+a_2F^2(\xi)$, where A,B,C,ρ,ω are arbitrary constants, and a_2,a_1,a_0 are given in (10). From the proposition, if we choose $C=-A=-\vartheta_2^2(0)\vartheta_4^2(0)$ and $B=\vartheta_2^2(0)-\vartheta_4^2(0)$,

We can get the solution to Benjamin-Ono equation in terms of theta functions:

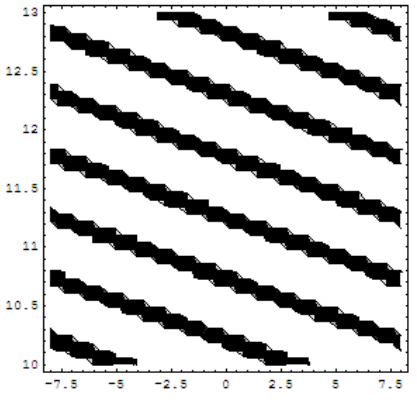
$$u(x,t)=\frac{-p^2\rho^2-2p\rho\omega-\omega^2+4s\rho^4B}{2r\rho^2}+\frac{6s\rho^2C}{r}\frac{\vartheta_1^2(\xi)}{\vartheta_3^2(\xi)},$$

where $\xi=\rho x+\omega t$, A,B,C,ρ,ω are arbitrary constants, and a_2,a_1,a_0 are given in (10).

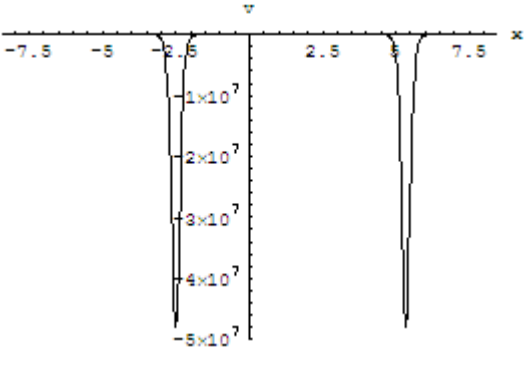
To grasp the characteristcs of solutions of Eq.(1), we dipict the figure of the solution $u(x,t)$ by using the mathematica, their properties and profiles are displayed in figures (a)-(d) under chosen parameters: $p = r = 2, s = 3, \rho = 0.4, \beta = 0.5, \omega = 6$ and $t = 2$ for 2D figure (c), $x = 2$ for 2D figure (d). From figures (a)-(d), it is easy to see that the solution $u(x,t)$ is periodic wave solutions.



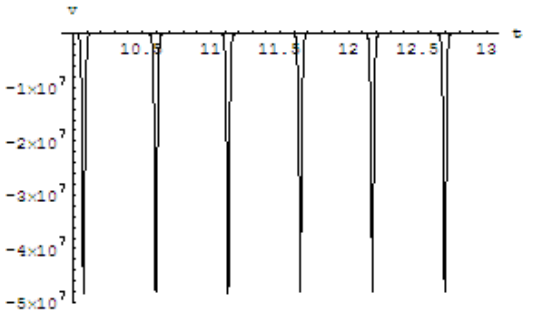
(a) Perspective view of the wave $u(x,t)$



(b) Overhead view of the wave $u(x,t)$



(c) The propogation of the wave along x-axis



(d) The propogation of the wave along t -axis

4 Summary

In this paper, we have studied the Benjamin-Ono equation. By using auxiliary equation method, some traveling wave solutions in terms of theta functions are successfully obtained with the aid of symbolic computation for the first time, they should be meaningful to explain some physics phenomena. It is shown that the auxiliary equation method is a very effective and powerful mathematical tool for solving nonlinear evolution equations in mathematics and physics. Moreover, with the aid of computer symbolic systems (Mathematica or Maple), the method can be conveniently operated .

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Fuzzy PI Control Based on the Instantaneous Power Balance for the DSTATCOM

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Abstract. Distribution Static Synchronous Compensator (DSTATCOM) to the public through the connection point into the reactive power can adjust the voltage of public access point, so as to meet the voltage quality. First of all papers DSTATCOM system in accordance with the instantaneous power balance theory derived DSTATCOM voltage used to control the direct voltage control strategy. In the control strategy without current detection circuit with traditional cascade control, compared with the control is simple, the advantages of fast response. And voltage control strategy for the direct control of the controller by the system parameters impact the performance of larger defects, a direct voltage DSTATCOM fuzzy PI control strategy, so that the instantaneous power balance in accordance with the direct voltage control has better control performance.

Keywords: Voltage regulation, Fuzzy control, DSTATCOM.

1 Introduction

This paper is focused on the control strategy for the DSTATCOM to stabilize the voltage at the point of common coupling (PCC) at the given value. The DSTATCOM regulates the voltage at the PCC by injecting reactive power to the PCC, making it meet the requirement of the voltage quality[1-3]. Many control strategies have been proposed, e.g., the cascade control strategy using voltage outer loop and current inner loop, in which it is difficult to design the controller as too many PI regulators should be embodied in the control system[6-8]. Some researchers use multi-variable control theory to design the controller through establishing a state.

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2 The Balance of Instantaneous Power of the DSTATCOM and Direct Voltage Control

Fig. 1 shows the single phase equivalent circuit of the DSTATCOM, in which three phase voltage inverter topology is applied and the direct current capacitance offers the

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direct current voltage support. The distribution system of the DSTATCOM is represented by Thevenin's equivalent circuit, in which Rf and Lf stand for the equivalent resistance and impedance of the transformer and the wave filter, e for the output voltage of the DSTATCOM transformer, Upcc for the voltage at the coupling function for the DSTATCOM and using the linear approximation at the working point[9,10]. But the performance of the DSTATCOM is influenced by the changes of the system's functioning condition. So it is especially valuable to find a easy-to-be-designed high-quality control strategy.

The direct voltage control strategy for the DSTATCOM has been proposed according to the balance theory of instantaneous power[4-5]. It doesn't need a mutual inductor and current detection circuit and makes control easier and response faster. But its performance will worsen when the parameters are changed as it relies too much on the equivalent electronic parameters of the coupling transformer, the filter as well as the circuit. To solve the problem, this paper proposes a fuzzy-PI-based direct voltage control strategy, maintaining its merits such as structural simplicity and fast response, giving it a good self-adjusting robust features[9-10]. Its validity and effectiveness is verified by the digital simulation results offered in the last part of the paper.

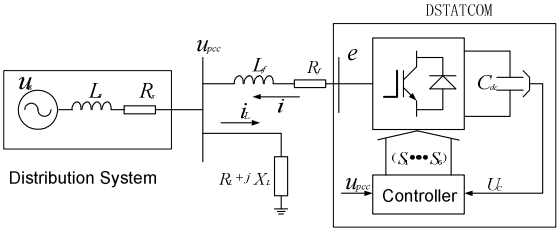

Fig. 1. Single phase equivalent circuit of the DSTATCOM

Fig.2 is a diagram showing the direct output voltage PI control of the DSTATCOM deduced from the aim of the DSTATCOM compensation, namely, the voltage at the coupling point and the direct current capacity.

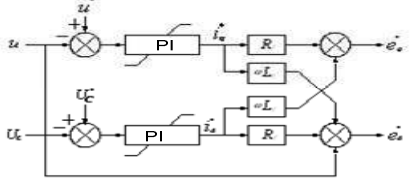

Fig. 2. diagram of the direct output voltage control of the DSTATCOM

As shown in the diagram, after the PI regulation, the error between the reference voltage at the coupling point and the actually measured value becomes the reference reactive current signal I^*_q, and the error between the reference direct current capacity

and its actually measured value becomes the reference active current signal I^*_d. After the current to voltage transformation, I^*_q and I^*_d become respectively the reference voltage signal e^*_q and e^*_d, which, as regulating signals, produce PWM drive signals thereafter.

3 The Fuzzy PI Control of the Direct Voltage for the DSTATCOM

Now the paper will offer the approach and process of the fuzzy PI controller's design, taking the control of the voltage at the PCC as an example, which is similar to the control of the direct capacity's voltage.

3.1 The Principles and Structure of the Fuzzy PI Controller

Fig. 3 is the block diagram of the DSTATCOM's fuzzy PI controller. According to fuzzy mathematic theories and approaches we summarize the regulating experiences of the operators and the technologies as IF(condition)-THEN(result)-form fuzzy rules, which, together with other related data(the original PI parameters), are stored in the computer.

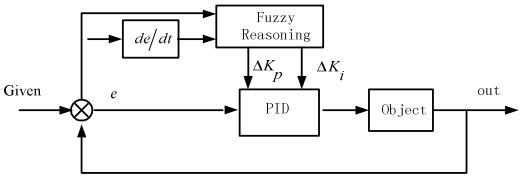

Fig. 4. block diagram of the fuzzy-PI controller

3.2 The Designing of the Fuzzy-PI Controller

The function of the regular PI controller may be described by this position arithmetic:

$$i(n) = K_p[e(n) + \frac{T}{K_i}\sum_{i=0}^{n-1} e(i)] \tag{1}$$

In it, e(n) is the input(deviation) of the controller at the nth sampling moment; i (n) is the output of the controller(controlling value) at the nth sampling moment, and i (n-1) the output at the (n-1)th moment; T is the sampling period; Ki is the integral constant; and Kp is the proportional increment.

From formula (1), we get the incremental formula of controllers I(n) and I(n-1):

$$\begin{aligned} \Delta i(n) &= i(n) - i(n-1) \\ &= K_p[e(n) - e(n-1) + \frac{T}{K_i} e(n-1)] \end{aligned} \tag{2}$$

$$\Delta e = e(n) - e(n-1) \tag{3}$$

The core of fuzzy deduction is the rules of parameter tuning for the controller that are obtained from on-the-spot regulation and experts' experiences. When the deviation appears, the controller will function to prevent it from increasing.

According to the object's actual characteristics and our regulating experiences, we summarize as the following rules as shown in Table 1.

Table 1. control rules of ΔKp

E / △E	NB	NM	NS	0	PS	PM	PB
NB	PB	PB	NB	PM	PS	PS	0
NM	PB	PB	NM	PM	PS	0	0
NS	PM	PM	NS	PS	0	NS	NM
0	PM	PS	0	0	NS	NM	NM
PS	PS	PS	0	NS	NS	NM	NM
PM	0	0	NS	NM	NM	NM	NB
PB	0	NS	NS	NM	NM	NB	NB

After the above fuzzy deduction, we de-fuzzilize (including the maximum recognition approach, center of gravity method, etc) the two corrected parameters regulated by the fuzzy-PI controller and choose its accurate value to calculate the amount of output control. This paper applied center-of-gravity to get the accurate value of output.

$$\begin{cases} \Delta K_P = f_P(e,\Delta e) = \dfrac{\sum_{j=1}^{n} \mu_j(e,\Delta e)\Delta K_{Pj}}{\sum_{j=1}^{n} \mu_j(e,\Delta e)} \\ \Delta K_i = f_i(e,\Delta e) = \dfrac{\sum_{j=1}^{n} \mu_j(e,\Delta e)\Delta K_{ij}}{\sum_{j=1}^{n} \mu_j(e,\Delta e)} \end{cases} \tag{4}$$

As Kp=K'p+ΔKp, Ki=K'I+ΔKi, so Kp, Ki are:

4 Conclusions

The DSTATCOM regulates the voltage at the PCC by injecting reactive power to it, thus making it meet the requirement of the voltage quality. According to the balance theory of instantaneous power in the DSTATCOM system, we've deduced the current-to-voltage converting relationship under the direct voltage control by the DSTATCOM, realized the no-current sensor control and so improved the DSTATCOM's response rate. To remove the drawback that the direct voltage control for the DSTATCOM based on the balance of instantaneous power is greatly influence by the changes of the equivalent parameters of the coupling transformer and the wave filter, the paper proposes the fuzzy PI control strategy for controlling the Vpcc and the voltage of the direct current capacity. Simulation results prove that the fuzzy-PI direct

voltage control strategy has a good self-adjusting robust characteristic suitable for the practical engineering application of the and DSTATCOM. The next step of our research will be how to apply the proposed strategy to the actual DSTATCOM equipment.

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An Image Encryption Algorithm Based on Chaos

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Abstract. A method of encryption is presented based on Logistic mapping image encryption method by using chaos theory. At first, the chaotic sequences are generated by Logistic chaotic map. Then, make the preliminary encryption combining with the original grayscale shift position disorderly. At last, make the simulation and analysis of experiment. The results show that the algorithm has large key space, quick speed and is easy to realize.

Keywords: Logistic mapping, Chaotic sequences, encryption, XOR.

1 Introduction

Chaos theory which is a kind of both qualitative and quantitative analysis method of thinking is used to explore dynamic systems which can't use a single data relationship but must use whole, continuous data can be explained and prediction of relationship between the behavior. The chaos is pseudo-random behavior that is produced by the simple uncertain nonlinear system. Its basic characteristics are pseudo-random continuous broadband power spectrum and it is very sensitive to initial conditions. [1].The earliest thought of applied cryptography with chaos learning can be traced back to 1949 when the classic articles Communication of Security System published by Shannon. Since 1980s, the idea that make the new password system with chaos system construction gets more and more attention. And the idea came from the natural connection between chaos system and pure cryptography system. On the other hand, for perfect cryptography characteristics is guaranteed by pseudo-random irregular sequence which is determined with the encryption process, a kind of any password system can be regarded as a chaotic system or kind of chaotic systems, from arithmetic point of view. It's like a complex dynamic system generated by chaotic sequences. With the chaos system applied in encryption will produce a better result, it's the first selection. The secret communication based on chaos theory, information encryption and information hiding technology research has become the international nonlinear science and information science two fields across one of the hottest new frontiers fusion[2].

2 Chaotic Encryption Principle

The structure of Chaos encryption system is most closely to the sequence of traditional cryptography theory. And chaotic sequences encryption algorithm is

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different from traditional algorithm. The fundamental difference is that the chaos system produces chaos, then makes binary chaotic sequence as flow of key which XOR expressly by bit exclusive to get ciphertext[3]. Chaotic signal divides into continuous chaotic sequence and discrete chaotic sequence. Figure 2-1 shows the principle of encrypting and decrypting chaotic sequence.

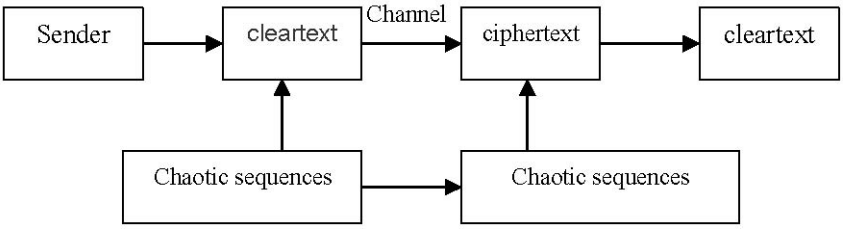


Fig. 1. The principle of chaotic sequences encryption

The features of Chaotic sequences encryption:

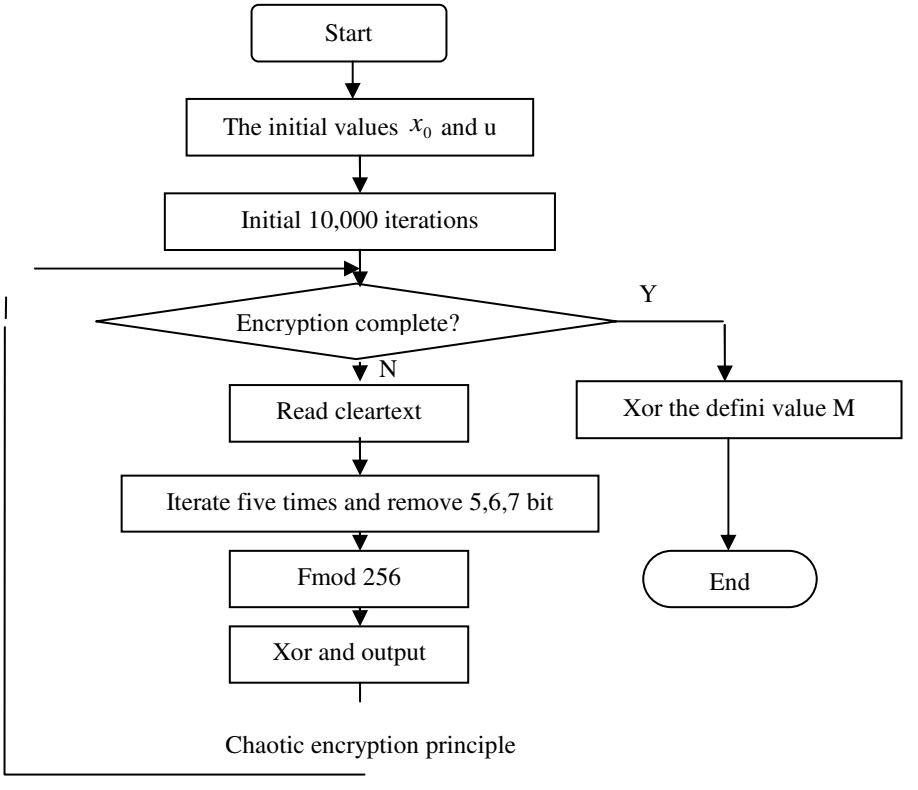
(1) Having very good randomness, it is similar to noise and is difficult to decipher; Its randomness is far superior to the random sequence generated by traditional random sequence generator ;
(2) It has big key space; Chaos System has multiple parameters;
(3) For chaos system is hard to be reconstructed, chaotic sequences also are difficult to reconstruct; So it is difficult to be decrypted ;
(4) It's convenient to produce chaotic sequences; Compared to the nonlinear feedback shift register, it has more flexibility.

3 Logistic Mapping Principle

Logistic mapping principle is widely used classic chaos mapping[4-6]. Its description has many methods and the method that this text adopts is as follows:

The initial values x_0 and u are arguments of the equations and also are key arguments of encryption system[8]; K={ x_0 ,u}.

(1) Chaotic sequences has ergodicity. The ergodicity of chaotic sequences is that chaotic variables can non-repeatedly ergodic all states within the scope of certain and according to their own rules.
(2) Logistic mapping which has randomness ,periodicity and initial value sensitivity is suited to image encryption.



4 The Design of Chaotic Image Encryption Algorithm

Assuming {Pn} is cleartext information sequence and {Kn} is key information sequence, make the binary processing after the Logistic chaotic equation iterates to produce sequence.(M is predetermined),{Cn} is the key information sequence, among them the K is key argument.

The design of encryption algorithm : $\{Cn\}=\{Pn\} \oplus \{Kn\} \oplus M$;

The design of solution algorithm : $\{Pn\}=\{Cn\} \oplus \{Kn\} \oplus M$;

(1) The arguments of Logistic system(u and initial x_0)are given; At this time, the value of u is 4 and x_0 is 0.1679842.Definition type of Logistic mapping system is: $x_n = - x_{n-1}(1- x_{n-1})$.With the definition, iterate 10,000 times;

(2) After reading cleartext, iterate the information 5 times; Get the effective values and fmod 256 with the values. then Kn XOR the Pn until all values completed;

(3) To strengthen the ciphertext privacy and improve the performance of encryption, then XOR the primary ciphertext with the positive value M and get the final ciphertext;

(4) When we want to get the information, we should decrypt by the opposite process; After these operation, we can get the true information.

5 Simulation and Analysis

This algorithm is based on MATLAB platform to realize. In the simulation, the size for the image taken is 512*512. And the simulation results are as follows; It contains encrypted images and decrypted images.




(a) original image (b) encryption image (c) decrypt correctly (d) decrypt falsely

With above figure, we can see that the original image becomes intangibly after the encryption; When get the correct key(4, x_0 =0.1679842)and M, we can decrypt correctly, as figure c shows. If take the key (4, x_0 =0.1679952) and M=0x55,we get the wrong image as figure d shows after decryption.

By the experimental result, parameters and initial value of minor differences will lead to the image that encrypted can't be decrypted correctly. This is caused by the Logistic chaos mapping initial value sensitivity. At the same time , the value M is important and if it's false ,we can't decrypt correctly.

6 Summary

With existing encryption algorithm, this paper puts forward another method. After getting the preliminary ciphertext which produced as like other method, the ciphertext then XOR with positive value M. It can keep the same security and strengthen the security of the information. What's more, this algorithm is easy to achieve and its speed is fast. At the same time, it has various keys and higher safety. The results for experiments, when carry on the multiple key value simulation, discovered that the key value has some limitations. The initial value of key has some limitations. The ideal encryption can't be made or even some can't be encrypted when the initial value beyond a certain boundary lines. Secondly, for chaos initial value, when use more decimal digits, get the better encryption.

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Application and Study on Heat Transfer Model for Continuous 82B Billet Casting

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Abstract. The centerline segregation in the 82B steel billet reduces seriously the final product quality; it is closely related to the unreasonable secondary cooling water system. This paper has established a two-dimensional non-steady-state heat transfer model for the continuous 82B billet casting process, and optimized the existing secondary cooling water scheme, The results show that: the strand surface temperature falling rate is lower than the center temperature falling rate in the original cooling water scheme; it is necessary to add an additional cooling subzone after the fourth subzone for decreasing centerline segregation; the optimal cooling water scheme is that cooling intensity of the fifth subzone is increased by 150% compared with the original fourth subzone.

Keywords: Heat transfer model, Continuous casting, 82B steel, Billet.

1 Introduction

The solidification process of molten steel contains heat transfer, mass transfer and other complex phenomena in continuous casting, which directly affect the billet quality. The centerline segregation often occurs in the 82B steel and other high-carbon steel billet, the metallurgical researchers usually apply electromagnetic stirring (EMS) technology to reduce the grade of centerline segregation [1~2], however, it is difficult to eliminate the centerline segregation wholly. In fact, if the surface temperature falling velocity is not approximate with the centerline temperature drop rate in billet, a negative suction force will be excited in the center region of billet, then the liquid steel containing higher alloying elements will be sucked to the center region, the centerline segregation will still be brought [3]. So it is important to optimize secondary water cooling scheme.

The paper has established a two-dimensional unsteady heat transfer model for continuous 82B billet casting, and analyzed the relevant influencing factors on strand temperature. The temperature information of liquid steel solidification process has been obtained. Finally, we have optimized the secondary cooling scheme and put forward a more ideal cooling scheme. The results can provide theoretical basis for optimization of secondary cooling water system in the actual continuous 82B steel billet casting process.

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2 Mathematical Model

To established a heat transfer model for 82B steel billet, some assumptions are made for simplification: (1) the heat transfer along casting direction is neglected, and solidification and heat transfer are simplified to that of two-dimensional, unsteady, thermal conduction; (2) the temperatures in liquid steel meniscus are equivalent to the casting temperature; (3) the dimension change of casting section is neglected; (4) the effect of liquid steel convection on heat transfer is considered; (5) the thermal physical parameters of steel are the function of temperature.

According to energy conservation law and above assumptions, the heat transfer mathematical equation of continuous billet casting can be derived as follows [4]:

$$\rho c \frac{\partial T}{\partial t} = \frac{\partial}{\partial x}(\lambda \frac{\partial T}{\partial x}) + \frac{\partial}{\partial y}(\lambda \frac{\partial T}{\partial y}) + L_s \tag{1}$$

Where, ρ is density of steel, kg/m^3; c is specific heat capacity of steel, J/(kg·℃); T is temperature, ℃; λ is thermal conductivity of steel, J/（m·s·℃）; t is time, s; x and y are coordinates, m; Ls is latent heat, kJ/kg. The thermal physical parameters of different temperature are given in table 1. The treatment method of thermal physical parameters in the different solidification phase is same with literature [5]. The solidus temperature of 82B steel is1352.7℃; the liquidus temperature of 82B steel is 1466.5℃, the latent heat of 82B steel is 272kJ/kg.

Table 1. Thermal physical parameters of 82B steel in different temperature

Temperature, ℃	600	1000	1300	1352.7	1466.5	1490	1520
Density, kg/m^3	7687.8	7481.6	7333.1	7307.2	6981.5	6962.9	6938.8
Specific heat capacity, J/(kg·℃)	571.2	632.9	632.1	691.3	802.8	811.8	825.8
Thermal conductivity, J/(m·s·℃)	23.99	28.94	32.66	33.31	32.95	33.38	33.94

2.1 Boundary Conditions

In Mould. The instantaneous heat flux along the casting direction in the mould is:

$$q_m = 2670000 - B\sqrt{t}_m \qquad J/(m^2 \cdot s) \tag{2}$$

Where, B is coefficient which is determined by relations of the average heat flux and instantaneous heat flux in mold, t_m is the billet residence time in the mold.

Secondary Cooling Zone. The heat flux in the secondary cooling zone is:

$$q_s = h_s \cdot (T_{sur} - T_w) + k \cdot \varepsilon\sigma\left[\left(\frac{T_{sur}+273}{100}\right)^4 - \left(\frac{T_a+273}{100}\right)^4\right] \qquad J/(m^2 \cdot s) \tag{3}$$

where, T_{sur} is the billet surface temperature, ℃; T_w is cooling water temperature, ℃; k is correction factor; ε is steel emissivity; σ is Boltzmann constant; Ta is ambient temperature, ℃; h_s is heat transfer coefficient in different secondary cooling subzone, which is defined as formula (4):

$$h_S = 5840 \times W^{0.451} \times \left(1 - 7.5 \times 10^{-3} \times T_w\right) \quad \text{J/(m}^2\text{·s·℃)} \tag{4}$$

Where, W is spraying water volume density, l/(cm^2.min).

Radiation cooling zone. The heat flux in the radiation cooling zone is:

$$q_a = \varepsilon\sigma\left[\left(\frac{T_{sur} + 273}{100}\right)^4 - \left(\frac{T_a + 273}{100}\right)^4\right] \quad J/(m^2 \cdot s) \tag{5}$$

2.2 Initial Condition

$$T(x, y, t)\big|_{t=0} = Tc \tag{6}$$

Where, Tc is the casting temperature of 82B steel.

3 Computation and Verification

The principle technological parameters and mold cooling conditions are given in table 2. The cooling conditions of secondary cooling zone are given in table 3. The length of air cooling zone is 7.5m. The casting section size is 150mm × 150mm.

Table 2. Principle technological parameters and mold cooling condition

Parameters	Value
Casting temperature, ℃	1490
Casting speed, m/min	1.73
Cooling water volume in the mold, m^3/h	130
Temperature difference at mold inlet and outlet, ℃	5.5

Table 3. Cooling conditions of secondary cooling zone

Cooling subzone	1	2	3	4
Length, m	0.37	1.911	2.419	1.7
Cooling water volume, m^3/h	4.23	4.31	1.065	0.665

The relations of strand temperature distribution and shell thickness and the distance from meniscus have been given in figure 1 under the above operation condition. In order to verify the model accuracy, we have made pin-shooting experiment to measure the solidified shell thickness of billet under the above operating condition. The pin-shooting sampling macrostructure graph is shown in figure 2.

As shown in figure 1, the reheating phenomenon occurs in the 2~ 4 spray subzone and air cooling zone, the reheating rate in different subzone is given in table 4. The position of final solidification point from meniscus is 9.909m; the position which the centerline solidification fraction is 0.3 from meniscus is 8.542m.

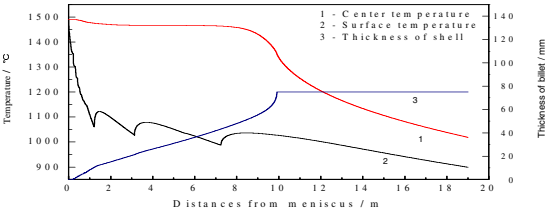

Fig. 1. Relations of temperature and thickness of strand and distance from meniscus

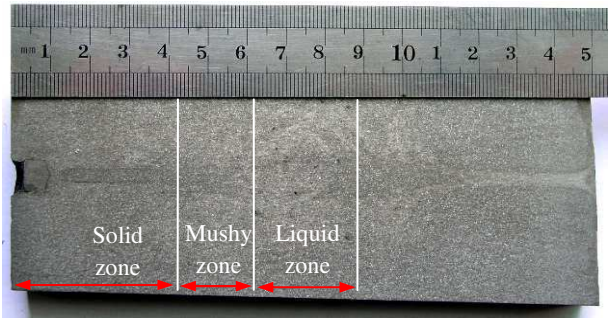

Fig. 2. Pin-shooting sampling macrostructure graph

Table 4. Reheating rate in different cooling subzone

Cooling subzone	Spray cooling subzone				Air cooling zone
	1	2	3	4	
Reheating rate, ℃/m	0	251.06	89.18	28.99	40.77

The experiment result shows that the shell thickness is 42mm in pin-shooting position, the corresponding calculated shell thickness is 42.35mm, and the relative error is 0.84%. This indicates that the reliability of heat transfer model is very high.

4 Optimization and Analysis

Although the EMS technology has been adopt in the mold, the results of production site show that there is still serious centerline segregation in billet. The results of heat transfer model shows that the surface temperature falling velocity is lower than the centerline temperature drop rate in billet. This also shows that the cooling intensity of the upper secondary zone is too high, while that of the lower secondary zone is too low. So, we have optimized the secondary cooling scheme. When the cooling water volume is decreased by 10% in the 1st spray cooling subzone and by 30% in the 2nd zubzone, the reheating rate of 2nd subzone decreases; meanwhile, the solidification shell thickness can satisfy the safety production need.

Moreover, when the 1st to 2nd subzone cooling scheme is maintained above optimization scheme and the 3rd subzone is same with original scheme, we have

increased cooling water volume by 50% and decreased cooling water volume by 50% and 100% in the 4th subzone separately. The temperature distributions are showed as figure 3 in the different cooling water scheme.

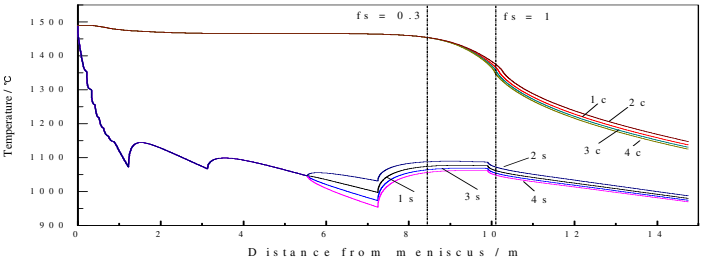

Fig. 3. Temperature distribution of billet under different secondary cooling scheme. 1~4 is cooling water scheme; s is Billet surface temperature; c is Billet center temperature, f_s is Solidification fraction.

From figure 3, we can find that the strand centerline temperature is hardly changed under different cooling condition, the surface temperature distribution changes greatly. However, whether increasing or decreasing of cooling intensity in the 4th cooling subzone, the surface temperature falling rate is larger than the center temperature falling rate in zone which the solidification fraction is 0.3 to1. So, it is necessary to add the additional 5th cooling zone for eliminating centerline segregation.

The length of the 5th cooling subzone was choosed as 2.659m, which is equal to the space between the final solidification point and the 4th subzone end under the origin cooling water scheme. The different optimal cooling water schemes are given in the table 5, the corresponding temperature curves of billet are showed as figure 4.

Table 5. Optimization cooling water scheme in fourth and fifth subzone

Optimization scheme	Cooling water volume, m^3/h	
	Fourth subzone	Fifth subzone (additional)
1	0.665	0.665
2	0.3325	0.3325
3	0.3325	0.665
4	0.3325	0.9975
5	0.3325	1.33

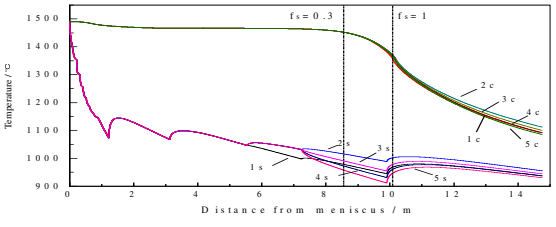

Fig. 4. Temperature distribution of billet under different secondary cooling scheme

From figure 4, the position which solidification fraction is 0.3 is not changed when the different cooling water scheme is applied, the distance of final solidification point from meniscus changes from 10.105m to 10.205 m. All five optimization schemes in table 5 can increase the billet surface temperature falling rate to some extent, but the increasing level is not enough in the fist to third scheme; the fifth optimized scheme can increase surface temperature falling rate adequately, but the billet surface temperature in the 5th subzone end is 911.38℃ which AlN and other intergranular compounds can precipitate in the grain boundary, then the surface horizontal crack may be brought in billet; so the optimal cooling water scheme is the fourth scheme.

5 Conclusions

(1) The pin-shooting experiment result is consistent with the result of the heat transfer model of billet.

(2) The strand surface temperature falling rate is lower than the center temperature falling rate in the original cooling water scheme.

(3) In order to decrease the grade of centerline segregation of billet, it is necessary to add an additional cooling subzone after the fourth subzone.

(4) The optimal cooling water scheme is that cooling intensity of fifth subzone increase by 150% compared with the original fourth subzone.

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The Study of Slow-Release Trace Co^{2+} Ceramsite on the Influence of Wastewater Anaerobic Treatment

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Abstract. Use fly ash, cement, lime, gypsum as main raw material, CaCl2, Na2SO4 and NaCl as complex additive, use steam curing method, in the process of preparation of ceramsite, add vermiculite with Co2+, then obtain ceramsite which can release Co2+ slowly. Experimental results show that the releasing content of Co2+ increases with the ruse of the temperature, from the fourth day, all can reach a certain balance concentration. Through contrast test with the control group, add Co2+ group and slow-release Co2+ ceramsite group in the microbial reactor can obtain: removal rate of add modification ceramsite is the peak, can reach up to 90.32%, 30.06% higher than control group, 14.48% higher than add Co2+ group.Slow-release ceramsite can significantly increase the activity of activated sludge, comparing with other ceramsite and add trace metal element directly, which has more superior process performance.

Keywords: unburned ceramsite, release, trace metal elements, microorganisms.

1 Introduction

In the process of wastewater anaerobic biological treatment, pH, reactor temperature, toxic substance, carbon sources, constant nutrition (N, P), vitamin, metabolic time, oxidation-reduction potential and the raw material mixed all have effect on the microbial anaerobic treatment [1,2].Although microbes need a small quatity of the trace metal elements, since trace metal elements involved in the composition of enzyme is an indispensible part of synthesis of microbial cells[3], Such as Co^{2+} is the components of vitamin Bl2, and stimulate the growth of inorganic chemoautotrophic bacteria like algae green bacteria, micrococcus and methanogen etc. especially the growth of methanogens[4], promoting the growth of methanogens and formation of methane. Lack of trace metal elements can lead to reduce biological activity, resulting in influence of the operation effect and stability of the whole reactor[5]. Research find[6], add an appropriate amount of trace metal elements in reactor can improve substrate biodegradation rate and gas yield, the reaction activate speed, and promoting formation of anaerobic granular sludge, but when it contains excessive additive amount, resulting in suppression of the growth of bacteria ; In other words, input excessive trace metal element can inhibit microbes activity, dosing trace metal elements salts directly can provide necessary trace metal elements of microbial ,but the hydroxyl in the water and the precipitation and complexation of colloid will reduce its biological effective degrees, excessively dosing will produce heavy metal pollution of water.Experimental

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will load Co^{2+} to the adsorbent of ceramsite, making it release Co^{2+} slowly, increasing the Biological effective degrees of microscale metals element, improving the microbial treatment efficiency of organic wastewater, reducing the potential environmental pollution risks of heavy metal by dosing metal ions directly to the wastewater.

2 Experimental Methods

2.1 Experimental Instruments and Drugs

Experimental instrument: Electro-thermal Constant-temperature Drying Oven (Tianjin Taisite Apparatus Co., LTD); ALB - 124 electronic analytical balance (Beijing Chengmeng Weiye technology Co., LTD.); PY500 intelligent digital pressure control instrument (FoShan Saipute Electronic Apparatus Co., LTD); LDZX - 75KB steam sterilizer (Shanghai Shenan instrument medical treatment Co., LTD) ; Press (Shanghai Wenyuan press Co., LTD).

Experimental drugs: glucose, Potassium dihydrogen phosphate, urea, sodium hydrogen carbonate, potassium bichromate; potassium dichromate, concentrated sulphuric acid, Silver sulfate, Cobaltous Chloride, potassium hydrogen phthalate and other drugs are all analysis pure reagent; Fly ash, cement, lime, gypsum, sodium sulfate, Calcium chloride fused etc.

2.2 Preparation of Ceramsite

The preparation of ceramsite: grinding fly ash 16g , cement 16g , lime 3.2g,, gypsum 0.4g in the mortarbox respectively , and mixing thoroughly in beaker of 250mL, then putting them in drying box ,the condition is 100℃and 40min; select and confirm Na_2SO_4 0.1 g and $CaCl_2$ 0.4g as stimulating agent into the beaker of 50mL, dissolving with appropriate water then in certain proportion mixed with the main ingredient, putting in press or extrusion press with manual granulation get spherical granule ceramsite, grain size is 4-6mm. ageing, natural drying and then steam curing, after make un-burned ceramsite. In the process of preparation of ceramsite, adding vermiculite with Co^{2+}, then obtain ceramsite which can release Co^{2+} slowly.

2.3 Release Experimental Methods of Different Carrier Ceramsite

Putting 20g ceramsite which loads different trace metals element into 150ml cone shaped bottle respectively, adding water to 100ml, under 298K constant temperature with the oscillations of 80r/min, take and replenish 50ml solution to analysis the release quantity of Co^{2+} everyday.

2.4 Application Experiment of Biological Ceramsite

Putting 200ml sludge in the culture flask, then join 300ml nutrient solution with 2000mg/L COD, taking 20g sample ceramsite in Microbial cultures respectively, and fully mix into incubator. Heating up 1℃ everyday, stop it until heated up 33℃. start from 26℃,sampling solution through sampling mouth every day and each 2ml.

3 Experimental Results and Discussion

3.1 Temperature on the Influence of Release Co^{2+} Ceramsite

Putting 20g ceramsite which loads trace metals element Co^{2+}, Constant temperature oscillation under different temperature , according to the method of 2.3, the results as shown in figure 1:

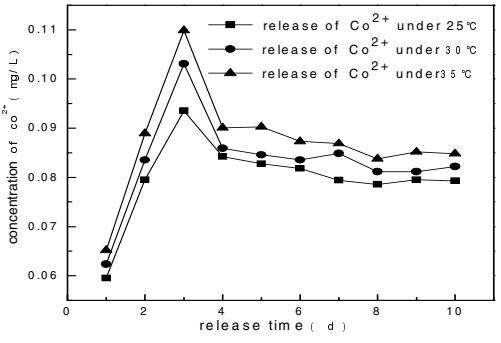

Fig. 1. The relation between release time and concentration of Co^{2+}

As can be seen from Figure 1, the releasing content of Co^{2+} increases with the rise of the temperature, from the fourth day, all can reach a certain balance concentration, the balance concentration is 0.079 mg/L, 0.082 mg/L and 0.085 mg/L respectively under different temperature of 25℃, 30℃ and 35℃.

3.2 Concentration of Co^{2+} on the Influence of Anaerobic Bioloical Treatment

According to the method of 2.4, which do not add ceramsite but add Co^{2+} 0, 05, 0.1, 0.2, 0.4, 0.8 mg/L in training device respectively, carry out experiments, the results of different concentration of Co^{2+} on the removal rate of COD as shown in figure 2.

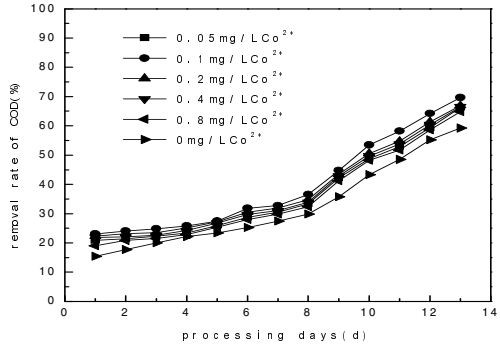

Fig. 2. The relation between processing days （d） and removal rate of COD

As can be seen from Figure 2, when deal with 13 days, removal rate of COD of blank group can reach to 59.26%, the group of the worst treatment effect among which is joining trace Co^{2+}, the removal rate of COD also amounting to 64.84%; can be seen obviously from Figure 1 ,When the concentration of Co^{2+} is 0.1 mg/L in the reactor , the promoting effect is maximumt on microbe , when deal with 13 days, its final removal rate of COD climbs to 69.68%; when the concentration of Co^{2+} below or above 0.1 mg/L, removal rate of COD all reduce, Explain that joining the proper concentration of Co^{2+}, will improve the activity of sludge in reactor.

3.3 Ceramsite of Slow-Release Co^{2+} on the Influence of Anaerobic Bioloical Treatment

According to the method of 2.4, adding ceramsite that load different content of Co^{2+} in incubators, simultaneously not add ceramsite but join 0.1 mg/L content of Co^{2+} as control group, training continuously, the result of the ceramsite of slow-release Co^{2+} on the removal rate of COD as shown in figure 3.

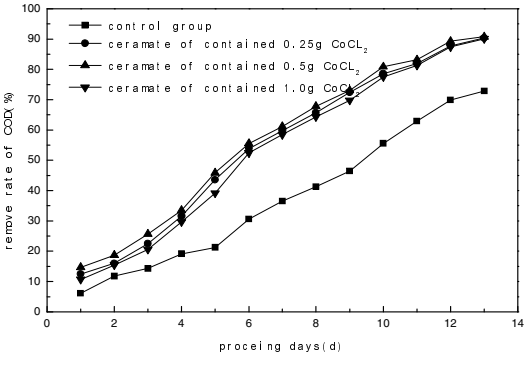

Fig. 3. The relation between processing days(d) and removal rate of COD (%)

As can be seen that in the figure 3, With the extension of microorganism cultivation period, The removal rate of COD is obviously increased. when deal with reach to 13 days, The control group's removal rate of COD amounting to 75.84%, and adding modified ceramsite in reactor, the removal rate of COD, climbing to 90.32%. it explains that the ceramsite of loaded trace metal elements in reactor, benefits to the formation of granular sludge, improving the activity of sludge, promoting the growth of microorganism, boosting the processing efficiency of microbes greatly. the ceramsite of loaded Co^{2+} on removal rate of COD and the production of methane all higher than the control group, on the anaerobic treatment with high concentration organic wastewater, the ceramsite of slow-release trace metals element has superior sludge, comparing with ordinary anaerobic activated sludge.

4 Conclusion

Using fly ash, cement, lime, gypsum as main raw material, $CaCl_2$, Na_2SO_4 and NaCl as complex additive, using steam curing method, in the process of preparation of ceramsite, adding vermiculite with Co^{2+},then obtain ceramsite which can release Co^{2+} slowly.Experimental results show that the release content of $Co^{2+}$of ceramsite increases with the increase of the temperature, from the fourth day, all can reach a certain balance concentration ,ceramsite has the stable slow release function. The contrast experiment among blank control group, single adding Co_{2+} group, and ceramsite of slow-release Co^{2+} shows that removal rate of adding modification ceramsite is the peak, can reach up to 90.32%, 30.06% higher than control group, 14.48% higher than adding Co^{2+} group. Slow-release ceramsite can significantly increase the activity of activated sludge, comparing with other ceramsite and adding trace metal element directly,which has more superior process performance.

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An Identity Intelligent Recognition System

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Abstract. The anti-theft technology has been a topic of interest to businesses and users. How to design an effective anti-theft identification system is the most important technology. This paper studied a biometric-based smart card technology, which can solve their problems effectively. Our system applied two-factor (smart card and biometric technology) authentication to replace the original single-factor authentication solution. As a result, that significantly lowered the risk of identity theft.

Keywords: intelligent identification, smart cards, key, fingerprint recognition.

The general identification techniques include three kinds: password technology, smart card technology (including USB KEY, IC card and RFID technologies) and biometric technology. Password technology is easy to be applied, and it has been used ever since. However, the security risk of password technology hindered its' applications at the high end market. Smart card technology and biometric technology are popular in the authentication area due to their inherent security features. On the other side, smart card technology is inconvenient to input and remember passwords, and there are some security vulnerabilities in biometrics technology.

Our system applied smart card-based fingerprint recognition technology to authenticate the user's identity. A user needs to provide his live fingerprint image before he can access the system. Then the system will automatically extract his fingerprint features, and the fingerprint characteristics are stored in the smart card and the system as a template. In order to start the system, the user is required to provide live fingerprint and the smart card for authentication. Only an authorized user is able to access the system.

1 System Structure

Fingerprint identification based on smart card technology stores the user's fingerprint (plain text or cipher text) on a smart card and the fingerprint identification system is installed in the smart card reader. The reader accesses the smart card and also scans the cardholder's fingerprint at the same time. It is able to confirm whether the cardholder is the real owner through matching the fingerprint in the card and the cardholder's fingerprint module saved in the identification system. After the confirmation, the scanned live fingerprint needs to be matched to the fingerprint in the system for verification. The user is able to access the system only after both the confirmation and verification are successfully passed. Shown in Figure 1, an embedded system is used to read and write into the smart card and apply the fingerprint recognition technology.

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The reading and writing modules in the figure is for the data exchange process with a smart card, including reading, writing and two-way authentication process between the card and modules. The collector is responsible for collecting the user's fingerprint image. The MCU is the center of the whole system and processes the fingerprint recognition algorithm. Some storage units are needed for such systems to store the fingerprint features for all users. The drive control module is used to control the various authentication components. The display and the keyboard part are used to provide interactive module interface for users.

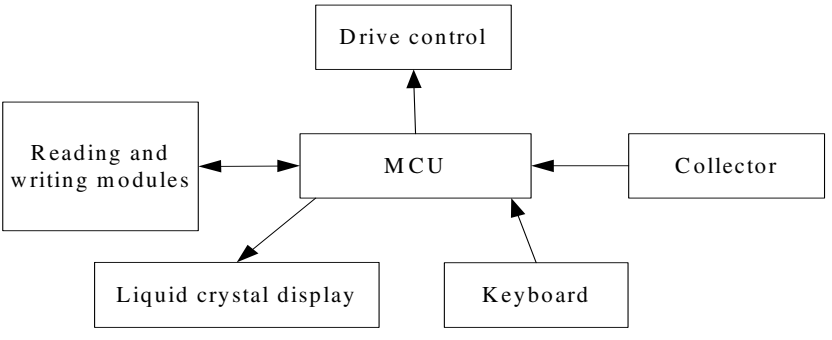

Fig. 1. Intelligent Recognition System owners

2 The Structure of a Smart Card

The smart card is integrated of a CPU, memory and other peripheral chips, and the size is similar to a phone card. Figure 2 shows the SLE66CL160S chip made by Infineon. It is a dual interface smart card chip, which supports both contact and contactless communications.

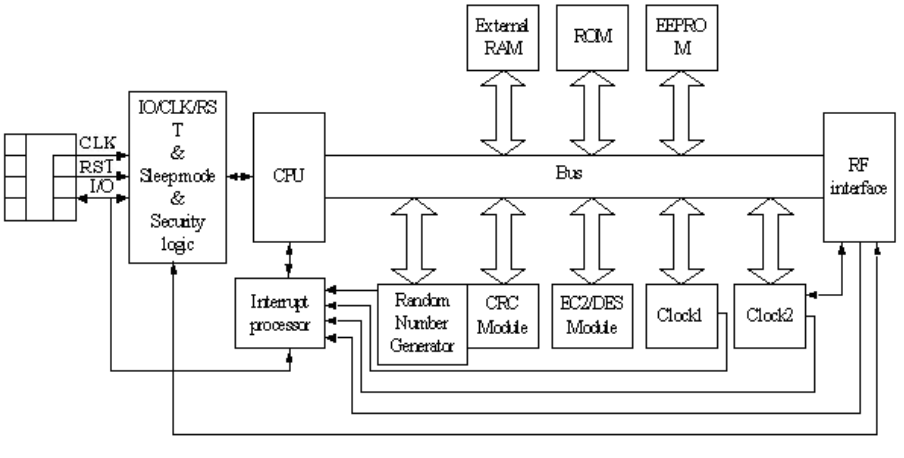

Fig. 2. Infineon's chip SLE66CL160S

In Figure 2, SLE66CL160S has two communication interfaces: contact interface and contactless interface (RF interface). RAM is used as an internal working unit to store command parameters, returned results, security status, temporary keys and temporary data during data processing. ROM is the storage unit for operating system in the card. EEPROM is the storage for user application data. In addition to the two interface module and other components for a single chip system, such as interrupt handlers, external RAM, ROM, clock, etc., this CPU card chip also contains several special components: random number generator, CRC module and EC2 / DES module, which play an key role for the CPU card to realize the security mechanism. Random number generator is used for internal and external authentication and anti-collision process. CRC module is used to generate the CRC verification data for contactless communication data block. EC2/DES module is a hardware encryption module, which uses ECC and DES encryption algorithm and achieves a speed much faster than that with a software encryption program.

3 Fingerprint Identification Process

The security features of smart cards are used to store the fingerprint features. The other processes are completed outside the card. Two aspects should be noted: one is the data transmission and authentication time in the card, the other is the safety certification. As a fingerprint image data after the feature extraction is only a few hundred bytes, and the memory of a smart card chip usually has dozens of K-byte size, a large number of fingerprint characteristics and personal information can be stored. Figure 3 shows the smart card-based fingerprint identification process.

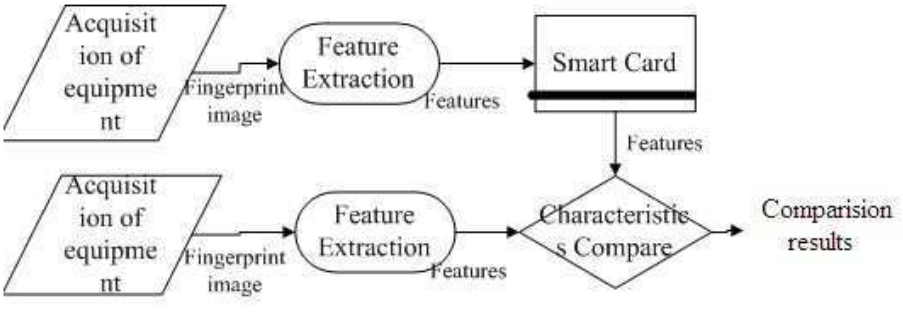

Fig. 3. The process of fingerprint identification

4 Safety Certification Process

Security of the system depends on the smart card and fingerprint recognition technology. In order to protect the features of smart card and fingerprint, the system uses a single key cipher based authentication scheme, which is shown in Figure 4 and includes the following three processes.

First: the internal certification process. The process is used to authenticate the card. The data for authentication is sent from the terminal to a smart card. Then the smart card encrypts the data with its own internal authentication keys for encryption and returns the cipher text, and the terminal decrypts the data with the same key. If the decrypted data is the same as the original data, the authentication is successful; otherwise, it fails.

Second: the external certification process. The process is used to authenticate the terminal. The terminal informs the card to take a random number, and then encrypts a random number with its own external authentication key encryption and sends it to the card. The card decrypts the cipher text with the same key. If the plain text is the same as the random number, the authentication is successful, otherwise, it fails.

Third: verification and matching process. Characteristics of existing templates TD and the cipher text with the TD hash value are sent to the terminal from the card. The terminal decrypts with the same key and verifies the hash value to ensure that the data transmission process is complete. Then the terminal collects the live fingerprint image, extracts the feature LD and compares the LD with the TD. According to the results of the comparison, we can achieve the purpose of access control.

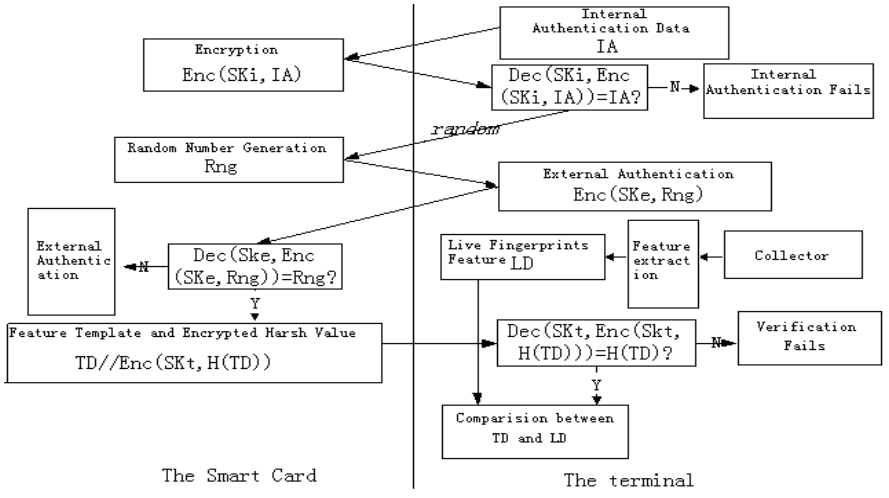

Fig. 4. The following are just for reference in

5 Performance Analysis

With the security certification program presented above, a demonstration system is built based on the Infineon SLE66CLX320P chip. The interested parameters include the time for three encryption and decryption algorithms and the time to send the fingerprint eigenvalues. The results are shown in Table 1.

Generally the performance of fingerprint recognition algorithm can be measured by EER (Equal Error Rate), FRR (false rejection rate) and FAR (false acceptance rate). To calculate the FRR, two fingerprints of the same person are compared, and a total of 300 comparisons are obtained. For the FAR, two different fingerprints from different people need to be compared, and a total of 1140 test results are obtained. The results

are shown in Table 2. The machine is a Pentium III computer (frequency of 1GHz, memory 256MB). As the fingerprints have a relatively small sample size, the results are only used for reference. Three adjustable parameters are:

$$\varepsilon = 8, \partial = 66.7\%, \beta = 50\% \cdot$$

The FRR and FAR values may change according to these parameters.

Table 1. Experimental parameters of the system

Category		Triple DES	RSA (5/10M)	ECDSA (5/10M)	Data transmission time (ms)
120 feature bytes	Type B	–	–	–	12010/106K=11.3
	T=0				12010/9600=125
8byte decryption		125.60 us	–	–	–
1024 mode bytes	Signature	–	820/410 ms	–	–
	Authentication		20/11 ms		
163 bytes index	Signature	–	–	255/130 ms	–
	Authentication			512/265 ms	
192 bytes index	Signature	–	–	285/142 ms	–
	Authentication			540/270 ms	

Table 2. Test results based on the structural alignment method

Sample database	EER	Average eigenvalue (byte)	Maximum matching memory (byte)	Average registering time(s)	Average comparison time(s)
adoption (optical sensor)	8.75%	42×5=210	3958	0.49	0.37

Generally a good system will be evaluated from several aspects: social and user acceptance, the degree of resistance to attack, certified accuracy, ease of use and convenience maintenance and management. The performance is analyzed based on the following aspects. First, it has high social and customer acceptance, as biometrics fingerprint technology is currently the most mature and most widely used technique, has been recognized by the majority of users. Second, this authentication scheme enhances the system against attack by using a two-factor authentication solution. Third, it is also very easy and fast to use. It only needs to provide smart cards and fingerprints collected at the scene, without providing the key. Finally, this system is also very convenient for maintenance and management. Except that the fingerprints collections are required during the registration period, other processes are done automatically. In addition, although the system has a comparison of the order N, since the registered users in the system has a small number (N), the matching time is less than 1.5 seconds, which a user can tolerate.

The Empirical Study on the Contribution Rate of China's R&D Expenditures to GDP Growth

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Abstract. More and more people concern about the R&D on the importance of national economic development. Based on econometric analysis method, this paper establishes the correlation analysis model of contribution rate of China's R&D expenditures to GDP Growth. From three aspects, that is, the sub-annual data regions, sub-regional historical data and general data analysis R&D expenditures, this paper analyses the correlation between R&D expenditures and GDP. By positive analysis, we obtain the following conclusions: China R&D expenses between 1999-2008 were significantly associated with GDP and R&D contribution to the GDP growth rate showed a small range of fluctuation and stabilized. And there is striking difference on the contribution rate of GDP growth between China's 31 provinces (municipalities). Finally, this paper puts forward some corresponding suggestions.

Keywords: R&D expenditures, GDP growth, contribution rate, Econometric models, Empirical Analysis.

1 Introduction

Technological progress has caused the increasing knowledge proportion of capital in the corporate production function and in turn, drawing-increasing attention is being attached to the R&D in the national economy. In 1980s, our country began to focus R&D in the assessment .We have also engaged in the research of measurement and capacity of R&D since 1990s. we can conclude that the technological and innovative ability showed positive relations with the inputs of R&D activities. And it can directly reflect scientific and technological power of the country. R&D plays an important role in the development of the regional economy and the technology and the enhance of country's comprehensive power. In recent years, some scholars, Chen zhibing, Shi jianjun, Hu hongping and Wu guangmou have done the relative research of R&D and GDP. With data of inner province they analysis the relations of all the individuals. Only Zhong guobao and Yan xiaojun proposed two articles using the overall data. For the ideal that China has the different national condition and uneven development, we used the definite data to compare the R&D expenditures with GDP in order to explore the contribution rate to the economic growth and the significance.

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2 The Analysis of Regional R&D Expenditures and the Development of GDP

2.1 The R&D Expenditures of the Regions

According to the explanations of the statistic communiqué in the inputs of the national science and technology, it refers to all the outputs used in the basic and applied research, including expenditures of the staff, material, fixed assets, and management and so on.

We can see the conditions of the R&D activities in China of the statistic communiqué. The outputs are increasing from 1999 to 2008. In follows, the expenditures are decreasing. And in 2001, Jiangxi RMB 0.78 billion, in 2000, RMB 0.82 billion; 0.04billion is the decreasing number, in Guangxi province 0.8 billion in 2001, in 2000, 0.84 billion. With 0.04billion decreasing. Guizhou Province 1.37billion in 2007, in 2006, 1.45billion, with 0.08 billion decreasing. In 2006 Yunnan province 2.09 billion, in 2005, 2.13 billion with 0.04 billion decreasing. In 2003, Xizang province 0.03billion, in 2002, 0.05 billion with 0.02 billion decreasing. In 2005, 0.03 billion, in 2004, 0.04 billion with 0.01billion decreasing. In 2000, Gansu province 0.73 billion, in 1999, 0.74 billion with 0.01 billion; In 2001, Qinghai province 0.12 billion, in 2000, 0.13 billion with 0.01 billion decreasing. It is revealed that all the expenditures are in an increasing trend. Due to the different bases, they don't share the same ground. So Beijing, Jiangsu, Guangdong, Shandong, Shanghai and Zhejiang occupy the higher R&D expenditures.

2.2 The GDP of the Individual Regions

The GDP conditions of the overall index is in an increasing trend with 10% updating rate in the decade from 1999 to 2008.we can see that the expenditures of the R&D are in line with the changing trend of GDP. Is there positive relation among them? Hence, we reuse the annual or past data and the overall data of the individual regions.

3 Construction of Theoretical Models

Once we need to research the inner relations among all the elements of the target, the construction of the theoretical model about the relations between the expenditures and the GDP is vital. Then we can conclude the general law by the mathematical model. However, in practice it is difficult to establish the mathematical model among all the variables due to the complex relations. The variables are influenced by other causal factors and they often caused the uncertain relations. The method of regression analysis is used to find the inner laws of all the variables on the basis of many experimental observations, in order to establish the mathematical expression between one and the other. In a word, regression analysis refers to the research the relations between one variable and the other one. This paper is shaped in three perspectives to analysis the relations.

Multiple linear regression model is $y = \beta_0 + \beta_1 x_1 + \beta_2 x_2 + \cdots + \beta_k x_k + \mu$.

(type3-1)

In the expression, u refers to the random disturbance term. It can also be expressed by matrix:

$Y = X\beta + \mu$ (type 3-2), in it,

$$Y = (Y_1, Y_2, \cdots, Y_n)'$$

$$\beta = (\beta_0, \beta_1, \beta_2, \cdots, \beta_k)'$$

$$\mu = (\mu_1, \mu_2, \cdots, \mu_n)'$$

$$X = \begin{bmatrix} 1 & X_{11} & X_{21} & \cdots & X_{k1} \\ 1 & X_{12} & X_{22} & \cdots & X_{k2} \\ \vdots & \vdots & \vdots & \cdots & \vdots \\ 1 & X_{1n} & X_{2n} & \cdots & X_{kn} \end{bmatrix}$$

4 The Relations between the Expenditures of R&D and GDP

4.1 Based on the Annual Data

We can conclude followings when we put the data into the 3-2 expression.

$Y_{i1} = 4111.467 + 43.277X_{i1}$ (type 4-1)
t value (3.343) (7.847)
R=0.825, $\overline{R}^2$=0.669 F =61.577

$Y_{i2} = 3682.589 + 43.517X_{i2}$ (type 4-2)
t value (3.238) (6.923)
R=0.789 , $\overline{R}^2$=0.610 F =47.936

$Y_{i3} = 3234.241 + 43.367X_{i3}$ (type 4-3)
t value(3.194) (6.294)
R=0.760 , $\overline{R}^2$=0.563 F =39.619

$Y_{i4} = 3021.205 + 42.484X_{i4}$ (type 4-4)
t value (3.325) (5.647)
R=0.724 , $\overline{R}^2$=0.507 F =31.886

$Y_{i5} = 2709.976 + 42.503X_{i5}$ (type 4-5)
t value (3.568) (5.486)
R=0.714 , $\overline{R}^2$=0.492 F =30.093

$Y_{i6} = 2267.655 + 44.132X_{i6}$ (type 4-6)
t value (3.527) (5.309)
R=0.702, $\overline{R}^2$=0.475 F =28.189

$Y_{i7} = 2080.173 + 43.249X_{i7}$ (type 4-7)
t value (3.766) (5.095)
R=0.687 , $\overline{R}^2$=0.454 F =25.960

$Y_{i8} = 1880.660 + 48.153X_{i8}$ (type 4-8)
t value (3.830) (5.134)
R=0.690 , $\overline{R}^2$=0.458 F =26.361

$Y_{i9} = 1813.636 + 47.932X_{i9}$ (type 4-9)
t value(3.808) (4.492)
R=0.641 , $\overline{R}^2$=0.390 F =20.179

$Y_{i10} = 1989.097 + 49.306X_{i10}$ (type 4-10)
t value (4.355) (3.311)
R=0.524 , $\overline{R}^2$=0.249 F =10.961

According to the test charm of correlation coefficient, Significant degree of freedom for the 25 level of 5%, 1% and 0.1% of the correlation coefficient R were 0.381, 0.487 and 0.554, type 4-1 ~ type 4-10 calculate the correlation coefficient, in addition to 0.524 (type 4-10, said 1999), it goes through a significant level of 1% of the test but not the 0.1% test, the other significant 0.1% through the test. It shows that from 1999 to 2008 R&D expenditures and GDP correlations significantly change from the R value of the Rule, which was significantly enhanced level of the trend year by year.

According to t distribution, a significant degree of freedom for the 29 level of 5% and 1% values were 2.045 and they determine 2.756, xi1, xi2 ... ... xi10 coefficient t value and they past the 1% significance level test. 1999 2008 R & D expenditures of the coefficient of stability of the overall range of change in 42.484 ~ 49.306, showing that in the past 10 years, the overall the contribution rate of R & D expenditures on GDP is basically stable.

According to f distribution, degrees of freedom for the (25, 1) and a significant level of 5% and 1% of the determined values were 4.24 and 7.77, type 4-1 ~ type 4-10 calculated f value, and all passed the examination. It shows that from 1999 to 2008 R&D expenditures and GDP of the general econometric model is significant.

4.2 Based on the Historical Data

To the historical data were incorporated into the type 3-2, can be drawn:

$Y_{1j} = 688.749 + 17.089X_{1j}$ (type 4-11)
t value (4.023) (34.202)
R=0.996, $\overline{R}^2 = 0.992$ $F = 1169.801$

$Y_{2j} = 1099.283 + 34.300X_{2j}$ (type 4-12)
t value(16.825) (40.199)
R=0.998, $\overline{R}^2 = 0.994$ $F = 1615.932$

$Y_{3j} = 2316.834 + 125.968X_{3j}$ (type 4-13)
t value (7.748) (25.051)
R=0.994, $\overline{R}^2 = 0.986$ $F = 628.081$

$Y_{4j} = 1152.679 + 95.318X_{4j}$ (type 4-14)
t value (7.970) (20.457)
R=0.991, $\overline{R}^2 = 0.979$ $F = 418.501$

$Y_{5j} = 1132.528 + 204.200X_{5j}$ (type 4-15)
t value(8.710) (23.807)
R=0.993, $\overline{R}^2 = 0.984$ $F = 566.781$

$Y_{6j} = 1839.582 + 55.050X_{6j}$ (type 4-16)
t value(3.578) (12.040)
R=0.973, $\overline{R}^2 = 0.941$ $F = 144.955$

$Y_{7j} = 455.679 + 93.457X_{7j}$ (type 4-17)
t value(1.051) (7.482)
R=0.935, $\overline{R}^2 = 0.859$ $F = 55.986$

$Y_{8j} = 1864.909 + 75.719X_{8j}$ (type 4-18)
t value(18.518) (34.629)
R=0.997, $\overline{R}^2 = 0.993$ $F = 1199.152$

$Y_{9j} = 2532.672 + 31.281X_{9j}$ (type 4-19)
t value(22.418) (55.724)
R=0.999, $\overline{R}^2 = 0.997$ $F = 3105.137$

$Y_{10j} = 5709.460 + 44.332X_{10j}$ (type 4-20)
t value(16.139) (35.731)
R=0.997, $\overline{R}^2 = 0.993$ $F = 1276.764$

$Y_{11j} = 5347.946 + 47.668X_{11j}$ (type 4-21)
t value(20.219) (31.204)
R=0.996, $\overline{R}^2 = 0.991$ $F = 973.681$

$Y_{12j} = 1741.271 + 74.577X_{12j}$ (type 4-22)
t value(13.092) (27.780)
R=0.995, $\overline{R}^2 = 0.988$ $F = 771.729$

$Y_{13j} = 2205.218 + 82.873X_{13j}$ (type 4-23)
t value(13.123) (26.881)
R=0.995, $\overline{R}^2 = 0.988$ $F = 722.561$

$Y_{14j} = 1494.686 + 81.847X_{14j}$ (type 4-24)
t value(18.235) (31.031)
R=0.996, $\overline{R}^2 = 0.991$ $F = 962.893$

$Y_{15j} = 5713.427 + 62.276X_{15j}$ (type 4-25)
t value(10.436) (23.441)
R=0.993, $\overline{R}^2 = 0.984$ $F = 549.490$

$Y_{16j} = 2491.855 + 128.297X_{16j}$ (type 4-26)
t value(7.464) (24.323)
R=0.993, $\overline{R}^2 = 0.985$ $F = 591.625$

$Y_{17j} = 1295.543 + 68.378X_{17j}$ (type 4-27)
t value (6.914) (28.481)

R=0.995, $\overline{R}^2$=0.989 F =811.147

$Y_{18j} = 2225.466 + 85.834X_{18j}$ (type 4-28)

t value(7.458) (14.952)

R=0.983, $\overline{R}^2$=0.961 F =223.555

$Y_{19j} = 4760.141 + 64.171X_{19j}$ (type 4-29)

t value (5.692) (20.435)

R=0.991, $\overline{R}^2$=0.979 F =417.581

$Y_{20j} = 978.744 + 198.194X_{20j}$ (type 4-30)

t value (3.672) (11.968)

R=0.973, $\overline{R}^2$=0.940 F =143.231

$Y_{21j} = 181.803 + 379.288X_{21j}$ (type 4-31)

t value(2.12) (8.262)

R=0.946, $\overline{R}^2$=0.882 F =68.264

$Y_{22j} = 1083.512 + 65.432X_{22j}$ (type 4-32)

t value (23.957) (44.541)

R=0.998, $\overline{R}^2$=0.995 F =1983.886

$Y_{23j} = 318.807 + 74.286X_{23j}$ (type 4-33)

t value (0.936) (20.574)

R=0.991, $\overline{R}^2$=0.979 F =423.296

$Y_{24j} = 367.725 + 151.591X_{24j}$ (type 4-34)

t value (3.134) (13.586)

R=0.979, $\overline{R}^2$=0.953 F =184.576

$Y_{25j} = 1011.055 + 142.571X_{25j}$ (type 4-35)

t value(6.154) (15.115)

R=0.983, $\overline{R}^2$=0.962 F =228.449

$Y_{26j} = 110.319 + 260.442X_{26j}$ (type 4-36)

t value(4.336) (5.474)

R=0.888, $\overline{R}^2$=0.763 F =29.970

$Y_{27j} = -487.432 + 48.599X_{27j}$ (type 4-37)

t value(-1.756) (15.220)

R=0.983, $\overline{R}^2$=0.962 F =231.644

$Y_{28j} = 326.005 + 87.749X_{28j}$ (type 4-38)

t value (4.650) (87.749)

R=0.992, $\overline{R}^2$=0.983 F =517.282

$Y_{29j} = 2.450 + 198.159X_{29j}$ (type 4-39)

t value (0.030) (6.548)

R=0.918, $\overline{R}^2$=0.823 F =42.883

$Y_{30j} = 175.382 + 110.166X_{30j}$ (type 4-40)

t value （4.777) (12.482)

R=0.975, $\overline{R}^2$=0.945 F =155.804

$Y_{31j} = 872.218 + 229.926X_{31j}$ (type 4-41)

t value(6.029) (11.878)

R=0.973, $\overline{R}^2$=0.940 F =141.083

According to the correlation coefficient of the test table, a significant degree of freedom for the 8 level of 5%, 1% and 0.1% of the correlation coefficient R were 0.632, 0.765 and 0.872, type 4-11 ~ type 4-41 to calculate the correlation coefficient can significant 0.1% through the test. It shows that 31 provinces (municipalities) of R&D expenditures and GDP were significantly correlated.According to t distribution, degrees of freedom for the 8 5% significance level and 1% respectively, 2.306 and determine the value of 3.355, x1j, x2j ... ... x31j coefficient t-value, and all through the 1% significance level test. According to f distribution, degrees of freedom (8,1) and a significant level of 5% and 1% of the determined values were 5.32 and 11.3, type 4-11 ~ type 4-41 calculated f value, and all passed the examination. Shows that 31 provinces (municipalities) of R&D expenditures and GDP, the general econometric model is significant.

4.3 Based on the Overall National Data

With the data into the type 3-2, can be drawn:

$$\sum_i Y_{ij} = 46731.200 + 61.025\sum_i X_{ij} \quad \text{(Type 4-42)}$$

t value (19.384) (62.165)

R=0.999) $\overline{R}^2$ =0.998 F =3864.490

According to the correlation coefficient of the test table, a significant degree of freedom for the 25 level of 5%, 1% and 0.1% of the correlation coefficient R were 0.381,0.487 and 0.554, type 4-42 to calculate the correlation coefficient, it can significantly past by 0.1 % of the test. It shows that from 1999 to 2008, the National R&D expenditures and GDP, the overall correlation is significant.

According to t distribution, a significant degree of freedom for the 29 level of 5% and 1% of the determined values were 2.045 and 2.756, x_{ii} coefficient t value through the significant level of 1% of the test. 1999 ~ 2008 National R & D expenditures of the coefficient of 61.025, showing that the overall national R&D expenditures on GDP, the contribution rate basically stable.

According to f distribution, degrees of freedom for the (25,1) and a significant level of 5% and 1% of the determined values were 4.24 and 7.77, type 4-42 calculated f value, and all passed the examination. Shows that from 1999 to 2008, the National R&D expenditures and GDP, the general econometric model is significant.

The ith the data x_{ij} and y_{ij} By substituting 3-2, can be drawn:

$Y = 2505.111 + 46.387X$ (Type 4-43)

t value (10.726)(23.845)

R=0.805, $\overline{R}^2$ =0.648 F =568.605

According to the correlation coefficient of the test table, a significant degree of freedom for the 200 level of 5%, 1% and 0.1% of the correlation coefficient R were 0.138, 0.181 and 0.230, type 4-43 can calculate the correlation coefficients were significant 0.1% through test. It shows that our R&D expenditures and GDP correlation significant.

According to t distribution, 240 degrees of freedom for the significance level of 5% and 1% of the determined values were 1.970 and 2.596, x coefficient t-value through the significant level of 1% of the test. China's R & D expenditures of the coefficient of 46.386, showing that China's R&D expenditures on GDP, the contribution rate stability.

According to f distribution, degrees of freedom (120,1) a significant level of 5% and 1% , as the determined values ,they were 3.92 and 6.85, type 4-43 calculated f values through testing. It shows that our R & D expenditures and GDP of the general econometric model is significant.

5 Conclusions

Econometric analysis is used in this paper. We can conclude the following suggestions from three perspectives, as all regions of sub-annual data, sub-regional historical data and general data are showed.

From 1999 to 2008, R&D expenses in China are significantly correlated with GDP. R&D expenditures and the annual GDP data, the sub-regions, sub-regional historical data and data on three aspects of the overall empirical analysis are showed. In addition to R values of 1999, a significant level of 1% pass the test but not the 0.1%

testing, other circumstances can pass the level of 0.1% through a significant test. According to t distribution, t value, and all under different circumstances by a significant level of 1% of the test. According to f distribution table, under different circumstances can calculate the f value by test. It shows that from 1999 to 2008, China's R&D expenditures and GDP correlation is significant, from the R value changes of view, meaning a significant trend of increase year by year .

R&D in China from 1999-2008, expenditures of the intensity (R&D expenditure to GDP,) increased year by year, the contribution rate on GDP growth shows a small range of fluctuation and stability. From 1999-2008 R&D expenses and sub-regional annual GDP data analysis, the contribution of R&D maintain a lesser extent in the range of 42.503-49.306 in fluctuations and stability since 2002, see Figure1.

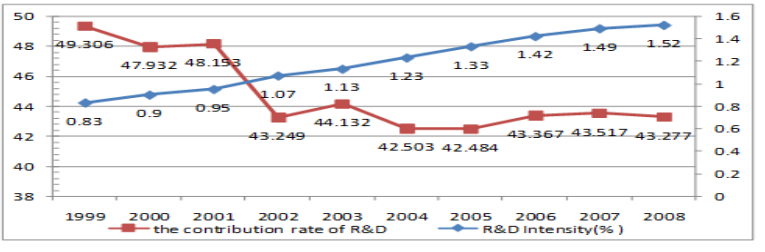

Fig. 1. Intensity and contribution rate of R&D

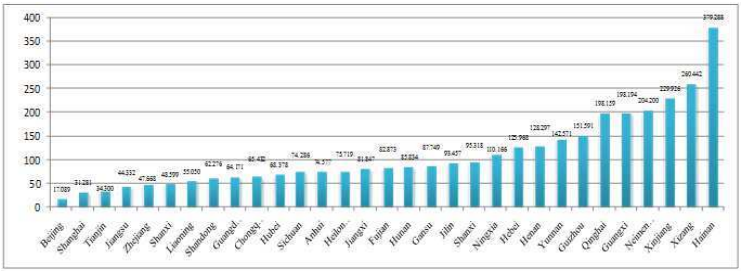

Fig. 2. The R&D expenditures on GDP contribution rate of 31 provinces

31 provinces (municipalities) of the R&D expenditures on GDP, a significant difference in the contribution rate showed a certain degree of regularity. 31 provinces (municipalities) of the R & D expenses in the 17.089 range changes in the overall coefficient of ~ 379.288, and normal distribution. R&D expenditures on GDP, the contribution of 17.089 to 50, there are six provinces (municipalities), from small to large : Beijing, Shanghai, Tianjin, Jiangsu, Zhejiang and Shaanxi; 50 ~ 100 in 14 provinces (autonomous municipalities), from small to large are: Liaoning, Shandong, Guangdong, Chongqing, Hubei, Sichuan, Anhui, Heilongjiang, Jiangxi, Fujian, Hunan, Gansu, Jilin and Shanxi; 100 ~ 150 4 provinces (municipalities), small to large are: Ningxia, Hebei, Henan and Yunnan; 150 ~ 200, there are three provinces (municipalities), from small to large are: Guizhou, Qinghai and Guangxi;

200 ~ 379.288 of 4 provinces (municipalities), small to large are: Inner Mongolia, Xinjiang, Tibet and Hainan, as shown in Figure2.

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SHE-PWM Control Technique in Grid-Connected Photovoltaic Systems Based on Walsh Transformation

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Abstract. In this paper, a new switching angle control methodology for inverters is developed to minish switching times to improve power efficiency. Based on Walsh transformation, it proposes a selective harmonic elimination-pulse width modulation (SHE-PWM) approach. The switching angles is obtained quickly, thus, for grid-connected photovoltaic system, realized is the online closed-loop control, obtaining unity power factor, improving system stability and effectively decreasing harmonic distortion. The simulation and experiment results validate the effectiveness of the control algorithm.

Keywords: Grid-connected photovoltaic system, Selective harmonic elimination-pulse width modulation (SHE-PWM), Walsh transformation.

1 Introduction

The boost-buck inverter for PV grid-connected systems gathers all the advantages of a string inverter topology and a transformerless converter [1]. The traditional controller of this kind of inverter is based on PWM control method. And how to decrease switch times, minish switching losses, eliminate harmonic, and improve power quality are the main issues for inverter switching control scheme. Selective harmonic elimination PWM (SHE-PWM) is a kind of switching control method benefited from its low switch frequency and high output power quality, and then saved the cost of filter for inverters. However the problem of on-line solving the nonlinear transcendental equations for inverter's switching angles is the main obstacle to its popular application [2-3].

This paper develops an SHE-PWM method for the boost-buck inverter in grid-connected PV system. Based on Walsh transformation, it obtains switching angles on-line quickly [4]. Therefore, it realizes closed-loop control for grid-connected photovoltaic system by SHE-PWM method, which improves system stability, increases system efficiency, and obtains unity power factor and low harmonic distortion. The simulation and experiment results validate the effectiveness of the proposed control design.

2 The SHE-PWM Based on Walsh Transformation

When one switching angle of PWM normalized wave is divided to N parts in the interval [0, 1), as shown in Fig.1, the switching angle α is lying in the lth subinterval [(l-1)/N, l/N)[5-6]. Then the coefficient $F(m, l)$ of Walsh function $Wal(m, l)$ is achieved as follows

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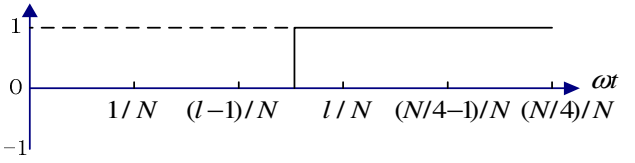

Fig. 1. The first quarter-wave of PWM waveform with one angle

$$F(m,l) = 4[\int_{(l-1)/N}^{\alpha} Wal(m,l)dt + \int_{\alpha}^{N/4} Wal(m,l)dt] = -4Wal(m,l)\alpha + Cal(m,l) \tag{1}$$

where $m = 4i - 3$, i = 1, 2, …, $N/4$.

$$Cal(m,l) = \frac{4}{N}[\sum_{h=l+1}^{N/4} Wal(m,h) + lWal(m,l)] \tag{2}$$

Therefore, when output waveform is with M switching angles which are lying in the subinterval $l_1, l_2, \cdots l_M$ respectively, SHE-PWM model by unipolar control in Walsh domain may be obtained by

$$U_n = BF[m,(l_1,l_2,\cdots,l_M)] \tag{3}$$

where

$$F[m,(l_1,l_2,\cdots,l_M)] = -\sum_{i=1}^{M}(-1)^i F(m,l_i)$$

By combining equation (1) and (3), the following equation is obtained.

$$U_n = -4BWal(m,l)\alpha + BCal(m,l) = D(m,l)\alpha + E(m,l) \tag{4}$$

Where $D(m,l) = -4BWal(m,l)$, $E(m,l) = BCal(m,l)$, and subject to

$$\frac{l_1-1}{N} < \alpha_1 < \frac{l_1}{N},\ \frac{l_2-1}{N} < \alpha_2 < \frac{l_2}{N},\ \ldots,\ \frac{l_M}{N} < \alpha_M < \frac{l_M}{N} \tag{5}$$

According to equation (5), the amplitude of fundamental frequency wave should satisfy M switching angles. That is $U_1^1 \cap U_1^2 \cap U_1^3 \cap \cdots \cap U_1^M = U_1^c \neq 0$, where U_1^i is the amplitude of fundamental frequency wave for each switching angles.

It is obviously that the key factor in the determination of any solution is to find $l_1, l_2, \cdots l_M$ subintervals in which M angles locate. The total number of combinations of M angles selected from N different subintervals is given by

$$C_{N_1}^M = \frac{N_1!}{(N_1-M)!M!} \tag{6}$$

where $N_1 = N/4$.

For the single-phase system

$$\alpha_{2k} = \alpha_{2k-1} = k * \frac{\pi}{M+1}, \quad k = 1, 2, \cdots M/2 \qquad (M \text{ is even number}) \tag{7}$$

$$\alpha_{2k} = \alpha_{2k-1} = k * \frac{\pi}{M+1}, \quad k = 1, 2, \cdots, \frac{M-1}{2}, \quad \alpha_M = \frac{\pi}{2} \qquad (M \text{ is odd number}) \tag{8}$$

For the three-phase system

$$\alpha_{2k} = \alpha_{2k-1} = \frac{\pi}{2} - \frac{k*2\pi}{3(M+1)}, \quad k = 1, 2, \cdots M/2 \qquad (M \text{ is even number}) \tag{9}$$

$$\alpha_{2k} = \alpha_{2k-1} = \frac{\pi}{2} - \frac{k*2\pi}{3(M+1)}, \quad k = 1, 2, \cdots, \frac{M-1}{2}, \quad \alpha_M = \frac{\pi}{2} \qquad (M \text{ is odd number}) \tag{10}$$

3 Photovoltaic System Based on Walsh SHE-PWM

Fig. 2 shows the power inverter's structure. Walsh SHE-PWM is proposed in the output control which gets switching angles on-line and realizes close-loop control for robustness. Such control algorithms will be shown in details in the following descriptions.

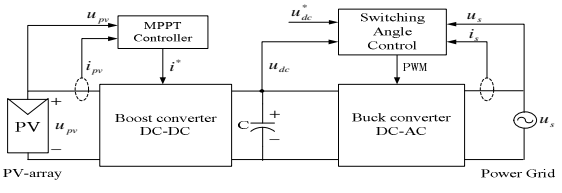

Fig. 2. The circuit of grid connected photovoltaic system and control scheme

As an instance, $M = 5$ to eliminate the 5th, 7th, 11th, and 13th order harmonics in three-phase system; and $N = 64$ to segment interval [0, 1) into 64 parts. The initial switching angles are determined by equation (10): $\alpha_1 = \alpha_2 = 50^o$, $\alpha_3 = \alpha_4 = 70^o$, $\alpha_5 = 90^o$.

The subintervals which M switching angles belong to are $l_1 = 9$, $l_2 = 10$, $l_3 = 12$, $l_4 = 13$, $l_5 = 16$. Then according to (5), the initial switching angles are subject to

$8\times\frac{360}{64}<\alpha_1<9\times\frac{360}{64}$, $9\times\frac{360}{64}<\alpha_2<10\times\frac{360}{64}$, $11\times\frac{360}{64}<\alpha_3<12\times\frac{360}{64}$,

$12\times\frac{360}{64}<\alpha_4<13\times\frac{360}{64}$, $15\times\frac{360}{64}<\alpha_5<16\times\frac{360}{64}$.

Based on equation (4), obtained are the following expressions:

$$U_1=-5.9252\alpha_1+6.4231\alpha_2-7.229\alpha_3+7.5293\alpha_4-7.9872\alpha_5+1.8705$$

$$U_5=6.7931\alpha_1-7.9104\alpha_2+4.7179\alpha_3-1.1621\alpha_4-7.6826\alpha_5+1.411$$

$$U_7=3.3535\alpha_1+1.9058\alpha_2-7.8341\alpha_3+5.8117\alpha_4+7.385\alpha_5-2.2066$$

$$U_{11}=-1.8508\alpha_1-5.6437\alpha_2+1.1176\alpha_3+6.1179\alpha_4+6.5332\alpha_5-1.9361$$

$$U_{13}=7.3872\alpha_1-3.193\alpha_2-6.4055\alpha_3-1.8146\alpha_4-5.9983\alpha_5+2.451$$

Let $U_5=U_7=U_{11}=U_{13}=0$, then $\alpha_1=50.625-6.8415U_1$, $\alpha_2=50.625+5.3729U_1$, $\alpha_3=67.500-1.6042U_1$, $\alpha_4=67.500+19.799U_1$, $\alpha_5=90.000-15.5615U_1$. Then the fundamental voltage amplitude U_1 is 0-0.2841.

Replacing the fundamental amplitude 0.2841, getting the initial switching angles for the next range of fundamental voltage, and repeating above step, the relationship between the switching angles and the fundamental amplitude in the other range of fundamental voltage is shown in Table 1.

4 Simulation and Experiment Results

MATLAB simulation of the whole system with SHE-PWM has been carried out. The photovoltaic inverter output voltage waveform is shown in Fig. 3 in one period.

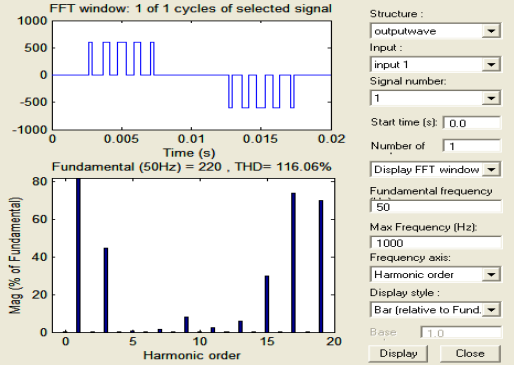

Fig. 3. A phase output voltage waveform by SHE-PWM

Compared with the carrier-based PWM method, Fig. 4 shows the inverter output voltage waveform with the same switching frequency.

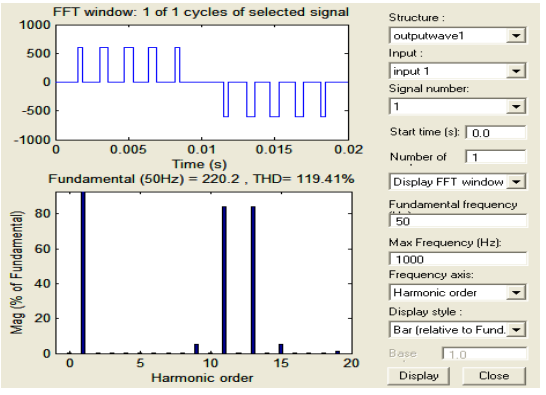

Fig. 4. A phase output voltage waveform by carrier-based PWM

It can be seen that the 5th, 7th, 11th, and 13th order voltage harmonic are eliminated by SHE-PWM control method. The triplen harmonics in each phase will be cancelled automatically in the three phase line-to-line voltages. Thus, the highest voltage harmonic need to be eliminated is 17th order. However, as to the carrier-based PWM method, with the same switching times, the highest voltage harmonic need to be eliminated is 11th order. Therefore, it may get output voltage waveform constituted by any voltage harmonic with SHE-PWM control method, and also lesser the burden of output filter when compared with carrier-based PWM control method.

A three phase 600W grid-connected PV system experiment prototype is built in lab, which is controlled by DSP TMS320LF2407A. The inverter stage control is based on Table 1. Fig. 5 shows the one phase voltage and current output of the PV system. And fig. 6 analyses output current harmonic. It verifies the harmonics are reduced with minimum switch times and the efficiency is 92.7% with the SHE-PWM control method.

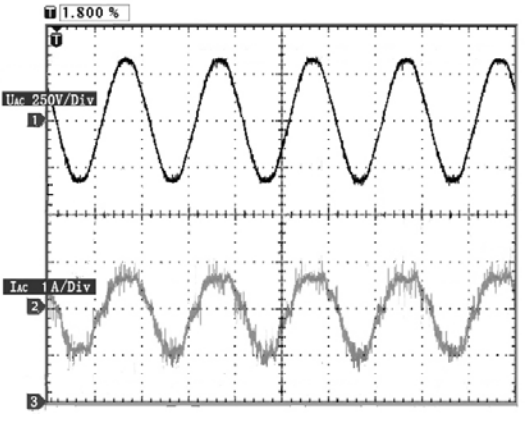

Fig. 5. Output results of grid-connected system. Ch1 is system output voltage, Ch2 is system output current.

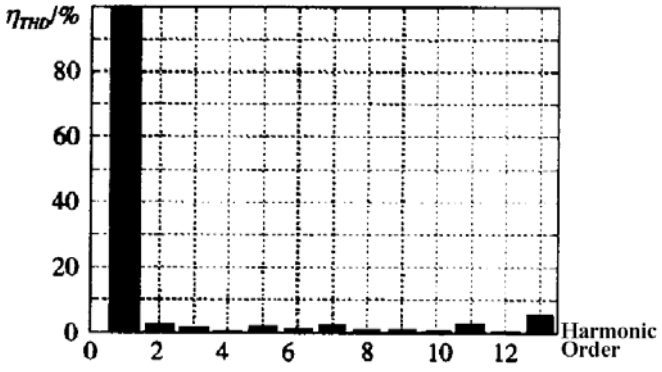

Fig. 6. Output harmonic analysis

Table 1. The results of three-phase unipolar inverter's switching angles when $M = 5$

Range of U_1	Each switching angles
0.0000~0.2841	α_1=50.625−6.8415U_1, α_2=50.625+5.3729U_1, α_3=67.500−1.6042U_1, α_4=67.500+19.7977U_1, α_5=90.000−15.5615U
0.2841~0.3781	α_1=51.1794−8.7927U_1, α_2=51.8484+1.0670U_1, α_3=70.9312−13.6805U_1, α_4=69.4659+12.8785U_1, α_5=89.2159−12.8019U_1
0.3781~0.5945	α_1=51.6537−10.0470U_1, α_2=52.8164−1.4927U_1, α_3=72.5440−17.9457U_1, α_4=75.2339−2.3750U_1, α_5=93.8761−25.1258U_1
0.5945~0.6035	α_1=55.0895−15.8261U_1, α_2=64.0503−20.3887U_1, α_3=77.8948−26.9459U_1, α_4=70.2786+5.9600U_1, α_5=91.4243−21.0018U_1
0.6035~0.6216	α_1=63.4657−29.7057U_1, α_2=88.6715−61.1867U_1, α_3=104.5020−71.0349U_1, α_4=104.5690−52.1038U_1, α_5=115.5034−62.1450U_1
0.6216~0.6221	α_1=52.2156−11.6078U_1, α_2=66.7325−25.8935U_1, α_3=91.6721−50.3955U_1, α_4=99.1117−43.3246U_1, α_5=112.4943−57.3043U_1
0.6221~0.6913	α_1=57.5133−20.1240U_1, α_2=64.1824−21.7941U_1, α_3=82.2525−35.2530U_1, α_4=95.1050−36.8836U_1, α_5=110.2851−53.7529U_1
0.6913~0.7000	α_1=89.2573−66.0424U_1, α_2=118.3416−100.1366U_1, α_3=187.9765−188.1852U_1, α_4=226.6286−230.1830U_1, α_5=160.2526−129.0797U_1
0.7000~0.7145	α_1=117.8624−106.9078U_1, α_2=205.0476−224.0052U_1, α_3=191.3514−193.0066U_1, α_4=147.2790−116.8238U_1, α_5=136.6476−95.3575U_1
0.7145~0.7343	α_1=84.6327−63.3434U_1, α_2=84.9929−58.9191U_1, α_3=84.7675−43.8299U_1, α_4=92.7308−40.4773U_1, α_5=105.1219−51.2335U_1
0.7343~0.7482	α_1=107.3057−94.2194U_1, α_2=117.8965−103.7273U_1, α_3=156.3043−141.2488U_1, α_4=183.6868−165.8834U_1, α_5=137.3486−96.6620U_1
0.7482~0.7532	α_1=123.9693−116.4918U_1, α_2=175.5868−180.8350U_1, α_3=152.1911−135.7512U_1, α_4=118.9109−79.3052U_1, α_5=118.4133−71.3534U_1
0.7532~0.8152	α_1=69.4165−47.3509U_1, α_2=53.0707−21.4659U_1, α_3=70.6314−27.4724U_1, α_4=83.4153−32.1812U_1, α_5=98.5875−45.0327U_1
0.8152~0.8387	α_1=89.7067−72.2395U_1, α_2=89.8042−66.5243U_1, α_3=160.6562−137.8996U_1, α_4=198.1979−174.1178U_1, α_5=141.9094−99.3133U_1
0.8387~0.8404	α_1=111.6600−98.4149U_1, α_2=164.5044−155.5912U_1, α_3=166.0193−144.2942U_1, α_4=130.0922−92.9137U_1, α_5=122.0121−75.5894U_1
0.8404~0.8740	α_1=67.8592−47.2818U_1, α_2=57.1099−28.7847U_1, α_3=87.2594−50.5738U_1, α_4=86.6238−41.1884U_1, α_5=96.4258−45.1429U_1
0.8740~0.8982	α_1=76.6519−57.3419U_1, α_2=72.2609−46.1199U_1, α_3=116.7061−84.2656U_1, α_4=95.4228−51.2560U_1, α_5=83.0570−29.8468U_1
0.8982~0.9091	α_1=94.2827−76.9721U_1, α_2=102.6416−79.9457U_1, α_3=175.7522−150.0074U_1, α_4=185.2509−151.2703U_1, α_5=128.4343−80.3698U_1
0.9091~0.9202	α_1=117.4025−102.4026U_1, α_2=181.2655−166.4276U_1, α_3=171.3485−145.1636U_1, α_4=98.7138−56.0842U_1, α_5=102.7683−52.1385U_1
0.9202~1.0250	α_1=61.4939−42.3772U_1, α_2=47.9869−22.3193U_1, α_3=73.0971−38.3874U_1, α_4=53.6085−7.0654U_1, α_5=80.7428−28.2020U_1

5 Conclusion

SHE-PWM control technique has become a significant PWM method for less switching loss for voltage source inverter. For off-line approach, the various sets of commutation angles in relation to modulation index are commonly determined in advance and look-up tables are required. This trouble can be avoided in on-line approach. The paper

presents a simple and on-line SHE-PWM method with Walsh transformation. It realizes closed-loop control for grid-connected photovoltaic system by SHE-PWM method. This control method has been mathematical described. The associated simulation results show that, with the same switching frequency, SHE-PWM control method obtains lower harmonic distortion than ordinary carrier-based PWM control method does, which alleviates the burden of output filter, increases system efficiency, obtains unity power factor and lowers harmonic distortion in grid-connected photovoltaic system. At last, a $600W$ experiment prototype further verifies the low harmonics and high efficiency of the control method.

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Research on Inter-cultural Strategic Management in Multinational Corporations

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Abstract. Multinational operation provides great opportunities for enterprises with the further expanding of economic globalization. Both effective analysis on intercultural advantage and successfully application in multinational corporation and management are the motivation and the premise, with which multinational companies can successfully capture the international market, and then further develop and strengthen. In this paper, the connotation of inter-cultural strategic management of corporations will be briefly introduced. Furthermore, the essential causes of cultural distinctions in multinational management are also analyzed. At last, issues such as how to manage the multinational corporations via inter-cultural instruments will be in-depth discussed.

Keywords: inter-culture, cultural distinction, strategic management, multinational corporations.

1 Background

In the "World Executive's Digest", cultural difficulties of transnational management were described: "All of overseas managers find invariably themselves in a dilemma, so that they fall in the confusion between the parent company and local subsidiaries." On the survey of 50 international multinational corporations in China, which has been made by management consultant Roland Berger, it showed that the training of overseas operations has been drawn not enough attention by Chinese enterprises. Language and culture of the host country were considered by respondents as the most minor factors for the location choices of overseas business. Some companies believed that as long as there are strict system and disciplines, the production in foreign countries will be able to proceed smoothly. This understanding usually occurs on the initial stage of internationalization. [1]

This fully demonstrates that if the cross-border business of a multinational company does not take cultural differences between the home and the host country into account, and blindly copies the home country's management model, it will undoubtedly arise negative consequences in the management of the host country.

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Therefore, it is very necessary to get to know the cultural differences between the home and the host country during the process of transnational management, to develop appropriate management strategies adapting to the host culture, and to improve their own effective intercultural management system.

2 Concepts in Intercultural Strategic Management

2.1 Culture

Culture is a complicate concept. According to the "Encyclopedia Britannica", there are about 160 definitions for "culture" in official publications all over the world. [2] Professor Geert Hofstede, who is the leader of cultural collaboration Institute Netherland and mainly engaged in the study of cultural differences, divided the concept of culture into two categories: the culture one refers to the civilization, which can be found in the education, arts and the literature, and constantly improved; the culture two is defined as a basic process that can resolve more problems about the human right than the former, and a collective idea planning that can distinguish a group from others. Therefore, culture is regarded by the second concept as a "common psychological procedure" shared by people who have the same education and life experience, rather than an individual characteristic. In this paper, culture two is applied to studying the intercultural strategic management.

2.2 Intercultural Strategic Management

The term strategy is initially attached to the military aspect. In the West, strategy comes from the Greek – "strategos", which ever meant the military general or the local chief executive, and then was later evolved into a military term relevant to plans or methods created by the military generals to command in the battle. In the modern times, "strategy" has been extended to political and economic fields. Strategic management implies that the overall measures and programs should be grasped and coordinated for achieving organizational goals. Intercultural strategic management here has profound economic significance. Intercultural communication occurs between different geographical spaces, such as between tribes, communities, regions, countries, etc.. In multinational companies, "inter-culture" is referring to the cultural shock generated in the process of exchange and cooperation between the parent company and subsidiaries in different countries or regions. Intercultural strategic management is applied to grasping coordination, control and other procedures of intercultural communication, management and other business operations on macro scale. Therefore, management of cultural differences is the core of intercultural strategic management.

However, as one coin with two sides, there are also advantages and disadvantages of cultural diversity for a multinational company. (see Table 1) [3]

Table 1. Advantages and Disadvantages of multiculturalism in International companies

Advantages	Disadvantages
➢ Advantages of the multiculturalism: Benefits from the multiculturalism in the international companies ➢ Expanding of the significance: Distinct opinions Easily to create new ideas More explanations ➢ More choices: Increasing creativity Increasing flexibility Increasing skills to resolve problems	➢ Disadvantages of the multiculturalism: Increasing the costs ➢ Distinctions increase: Intangibility of significance Complexity Chaos in the operation ➢ Difficulties in agreement: Failing in communication Difficultly to reach an agreement ➢ Difficulties in unifying operations Difficultly to agree unified operation plan

American scholar David A. Ricks pointed out that almost all transnational corporations fail in business just because they neglect cultural differences, which are regarded as basic or subtle. Peter F. Drucker, American management expert, also believed that the business management of multinational companies can be considered as a question about that combines political and cultural diversity to be managed. Thus, if we can take full advantages of intercultural superiority, avoid and diminish cultural differences as well as management confusion and additional cost derived from intercultural conflicts, cooperation resources and opportunities would be increased, and then it could generate spillover effects–"1+1>1" for cross-border management of international companies.

3 Cultural Distinction Management — The Essence of Intercultural Strategic Management

3.1 The Causes of Cultural Distinction

As the philosopher Blaise Pascal asserted in his book "Pensées": "In the Pyrenees here is the truth of things, in the Pyrenees Mountains Edge becomes false." Cultural distinction refers to differences between different countries, ethnics and cultures. Hofstede found that the primary causes of cultural distinction including four aspects: power distance, individualism and collectivism, uncertainty avoidance, masculine and feminine tendencies. [4]

(1) Power Distance (PD): Power distance refers to the acceptance of unequal distribution for social members in the society or organization. Cultural distinction of

power distance is mainly reflected in the relationship between upper and lower levels. In the high power distance culture, obedience and gregarious are emphasized. Managers make decision arbitrarily and paternalistically, while their subordinates are absolutely obeying to orders, and can not argue with the boss. On the contrary, in the low power distance culture, the independence of individuality is stressed more. They encourage different views. Subordinates are easily accessible to Managers and dare to argue with the boss.

(2) Individualism – Collectivism (IND): Individualism refers to a tendency in a loose social structure. People only care about themselves and their closest relatives, while collectivism indicates that in a tight social structure, people want to be cared by their internal groups, and are also absolute loyal to their own groups. With a strong individualistic tendency, culture attaches great importance to individual creativity and achievement. People are encouraged to make decisions by themselves rather than relying on their collective support. In contrast, culture with high collective tendency pays more attention to collective decision-making. Individual interests must obey the collective.

(3) Uncertainty Avoidance (UA): Uncertainty avoidance refers to various considerations made by a society to avoid the risk based on their uncertainty by the level of threat events or circumstances. Strong uncertainty avoidance can not tolerate different opinions and perspectives during its maintenance of the established social beliefs and behavior norms. It performs in the company as clear responsibilities for the internal organization. Hence, the procedure of decision-making is slow and inflexible. The weak uncertainty avoidance is a society that can stick to a more tolerant atmosphere. In this society, its members would like to take risks and individual creativity will be encouraged.

(4) Masculinity – Femininity (MAF): The masculinity indicates that the value of pursuing success, money and material dominates on the society. Masculine society believes that the meaning of life lies in hard working to achieve success, money, material and social status. Men should be more self-determined and become the leader. In the feminine society, the quality of life is more important. People work just for living. They pay more attention to friendships and relationships than money and material.

3.2 Effective Intercultural Strategic Management

Based on the above analysis, cultural differences can be varied, but reasons of cultural differences are relatively limited. In order to operate successfully and to achieve desired goals, multinational corporations should adopt for intercultural management appropriate strategies focusing on the following aspects:

(1) It is significant for intercultural management to establish correct thoughts on intercultural management. On the one hand, we must recognize that cultural distinctions are objective. We should overcome the narrow ideology, and pay more attention to learning and understanding language, culture, economic, and law of foreign countries. All cultures are historical heritages and belong to the common sense of countries and nations. On the other hand, cultural differences should be considered as opportunities and advantages rather than a threat and disadvantages.

Cultural differences can not only bring challenges, but also create more business opportunities for the development of multinational corporations.

(2) It also should be drawn attention on enhancing cultural integration, developing and improving intercultural communication skills. If the team members have different cultures, this communication process would become more complex and more important. Successful intercultural communication is more helpful for companies better to understand cultural differences, and to tackle cultural conflict. On the contrary, without good communication it could result in interruption, irrational reactions and other negative consequences between members of the multicultural organization. And thus it will lead to a vicious circle, which will deepen the conflict, as well as intensify the confrontation. Moreover, enterprises would also fail their investments caused by a series of misunderstandings. Therefore, in multinational operations, we should understand various verbal and nonverbal communication differences of the host country and establish various formal or informal, tangible or intangible organizations and channels for intercultural communication.

(3) People should make intercultural understanding through intercultural training. If a company wants to operate beyond boundaries and reach its business goals, three cultures, namely its motherland's culture, culture of the target market and corporate culture must be integrated. Therefore, multinational enterprises must adopt in the cultural environment of the host country two distinct adaptation strategies: following cultural strategy (to be changed) and innovation cultural strategy (to change others). Most of multinational companies have chosen the first strategy, also called learning strategy. For Chinese multinational corporations, which quality and management experience are far from the Western giants, it should be friendly and efficient to choose learning strategy that can be achieved by the intercultural training. Intercultural training of companies should be comprised by three aspects: the training for the overseas assignment, the training for the personnel of the host country and training for the multi-cultural team. The intercultural training is mainly involving cultural awareness, cultural sensitivity training, language learning, local environmental simulation, etc.. Through the training, such as short lectures, role playing, scenario dialogues, analysis on examples and other forms, cultural sensitivity training attempts to strengthen reaction and adaptability of the staff towards different cultural environments, in order to effectively break cultural barriers and restraints in the heart of every employee and better to find out the similarities between different cultures, as well as to strengthen each employee‘s adaptability to different cultural environment, and to strengthen coordination and integration between different cultures.

(4) Compared with three strategies mentioned above, it should not be neglected to develop intercultural strategies between parent company and subsidiaries. For multinational corporations (MNCs), to deal with cultural distinctions of subsidiaries in different countries, different strategies should be considered. MNCs usually carry out three strategies: the first one is the local cultural strategy, which adopts management approaches of subsidiary's country. The parent company do not directly intervene subsidiary's operations and management, but major business indicators (such as profits, sales revenue, etc.) of the subsidiary are determined by the parent company. As for the personnel arrangement, except a very small number of senior management positions occupied by the citizens of the home country, the rest of senior

management positions and technical positions are generally undertaken by selecting and recruiting the locals. Localization is benefit for MNCs to diminish high costs of multinational operations, and to enhance integration with local socio-culture. It is also conducive to ensure economic security for the host country, to increase employment opportunities, and to accelerate to catch up with the international practice. Localization strategy is the most effective way for MNCs to resolve cultural conflicts. The second one is cultural transfer strategy, by which the parent company implements policies and methods that are the same or similar with its domestic practices in all foreign affiliates. The core of this strategy is that all important positions in subsidiaries of MNCs are undertaken by people from the home country. The parent company attempts to transplant its cultural practices into subsidiaries through the presence of senior management from the home country. Then the local staff will gradually adapt and accept this foreign culture, and run the daily operations according to the context of this cultural model. Multinational companies, which use this model, must have strong economic power and huge impact around the world. Its corporate culture should have been widely recognized and can be accepted by other countries. The third one is the strategy of globalization including the strategy of cultural compatibility and cultural avoidance strategy. Cultural compatibility strategy means that the main culture of subsidiaries is neither from the home country nor from the host country. Although there is a big difference between them, both of them are not mutually exclusive, but complement by each other and run together. Cultural avoidance strategy asserts that there exists a huge difference between the home country and the host country. Overseas managers will pay particular attention to avoid unnecessary intercultural conflict derived from major distinctions between both cultures. In addition, the choice of these three strategies depends on ideas and values of the company, as well as the local realities.

In the context of economic globalization, international business of enterprises has become an inevitable trend. Moreover, researching on intercultural management has played a significant role in the process of multinational management. It is easy to draw a conclusion that multinational corporations can only remain their unbeatable position in the fierce competition when they define sources of cultural distinctions clearly, and plan the right management strategies, which are not only consistent with the interest of the enterprise's development, but should also meet the requirement of the host culture.

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Creation of Different Groundwater Conditions and Acclimation of Chlorinated Carbons Degradation Microorganisms

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Abstract. Acclimation of chlorinated carbons degradation microorganism and creation of different groundwater conditions were studied in the paper. The results show that with simulated groundwater and appropriate electron acceptors chosen, groundwater conditions desired can be created. Microorganism quantity and activity have been enhanced after 5 acclimation cycles. However, more than 90% of PCE removal efficiency was due to volatilization instead of biodegradation. Some TCE detected show that chlorinated carbons degradation microorganism was accumulated.

Keywords: groundwater, chlorinated carbons, microorganism, acclimation.

1 Introduction

It is necessary to study chlorinated carbons control and rehabilitation due to their universality and jeopardy to environmental ecology. Microbiological rehabilitation is one of technology that rehabilitate contaminated environment with specific biological absorption, transformation and degradation process. Compared with physical and chemical technology, the microbiological technology is relatively economic with low treatment cost, no secondary contamination and hazard-free [1][2][3].

Since it is difficult to obtain microorganisms from aquifer contaminated by chlorinate carbons, microorganisms acclimation is needed for experiments carried out in the labs. During acclimation, some differential microorganisms can produce enzyme to decompose contaminant with inducement of contaminant and to biodegrade contaminant further. The essence of acclimation is under certain condition, microorganisms that can utilize target contaminants can accumulate directionally, while those that cannot utilize target contaminants disappear gradually.

In order to create different groundwater conditions, it is necessary to add some electron acceptor. In the paper, PCE is chosen as target contaminant. It is well known that PCE can only be co- metabolized under anaerobic conditions. Since acetic acid can be produced by some organic matters, it is chosen as electron donor for in PCE continuation site, other organic matters exist simultaneously.

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2 Materials and Methods

Materials. Compositions of simulated water are show in table1. All chemical substances utilized are of analytical grade.

Instruments. HP6890 gas chromatograph (GC) with HP7694 automatic headspace sampler, gyratory shaker, anaerobic glove box, biochemical incubator, DX-120 ion chromatography (IC), ultra-violet and visible spectrophotometer, stable temperature bath, 650mL glass bottles.

Analytical Techniques. Concentration of PCE and its biodegradation products were determined by the headspace method on a HP6890 gas chromatograph. The chromatograph used a Ni electron capture detector (ECD; 250 °C) and a HP-624 column (30-m long, 0.53mm ID) with temperature programming (The column temperature was initially 50°C and gradually increased to 70°C at a rate of 5°C /min followed by 10°C/min up to 100 °C for 2 min). Flow rate of the column was 3.0 mL/min and the split ratio was 5:1. The carrier gas was nitrogen at a flow rate of 30 ml/min. The samples were injected the gas chromatograph through the HP7694 automatic headspace sampler. The temperature of vial, loop and T.R line was 50°C, 60°C and 70°C respectively. The injection time and cycling time were 1 min and 5 min respectively. The detection limits for PCE, TCE, DCEs and VC were ~1μg/L.

Nitrate ion and sulfate ion were determined by IC (DX-120) with AS14 (4mmol/L, 10-32) with 3.5mmol/L Na_2CO_3 and 1.0mmol/L $NaHCO_3$ as eluate, and CS12A (4×250mmol/L, 10-32) with 20mmol/L methanesulfonic acid as eluate. Flow velocity of anion and cation was 1.10mL/min and 1.00mL/min respectively. The carrier gas was nitrogen.

Microorganism activity was analyzed according to fluorescein diacetate (FDA), which can be used to measure enzyme activity produced by microbes in a sample [4].

Table 1. Composition of simulated wate

Compositons	Con. (mg/L)	Compositons	Con. (mg/L)	Compositons	Con. (mg/L)
KCl	305.6	KH_2PO_4,	197.3	$MgCl_2•6H_2O$	20.3
NH_4Cl	898.6	$K_2HPO_4•3H_2O$	422.2	Na_2CO_3	159.0
$CaCl_2$	67.7	NaCl	35.1	$Na_2S•9H_2O$	12.0
$MnCl_2•4H_2O$	0.198	$ZnCl_2$	0.136	$NiCl_2•6H_2O$	0.24
$FeCl_2•4H_2O$	0.198	$CuCl_2•2H_2O$	0.17		
$CoCl_2•6H_2O$	0.238	H_3BO_3	0.06		

Microbial Acclimation under Iron Reducing Condition. The PCE and acetic acid stock solution was prepared one day before the experiment, and the molar concentration of acetic acid was 4 times that of PCE. The anaerobic microbial consortia were obtained from the culture that obtained in laboratory.

In 650mL glass bottles with 50mL culture solution, anaerobic mix-culture consortia, corresponding electron acceptors, and the mixture of acetic acid and PCE were added in sequence. The initial concentration (theory concentration) of PCE and

acetic acid was 60.3 nmol/L and 241.2 nmol/L respectively. And the volume of mixtures was kept at 500mL. Then the bottles were sealed with Teflon-lined septa and rubber stopper immediately, and were incubated in a gyratory shaker at 150rpm and room temperature (20℃).

To acclimate and enrich the microorganism that can adapt to PCE, the concentration of PCE in bottles increased gradually. When PCE removal efficiency was more than 90%, the inoculums was transferred to fresh culture solution with higher concentration of PCE. The inoculums volume used for transfer was 10 %(v/v).

Electron acceptors added to create different groundwater conditions are shown in table 2. During acclimation, PCE added in 5 cycles is 10μg/L, 30μg/L, 60μg/L, 90μg/L and 120μg/L respectively.

Table 2. Electron acceptors added to create different groundwater conditions

No.	Groundwater condition	Chemical substance	Concentration [mmol/L]
1	Denitrification	$NaNO_3$	20
2	Iron reduction	amorphous $Fe(OH)_3$	20
3	Sulfate reduction	Na_2NO_4	20
		$NaNO_3$	10
4	Mixing electron acceptors	amorphous $Fe(OH)_3$	10
		Na_2NO_4	10

3 Results and Discussion

Four different groundwater conditions were created with 5 acclimation cycles. Variation of microorganisms, electron acceptors PCE are discussed below.

Variation of microorganisms. Variation of microorganisms is shown in fig.1 (a, denitrification condition; b, Fe reduction condition; c, sulfate reduction condition; d, Mixing electron acceptors). Microorganisms in different groundwater conditions show the same variation trend, that is microorganism quantity increase gradually without quantification.

4 Variation of Electron Acceptors

Denitrification condition. Utilizing Efficiency of NO_3^- in Denitrifying Environment is shown in table 4. During acclimation in 5 cycles, Utilizing Efficiency of NO_3^- reached nearly 100%. NO_2^- was produced in 2-3 days, while no NO_3^- and NO_2^- was detected by the end of each cycle, which indicates that NO_3^- was reduced to NO_2^- first and then to N_2. However, N_2 was not analyzed for the limitation of experimental condition.

Table 4. Utilization efficiency of NO_3^-during denitrification condition creation[%]

cycle	1st	2nd	3rd	4th	5th
Utilizition Efficiency	99.8	100	100	100	100

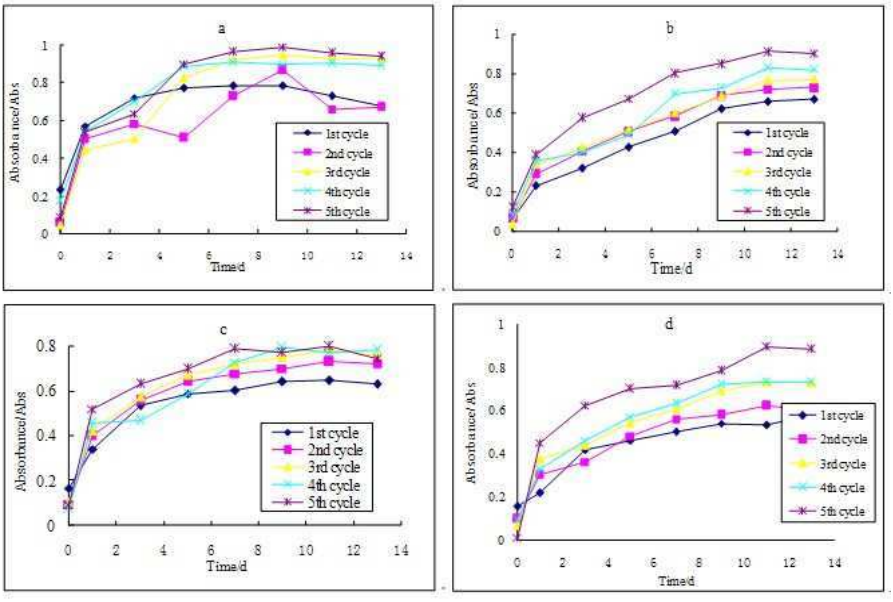

Fig. 1. Microorganisml Growth during Acclimation

Fe reduction condition. By the end of acclimation cycle, Fe(II) concentration was measured (table 5), which show that Fe(II) produced increase with the acclimation. In the end of the 5th cycle, Fe(II) concentration reached 45.8mg/L, while in the controlling sample, it was only 1.17mg/L, which show that Fe reduction condition was created.

Table 5. Fe(Ⅱ) concentration during Iron Reduction condition creation [mg/L]

cycle	1st	2nd	3rd	4th	5th
Iron Reduction condition	3.98	9.29	17.9	33.7	45.8
Controlling condition	0.91	0.87	1.23	0.93	1.17

Table 5. Utilization of SO_4^{2-} during sulfate reduction condition creation

cycle	1st	2nd	3rd	4th	5th
Utilization Efficiency[%]	6.07	7.80	9.16	9.61	9.66
SO_4^{2-} utilized [mg/L]	133.7	137.5	138.3	138.2	146.9

Sulfate reduction condition. Compared with utilization efficiency of NO_3^- in denitrifying condition, utilization efficiency of SO_4^{2-} is lower, less than 10%. The reason might be that redox potential needed to create the condition is relatively low, so it is difficult for SO_4^{2-} to be utilized. However, more than 100mg/L SO_4^{2-} was utilized during each cycle, and both SO_4^{2-} utilized and utilization efficiency increased

e with acclimation time extending. Thus, it is considered that sulfate reduction condition has been created.

Mixing electron acceptors condition. There is no last word for electron acceptors utilized simultaneously or orderly in mixing electron acceptors condition[5]. When NO_3^- concentration is relatively high, there is no obvious variation of SO_4^{2-}, and few Fe(Ⅱ) is produced. While NO_3^- concentration is relatively low, some SO_4^{2-} is utilized and Fe(Ⅱ) is produced. Variation of NO_3^- and SO_4^{2-} in 5 cycles is shown in fig. 2, which shows that microorganisms utilize electron acceptor with high priority first. However, it does not mean that electron acceptor with high priority is consumed completely, then electron acceptor with low priority is utilized. Fe(II) is relatively low in 5 cycles. Although the priority of Fe(Ⅲ) is higher than that of SO_4^{2-}, SO_4^{2-} is utilized preferentially, which might be it is easy for microorganism to utilized SO_4^{2-} in the form of ion.

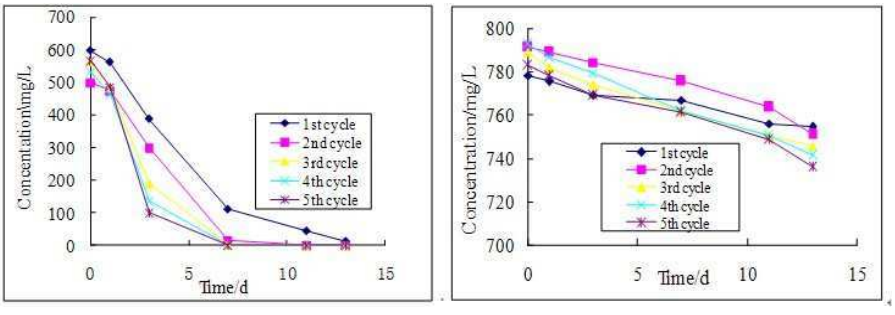

Fig. 2. Variation of NO_3^- and SO_4^{2-} in 5 cycles

Variation of PCE. Although PCE removal efficiency in different conditions reached 90%, most of them were removed by volatilation instead of biodegradation. TCE was detected only in iron reduction condition, which indicates that PCE dechlorination microorganism has adapted the condition. In other conditons, no TCE was detected, which might be PCE dechlorination microorganism has not adapted the condition, or PCE coulb not be dechlorinated in such conditions, or it is impossible to detect TCE for most high volatilation.

5 Summary

With simulated groundwater and appropriate electron acceptors chosen, groundwater conditions desired can be created. Microorganism quantity and activity have been enhanced after 5 acclimation cycles. More than 90% of PCE removal efficiency was due to volatilization instead of biodegradation. Some TCE detected show that chlorinated carbons degradation microorganism was accumulated.

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Research on Delicacy of Wind Power Industry Finance Policy

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Abstract. According to Wind power industry manufacture information, some measures are put forward based on the government funded the preferential tax policy, investment and financing system, renewable energy security system, the full purchase price, the compensation mechanism for reimbursement way, trade certificates policy, green renewable energy development fund, the enthusiasm of the local government, the import tariff policy, policy in wind power technology research and development and service link, policy in wind power equipment manufacturing,

Keywords: The wind power industry, finance policy, delicacy.

1 Introduction

The evolutionary game model is used to analyze the financial policy effect. Establishment of a special support fund subsidies wind generator. 2008 years on the introduction of the "wind power generation equipment industrialization special funds management, first put forward in the interim measures for cash, but to direct the support strength is low, get more harsh conditions. A great wind project development fund, speed up the large capacity of research and development of the fan. Key support new large wind power generator (mw localization level above wind generator), especially to the development and manufacture of wind power grid or strengthen take off for grid impact small network of developed country, support fan large wind power pre-project declaration and large wind farm project construction, to encourage and to attract domestic and international enterprise groups in cluster district investment wind power industry [1-3]..

2 Delicacy Measures

1. Government fund policy. China already has the ability to implement the diversity of funding policy. The basic principle is within a certain period of time to give new wind farms fixed proportion or amount of investment subsidies, or to provide long-term stable power wind farm subsidies, etc. At the same time, in the conditions mature areas, reduce funding, and promote the development of the enterprise itself operation ability; Have the potential of wind power in the region, and increase the funding

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efforts, speed up the speed of wind power development area. Specific to take the following measures: one is to equipment manufacturers of subsidies of the policies for each unit provides no more than 200000 funds allowance; 2 it is the government of wind power investors for direct subsidies, if choose per 450 ~ 2 000 kW unit, then each kW subsidies of 500 700 yuan, and provide favorable low-interest loans; Three is power subsidies, wind power on the Internet to every divorcing 0.05 0.1 yuan of subsidy.

2. Preferential tax is divided into direct of renewable energy in the implementation of the tax preferential and to the renewable energy tax policy two kinds big. 1, and the individual investment renewable energy projects are exempted from income tax; 2, wind power can get a 5 yuan production deduction tax; 3 and the wind generator import tariff rate is 25%, the bulk of the original investigation import tariffs. In order to improve the current taxation policy, improve the wind power industry support, tax regulation policy Suggestions from the following several aspects: (1) perfect further improve the wind power enterprise of strength, as in tax reductions or exemptions appreciation of 8.5% on the basis of tax shall be levied at the further; Wind power enterprise income tax relief tax rate. Wind power enterprise purchase for power generation equipment provide tax relief. (2) to rein in the coal industry and enterprise energy tax collection and a carbon tax, indirect improve wind power enterprise competitive advantage. (3) improve the allowance for depreciation of wind power equipment and reduction of wind power equipment depreciation in the short term, and reduce the cost of wind power. (4) in the acquisition of wind power enterprise production all power at the same time, by every kWh electricity 1 ~ 2 cents level, the extra pay "wind power resource", and finally by land tax department according to local wind power of the Internet to wind power enterprise is located, the government implemented the transfer payment. Through the "wind power resource" way to improve wind field of finance and tax subsidies seat government mechanism, and, to some extent, can contain the wind power equipment manufacturing capacity in the low level repeated construction.

3. Investment and financing system. Specific include increasing government support system, strengthen the bank and the support of the play an active BOT, energy fund, stock market such as the way of financing function. At present the capital market of the listed company less wind field, direct financing have not become the main channel to wind power industry financing. National financial institutions, especially the policy Banks may establish renewable energy investment special or quotas.

Introducing folk capital, exerting the role of C D M project in wind power project, and Exploring B O T mode in the application of wind power industry are good ways

4. Renewable energy and affordable acquisition system. The government planes the development and utilization of renewable energy; During the planning period shall be determined in the renewable energy generating capacity of all of its proportion; Formulate grid enterprises Co., LTD scheduling and full purchase renewable energy the concrete method of quotas, and pure air supply, electricity and wind power thermal power 'after the reapers' long-distance transmission project; Will the wind power into electricity system to plan as a whole; The wind power market share targets. Mandatory

5. Financial institutions to take a project back calculation for price, reimbursement way, loan risk reduced year by year. According to the development of the western region preferential tax policy. Build a 50000 mw of wind power projects, the total amount of investment of the plan is about 500 million yuan, the enterprise from its own funds accounted for 20%, about 100 million yuan; Bank loans accounted for 80%, about 400 million yuan, the bank to the project is adopting the electricity price way, in loan time limit for 15 years, each year, some payments agreed upon the principal repayment 26.7 million yuan.

6. Build the wind power grid and limit compensation mechanism of production capacity, reduce the loss, enhance the enterprise have profit level, promoting renewable resources development. Because the wind power intermittent, random, the characteristics of the volatility of wind power grid ratio, certain limits. On one hand, each big power grid should take big boot way as the wind load, the large capacity to accept the wind power create conditions. On the other hand, the state shall establish and improve the capacity and limit for peak shaving, abandon the wind to factors such as enterprise losses related economic compensation policy and to promote the healthy development of renewable resources.

7. Green certificates can trade policy. There is no domestic policy implementation in this. However, from foreign trade can be green certificates policy implementation analysis shows that can trade influence factors of green certificates system including renewable coefficient, the environmental impact coefficient, technology and the maturity, investment costs and the government guidance. Through the domestic and international wind development environment of the comparative analysis, we know in our country, these factors can be met. Therefore, our country for wind power development can trade green certificates system. Can work in trade green certificate, can will wind power quotas determined for 0.6% 0.8%, at the same time to determine a penalty, such as is not up to the standard for the quotas by market can be part of the deal to buy green certificates them to accomplish the quotas, but can trade certificates of green and market price is determined by the market. And, this policy with the China development and wind power to modify the wind power quota proportion regularly.

8. The establishment of a national renewable energy development fund, special funds for developing wind power industry. The wind power research into the state science and technology development planning, arrange special funds to support. Support the domestic research institutions to raise innovation ability, the introduction of foreign advanced technology and equipment, to speed up the digestion absorption, the formation of the ability of independent innovation. Further to increase domestic wind power equipment support, and encourage scientific research institutions and electric power equipment production enterprise to increase the wind power equipment (especially large capacity motor) the scientific research of the wind investment, improve the domestic wind power equipment manufacturing capacity, spare parts necessary production capacity, reduce domestic wind power equipment price. In foreign countries, governments to attach great importance to its wind power r&d industry support. Australia, Brazil, Britain and other countries widely used government loans and funding support wind power equipment research and development. At present, China has started to carry out a wind power equipment

research and development of the government subsidies, but the strength of the support is not enough. At present, our country should further increase national finance allocates funds, and further enrich support measures, improve the wind power equipment manufacture of degree in China. Solve the source of the subsidies in the current of the channel, power consumption per kilowatt-hour collection of money 2 to renewable energy based on electricity additional, suggested that the budget of the central and local financial input for wind power electricity prices are part of subsidies, and future carbon levy taxes, ecological construction tax source of tax money to broaden financial subsidies for the source of the funds.

9. The local government support the enthusiasm of the wind power industry. The local governments at all levels to mobilize the enthusiasm of developing wind power industry, make its according to local conditions, formulate local preferential policies to attract investors, promote the wind power industry fast development. Because the wind resources situation, the power grid around the development level and market environment and related wind conditions for the development of the development of wind power of different, there are strong regional differences, a central government, local government enjoy it more information advantage, better understanding and monitoring to local wind power industry development practice.

10. In the wind power technology research and development and service link policy

Wind power enterprise engaged in research and development, and to the enterprise, encourages its service technical achievement transfer of wind power technology transfer, the enterprise, in the transfer of technology obtained when the income tax cuts. According to the new income tax policy, a tax year in a resident enterprise technology transfer income not more than 5 million yuan shall be exempted from the enterprise income tax; part, More than 5 million yuan of above, by half part of enterprise income tax. In the technology transfer contract, and transferred technology under the inseparable technology consultation and technology services and training may concurrently income exempt income range. Included in the A technology transfer contract shall be in the cognizance of the science and technology department at or above the provincial level issued by the technology contract registration as the basis.

11. In the wind power equipment manufacturing link policy

According to the national key support high and new technology enterprise, enjoy preferential policies according to 15% of the enterprise income tax preferential tax rate. The preferential tax policy to clear with technology research and development capabilities and independent innovation products fan equipment production enterprise, encourage with independent intellectual property rights of the fan equipment manufacture enterprise development, and don't encourage technology content low, resources consumption, lack of the core competitiveness of the fan equipment manufacturing areas of repeated investment.

Wind power manufacturing enterprise of technology development and research for the cost of intangible assets, failure to form, development cost can according to 150% of the actual amount in the calculation of the enterprise income tax deducted, form of intangible assets, research and development cost can according to actual amount to

150% of intangible assets, the original value in accordance with tax law and amortized over. Encourage enterprises to increase of technology research and development and the independent innovation of investment, improve the wind power industry and innovation ability of independent research and development.

12. Adjust and perfect equipment import tariff policy

In order to promote the development of the manufacturing industry in domestic fan equipment, according to the fan equipment manufacture level of each case, take import duties policy: first, the import restrictions in China, research and development and the production ability with the model will not be preferential import fan. According to our country at present domestic fan the single capacity of the development in 2010, 2012 years ago, a single 3 MW capacity import under no tax free, the fan every two years according to the market situation of the corresponding enlarges import minimum capacity, such as single: 2013 a 2015, single capacity to import the 4 MW no tax free. No tax free for the mouth of the equipment, according to the relevant laws and regulations, the collection in the link of import duty and VAT. Second, the import of key parts and raw materials to give duty-free favourable policy. To comply with the support of the national important technological equipment and product catalogue and the important technical equipment and product catalogue, import critical parts and material goods list of the conditions of the catalogue of the enlargement of parts and material, enjoy the import links will be exempted from duty and VAT. Such as: for single capacity in 1. The fan with SMW method or above the necessary import parts and material, can enjoy the preferential policy. The policy should be based on the domestic market conditions, regular revision, adjust the accomplishment. Third, maintain fair market competition, ability is insufficient supply in the domestic market and imported key parts and material to import duties, value added tax preferential at the same time, the discount rate should also take care to the same domestic manufacturing products, make domestic enterprises enjoy equal tax breaks. Otherwise, the preferential tax on imported duty-free or, lead to local parts value is relative taller, reduce the price of foreign product competitive advantage, compress the local parts market, away from encourage domestic manufacturing's original intention, and industrial development goals run in opposite directions. Fourth, to encourage equipment technology development and innovation, should formulate special research and development of wind power to use import tariffs and value added tax preferential policies for foreign purchases, the machine or parts used in scientific research fan test and technology research and development purposes, the country should be exempt from taxes.

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Research on Delicacy of Wind Power Industry Manufacturer Information

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Abstract. According to Wind power industry manufacture information, some measures are put forward based on examination authentication system, professional training, wind power unit test center, wind resources evaluation data, power quality index requirements, wind power planning project to the environment assessment, the series and classification, standardization, technology platform, power generation mode, quality supervision system construction

Keywords: The wind power industry, technology innovation, delicacy.

1 Introduction

Formulating and promulgating the wind power industry unified long-term development, including resources evaluation, configuration mechanism, the power grid construction, the development of science and technology, industrial supporting new development planning. It is necessary to resolve key content in the planning of the disconnection between each other. It is nature to establish our natural environment and resource conditions of wind power equipment standard, testing and certification system, and ready to build mandatory certification system[1-3].

2 Delicacy Measures

1. Examination authentication system. The authentication of wind power engineering project is the purpose of the evaluation already through the type approval: the wind generator and its corresponding tower foundation design with wind farms are the environmental conditions, and power grid conditions, the authentication institutions that will assess the wind farms in wind resources conditions of the site, foundation conditions, the conditions of transport and power grid condition are and finalize the design wind power generators design and design of the parameters of the Kentucky to determine which is suitable. Comprehensive considering the typhoon, dust, temperature, etc and power grid conditions make the climate characteristics of China's wind power technology standard, practice examination authentication system. To improve the quality of the motor, regulation of the industry wind electrical bark, also for wind power franchise bidding of domestic fan asked to provide access basis.

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2. Professional training. Wind power as the new industry, needs to cultivate many people to design, research and development, manufacturing, construct, operation management talent. With the large-scale development of wind power, wind power of the lack of talent has become extremely outstanding problems. Therefore, the state, society, universities, enterprises should actively cultivate the talents for China's wind power industry, the development and lay a solid foundation, this also is the key to the development of wind power. Our country at present the serious lack of wind power can hold the construction of the global total designer and chief engineer talents, and wind power technology involved in aerodynamics, materials science, acoustics, mechanical engineering, power engineering, electrical engineering, control technology, meteorology, environmental science, etc disciplines, train a comprehensive grasp these science and technology to the training of talents, and the subsequent object of quality and developing the system requirements are very high. The grid wind power technology involves more unprecedented, the required technical problems of professional talents training is more difficult. Science and technology is the first productive forces, especially the wind power equipment manufacturing wind power industry is a collection of aerodynamics, machinery manufacturing, power generation technology, electronic control and high reliability design is a comprehensive hi-tech industry and knowledge intensive industry. At present our country construction and equipment manufacturing wind farms of the key technology, public technology research and testing the authentication system construction and the international advanced level are also gap. So, need to be in national scientific research institutions and university, established by the wind power technology application of basic research projects, to carry out their wind resources, fluid dynamics, machinery manufacturing, power electronics, electric power grid, and other aspects of the theory and experiment. The basic research and training, and the combination of wind power development needs according to cultivate a group such as graduate student of senior personnel, choose a few higher schools and technical secondary school, and set up the wind power professional course, build up the wind power professional. Meanwhile, it is necessary to hold the wind power technology training by combining with the wind power development needs,

3. Wind power unit test center. Based on all varieties of test conditions wind farms, establish the wind generator test center, wind energy resources evaluation to consider when air density, turbulence intensity, salt fog, and climate factors, and reliability, power loss and fan blade pollution on energy losses, etc. Reduction coefficient was between 0.7 and 0.8, and for wind power equipment testing, the authentication and wind power equipment manufacturing enterprises provide technical conditions test.

4. Wind resources evaluation data. Some wind farm area while measuring wind time is very long, but the measurement data integrity rate is low, the records for is not standard. By local departments to provide some measure of the material, there are the original measure wind data gaps and distortion of the serious phenomenon. Draw complete detailed wind distribution, such as perfecting basis to prepare.

5. Power quality index requirements. Wind farms to meet power quality from the technical requirement, and can lead to index of voltage deviation, voltage flicker, change and harmonic of related parameter is restricted to effectively reduce the power quality on the influence of the power grid.

6. Environment evaluation of wind power planning project. Large scale wind infrastructure for some topography and landforms such as swamp, beach, the sea and fresh water, causing water quality species of animals and plants live environmental influence need environmental assessment. In the location and engineering construction stage, may appear fan design way, take up the stationing position farmland, military facilities, cultural relic, measurement and control points, so that the whole wind power engineering by fan decorate spacing, terrain of factors, eventually give up part of flight reservation or adjust to a rich wind, the serious influence the whole point of economic indicators project wind farms.

7. Standardization and serialization. Wind power development in China at an early stage, with the classification and a series of working conditions and standardization, should be in full on the basis of research, absorb international experience as soon as possible in our country, on classification of series and standardization, policy, unified model spectrum, in a certain period of time relative stable investment market model type and capacity level; Perfect industry chain, realize the scale, and wind power equipment classification, and standardized production, the improvement of the fan operation time and the enlargement of life in an important position, achieved through scale to reduce the production cost, so as to realize the goal of reducing the cost of wind power. Wind energy industry standardization technical committee has completed ten of the wind power standards and submitted to the committee, is developing standard examination standard 6 items, 2011 year plan set the standards of nine.

8. Technology platform. The power of a rely on the government set up to provide public services information technology platform, to the enterprise can provide testing wind machines and parts of the blade experimental platform, developed in our country can adapt to the wind generator field conditions. In xinjiang, the Inner Mongolia region quite severe storms, fan field work conditions; the southeast coastal area summer, also easy to cause the typhoon frequent fan, these are damaged need to be taken into account. Platform can include such as simulated the wind test wind energy, wind energy resources evaluation, such as blade component testing institutions, wind power equipment component testing center, etc. These public test facilities and institutions, for each of the wind power enterprise prototype test, performance improvement, material experiment and research and development activities provided places, to avoid the government support a specific enterprise and the formation of technology monopoly, reduced industry development initial period of repeatability of infrastructure investment, reduced the enterprise innovation at the early stage of the development cost, but also for the wind generator testing and certification, provides the technical means for wind power equipment, the market access provided technical support. In the industrial development and mature, through the transfer or private shareholder, these provide public services organization also gradually commercialization, reduce the reliance on government funding.

9. The diversification of power generation mode

First, land wind power model is low wind power generation technology prospect, main model is a large wind power generators. This model is the key to the power grid transmission.

Second, offshore wind power is quite shallow coastal waters, the installation of more mega watt of large wind turbine, decorate large-scale wind farms. The model of the main factors of the wind farm is in the planning and construction costs. But offshore wind power advantage is obviously occupied land, sea wind resources is better.

Three, the light-wind supplementary and building integrated.

10. Strengthen quality supervision system construction. Northeast China, northwest, already appear more than cause fan manufacture and construction quality problem caused by the collapse accident, more serious accident: January 20, 2010 ZuoYun project collapsed datang fan; January 24, 2010, huaneng treasure longshan wind farms happen fan burned accident; In April, 2010, Inner Mongolia fai, SuSiLan fan who tin wind farms on fire unit, collapse; In July 2010, dandong Marine red wind farms 8 fan fault; In August, 2010, gansu melon continent building wind units collapse, and so on. The cause of the accident caused by wind, not just fan manufacture quality problem, and equipment quality and construction quality and so on various issues.

From China wind power industry in high speed development in the event that quality problem need quality supervision innovation: first is the product quality supervision and innovation, by the government or industry association set the standards, and independent or entrust about the authentication institutions implementing. The localization testing mechanism not only ensure the fan, but also the equipment manufacturing quality effectively protected the domestic wind power market; Second, the engineering quality supervision is the government's administrative responsibilities by direct supervision ways, one of the supervision and inspection and indirect supervision and inspection of the two patterns. Third, establish the quality supervision and monitoring normal mechanism. Must be able to adapt to our country electric power industry management system, further adjust and perfect the electric power industry quality supervision mechanism, modification work rules, clear, and deepen the relationship between all parties work and perfect the supervision and inspection of the stage work scope and content and work, and formulate the depth of the normal random checking and work in the way. Fourth, the electric power industry establishes quality supervision, information release system. Suggestions based on web sites and plane media to establish uniform, the normal quality of the project information release system. Fifth, regulate quality supervision expert library and experts hiring system.

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Research on Delicacy of Wind Power Industry Technology Innovation

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Abstract. According to Wind power industry in technology innovation, some measures are put forward based on the spare part supporting ability, service system, the wind power grid connected technology, leaf, reliability design, installation equipment, wind power intelligent technology, intelligent transport technology, wind generator team technologies.

Keywords: The wind power industry, technology innovation, delicacy.

1 Introduction

The wind power industry development needs of the market and technology two-way driver, but focuses on technology innovation. In Denmark, as a representative of the European countries for wind power industry, given the large subsidies, but with China to the practice of wind farm subsidies on different is, Denmark will 80% of the fund subsidies to the wind power equipment manufacturing, thus in the wind power fast development at the same time, created the international leading wind power equipment manufacturing industry. Our country should strengthen the wind power equipment manufacturing technology innovation and industrialization of a special efforts, in 863, 973, the national science and technology special, the major technology industrialization in wind power fields to increase the special investment.

2 Technology Innovation

Our country to the support of the development can be divided into two parts: one is investment in special application technology, such as the development of special application type of patent; 2 it is for the basic aspects of investment, such as related to the basic research, the technology field operation indicators, the establishment of the public examination platform to establish the system of investment, these output of publicity. Both have positive significance in resources, but under the restriction of the distribution of there will be different, causing the income difference. China's wind generator set is more for pulp for pulp speed of megawatts below the rank type, technology and power, and old small units in the field shall ensure that can be set in the wild should guarantee and reliable operation of the 20 years, to withstand all kinds of extremely bad weather and very complex wind alternating load [1-3].

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Technical innovation is first mechanism consummation and innovation. In the machine manufacturing, enhance form a reasonable design independent research and development mechanism; Perfect parts matching capacity as well as the complete wind power industry chain. The wind power technology personnel training is speeding up. At present China has entered into the wind power industry of rapid development, to meet the needs of the strong, but the wind power industry more serious talent vacancy. So, should the basic research and training, and the combination of wind power development according to cultivate a group high-level talents, choose some institutions of higher learning and the secondary school, build wind power professional courses, gradually set up a professional wind power. Meanwhile, combined with the wind power development needs, held the wind power technology training class, solve the problem of wind power talent is in short supply. Pay particular attention to strengthening production, study and research combining, through the integration of resources, joint innovation, reasonable arrangement of market share and intellectual property rights, as well as the students into the enterprise teaching form, make enterprises, scientific research institutions and universities complementary strengths, common development.

Technical innovation is the key is the core technology segmentation, and the overall technology integration. Each wind power generators although unit power is less, but each unit itself is an independent small power plant. Each subsystem and their work with the father coordinate system is a complex matching projects can be intelligent fuzzy control, from start building fed into the power generation systems more coordination optimization algorithm. Second is key parts, such as large bearings and electrical control system. Application of the principle of aerodynamics best wind blade form design, applied multibody dynamics simulation technology to realize the wind generator climate of the performance prediction and evaluation, application mechanism design theory and the theory of the wind generator electromagnetism best performance match and so on. Attract province key laboratory, so you are to participate in international competition and we compete feelers extends to the innovation of the source. At the same time, also for key laboratory of economic and social development in the service to provide a good platform.

3 Delicacy Measures

1. Professional ways to improve the part supporting ability. Wind power generators main components including leaf, gear box, generators, yaw institutions and electronic, is a complete industry chain, parts of technology and quality decides the whole machine performance, the enterprise is in the development of new type, rely on the professional design company overall design, the main parts, special needs to market purchase parts professional research and development by. High degree of specialization of general assembly branch said the new model can not only shorten the development cycle, and can ensure the quality. The specialized production can not only ensure the quality of products and to shorten new product development cycle, only rely on the market to be effective rational disposition of resources, make our country wind power industry fast on the road of development.

2. Establish service system. In the wind power industry development, the establishment of a complete service system is very important, and wind power equipment manufacturing industry is a complete industry chain, a clear division of professional, a high degree, a wind power equipment general design company, general assembly branch, spare parts, logistics company, in wind turbine construction has the resources evaluation, micro site selection, planning and construction equipment procurement, wind farms, wind energy management service and a series of professional company, the company hire these professional investors can be completed all procedures, after the completion of the wind farms into operation management company, only pay attention to in returns.

3. Wind power grid connected technology. Chinese monsoon climate of wind power voltage instability caused by lightning, plus moment caused by the outbreak, and it is hard to short circuit and low voltage power grid to be incorporated, so use to deal with the flexibility and security. Through the control system, box change, research, STATCOM effort to solve plagued the country wind field of common technology combined problem, for fan access to provide the power grid solution. To carry out large wind power base simulation research on the grid large wind power in the stable operation, large-scale access grid scheduling problems related to power grid and wind power, voltage control ability, wind farms across the related problems of low voltage research, strengthening grid stability, strengthen the power quality monitoring and improve application, wind power prediction, coordinate with the cooperation of all kinds of power; At the same time strengthening operation of large scale wind grid technology research, such as wind power dispatching mode, wind power dispatching operation support system development, regional coordination control system of wind power dispatching research and development. The power grid to contain wind farms are abundant, a sexual development evaluation in intelligent power grid of the abundance of evaluation index and standards contain wind farms, research the power grid of short-term assessment, and realize the abundant power grid online monitoring; Contain wind farms in power grid of abundant estimates, the medium and long term, plenty of power system planning and evaluation of the relationship.

4. The blade is wind power generation units of the power source, but since 2.0 mw wind power blade with size (45.3 meters long), local thick thickness (100 mm), and other characteristics, the industry faces many technical bottleneck, is China's wind power industry development of one of the boards. Will develop curing temperature, exothermic peak and gel time matching, vacuum infusion of those have been supervised pipeline blade root, large thickness of the composite material diversion permeate etc technology research, the comprehensive grasp the production technology and the key technology to realize large-scale production.

5. Reliability. Because the wind generator, gear box, bearing is located in the top of the wind generator, so maintenance is difficult, the high cost of maintenance. Therefore, high reliability design is the first priority, will carry out the optimization by inside and outside road, comprehensive monitoring, insulation class H system of research, to guarantee the safe and reliable operation of the generator for a long time. And the whole power frequency conversion, with frequency conversion device quickly adjust the generator of flexible active power and reactive power grid, and

realize the stable, grid impulse current is not more than 20% of the rated current. At the same time through the lightweight design, labyrinth seal technology, lubrication cooling system design to improve the reliability of the gear box and lightweight needs.

6. Installation equipment. Wind power installation equipment is wind farm construction indispensable important equipment, China is the wind power industry development of the weak link, it is one of the use of high (up to 100 m) of the crane arm, its main arm can change range in vertical plane within (like fishing rod), and can in the plane of the 360 ° turned, and therefore there are great safety risk. Through the research of daruma technology, rapid alignment and long distance also prowled the adaptability, risk assessment and transportation countermeasures technology research, fills domestic wind power installation special crane the blank.

7. Intelligent wind power technology. From the fan itself, in order to maximize use of wind, the wind generator installed capacity increases day by day, the fixed pitch to change from the OARS control, from constant speed constant frequency to VSCF, from the trend of development of the look, in large wind power generators variable speed technology will from the paddle is very popular. And the corresponding, this development trend is greatly enhanced power electronic technology in the application of wind power units. From the wind field the whole, mobilize numerous fan collaborative operation, instant control the wind power parameters, ensure the grid reliability and stability is the trend of the development of the future. Such as wind field scheduling staff need to control and coordinate the wind through the field of a fan of reactive power, and coordinate the wind field may have other reactive power equipment, to effectively regulate the whole wind farms and network, and the even more distant voltage and reactive power. In addition, encounter power grid failure, such as trip need enough low voltage across the ability, this also needs the relative power electronic technology as support. To achieve these ends, need highly complex control management system. The future of wind power "intelligent" attribute is getting stronger, and this is "smart grid" of the natural needs.

8. Wind power transport technology. 750 kV series compensation and controllable high and so on many of the most advanced flexible transmission technology. In order to adapt to the needs of the wind generator intermittent power, wind power station are installed all (15% ~ 20% of the dynamic reactive compensation equipment (S V C or S V G), add up to a total capacity of 700000 kvar need. At present, the domestic generally does not have the wind generator voltage and power factor adjustment ability, usually can only do constant power factor, the parallel operation early wind generator, still need to provide reactive power grid can be issued active power. According to the power system analysis conclusion, if the wind power units can't achieve the voltage control mode, will allow 750 kV power grid send wind power ability is 1 million kW or more, the wind generator manufacturing technology level become wind power sent out the technical ability "bottleneck". Wind power units do not have regular units have low voltage across the ability, as power grid failure or shock appear voltage flicker, wind power units often take cutting machine escape way to protect unit, make grid accident treatment more difficult, can lead to expanding the incident, and even cause the network voltage collapse.

9. Wind generator team technologies. Foreign mainstream technological development for change propeller VSCF and no gear box permanent magnet direct driving technology for the original onshore wind power units of the design, analysis, such as using modified large capacity generator and increase data, raising parts redundancy and so on, especially electrical system cannot be neglected. The development of new wind generator structure form, variable speed operation is the offshore wind generator main form. In Europe, Germany, the Netherlands, Britain's fan manufacture company has go very far away. They not only in their respective fan on the basis of 6 mw grade fan launched, more started 10 megawatts of sea fan development programs.

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A Study of Mode on Influencing Quality Elements in NC Processing

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Abstract. The paper analyzes error sources of the NC machine tool in the process. Errors of CNC machine control system were molded, analyzed, and determined in various parameters in the mode. In order to improve the control process and it proposes the use of neural network method. The causes of errors are analyzed, its error mode is set up, and the ways to decrease error are put forward. The last part of this paper analyses the error of the programming process and workpieces in the assembly process, and improving methods.

Keywords: NC machining, Neural network, NC system errors, Machine error.

1 Introduction

Numerical control technique (NC) is important in modern times, as processes with NC may put up productivity, stabilize produce quality, shorten processing cycle, increase production flexibility, and automate process to all sorts of complex precision components. But in process it may produce unnecessary errors, which may cause component parts be scrapped. So it is important and necessary to analyze data and constitute model of the affecting factors of NC machining quality errors, and adopt corresponding measures to improve its performance.

There are many factors that influence quality errors of NC machining. In summary there are three main groups: The first is error by digit control machine tool; the second is error in Programming process; And the last is error in workpiece assembly (such as Cutter, jig, positioning, etc.).

2 Error of Digit Control Machine Tool

The error of machine tool Comes from NC system and Mechanical parts.

2.1 The Error of NC System

According to servo system control mode, NC system can be divided into open-loop control system, half closed-loop control system and closed-loop control system.

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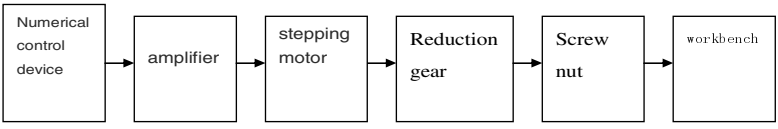

Fig. 1. The typical open-loop control system

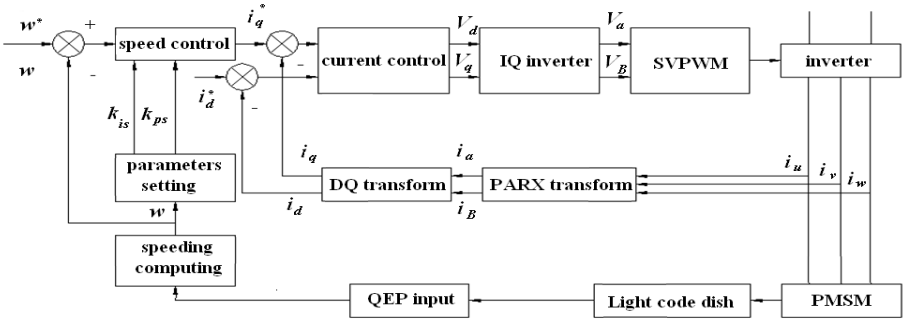

Fig. 2. Spindle servo system diagram of Four axis machining center

Figure 1 is the typical open-loop control system and simplified system. As the system has no table position detection device, or position feedback device or corrective control system, workbench displacement precision depends on step distance angular accuracy of the stepper motor and transmission precision of gears and screws. In order to diminish error, the accuracy of each component loop must be improved, which is controlled by the closed-loop system.

Figure 2 is the system diagram of a four axis machining center of a typical closed-loop Spindle servo system that adopts two loop controlling structure which includes current loop and speed loop. In order to reduce the error production we can make an adaptive design according to actual need [1].

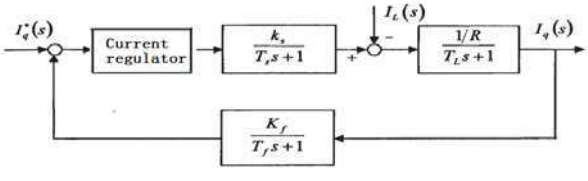

Fig. 3. Current loop structure

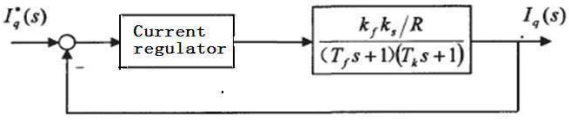

Fig. 4. Current loop simplified structure

In order to reduce system error, pilot out current loop parameters from the PID current regulator, firstly, parameters must be adjusted. Then Fig.3 can be drawn from Fig.2, and then can be simplified to Fig.4.

Current loop for the closed-loop transfer function is:

$$G_c(s) = \frac{K_1}{T_k s^2 + s + K_l}$$

Comparing the above with standard closed-loop transfer function of second order system $\frac{\omega_n^2}{(s^2 + 2\xi\omega_n s + \omega_n^2)}$, there is $\xi = \frac{1}{2\omega_n T_k}$

By: $\omega_n = \sqrt{\frac{K_l}{T_k}}$ then $\xi = \frac{0.5}{\sqrt{T_l T_k}}$

In the circumstances of damping coefficient $\zeta = 0.707$, the integrated response performance of second order system is the best. The system's error is less. Then PI coefficient of current regulator is defined.

Now select for speed loop parameter, Fig.5 is Speed loop structure from Fig. 2.

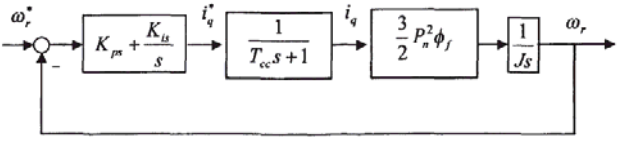

Fig. 5. Speed loop structure

ω_r^* and ω_r is the given speed and feedback speed; K_{ps} and K_{is} is Speed loop scale coefficients and integral coefficients; T_{cc} is Current loop closed-loop time constant; P_n is Motor extremely logarithm; ϕ_f is Magnetic chain of Stator winding through permanent magnetic base wave excitation magnetic field ; J is The rotational inertia of the system. The velocity loop open-loop transfer function is:

$$G_s(s) = \frac{K(\tau s + 1)}{s^2(T_{cc}s + 1)}$$

Here $K = \frac{3P_n\psi_f K_{ps}}{2J}$, $\tau = \frac{K_{ps}}{K_{is}}$. By velocity loop open-loop transfer function can be seen: Speed loop by PI series after correction is the typical type II system[4]. In order to maximize velocity loop phase angle tolerance and the response speed as quickly as possible, generally speaking, choosing $H = \frac{\tau}{T_{cc}} = 4$, $K = \frac{1}{8T_{cc}^2}$ are relatively appropriate. Hope characteristics is:

$$G(s) = \frac{K(\tau s + 1)}{s^2(T_{cc}s + 1)} = \frac{4T_{cc}s + 1}{8T_{cc}^2 s^2(T_{cc}s + 1)}, \quad \text{and} \quad K_{is} = \frac{J}{12P\psi_f T_{cc}^2},$$

$$K_{ps} = HT_i K_i = \frac{HJ}{12\psi_f T_{cc}}$$

From the above Controller parameter calculation formula we can find out that, Scale, integral department and the rotation inertia in the required speed regulator are valuable to a linear relationship. By the above law better control effect can be achieved.

Neuron PID speed controller [2] [3] [5]. Figure 6 shows single neuron structure. The control strategy of theoretical is as following [3 ~ 5]:

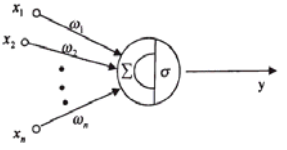

Fig. 6. Single neuron structure

Neurons input:

$$x_1(k) = e(k) \tag{1}$$

$$x_2(k) = \sum_{j=1}^{k} e(j) \tag{2}$$

$$x_3(k) = e(k) - e(k-1) \tag{3}$$

Network output:

$$u(k) = \omega_1 x_1(k) + \omega_2 x_2(k) + \omega_3 x_3(k) \tag{4}$$

Neuron controller has the similar structure of PID controller, ω_1, ω_2 and ω_3 are corresponding to PID control parameters K_p, K_i and K_d. Through the adjustment of weighting coefficients, adaptive parameters can be realized. Suppose weighting coefficients is:

$$\omega_i(k+1) = \omega_i(k) + \eta_i e(k) u(k) x_i(k) \tag{5}$$

Search along the negative gradient direction of $\omega_i(k)$, it can get:

$$\Delta\omega_i(k) = \omega_i(k+1) - \omega_i(k) = -\eta_i \frac{\partial J}{\partial \omega_i(k)} = \eta_i e(k+1) x_i(k) \frac{\partial y(k+1)}{\partial u(k)} \tag{6}$$

Because $\frac{\partial y(k+1)}{\partial u(k)}$ is usually unknown in the PID algorithm, it is replaced by symbols function approximately $\mathrm{sgn} = \frac{\partial y(k+1)}{\partial u(k)}$, then it gets:

$$\omega_i(k+1) = \omega_i(k) + \eta_i e(k+1) x_i(k) \operatorname{sgn} \frac{\partial y(k+1)}{\partial u(k)} \tag{7}$$

By what can be seen from above, the adjustment algorithm of the weights is simple, it adopts only addition and multiplication calculation, which greatly reduces computation, thus using DSP can completely realize setting the parameters online.

2.2 Error Produced by Mechanical Parts

Feed pulse from CNC drives circuit amplification, steps motor rotating one step distance and screws rotation by reduction gear. And stepping motor through screw nut pair drives workbench mobile. As shown in figure 1. A series of mechanical motion creates many errors. Moreover, the gear, the driving shaft, and the deputy transmission screw of machine tools cause reversal clearance. When the workbench retrogresses, this gap will cause motor empty go and the workbench do not sport. The phenomenon results in error; the stress of the transmission part deformation and thermal deformation causes the error; Workbench guides error; Screw pitch accumulates error; etc.

Set m as a main error source. Then comprehensive transmission errors y are x_{m-1} by K sets of data, $(x_{j,1}, x_{j,2}, \ldots x_{j,m}, x_{j,m+1})$ (j=1,2,…k). Then its overall transmission error model is:

$$\begin{cases} x_{j,m+1} = \beta + \beta_1 x_{j1} + \ldots + \beta_m x_{m+1} + \varepsilon_j \\ \varepsilon_j \sim N(0, \sigma^2) \end{cases}$$

$$\overline{x_j} = \frac{1}{n}\sum_{i=1}^{n} x_{ij}$$

$$\sigma_j = \sqrt{H_{ij}} = \sqrt{\sum_{i=1}^{n} (x_{ij} - x_j)/(n-1)}$$

$$Z_{ij} = \frac{x_{ij} - x_j}{\sqrt{H_{ij}}} (i = 1,2,\ldots k;\ j = 1,2,\ldots,\ m+1)$$

$$\overline{z_j} = \frac{1}{n}\sum_i Z_{ij} = 0 \qquad \sum_j z_{ij}^2 = 1$$

$$\sum_i Z_{ij} Z_{ik} = \sum_i \frac{(x_{ij} - \overline{x_j})(x_{ik} - \overline{x_k})}{\sigma_j \sigma_k} = r_{jk}$$

Assume the standardized variables of the above are $Z_1, Z_2, \ldots, Z_{m+1}$, we may establish standardized regression equation:

$$\hat{Z} = \hat{\beta}_0^r + \hat{\beta}_1^r Z_1 + \beta_2^r Z_2 + \ldots \hat{\beta}_m^r Z_m$$

Then with the comprehensive use of the above all, we can get the every error x_j and total error y.

In addition, when the driver -axes of machine Starts and stops, it will have a Raising and lowering speed process. Higher NC machine with hydraulic drive and lock systems can finish it in a very short period of time. But the transmission system also has more or less lags. When processing outline of groove type surface within, tool causes easily "super Journey", that is, it will produce processing error. So near the corner before feeding speed will be reduced with programs. Meanwhile subdivision processing lines, tooth gap compensation, pitch error compensation etc. will be made so that mechanical servo system accuracy is adjusted.

3 Programming Produced Error

In programming, if data are processed improperly, Process parameter selection is inappropriate and formulated processing route is not reasonable, it will produce errors. Take the following measures to improve: ①Treat the mathematical and digital size correctly; ②Determine the appropriate processing parameters; ③Formulate rational processing line, etc.

4 Error of Workpiece Assembly

Work piece assembly produces error. For example, Cutter, jig and positioning may produce errors. In processing process, we can choose the standard, durable degree of tall, red-rigid higher, excellent materials which are appropriate for NC tools. The locating data can be used as much as possible with design benchmark superposes. In a convenient clamping premise, the fitting clearance between positioning components and positioning surface are kept as smaller as possible. In such way, we can reduce benchmark displacement errors.

5 Conclusion

The paper studies the processing quality factors of NC machine tools, analyzes various errors, and presents the methods of error reduction. Thus, processing quality of NC machining can be effectively improved.

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Comparison of PBL and the Traditional Teaching Method in the Teaching of Economics

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Abstract. PBL is a popular method in most developed countries which spreads students' mind and horizon. Although PBL has been widely used in disciplines such as medicine and biology, etc, teachers have not attached much importance to this method in economics teaching in China. In this paper, we made an attempt to apply PBL in economics teaching, and contract the teaching effect of PBL with the teaching effect of the traditional lecture-based teaching method. The difference is significant. Better learning effects are achieved by those students who have experienced PBL. Specifically, students who have experienced PBL have shown higher learning enthusiasm and analyzing ability. What's more, their writing skills and presentation skills are also well cultivated. About the knowledge acquisition, PBL does not show advantage. Some proposals are put forward to further promote the teaching effect of PBL.

Keywords: PBL, lecture-based teaching, teaching effect.

1 Background

Economics is a practical science. The content of this course is closely related to our daily life. This course should have to be enjoyed by students. But in practice, most students say the analytical method is relatively abstract and complicated formulas and graphics are taking over the texts, all these make this course too abstract and too difficult to understand, and correspondingly, it's not easy to use economic theories to explain the real world.

Why the teaching effect is far away from our ideal? The reason lies perhaps in our teaching methods. In traditional lecture-based teaching, the role of the teachers is instruction, and the role of the students is listening and watching, that is, the flow of information goes one way only. This traditional lecture-based teaching mode cannot inspire students learning interest and motivation, make the formulas and graphics even more difficult, and is unfavorable to create students' divergent thinking.

To overcome these shortcomings, we try a PBL (problem-based learning) teaching method in economics teaching, and contract the teaching effect of PBL with the teaching effect of the traditional lecture-based teaching method, hoping that this attempt would provide a helpful reference for economics teaching reform.

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2 Introduction of the PBL

PBL has been described as "the learning that results from the process of working towards the understanding or resolution of a problem" [1]. This method was firstly introduced by professor HowardBra—rows in medical college of McMaster University in Canada in 1969, and ever since then is getting constant development. Now PBL has been widely used in many different disciplines, including medicine, biology, physiology, psychology, engineering education, social work education, etc.

In PBL teaching, circumstances, problems, students and teachers are the four indispensable basic elements. Circumstances and problems are the core of the teaching process. Students should work to understand or resolute the problem, and teachers are the partner or the organizer of students. In the implementation process of PBL, a suitable circumstance should be firstly carefully created and introduced clearly to students, and then students should be divided to several groups, one group is formed by 4-6 students. Students should work out study plan and control the study process by themselves. To solve the practical problems, they will fully utilize the precedent knowledge, and will acquire new knowledge actively. And then, the results will be displayed, reflection and evaluation will be made. The complete process of PBL can be displayed as in Figure 1.

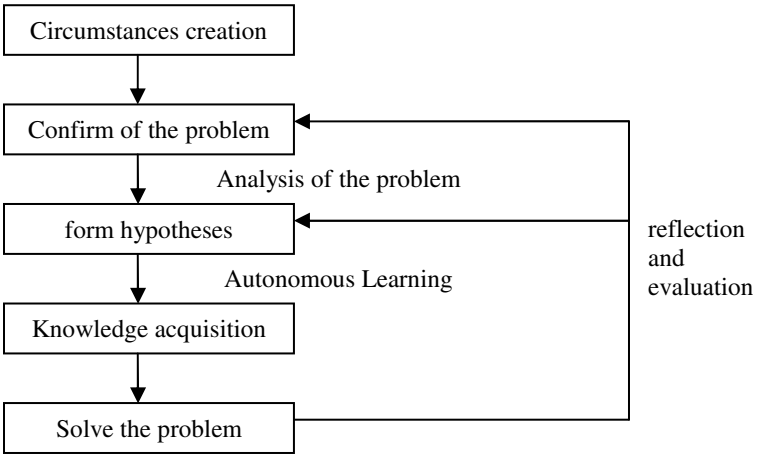

Fig. 1. Process of PBL

The main differences between PBL and traditional lecture-based teaching include:

Firstly, the lecture-based learning is aimed at impart systematic, comprehensive and profound knowledge to students, while the PBL pays more attention to the practicality of knowledge.

Secondly, in traditional lecture-based classroom teaching, teachers play the leading role, focusing on classroom teaching. Teachers impart knowledge to students in a large class, and students receive information passively. While in PBL, students play

the leading role, they focus on the problem and participate forwardly in the whole process of learning. Teachers' role is to guide and .grasp the overall situation.

Thirdly, in traditional lecture-based teaching, unified exams are arranged in the middle or at the end of the semester to assess the learning effect. While in PBL, both the number of times of students' making a speech, and the quality of the speech will be considered in the assessment. Comprehensive Evaluation is made by teacher considering not only the understanding degree of basic concepts or theories, but also the means, ability and train of thought of solving the problem.

About the learning effect, PBL has been recognized as a methodology which can promote integration of knowledge and foster a deeper approach to life-long learning [2]. Although some researchers have no confidence about PBL in terms of knowledge acquisition [3], a lot of researches have confirmed that PBL does have advantages. The degree of knowledge acquisition for students following PBL is no worse than students following traditional teaching [4]. Students show higher studying enthusiasm [5] by PBL. And students by PBL are more likely to become a researcher [6]. They also show higher application ability [7].

3 Application of PBL in Economics Teaching

The most important stage in PBL is to create a suitable circumstance, in which students should work to solve the key problem. The circumstances can be divided into 3 catalogues.

The first type of circumstance is to cooperate with a company, that is, to arrange students practicing in companies. By attending the work in practice, students can learn by doing. But this kind of PBL needs good training plan both for the school and for the company.

The second type of circumstance is to establish simulation laboratory. The fundamental aspects will be simulated by computers or commodity. Virtual transaction and circulation will be displayed to unfold the authentic economic life. This kind of circumstance needs corresponding simulation software or laboratory.

The third type of circumstance is to display economic news to students which has happened in our real economic life not long ago, and which can arouse students' curiosity. And then several questions arising from the background can be put forward.

Due to the limited condition, we choose the third type of circumstance which displaying economic news to students. After carefully selection, we displayed a 10-minutes-long video about the rising of CPI. And then, we ask students what is CPI? Why CPI has been climbing? Whether this means inflation? And what can government do? Next, we divide students into several groups each group including 4-6 students, and ask students to go and look for answers for themselves. The deadline of the task is 1 month. After 1 month, students should step up onto the platform and make a speech. The score is both determined by teacher and by students of other groups.

4 Comparison of Learning Effect between PBL and the Traditional Teaching Method

In the first term of 2010-2011school years, we conducted a control experiment in which we compared the learning effect of PBL and the traditional teaching method.

We chose 4 classes who are all economic major and 80% of the students in all classes are sophomore. Then we randomly choose 2 of the 4 class as the experimental groups in which we try the PBL teaching mode; and the remaining 2 classes as the control groups in which we adopted traditional teaching method.

We design a set of questionnaires, which mainly pay attention to the following two questions: whether PBL can help improve students' learning interest, if so, to what degree? Whether PBL can help improve analyzing ability? Whether PBL can help improve problem-solving ability? Etc. To make answers more concrete, the questionnaires are anonymous. The Final Examination Scores are also compared between the experimental groups and the control groups to find that whether PBL can improve understanding of the theory and improve memory.

The questionnaires were sent out at the end of the semester. The instructions were unified by the experienced teacher. And the questionnaires were collected on the spot. Excluding students who were on sick leave or on business leave, 326 available questionnaires were retrieved including 165 from the experimental groups and 161 from the control group. The result of questionnaire investigation is summarized as in table1.

Table 1. Comparison of learning effect between PBL and traditional teaching method

	experiment groups	control groups	P value
Can inspire learning interest	90.3%	74.5%	0.000
Can promote learning enthusiasm	87.9%	68.3%	0.004
Can enhance participating consciousness	78.8%	67.1%	0.016
Can promote analyzing ability	81.8%	69.6%	0.030
Can improve language expression	77.6%	67.1%	0.027
Can develop Self-learning ability	84.2%	77.6%	0.009
Can improve learning efficiency	59.4%	63.4%	0.235
Can improve information acquisition ability	85.5%	78.3%	0.026
Can improve ability to analyze and use information	88.5%	64.6%	0.000
Can improve ability to analyze and solve problems	81.2%	64.6%	0.000
Can improve practical ability	61.8%	59.6%	0.376
Can improve writing ability	78.2%	54.0%	0.006
Can enhance communication between teachers and students	89.1%	67.1%	0.012
Can strengthen team cooperation	86.7%	54.7%	0.010
Like this teaching method	80.6%	70.2%	0.016

Seen as in table 1, a higher proportion of students in experimental groups which adopt PBL say the adopted teaching method can inspire learning interest, promote learning enthusiasm, can enhance participating consciousness, promote analyzing ability, improve language expression, develop self-learning ability, can improve

information acquisition ability, improve ability to analyze and use information, can improve ability to analyze and solve problems, can improve writing ability, enhance communication between teachers and students and can strengthen team cooperation. The difference is statistic significant, that is, p value is less than 0.05. What's more, 80.6% of students in groups adopting PBL say they like this teaching method, while only 70.2% of students in groups adopting traditional teaching method like current teaching method. The difference is statistic significant too. When asked about whether current teaching method can improve learning efficiency, or improve practical ability, there are no statistic significant differences between the two groups, that is, p value is greater than 0.05.

The Final Examination scores are also compared. The average score in groups adopting PBL is 83.2, and the average score in groups adopting traditional teaching method is 84.6, the significance tests show that there is no statistic significant differences between the two groups, that is, p value is greater than 0.05. One possible reason is that although PBL can stimulate students to acquire knowledge positively and eagerly, but this method has not inspired students to acquire knowledge comprehensively and profoundly. Another possible reason may lie in the designing of final examination. The final examination may reflect more the degree of knowledge acquisition, but not the ability of knowledge application.

5 Conclusion

PBL is a popular method in most developed countries which spreads students' mind and horizon. Although PBL has been widely used in disciplines such as medicine and biology, etc, teachers have not attached much importance to this method in economics teaching in China.

Due to the poor teaching effect of traditional teaching method in economics teaching, we make a preliminary attempt to apply PBL in economics teaching. To some extend, the attempt has succeeded. Better learning effects are achieved by those students who have experienced PBL. Specifically, students who have experienced PBL have shown higher learning enthusiasm and analyzing ability. What's more, their writing skills and presentation skills are also well cultivated. About the knowledge acquisition, PBL does not show advantage. There is not significant difference about the final examination score for students who experienced different teaching method.

To get better teaching effect, there still is something to do in applying PBL in economics teaching.

Firstly, the course assessment system should be carefully rearranged. In the past, the final examinations paid more attention to the knowledge acquisition, but not the knowledge application. This may be the possible reason why students who have experienced PBL didn't gain higher score. Furthermore, the score gained in the final examination is a very important part of the total score of the course. This may discourage students to invest more time and energy in finishing work in PBL. To solve the problem, we can raise the weight of the score of PBL in the total score. Or we can design some questions closely related to the PBL in the term papers, so that students will pay more attention to the work designed in PBL and then can learn more by doing the work.

Secondly, teachers should pay more attention to process monitoring. The work of PBL is done by groups of students. Although we have controlled the size of the groups within the limit of 4-6 students, there is still some group whose work is done by a specific student and not by the whole group. While the assessment is give to the whole group, so the score students get may not reflect the true contribution. To avoid the problem, we should control the process more strictly. For instance, we can require students to report their division of labor and tell them the weight of score beforehand. And then require students to turn in their working report respectively, in addition to the final work report. The total score is composed of two parts: one is the score for the final working paper, and the other is the score for the contribution reflected by the working paper. So different students may get different score even they are from the same group. This method may stimulate students to work harder to fulfill the task in PBL.

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Effects of Phosphate on the Growth of Alexandrium Tamarense at Different Initial Nitrate Concentrations in Laboratory Cultures

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Abstract. The objective of this study is to reveal the effects of phosphate on the growth characteristics of Alexandrium tamarense at three different fixed initial nitrate concentrations [14.29 (low-N), 25.00 (medium-N) and 35.71 μmol/L (high-N)] in laboratory cultures. Experiments were carried out in three independent batch cultures respectively. The cell density and the specific growth rate were assessed as response parameters. The results show that both the cell density and the specific growth rate of A. tamarense increase with the increase of phosphate concentration in low-N-grown cultures, followed by those in medium-N-grown and high-N-grown cultures. And the highest average cell density in low-N-grown, medium-N-grown, and high-N-grown cultures was 1931×104, 4098×104 and 5871×104 cells/L, respectively. The specific growth rate was 3.73, 7.17 and 8.96 d-1, respectively. The results suggested that blooms of A. tamarense are more likely to form in the high nitrate and phosphate concentration than in the low nitrate and phosphate concentration in the natural marine environment.

Keywords: Alexandrium tamarense, phosphate, nitrogen, cell density, specific growth rate, red tide bloom.

1 Introduction

The cell density, the specific growth rate and the distribution of marine algae are primarily controlled by light, temperature, salinity, nutrients, and so on [1]. Of the many natural factors thought to play an important role in red tide bloom dynamics, the nutrient has been generally considered the most important factor [2]. With the rapid development of modern industry and agriculture and the speeding up of ocean exploitation, a large amount of industrial wastewater and domestic sewage rich in nitrogen, phosphorus and other nutrient substances are discharged directly into coastal waters without any treatment, which has caused phytoplankton blooms including blooms of harmful taxa, to develop [3-5].

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Alexandrium tamarense, a dinoflagellate, is known to produce a suite of paralytic shellfish toxins (PST) that cause paralytic shellfish poisoning (PSP) in mammals including humans [2, 4, 6]. There is a high frequency of the occurrence of *A. tamarense* blooms in coastal waters of the United States, Canada, Europe, South America, Philippines, Japan, China and other oceanic regions, and this has attracted concern from all over the world [7-10]. As there are obvious relationships between algal blooms and the nutrient concentrations, a large number of studies have been carried out on the effect of nutrient concentrations on the growth of *A. tamarense* and other dinoflagellate species. Most studies agreed that nitrogen or phosphorus limitation reduces the growth of dinoflagellates [11-13]. However, the nitrogen and phosphorus nutrient concentrations in their experimental setting [14, 15] were generally higher than those in the natural seawaters. The blooms of *A. tamarense* usually occur in natural seawaters, where the nutrient concentrations are lower than those in the experimental setting. Thus, to predict the bloom of *A. tamarense*, it is necessary to study the growth characteristics of *A.tamarense* under nutrient concentrations, which is close to the natural conditions.

The purpose of the present study is to assess the effect of phosphate on the cell density and the specific growth rate of *A. tamarense* at different fixed initial nitrogen concentrations, which, according to the nitrogen concentration defined by the National Seawater Quality Standard of China, was close to those in natural seawaters.

2 Materials and Methods

Non-axenic strains of *Alexandrium tamarense* PLY173 were obtained from the National Marine Environmental Monitoring Center (NMEMC), State Oceanic Administration (SOA), Dalian, P.R. China. The culture of this strain was routinely maintained at 25±1□, 30±1 PSU and about 58.5 μmol photon $m^{-2}s^{-1}$ provided by cool white fluorescent tubes under 12 h light: 12 h dark cycle. A modified f/2-medium without silicate and artificial seawater following Harrison formula [16] were employed throughout the present study.

Experiments were carried out with fixed initial low-nitrate, medium-nitrate and high-nitrate in three independent batch cultures. $NaNO_3$ and NaH_2PO_4 were used for the nitrate and phosphate sources. All treatments were given in duplicate with 3.0 L tri-conical glass flasks. A 2.0 L unialgal stock culture was grown to its late exponential phase at a concentration of 50×10^4 cells/L and used as inoculants.

At 14.29 μmol/L of nitrate (case 1 seawater, defined by the National Seawater Quality Standard of China, low-N) grown cultures (batch culture I), NaH_2PO_4 was used to prepare the culture media that contained 0.16, 0.18, 0.20, 0.24, 0.29, 0.36, 0.48, 0.71, 1.43, and 14.29 μmol/L of phosphate respectively. Table 1 illustrates the details of the preparation of phosphate and nitrate concentration in batch culture II and batch culture III respectively.

Growth was monitored by direct microscopic counts of cells from subsamples taken every day at set time points following short gentle mixing. Specific growth rate, μ (d^{-1}), was calculated over the whole growth phase using the following equation [17]:

$$\mu = \frac{dN}{Ndt} \tag{1}$$

Here N is the cell density (cells/L), t is the time for algal growth (d).

The relationship between specific growth rates (μ) and phosphate concentrations was described by the Monod equation [18, 19]:

$$\mu = \mu_{\max} \times \frac{P}{P + K_s} \tag{2}$$

Here μ_{max} is the maximum specific growth rate (d^{-1}), P is the phosphate concentration (μmol/L), and K_s is the half saturation constant (μmol/L).

Table 1. Concentration gradient of nitrogen (N) and phosphorous (P)

	The initial nitrogen concentrations fixed as 14.29 μmol/L (low-N) Phosphate concentration (μmol/L)	The initial nitrogen concentrations fixed as 25.00 μmol/L (medium-N) Phosphate concentration (μmol/L)	The initial nitrogen concentrations fixed as 35.71 μmol/L (high-N) Phosphate concentration (μmol/L)
1	0.16	0.28	0.40
2	0.18	0.31	0.45
3	0.20	0.36	0.51
4	0.24	0.42	0.60
5	0.29	0.50	0.71
6	0.36	0.63	0.89
7	0.48	0.83	1.19
8	0.71	1.25	1.79
9	1.429	2.50	3.57
10	14.29	25.00	35.71
	batch cultures I	batch cultures II	batch cultures III

3 Results

The effects of phosphate on the algal cell density and the specific growth rate of *Alexandrium tamarense* at the initial nitrate concentration of 14.29 (low-nitrate, case 1 seawater, batch cultures I), 25.00 (medium-nitrate, case 2 and 3 seawater, batch cultures II) and 35.71 μmol/L (high-nitrate, case 4 seawater, batch cultures III) are shown in Fig. 1 and Fig. 2 respectively.

In batch cultures I, the cell density of *A. tamarense* increased significantly with the increase of phosphate concentration (ANOVA, $P<0.05$). And the highest cell density of *A. tamarense* was observed in 14.29 μM cultures with a mean value of 1931×10^4 cells/L (Fig.1A). The cell density varied in batch cultures II and batch cultures III also showed an increase significantly with the increase of phosphate concentration

(ANOVA, $P<0.05$) in similar to those observed in the batch cultures I. But the highest mean cell densities observed in batch cultures II was 4098×10^4 in 25.00 μM cultures and in batch cultures III was 5871×10^4 cells/L in 35.71μM cultures respectively (Fig.1B and Fig.1C). Furthermore, under the different condition of initial nitrate concentration, the cell densities of *A. tamarense* in batch cultures III were higher than in batch cultures II and in batch cultures I.

Fig.2 shows the specific growth rate (μ) of *A. tamarense* under different PO_4^{3-} concentrations at batch cultures I, batch cultures II and batch cultures III, respectively. The parameters value of Equation (2) under various batch cultures conditions were obtained based on OriginLab 7.5 software-platform (Table 2). In batch cultures I, μ of *A. tamarense* increased significantly with increasing phosphate concentration (ANOVA, $P<0.01$) and the maximum mean μ of 3.73 d^{-1} was found when the P concentration was 14.29 μM (Fig.2A), and the half saturation constants, K_s, were 0.14 μM (Table 2). The μ of *A. tamarense* varied in batch cultures II and batch cultures III also showed an increase significantly with the increase of phosphate concentration (ANOVA, $P<0.01$) in similar to those observed in the batch cultures I. But the maximum mean μ observed in batch cultures II and batch cultures III were 7.17 and 8.96 d^{-1}, respectively (Fig.2B and Fig.2C), and the half saturation constants, K_s, were 0.29 and 0.478 μM, respectively (Table 2).

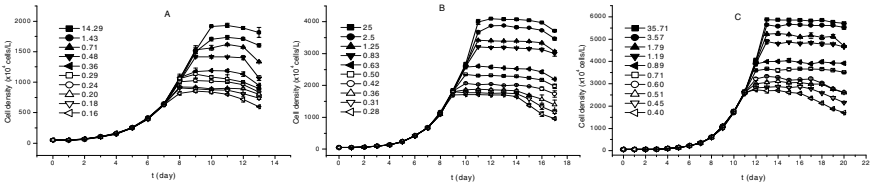

Fig. 1. Cell density of *Alexandrium tamarense* under different phosphate concentrations in fixed initial low-nitrate-grown (A), medium-nitrate-grown (B), and high-nitrate-grown (C) cultures

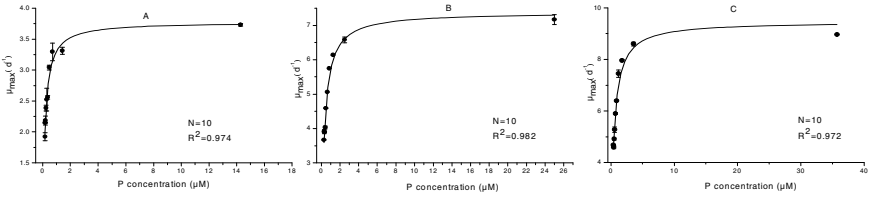

Fig. 2. The relationship between the specific growth rate (d^{-1}) and the phosphate concentration (μmol/L) of *A. tamarense*. Solid line is the Eq. (2).

4 Discussion

Phosphorus and nitrogen were the key nutrients for the algal growth. Our results from this study indicate that *A. tamarense* is able to grow in different phosphate levels

under low-nitrogen, medium-nitrogen and high-nitrogen. But different phosphate and different fixed initial nitrate concentrations may yield differences in the cell density and specific growth rate.

In the growth response to different phosphate concentrations of *A. tamarense*, the cell density and the specific growth rate increased with the increase of phosphate concentration whether in low, medium, or high-nitrate-grown culture. There was no inhibition of the growth of *A. tamarense* with phosphate concentrations, but the growth was suppressed under P limitation in this study. The results presented in this study are consistent with the previous studies that the deficiency of phosphate decreases growth [14, 20-24].

In the growth response to different fixed initial nitrogen concentrations of *A. tamarense*, the highest cell density and the highest specific growth rate obtained in the fixed initial high-nitrate-grown cultures show that the fixed initial high-nitrate concentration is the preferred culture concentration. In other words, the higher the fixed initial nitrate concentration, the more favorable to the growth of *A. tamarense*. Our results were consistent with the reports on other observations that the deficiency of nitrate decreased the cell growth [14, 20-24].

The maximum specific growth rate, μ_{max}, and the half saturation constants, K_s, for the uptake of phosphate, which were estimated from the Monod equation curve fit for low, medium, and high-nitrate-grown cultures, increased with the increase of the fixed initial nitrate concentration in this study. The values of μ_{max} were found to be much higher than those observed in some other studies of *Alexandrium* species (Table 2). However the values of K_s were found to be much lower than those observed in some other studies of *Alexandrium* species (Table 2), and higher than those

Table 2. Summary of the maximum growth rate (μ_{max}) and the half saturation coefficient (K_s) for the phosphate uptake of various *Alexandrium* species

Species	μ_{max} (d^{-1})	K_s (μmol/L)	Reference
A. tamarense (PLY173)	3.78	0.14	This study, in low-NO_3-fixed-grown culture
A. tamarense (PLY173)	7.38	0.29	This study, in medium-NO_3-fixed-grown culture
A. tamarense (PLY173)	9.46	0.48	This study, in high-NO_3-fixed-grown culture
A. minutum (AmKB06)	0.40	3.64	[18]
A. minutum (AmKB06)	0.67	2.51	[18]
A. minutum (L1)	0.24	0.12	[25]
A. minutum (AL1V)	0.298	1.16	[26]
A. tamarense (MDQ1096)	0.276	1.68	[26]
A. tamarense (EF04)	0.253	1.00	[26]
A. tamarense (ATHS92)	0.54	2.6	[27]

observed in *A. minutum* [25]. The causes of the differences could be as follows: (1)the calculation of the specific growth rate, μ, was from different equations, which might contribute to the difference in μ_{max}; (2) ecotypic variation among different species might contribute to the difference in K_s; (3) the difference between the present study and the previous ones in laboratory culture settings (such as the fixed initial nitrogen concentrations, low phosphorus concentrations gradients, etc.) might also contribute to the difference in K_s.

Generally, the conditions of algal blooms could be the ambient factors (such as nutrient, temperature, light intensity, etc.) that reach the ecological niche for the algal growth. But it has been generally accepted that increased algal blooms around the world are related to nutrient loading and nutrient ratios. In the present study, using the nitrate concentration defined by the National Seawater Quality Standard of China, we obtained the growth characteristics of *A.tamarense* at different phosphate concentrations and different fixed initial nitrate concentrations. Our findings suggest that in the natural marine environment, blooms of *A. tamarense* are more likely to form in the high nitrate and phosphate concentration than in the low and phosphate concentration.

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Legal System of Power Frequency Electromagnetic Field in Power Transmission Projects

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Abstract. With the planning and construction of long-distance and ultra high voltage transmission project, the impacts on environment and human health result from frequency electromagnetic fields, have received more and more attention. In this paper the present laws and regulations about frequency electromagnetic fields in China are summarized, then the deficiency and defects, such as legislative gaps, lower level of legislation, lack of national standards and weak operability of the present laws and regulations are pointed out. Therefore, suggestions on improving laws and regulations about frequency electromagnetic fields are given, including building special legislation, the perfection of national standards, enrichment of law content, enhancement of the operability. Moreover, the system of public participation should be built to eliminate public concerns.

Keywords: frequency electromagnetic fields, legislation, power transmission equipment.

1 Introduction

Power frequency electromagnetic field is an extremely low frequency electromagnetic field (ELFEMF) generated by a variety of voltage levels power lines and electrical appliances, and its wavelength to 6000km[1]. The operating frequency is 50Hz in China and some European and 60Hz in United States, Canada and other countries respectively [2]. Since 1927 Former Soviet Union reported long-time working, under 500kv substation or high-voltage transmission lines caused the nervous system, cardiovascular system disorders and changes in blood [3]. Thus potential hazards from power frequency electromagnetic fields have gradually been concerned. ELFEMF has classified as suspected human carcinogens by International Agency for Research on Cancer [4]. Since the former Environmental Protection Administration formulated "Regulations on electromagnetic radiation protection" in China in 1988, the electromagnetic radiation pollution control legislation has been established gradually. But the specific power frequency electromagnetic radiation pollution laws and regulations have not yet developed and there are still controversies in standards establishing [5, 6].

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2 Laws and Regulations in Power Frequency Electromagnetic Fields

Since 1979 the "PRC Environmental Protection Law" (trial) was enacted, Laws on environmental protections have been evolving a relatively complete legal system formed by law, the State Council administrative regulations, government regulations, local government laws and regulations, environmental standards and international environmental treaties. However the system is not perfect enough in power frequency electromagnetic field.

2.1 Law and Administrative Regulation

In national laws and administrative regulations, there are only general provisions concerning the power frequency electromagnetic fields radiation pollution prevention and protection in the "Environmental Protection Law of PRC", "National Construction Project Environmental Protection Management Regulations" (1998), "Environmental Impact Assessment (EIA) Law of PRC" (2002) and "Planning EIA Ordinance" (2009).

2.2 Government Regulations

According to state laws above, the State Environmental Protection Department (the former State Environmental Protection Agency) has formulated "Regulations for Electromagnetic Radiation Protection" (1988), "Electromagnetic Radiation Protection Management Method" (1997) and "Construction Project EIA Classification Administration List" (2008) involved power frequency electromagnetic fields.

2.3 Local Government Laws and Regulations

Based on the laws and regulations of the state, local governments have formulated special local laws and regulations, making up the blank of the laws and regulations in the power frequency electromagnetic field , such as "Ningxia Prevention and control of radiation pollution of the environment management approach"(1999), "Hebei Management of Environmental Protection electromagnetic radiation"(2000), "Shandong Radiation Management Approach"(2003), "Jilin Radiation Pollution Prevention Regulation"(2004), "Tianjin Environmental Protection Measures for the Administration of electromagnetic radiation"(2006) and "Jiangsu Radiation Pollution Prevention Regulation"(2007). Other provincial legislation has been also underway, such as Environmental Protection Bureaus of Sichuan, Guangdong, Shanxi and Heilongjiang which are planing introduce "Radiation Pollution Regulation".

2.4 Environmental Standard

The existing relevant environmental standards currently are "Electromagnetic Radiation Monitoring Instruments and Methods"(1996), "Guidline on Management of Radioactive Environmental protection EIA Methods and standards on Electro-magnetic Radiation"(1996), "Technical Regulations on EIA of Electromagnetic

Radiation Produced by 500kv Ultra-high Voltage Transmission and Transfer Power Engineering"(1998) and "Measurement Method on Power Frequency Electric and Magnetic Field of High-voltage AC Overhead Transmission Lines and Sub-stations"(2005). Some standards are being developed to supple the lack of current standards, such as "Electromagnetic Radiation Exposure Limits and Measurement Methods", "Protection Regulations on Electric Field, Magnetic Field, and Electromagnetic Field" and "EIA Technology Guidelines - Power Transmission Project".

2.5 Power Frequency Electromagnetic Fields Regulations and Standards in Power Transmission Project EIA

In 2008, the State senator put the transmission line construction project into the "Construction project environmental impact assessment classification administration list". In the list of Electromagnetic radiation construction projects and equipment of "Electromagnetic Radiation Protection Management Method", a strong power frequency radiation systems contain with transmission and distribution system with voltages above100 kv, power frequency equipment with current above 100A, light rail and railway electrification. At present, the main standard of frequency electromagnetic field measurement is "Measurement Method on Power Frequency Electric and Magnetic Field of High-voltage AC Overhead Transmission Lines and Substations" promulgated by the Nation Development and Reform Commission. And EIA of the power companies on power frequency electromagnetic field based primarily on "Technical Regulations on Environmental Impact Assessment of Electromagnetic Radiation Produced by 500 kv Ultrahigh Voltage Transmission and Transfer Power Engineering" (HJ/T24-98). A draft standard as amendment of the standard above is "Environmental Impact Assessment Technology Guidelines - Power Transmission Project", which expanded the scope of the evaluation and defined the evaluation on power frequency electromagnetic field under different voltage levels.

3 Defects of Laws and Regulations about Power Frequency Electromagnetic Fields

The major pollution of high-voltage power transmission engineering is caused by electromagnetic radiation and the power frequency electromagnetic fields (PFEF) which is now very controversial and can’t be ignored. Therefore, the construction of power transmission project should note these problems and must comply with relevant state laws and regulations. However, there are still many weaknesses on laws and regulations about frequency electromagnetic.

3.1 Legislative Gaps

Pollution control legislation is established by the basic law plus a special legislative. Basic Law makes a general explain to pollution prevention, and then develop the specific pollution control legislation. "Water Pollution Control Act" and "Air Pollution Control Act" belong to the special legislation, and they can be effective to

prevent and treat various types of pollution. And so far, we have not issued a special legislation about electromagnetic radiation pollution prevention which includes PFEF [7]. "Management of Environmental Protection of electromagnetic radiation" is the only regulation about electromagnetic radiation. It is a department regulation which is established by state environmental protection administration. But in china, the principle of sectoral legislation is "whoever is in charge drafted, who drafted who protects". So these laws and regulations drafted by relevant industry sectors are difficult to take the initiative to consider the PFEF problems, and a lot of content of "Management of Environmental Protection of electromagnetic radiation" are not reflected in these l regulations.

Lack of local laws and regulations should also be a cause for concern. According to the principle of unity of our country's legislation, local legislation should not conflict with national legislation, therefore, local legislation is generally complementary and implementation to national legislation. That is, local administration refines and operates national legislation according to local conditions. But most of the local legislation simply repeated national legislation, so they have not played the due role.

3.2 Lack of National Standards of PFEF

As a national standard, "Electromagnetic radiation protection" (GB8702-1988) provides a standard of high-frequency radiation limits, but this standard don't apply for PFEF which the frequency is only 50HZ. "Technical Regulations on EIA of Electromagnetic Radiation Produced by 500 kv Ultra-high Voltage Transmission and Transfer Power Engineering" is industry standard (HJ/T24-1998), it is the main basis for evaluation about PFEF. However, the provisions of the electromagnetic of frequency are not clear and it is limited to 500kv EHV transmission and distribution project. In 2006, national standardization management committee started to draft exposure standards of PFEF [8]. In 2008, electromagnetic environment national standards sector coordination meeting has made a "High-voltage power lines, substation power frequency electric, magnetic exposure limits" (mandatory standards) which the occupational exposure to electric and magnetic limit are the same with International Commission on Non-Ionizing Radiation Protection's (ICNIRP). But some scholars believe that ICNIRP's guideline is formulated according to immediate short-term exposure to electromagnetic effects generated by the development of the known health hazards. Moreover, ICNIRP's guideline has not made the non-thermal effects as a basis for setting limits. These one-side understandings about PFEF effects make the guidelines of the standards lack of scientific and it fails to adequately protect human health effects. Therefore, drafting a scientific and rational national standard about PFEF according to our country's actual situation is imperative.

3.3 Operability of the Existing Relevant Laws and Regulations Is Not Strong

The regulations have not legal responsibility. For example, "Environmental Assessment Act" demands the project's "significant changes" need fulfill the requirements of environmental protection procedures, but the so-called "significant changes" is not clearly defined, so its operability is not strong. The exact path of the line of grid project can only be determined in the preliminary design stage, and there

may be some changes during construction phase, and many changes are conducive to environmental protection, but what is "significant changes" is not clear so as to the actual operation is very difficult. If the project has to be reapproved as long as it changed, this project cannot be built normally. If the change is not submitted for approval, there are some certain legal risks and final acceptance is difficult to pass.

4 Legislative Proposals about PFEF

Following suggestions are proposed based on those legal problems about PFEF.

4.1 Special Legislation about PFEF

China has formulated the "Water Pollution Control Act", "Air Pollution Control Act", "Radioactive Pollution Control Act" and other special laws, these special laws has indeed played a very important role on preventing related to environment pollution and protecting environment. In contrast, there is not a special legislation about PFEF while environmental problems caused by power transmission project on the impact on the lives of people have become increasingly prominent, so as to there is no laws to comply with when encounter this problems. So formulating "Electromagnetic Radiation Pollution Control Act" included PFEF is important.

4.2 Formulate National Standard as Soon as Possible

Absence of national standard means that there is no authority interpretation on whether PFEF is harmful to people, and no authority standard can be comply with when we do environmental assessment on PFEF. So we should establish national standard in line with China's national conditions as soon as possible.

4.3 Public Participation

Environmental impact of PFEF is subtle and there are some controversies on science about PFEF, Moreover, power transmission equipment is a potential mystery to people. These will increase the public's fear of PFEF, and people will intensely oppose power transmission project even if the impact of PFEF to environment is insignificant. The best way to eliminate this confrontation is that let parties understand, communicate and respect each other through public participation. And public participation can also eliminate people’s misunderstanding and fear about PFEF. So it is an important part of frequency electromagnetic s legislation to set up public participation which can safeguard the public right to information, public participation in decision-making, public supervision.

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Investigation on Index System for Major Pollutants Emission Reduction in Structure, Engineering and Supervision

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Abstract. Combining the achievement for the major pollutants emission reduction during the 11th Five-Year Plan period with the reduction demands in the 12th Five-Year Plan, an index system for major pollutants emission reduction was established based on the three primary reduction measures of structure emission reduction, engineering emission reduction, supervision emission reduction. The establishment of the index system could help to assess the emission reduction effect for the major pollutants in China, and provided a basis to the further research of the pollutants total amount control.

Keywords: index system, emission reduction, major pollutants, structure, engineering, supervision.

1 Introduction

China is still in the late-mid of industrialization during the period of the 12th Five-Year, and industrialization and urbanization are still in the accelerated development stage, the contradiction between resources and environment will be more concentrated. Energy saving and emission reduction has become the important implement for building a resource-based, environment-friendly society, promoting economic restructuring, and changing the growth mode. How to reduce emission for the major pollutants through a scientific and rational method has been a significant issue in China. In recent years, scholars have developed a series of related studies, focused on the socio-economic impact studies for energy conservation [1], discussed the implementation of energy saving from the views of legal, policy [2], and energy conservation in the enterprise or industry [3]. Some index systems have been constructed for assessing the emission reduction effect of a city or an area [4]. However, there is a lack of independent and universal research to systematic analysis the effects of Chinese major pollutants total amount emission. Further, a set of scientific and reasonable evaluation index system is on demanded to set up that could be extensively applied to assess the result of emission reduction in different area. Therefore, this study attempts to build a universal index system for assessing the major pollutants emission reduction effect in China.

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2 Achievement of the Emission Reduction

During the period of the 11th Five-Year, national emission of the major pollutants (chemical oxygen demand, COD and sulfur dioxide, SO_2) reduced by 10% has been a binding target [5]. Due to 2010, the national COD and SO_2 emissions have been reduced by 10% than the ones in 2005, respectively. Specifically, the COD emission reduced to 1272.8 from 1414.2 million tons in 2005, meanwhile, the SO_2 emission decreased to 2294.4 while the one in 2005 was 2549.4 million tons.

In the year 2010, the three domain measures were steady developed. Firstly- structure emission reduction, the small flame electrical machinery was shut down totally; all of the high-energy and high emission industries (such as steel, cement, coking and papermaking, alcohol, monosodium glutamate) completed the task of eliminates the backward production projects. The proportion of thermal power installed capacity for thermal power unit (more than 300, 000 kw) accounts for more than 70% in power industry, which was only 47% in 2005, and the coal consumption of thermal power supply decreased 9.5%; the load of COD discharge per unit product for the paper industry fell 45%. Secondly- engineering emission reduction, the installed capacity of new fire coal desulfurization unit was 107 million kilowatts, and for thermal power desulfurization unit reached up to 578 million kw, the proportion raised to 82.6% from 12% in 2005; the new treatment capacity of urban sewage was 19 million cubic meters per day, the urban sewage treatment rate increased to more than 75% comparing to 52% in 2005; 170 sets of steel sinter plant flue gas desulfurization facilities were accumulative total built up and running, the proportion of sintering machine increased from 0% in 2005 to 15.6% in 2010. Thirdly- supervision emission reduction, more than 10 billion yuan central financial was invested to support the national pollution reduction system and environmental protection supervision ability construction. 343 pollution monitoring center with more than 100, 000 sets of monitoring equipment were built up to automatic monitor 15, 000 enterprises, the ability of environmental regulatory was significantly enhanced. Energy conservation and emission reduction in power generation scheduling was developed in Southern Power Grid Company and several provinces to examine the operating rate of coal desulfurization unit and deduct desulfurization electrovalence, the operating rate achieved more than 95% that it was less than 60% in 2005. The compliance rate of SO_2 and COD from the national controlled key pollution sources reached 92% and 94%, respectively, which increased 22 and 34 percentages comparing to 2005 [6].

Ammonia nitrogen and oxynitride (NOx) were added as the major pollutants in the 12th Five-Year Plan [7]. The targets of the emission reduction were restrained as 8% for COD and SO_2, 10% for ammonia nitrogen and NOx [8]. Thus, more effective measures should be taken to achieve the targets of the emission reduction.

2.1 Establishment Principles

The index system plays a vital role in assessing the effect of major pollutants emission reduction. In this paper, the index system was established according to the following principles [9-10]: representativeness and pertinence, independence, comparability and measurability, completeness, systematicness and hierarchy.

Specifically, the selected indicators should be able to clearly reflected the realistic problems of the emission reduction; there was not significant interaction effects or linear relationship between each indicator; the selection of the indicators should consider the comparison requirements between different years or areas, the indicators also should be quantification, and easy to obtain or calculate; the index system should be constructed from a comprehensive view, so as not to miss important information.

2.2 Main Content of the Index System

According to the establishment principles above, 29 indexes were selected in the indicator layer. The index system considered different industries, pollution sources, and control factors. The detailed structure is shown in table 1..

2.3 Index Introduction

There are three domain aspects in the rule layer of the index system, they are structure emission reduction, engineering emission reduction, and supervision emission reduction.

Structure emission reduction. It is an important emission reduction measure by adjusting the industry structure and eliminating the enterprises, production lines and equipments with backward technology, high energy consumption, and heavily polluted, including the industries of electric power, steel, building materials, electrolytic aluminium, ferroalloy, calcium carbide, coke, chemical, coal, pulp and paper, and food etc.

Structure adjustment of industrial water pollution: It refers to the cut-down amount from closing industrial enterprise or closing part production line and production facilities;

Structure adjustment of aquaculture: The emission reduction is to reduce the fence breeding area according to the relevant requirements, and estimate the emission reduction based on the practical decrease amount of the aquatic products (such as fish, prawns, crabs and shellfish) and the pollutants coefficient;

Eliminate of backward production capacity project: Determine the eliminated backward production project by industries, and caculate the reduction amount according to the pollutants emission base values of the eliminatived equipment in 2010.

Engineering emission reduction: It is an emission reduction measure by adapting the pollution treatment projects. It mainly contains the constructions of water pollution treatment and air pollution treatment engineering.

Water pollution treatment engineering: It includs 3 aspects- industrial, urban, and livestock breeding sewage treatment. Emission reduction of industrial sewage advanced disposal contains the reduction from the new construction of industrial enterprise treatment project, the reduction from the implement of clean production, reclaimed water reused, and the reduction from construction of the centralized sewage treatment facilities in industry park; Urban sewage centralized treatment projects broadly into four categories: reduction from newly-built sewage treatment facilities,

Table 1. Index System for Major Pollutants Emission Reduction

Target Layer	Rule Layer	Domain Layer	Indicator Layer
Major Pollutants Emission Reduction	Structure emission reduction	Structure adjustment of industrial water pollution	Eliminated, crackdowns, and close enterprise
			Closed part production line, eliminated some production equipment
		Structure adjustment of aquaculture	Reduce fencing breeding area of aquaculture
		Eliminate of backward production capacity project	Determined eliminate of backward production project according to industries
	Engineering emission reduction	Industrial sewage advanced disposal	Construct new treatment project
			Clean production and use reclaimed water
			Construct centralized sewage treatment facilities
		Urban sewage centralized treatment	Construct new sewage treatment facilities
			Perfect pipe network of wastewater collection
			Improve the emission standard
			Sewage reuse
		Livestock breeding sewage treatment	Improve breeding method
			Construct pollution treatment equipment
		Air pollution control of SO_2	Power plants desulfurized
			Steel sintering flue gas desulfurization
			SO_2 management of oil refining industry
			Coke oven gas desulfurization
			Treatment of sulfuric acid tail gas
			Building materials furnace flue gas desulfurization
			Coal boiler flue gas desulfurization
		Air pollution control of NO_x	Reconstruction of electric power industry low nitrogen combustion and flue gas denitration
			Reconstruction of cement industry low nitrogen combustion and denitration
			Steel sintering flue gas denitration
			Coal boiler low nitrogen combustion
			Eliminate of motor vehicle
			Oil instead of motor vehicle
	Supervision emission reduction	Management reduction of SO_2	SO_2 reduction of the circulating fluidized bed boiler
			SO_2 reduction of the sintering flue gas desulfurization facilities
		Management reduction of NO_x	NO_x reduction of the coal-fired units flue gas denitration facilities

reduction from improving the load rate of the original sewage treatment facilities through perfecting pipe network of wastewater collection, reduction from improving the pollutants emission standards, and reduction from sewage reuse; Emission reduction technology measures of livestock breeding sewage treatment project includes the improvement of breeding method, which adopt biological fermentation bed, mat paddings, and bedding material stalks or product into organic fertilizer, from these 70% of the produced COD and 60% of the ammonia nitrogen were reduced. Construction of pollution treatment facilities is also a method to dispose the pollution from livestock breeding.

Air pollution treatment engineering: The control factors of air pollution treatment comprise SO_2 and NOx. SO_2 treatment projects mainly aim at the flue gas desulfurization and tail gas treatment engineering in the industries of power, steel, oil, coke oven and building materials, etc. The treatment of NOx mainly focus on engineering of low nitrogen combustion transformation, flue gas denitration, and motor vehicle oil substitution in the industries of power, steel, cement, coal boiler, and motor vehicle.

Supervision emission reduction: It is an vital emission reduction measure that through the environmental management means of strict environmental law-enforcement supervision for realizing stable and standard discharge, and improve the emission standard of key pollution industries, also including the implementation of cleaner production. For example the coal-fired units with desulfurization facilities but inefficient (such as circulating fluidized bed boiler, sintering flue gas desulfurization facilities) or have already installed denitration facilities but run abnormally at the end of the 11th Five-Year. The measure of supervision could increase the amount of emission reduction by strengthening management, improving the operation rate, and perfecting online monitoring.

3 Summary

An assessment index system for major pollutants emission reduction was established from the perspectives of structure, engineering and supervision emission reduction based on the reduction effect analysis of the 11th Five-Year period, the index system contains the emission reduction from different pollution control factors and sources, and it could be used to assess the emission reduction effect in China.

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A Review on Ecological and Environment Impact Assessment of Municipal Power Transmission and Transformation System

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Abstract. The paper studied the electromagnetic field engendered by the municipal power transmission and transformation system as also the electromagnetic radiation effects and the influence on environment and organism, an attempt has been made to understand and review the various emerging issues related to it. Based on the comprehension and discussion, shortcomings in related field as also suggestions are proposed.

Keywords: power transmission and transformation, industrial frequency electromagnetic field, environmental influence, electromagnetic radiation.

1 Introduction

Due to the rapid increase of China's comprehensive national strength and social economy, power demand also experiences a rapid growing, causing the increase of whole electric power industry. What's more, in order to improve the utilization ratio of energy, the power grid are marching to super-high voltage, high-capacity and long-range type [1]. In the meantime, more and more attentions are pay to the impact of high voltage power transmission and transformation project on urban population.

The electromagnetic radiation is a process that emitter emits energy to space environment in form of electromagnetic waves. Electromagnetic environment is the total of all electromagnetic phenomena exist in a given place [2, 3]. The alternating current (AC) rated industrial frequency in China is 50 Hz. The electric field and magnetic field caused by industrial frequency are defined as industrial frequency electric field and industrial frequency magnetic field, respectively [4].

Many countries have their own electromagnetic field exposure standard. Some organizations such as the European Commission (ICNIRP, CEU) also have their own guidelines [5]. The standard of electric intensity and magnetic induction environmental impact assessment of China is stricter to most countries and organizations and it is relatively safe [6].

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2 The Influence of Different Voltage Levels Municipal Power Transmission and Transformation Systems on Surrounding Electromagnetic Environment

According to large amount of research and analysis, three power transmission and transformation systems under different voltage located in different cities are chose as research objects, 10 kV in Shanghai [7], 110 kV in Shangbancheng [8] and 220 kV in Beijing [9]. Both the electric intensity and magnetic induction engendered by transmission lines and related facilities are measured for each measuring point. The stationing of measuring points and measurement are referred to "The 500 kV ultrahigh pressure conversion engineering electromagnetic radiation environment impact assessment technical specifications" (HJ/T24-1998), and adjusted on the basis of the practical situation. The change trends of strength along with the monitoring sites are shown in Figure 1 and Figure 2.

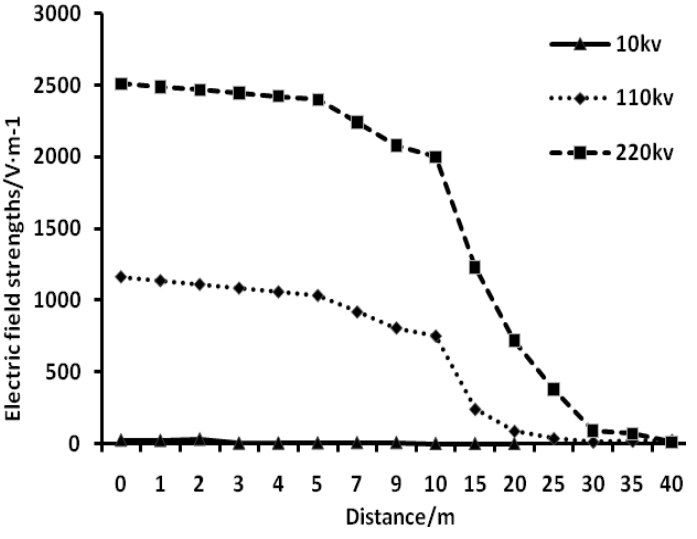

Fig. 1. The change trends of electric field strengths along with the monitoring sites

As is shown in Figure 1 and Figure 2, electric intensity is 1.30~1.40 V/m, magnetic induction is 0.20~1.08 μT around the 10 kV substation. The maximum of electric intensity of 110 kV transmission line in Shangbancheng is 1163.2 V/m and maximum of magnetic induction strength is 1.902 μT. The peak value of electric intensity is 2510 V/m, and the peak value of magnetic induction strength is 4.998 μT.

Above the cases, the results of electric intensity and magnetic induction strength measured in transmission lines and related facilities under 3 kinds of voltage showed that strength are obviously presented to decline along with the increase of distance. For the three kinds of power transmission lines, the electric intensity and the magnetic

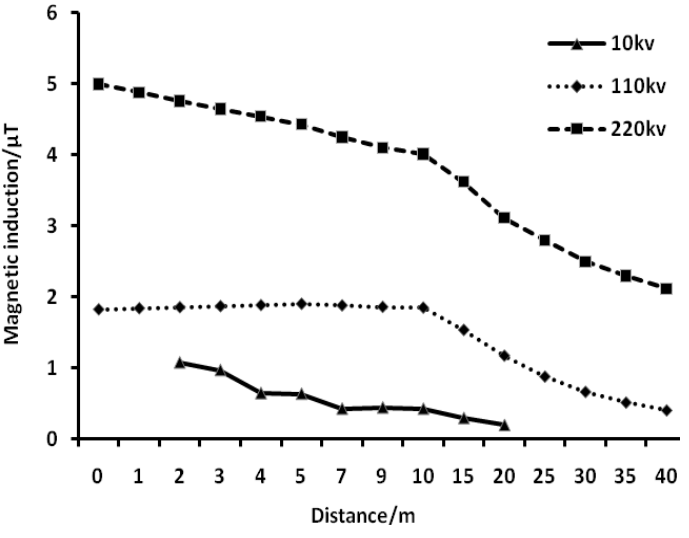

Fig. 2. The change trends of magnetic induction along with the monitoring sites

induction of 220 kV are the strongest, 110 kV take the second place, and 10 kV obtain the least strength. The biggest strength values among the 3 kinds of voltage are less than 4 kV/m of the electric field and 0.1 mT of magnetic field of residential evaluation standard. The conclusion is that these three kinds of voltage around the electromagnetic environment are relatively safe.

3 The Influence of Municipal Power Transmission and Transformation System Electromagnetic Field on Biology

The influence of electromagnetic field on biology is often called the health effect or ecological effect, when biology is in an electromagnetic field, called exposure [10]. The question whether the exposure of biology to electromagnetic field has potential biological effect or health hazard has become an important subject of scientific research since the late 19th century, especially in recent 40 years, large amount of research has been developed, and related evaluation standard has been set [11].

3.1 Influences of Industrial Frequency Electromagnetic Field on Human Body

Since the paper "electric field has a direct impact on the human body" published by Kcrobkova and Asanova in 1972, subsequent research has been developed. For example, researchers in America developed a 9 years medical follow-up study for 10 workers who have engaged in electric work for about 20years. German researcher, Thingol developed a study with 45 testees, by letting them exposure in the 0kV/m and15kV/m electric field and measuring their ecg, eeg, blood pressure to make a comparison. Results of most studies do not show apparent health hazard when exposed in electromagnetic field, especially for homely electromagnetic field [12].

In consideration of all the results, International Conference on Large High Voltage Electric System, Conference International des Grands Reseaux Electriquesthe international (CIGRE) points out in the final communiqué that the electric field caused by the high-tension line do not have health hazard, and the limitation of allowable electric field is far higher than the existing electric field, thus it has a large safety threshold [13].

3.2 Influences of Industrial Frequency Electromagnetic Field on Animals

Many studies have been developed on the influence of electromagnetic field on animals. Italia researcher, ENEL developed an experiment on animals, and the results show there are no obvious changes on the mean value of SVstrokevolume, rhythm of the heart and arteries blood pressure. Knicherboher point out in his reports that the intensity of reaction is increase with the electromagnetic field. The laboratory mice do not have obvious response when the electric field is 160 kV/m; when the electric field is 220 kV/m, the laboratory mice slightly uneasy; however, when the electric field is 700 kV/m, the laboratory mice obvious uneasy; and some laboratory mice are paralyzed when the electric field is 1000 kV/m. There is no obvious change in general habits and fertility under all conditions [14].

The result show that when the electromagnetic field strength is not so high, the influences on animals are not obvious; and only when the value of electromagnetic field reach a considerable level can influence be observed. However, most of the electromagnetic field caused by power transmission and transformation system is lower than 10 kV/m. Therefore, the influence is negligible.

3.3 Influences of Industrial Frequency Electromagnetic Field on Plants

Similar to animal testing, many studies have also been developed on the influence of electromagnetic field on plants. In 1979, Miller, researcher of University of Rochester, developed a study fuscous on the influences of electromagnetic field on underground plant. The result show that when the electromagnetic field strength of solution is 360~430 V/m, the growth of plant root system slowed. However, it is hardly to reach such a strength level in atmosphere, in other words, electromagnetic field has little influence on plants.

Similarly, studies developed by researchers of Electric Power Research Institute (EPRI) and some universities also showed that electromagnetic field caused by electric transmission line can hardly influence the growth of plants [15].

4 Conclusions and Suggestions

The studies on the influence of industrial frequency electromagnetic radiation caused by different power transmission lines and the influence on organism show the shortcomings of study on industrial frequency electromagnetic field in China: (i) Corresponding national standards and laws of industrial frequency electromagnetic field hasn't been published in our country, and still using environmental protection standard, i.e. the 500 kV ultrahigh pressure conversion engineering electromagnetic radiation environment impact assessment technical specifications; (ii) Most research

works developed in our country are mainly concentrated in the electromagnetic radiation numerical; however, the long-term cumulative effects and even physiological impact are not considered by the relevant research, and (iii) The public do not have correct knowledge to the effects of the electromagnetic radiation and even have some panic feelings duo to the lack of right guidance.

Based on the shortcomings of study on industrial frequency electromagnetic field in China, suggestions will be as follows: (i) To publish relevant laws and regulations on the impact assessment of electromagnetic radiation, and the laws and regulations should be strictly implement in each stage of power grid planning, design, construction and operation; (ii) In view of the phenomenon that the decrease of field strength can effectively reduce the influence of electromagnetic radiation; therefore, by adjusting the distance between wire, the distance from ground, splitting wire structure size and the arrangement of the phase conductors' way to reduce the strength of electric field, so as to reduce the effect of electromagnetic radiation; (iii) Make reasonable planning for the location of power transmission and transformation project, and install shielding facilities to the transmission lines which cross the residential area. In addition, strengthen urban forestation and reforestation can effectively absorb electromagnetic radiation, and (iv) Through scientific propaganda and other ways to correctly lead the public and gradually eliminate the misunderstandings and panic of the public to the influence of electromagnetic radiation.

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Land Treatment and Resource Utilization for Food Processing Wastewater

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Abstract. Land treatment and resource utilization for food processing wastewater was studied in this paper. The results show that under scientific design and standardized management, food processing wastewater could be used in agricultural irrigation safely and reliably with a certain pre-treatment process, which has no adverse impact on the quality and the environment of crops. Besides, water resource and nutrients could be used effectively, processing and operating costs could be reduced significantly, which is consistent with guiding principle of recycling economy development and resource-saving society construction in China, and has broad market prospects.

Keywords: food processing wastewater, resource utilization, Land treatment, irrigation.

1 Introduction

A large amount of water is usually utilized in food processing industry; accordingly, a large amount of wastewater is produced. For example, water consumption of sugar, beer, can and alcohol per ton is 150t, 35t, 100t and 200t respectively [1].

Traditional treatment technology, such as biofilm treatment, SBR, UASB, hydrolytic acidification and membrane separation is usually used to treat wastewater discharge from food processing industry[2][3]. However, it is difficult to meet corresponding standard, which is more and more strict. Besides, organic matters in waste water cannot be utilized fully, which causes double waste of energy and resource [4][5].

Under the condition of cycle economy, low-carbon economy, and ecological industry promotion, it is necessary to initiate a new approach to fulfill resource utilization of waste water from food processing industry. Aiming to problems existing in the process of beet sugar, such as irrational resource collocation, high energy consumption, and serious environmental contamination et al., agriculture demonstration of recycling economy was carried out to fulfill double-win between agricultural economic and environmental protection.

2 Demonstration of Waste Water Resource Utilization in Nanhua Sugar Co

Nanhua Sugar Co. is an enterprise to produce white sugar with sugar beet as raw materials with the capacity of 3000t/day and discharge water of 800,000t/year, which

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lasts from October to January in next year. It is necessary to consider some key issues, including: (1) storage of wastewater through the winter and water quality stabilization technology to be considered, (2) based on hydraulic load, organic load, nitrogen load, and eluviate load of soil-crop system, wastewater allocation schedule in different growth phases to be organized, (3) irrigation system to be designed according to in-situ terrain, land use and the demand of large scale self-moving sprinkler irrigation equipment.

Water quality and water quantity. Water quality designed is shown in table 1. Water quantity designed is 800,000m^3/year. All wastewater treated will be utilized to irrigate cropland to fulfill zero discharge.

Table 1. Water quality designed

COD[mg/L]	BOD[mg/L]	NH_4^+-N[mg/L]	pH	TDS[mg/L]
5000	2000	16	6.5	2300

Process flow diagram. Process flow diagram is shown in fig.1.

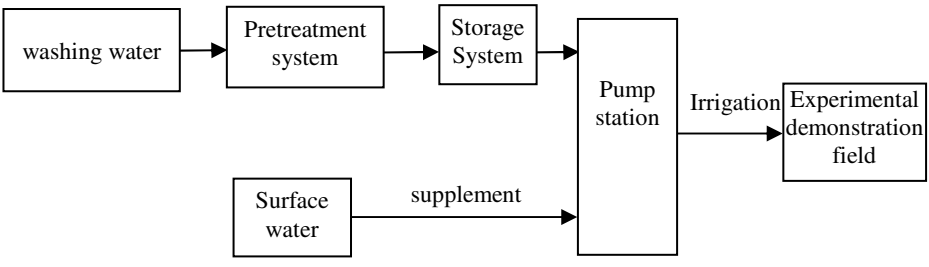


Fig. 1. Process flow diagram

3 Description and Technique Parameters

Pretreatment facilities. Pretreatment facilities, such as grill, hydraulic screen and radial-flow sedimentation tank et al., is utilized to separate and remove mud and

Table 2. Technical parameters of grill well

Parameter	Description
External dimension	6.0×3.0×5 m
Ditch width	1 m
Structural configuration	Reinforced concrete, underground
Corollary equipment	Rotary grill
Quantity	2, one is for utilization, the other is for reserve
Material	Main body is carbon steel and anti-corrosion, transmission parts are stainless steel, ABS
Model	GH-1000
Power	1.1 kw per grill

sand, sugar beet wastes in wastewater to meet the demand of follow-up storage, transportation and allocation. Technique parameters of grill well are shown in table 2.

Pre-sedimentation tank. Parameters of pre-sedimentation tank are shown in table 3.

Table 3. Technical parameters of pre-sedimentation tank

Parameter	Description
External dimension	Φ18×4.0 m
Residence time	1.8 h
Surface load	2.0 $m^3/m^2 \cdot h$
Structural configuration	Reinforced concrete, underground
Corollary equipment	Unilateral transmission suction sludge scraper
Quantity	1
Material	Carbon steel and anti-corrosion
Model	DZG-18
Power	0.75 kw per scraper
Peripheral speed	2-3 m/min

Storage/ stabilization pond. Storage pond is utilized to storage organic wastewater, which can solve storage in winter and improve water quality. During storage process, large molecular organic matter of wastewater can be biodegraded by microorganisms. Thus, it is easy for soil microorganism and plant to utilize and absorb in soil environment after irrigation. Technical parameter of stabilization pond is shown in table 4.

Table 4. Technical parameters of stabilization pond

Parameter	Description
Area	33 ha
Average depth	3 m
Effective volume	1.0×10^6 m^3

Transportation and allocation system. Wastewater storage in the pond should be allocated to the crop field according to nutrients needed by crops quantificationally and Periodically. First, water is pressured by lifting pump station, then is transported to irrigators by pipeline, and finally is allocated to crop filed by irrigators. Allocation system is the key equipment or crop filed irrigation, including 10 groups of self-moving center pivot irrigators with stable and reliable utilization effectiveness. Technical parameters of water pumping station are shown in table 5.

Table 5. Technical parameters of water pumping station

Parameter	Description
External dimension	12.5×8×6 m
Effective volume	200 m^3
Structural style	Reinforced concrete, underground
Corollary equipment	Lifting pump
Quantity	4
Meterial	Carbon steel and anti-corrosion
Model	CORNELL 8H
Power	60kw per pump
Material of main delivery pipe	PVC
Diameter of main delivery pipe	400 mm
Length of main delivery pipe	10000 m

Irrigation system. Technical parameter of center pivot are shown in table 6.

Table 6. Technical parameters of center pivot

Parameter	Description
Length	464 m
Sprinkler space	2.8 m
Flow required for irrigation	200 t/hr
Daily irrigation ratio	7.09 mm/d
Time required to walk a circle	11.8 hr
Max application rate	3 mm/circle
Power	7.4 kw/span

Soil-plant system. Soil-plant system is the key to the demonstration, including multiple purification units. According to specification of allocation equipment, purification unit is divided as circle block with the diameter of 920m, where some economic crops, such as sugar beet, wheat, corn, and potato are planted. Gradient is

Table 7. Technical parameter of land treatment system

Parameter	Description
Quantity	10
Diameter	920 m
Effective planting area	70 Ha
Total planting area	700 Ha
Design irrigation intensity	200 mm/a
Max surface gradient	< 15°
Maximum infiltration rate	0.2 cm/h
BOD load limit	3.4 t/ha
Design BOD load	2.2 t/ha
Design longevity	Sustainable use

designed according to natural terrain and flood control with the maximum of 15^{o}. Field ditch of crops extends along surface gradient as distribution and discharge equipment of rainfall. Technical parameters of land treatment system are shown in table 7.

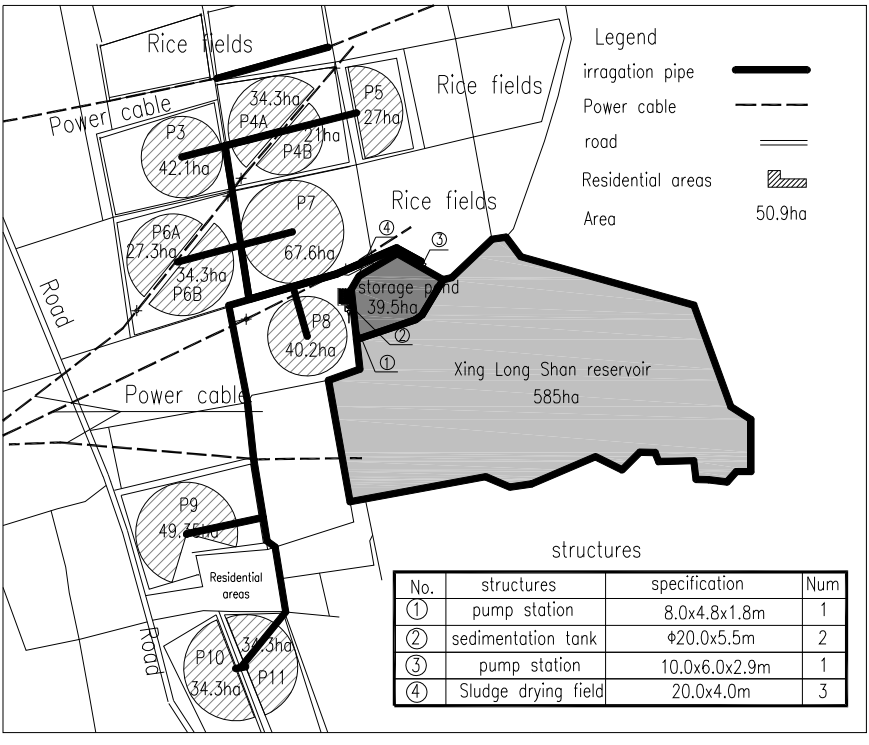
Layout of demonstration project. The layout of demonstration project is shown in fig. 2.

Construction and monitoring results of demonstration project. During the operation of demonstration project, 274500m^3 sugar beet washing water was distributed to 457.5 ha crop filed for several times evenly with average of 60mm. Construction and monitoring results of demonstration project. During the operation of demonstration project, 274500m^3 sugar beet washing water was distributed to 457.5 ha crop filed for several times evenly with average of 60mm. Monitoring results of water quality and crop yield are shown in table 8, which show that corn, beet and soybean grows well.

Table 8. Crop growth of beet washing wastewater land treatment demonstration project in 2010

No.	Crop type	Area[Ha]	Yield[kg/Ha]	Total yeild [kg]	Crop growth	Crop development
P3	Corn	39.6	9500	376200	Good	Normal
P4A	Corn	32.2	9500	305900	Good	Normal
P4B	Corn	19.8	9500	188100	Good	Normal
P5	Soybean	25.6	2200	56320	Good	Normal
P6A	Corn	25.6	9800	250880	Good	Normal
P6B	Corn	32.2	9800	315560	Good	Normal
P7	Soybean	64.5	2500	161250	Good	Normal
P8	Soybean	39.6	2550	100980	Good	Normal
P9	Beet	49.4	4600	227240	Good	Normal
P10	Corn	64.5	9950	641775	Good	Normal
P11	Corn	64.5	9950	641775	Good	Normal

Note: crop yield (reference value) of the same land in 2009 : corn = 9045 kg/Ha; beet = 4500 kg/Ha; soybean = 2430 kg/Ha.



No.	structures	specification	Num
①	pump station	8.0x4.8x1.8m	1
②	sedimentation tank	Φ20.0x5.5m	2
③	pump station	10.0x6.0x2.9m	1
④	Sludge drying field	20.0x4.0m	3

Fig. 2. Layout of demonstration project

4 Summary

Based on the results that obtained from the demonstration project, it is expected that wastewater land treatment and resource utilization can be applied to areas with modern agriculture. Thus, it is possible for enterprises to fulfill sustainable development to obtain economic benefit and environmental benefit. With the gradual deepening of low-carbon economy and recycling economy, gradual improvement of science and technology, and management level, wastewater land treatment and resource utilization will be utilized widely, which will be important part of modern agriculture combined with agriculture production and food process.

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Preliminary Discussion on Health Effects on Human and Exposure Limits of Power Frequency Electric and Magnetic Fields

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Abstract. This paper summarized the electric and magnetic fields of extremely low frequency (ELF-EMF) exposure limits in some countries or international organizations and contrast that with ICNIRP guidelines, with considering our electromagnetic environment and the conclusion of human health risk assessment by World Health Organization(WHO), analysis a number of different viewpoints, it shows that there is not a significant environmental impact on residential of ELF-EMF and the necessary for correctly understand the International Commission for Non-Ionizing Radiation Protection (ICNIRP) guidelines.

Keywords: power frequency electric, health effects, exposure limits, guidelines.

1 Introduction

Power frequency electromagnetic fields are also called electric and magnetic fields of extremely low frequency (ELF-EMF), and it is receiving growing attention in recent years because of concerns that exposure to such fields might cause or contribute to adverse health effects [1].

As the public with the growing awareness of environmental protection in recent years, more concerns exist over the possibility that exposure to ELF-EMF may present a health hazard to workers and the general public by power transmission project. However, people do not understand the characteristics of electromagnetic fields or electromagnetic waves, and always confused the high voltage power lines or substation with electromagnetic radiation, add to the misleading by various media publicized, lead the public to increasing concern about the healthy effect of ELF-EMF. Meanwhile, it was a long time before the establishment of standards about ELF-EMF in our country and the serious imbalance in public information of electromagnetic healthy conditions; bring out more environmental litigation on power transmission project. In order to resolve this matter as soon as possible, the development of relevant standards are actively promoted by our country, but in the determination methods of ELF-EMF exposure limits, it has become a focus of social

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and hot issues that choose "reasonable but lowest possible" or directly use international standards recommended by WHO.

This overview was based on the national conditions, combined with background of power transmission project ELF-EMF, considered the relevant international standard or guidelines and the health effects risk assessment conclusion were presented by the WHO "Environmental Health Criteria Program", explored the analysis of some issue, directing towards the exposure limits determination and environmental impact of ELF-EMF on residential communities, analyzed them to find a series of plans for solve outstanding environmental problems on power grid.

2 Health Effects on Human

Since Wertheimer published a study that incidence rate of childhood cancer that living nearby electrical wiring configurations, proved that more than double or twice for average children in 1979, the harm of ELF-EMF had become a hotspot recently[2]. As the public have focused on the existence on the health effects of ELF-EMF, international authoritative WHO had established "Environmental Health Criteria Program" of ELF-EMF in 1996, in order to investigate the potential risk with relevant electromagnetic technology. Recently one team of WHO summarized that the research on health effects of ELF-EMF in the last decade, this program have obtained definite conclusion about medical assessment as follow.

It is the fact that there is no public health problem arisen about ELF-EMF which the public encounter frequently. Acute biological effects have been established for exposure to ELF-EMF in the frequency range up to 100 kHz that may have adverse consequences on health, and became the foundation of the international exposure guideline.

The WHO concludes for the Long-term health effects of ELF-EMF: In general, consistent epidemiological evidence suggests that chronic low-intensity ELF magnetic field exposure is associated with an increased risk of childhood leukaemia. However, the evidence for a causal relationship is limited. For the Long-term health effects of ELF-EMF, including childhood cancers, adult cancer, melancholia, idioctonia, cardiovascular disorders, dysgenesis, suppression, immune system variation neural biological effects and neural degenerative disease, the conclusion of evaluation by WHO is the consistent epidemiological evidence for the health effects is less than for childhood leukaemia, therefore exposure limits based upon epidemiological evidence are not recommended, but some precautionary measures are warranted and the international guidelines exist that have addressed this issue. Compliance with these guidelines provides adequate protection.

The power industry and environmental protection are at a rapid period of development in our country which has become a WTO member, because of our own characteristics, so we should analyze the health effects on human and exposure limits of ELF-EMF combine with the basic situation in our country and international guidelines.

3 International Exposure Limits of ELF-EMF

Many countries in the world have their own electromagnetic field exposure limits. Some international organizations such as the European Union Commission also set up their own guidelines as the foundation for their own exposure limits. In Table 1 are the limits of occupational exposures and public exposures by ELF-EMF in some countries and international organizations (The figures in table are effective value for power frequency sine wave) excludes time limits, local exposure and field strength for special place.

Table 1. ELF-EMF exposure limits in some countries and international organizations

Organization		Time	Frequency/Hz	E/(kV·m$^{-1)}$		B/μT		Contact current /mA	
				Occupation exposure	Public exposure	Occupation exposure	Public exposure	Occupation exposure	Public exposure
ICNIRP		1988	50	10	5	500	100	1	0.5
			60	8.3	4.2	420	83	1	0.5
USA	ACGIH	2005	50/60	25	-	1000	-	-	-
	IEEE	2002	50	20	5	2710	904	1.5	0.5
European Union		2004/1999	50	10	5	500	100	1.0	0.5
UK		1993	50	12	12	1600	1600	0.5	0.5-
Japan		1976	50	3	3	-	-	-	-
Germany		1996	50	-	5	-	100	-	-
Australia		1989	50/60	10	5	500	100	-	-
China (exposure draft)		2002	50	6	4	78	22	1	0.5

International Commission on Non-ionizing Radiation Protection (ICNIRP) has published guidelines for the exposures limits of non-ionizing radiation which were recognized by many international organizations such as WHO and ILO [3]. ICNIRP proposes a concept "limitation" that is classified into "basic restrictions" and "reference levels" [4]. The limitation does not mean the security limit or detrimental limit [3]. This guideline summarized the findings of epidemiology, volunteers, cellular studies and organism studies, and consistent epidemiological evidence for a causal relationship between ELF-EMF and tumor formation is limited, so the data cannot be used as the basis of the formulation for the standards [5].

The European Commission have published the lower limit which protects workers from any material damage in 2004 [6] and the exposures limit of EMF for general public [7], many member country of European Union have accepted this standard and it have become a framework for other standards. This standard is also based on the ICNIRP guidelines and because of the main concern is the effect of ELF-EMF on central nervous system, so other body parts can be exposed to higher frequency that does not factor in carcinogenic effect of long-term exposure.

Because of the USA have no unified national standard, some academic organization and some states according to itself condition define their own standards. American Conference of Governmental Industrial Hygienistsd (ACGIH) have published assemble standards include any physical, chemical and biological exposure limits [8]. IEEE have published the exposure limits of ELF-EMF (<3kHz), this guidelines compared with others the most important characteristic is the physical quantities which used to derived this standard is E and other is J[9], try to find a more accurate value for the effects of EMF on human in the body.

National Radiological Protection Board (NRPB)[10], Australia [11]and Germany [12] are based on the ICNRP guidelines to derive their own exposure limits but the values have slightly differ. Ministry of Economy, Trade and Industry (METI) have determined the exposure limits of E near the ground and it is stricter than ICNIRP [13].

4 Discussion

4.1 "Short-Term Effect" Analysis

Many domestic experts offered that the international guidelines and standards is based on short-term healthy effects without any reasons to mislead the reader, but in fact, the guideline is derived after totally view the published literature. In the process of established guideline, all the research must be evaluated the credibility and only the impact which has been identified can be used as the foundation for developing the exposure limits. Long-term exposure to ELF-EMF is not considered have identified causal relationship with cancer, therefore, these guidelines are based on short-term immediate health effects just like the surface stimulation of peripheral nerve and muscle, shock and burns derived from touch conductors and the raise of tissue temperature due to exposure to EMF to absorb energy. For the long-term potential exposure effects, such as increased risk of cancer, although epidemiological studies want to find the carcinogenic potential of ELF-EMF, they could not provide convincing evidence and the conclusion provided by ICNIRP shows that the data is not enough to be the foundation for establishing the standards. So the viewpoint about "short-term effect" is wrong.

4.2 "Non-thermal Effect" Analysis

There is an unauthentic viewpoint that if the electromagnetic waves cannot cause the temperature rise (non-thermal effect), the ICNIRP guidelines cannot be used to derive the exposure limits. First of all, according to the WHO, health is physical, mental and social well-being, not merely the absence of disease or infirmity. "Biological effects" is a physiological response to exposure to electromagnetic fields. Some effects may be in the normal physiological range of minor reactions, and some may lead to pathological conditions, of course, some may also be beneficial to humans. The annoyance or discomfort caused by exposure to electromagnetic fields may not be pathological, but if happens, it may be make a negative effect on the fine mental and physical state, thus this effect may be consider as "health hazard". Health hazard is such a biological effect, that the health effect out of compensation mechanism in the body and it would be damage the positive state of health or body.

Though "non-thermal effect" had been researched in ICNIRP guideline, for example "The experimentation shows that high frequency electromagnetic field cannot cause cancer-promoting or deformity without heat radiation", "Non-thermal amplitude modulation EMF have so few effects on biological systems that it is difficult to associate with potential health hazards, some experts still completely deny it.

4.3 "Wide Value" Analysis

In social surveys, somebody put forward the exposure limits proposed by international guidelines and standards is too wide that it is recommended to reduce it to correspond with the state of ELF-EMF in our country. WHO have clearly claimed that "exposure limit" in the standards of ELF-EMF by the ICNIRP guidelines is founded on "damage threshold". Currently, there are not any comprehensive assessment of medical research can subvert or influence WHO "Environmental Health Criteria Program", and 100μT is "exposure limit", not "damage threshold", so it is not necessary to reduce the limits of these quantitative exposure. We should not only refer to the few "positive" case studies, or set a line to above the level of the general electromagnetic field to adjust the exposure limits of international standards which recommend by WHO. This approach not only deviated from the principle which the WHO to uphold evidence-based, but also make technology development barriers for the entire industry, transportation system and technological progress and power develop lines in the future.

5 Conclusion

Drawing on the point of authoritative international organizations and standards, indicating there is not a significant environmental impact on residential of ELF-EMF. The international standards recommended by WHO has become the choice for most countries. In view of the determination methods for ELF-EMF, the research methods and technical issues of ICNIRP guidelines, there exists a number of misconstrue we must analyze that carefully. While the environmental disputes around the power transmission project is increasing, but with our environmental laws has been constantly improved, the actively promoting public information of ELF-EMF health effect, we must gradually create the harmonious environment for both power industry and environmental erotection development.

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Controlling Indices for Low-Carbon City Based on Emission Reduction in Structure, Technology and Supervision

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Abstract. On the basis of traditional assessment indices and combining practical indices summarized from the practical experience of LCC development home and abroad, a controlling index system was build comprising three aspects such as structure emission reduction, technology emission reduction and supervision emission reduction. The indices selected in this paper are of high practical application and operation, and could provide a basis for controlling approach of reducing GHG and saving energies.

Keywords: controlling indices, low-carbon city, structure emission reduction, technology emission reduction, supervision emission reduction.

1 Introduction

Global warming has caused serious concern of the international community, and low-carbon economy (LCE) is welcomed all around the world as the most effective model of economic development. Establishment of low-carbon city (LCC) has been rising in the whole world based on the LCE theory, as the most important carrier. Meanwhile, how to assess the development of LCC has been an important topic [1]. At present, study on assessment index system of LCC has got off the ground, but differences between the systems are obvious and the coverage of the indices is limit due to the different concept and emphasis of scholars. In this paper, a controlling index system is established on the basis of organizing and summarizing of previous documents and incorporating practical experiences on LCC development home and abroad, aiming at building a controlling index system which is overall, systematic, operative and practical, in order to provide a reference for carbon emission control.

2 Practical Experiences of LCC Development Home and Abroad

Development of LCC was tentatively approached in some countries home and abroad on the basis of LCE theory. London draws up a plan of carbon reduction, utilization

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of regenerated energy, distributed energy system and so on, and establish Administration of Climate Change. The ZED community in Sutton near London realizes ZED development via energy conservation in building, rejection of oil energy utilization and low carbon traffic. Utilization of solar electrical energy generation gets mature day by day in Holland while the wind power has been fully utilized. The power capacity generated in the community not only can be self-sufficiency, but also could be conveyed to the electrified wire netting [2-3]. Berlin becomes one of the cities which has the biggest regional heat supply net achieving energy saving and GHG emission by CHP technology and striving to develop miniature power generation. In Barcelona, developments and constructions are provided to use solar collector to promote LCC development. Tokyo strives to develop energy conservation in buildings to promote efficiency of water supply by 2 times by using the waste heat of natural gas for power generation. Copenhagen, the capital of Denmark, practices wind power and biomass energy power vigorously, extends energy saving buildings, promotes preferential tax policy of low carbon energy and utilizes no emission model to achieve electric power supply [4]. Danish government plays an important role in energy saving in the past 25 years to make Denmark famous all around the world for its low carbon community. The economy growth of Denmark is 75% while the total consumption remains unchanged. Its gravity of regenerated energy in total electric power is up to 30%, and 20% of it is from wind power [5].USA invests US$2.2 billion in innovation and development of clear coal technique, and establishes "Clear Coal Electric Power Generation Project" to support government and enterprise to establish clear coal power plant all along [6].

In the year 2006, Baoding proposed the conception of "Chinese Electricity Valley", including six industries such as photovoltaic (PV), wind power, transmissions and substations, energy saving and power automation. The new energy enterprises here increase rapidly, and industry added value accounts for 10.6% of the whole city [7]. At the beginning of the year 2008, WWF and Ministry of Construction took Baoding in and Shanghai as trials carrying out LCC development demonstration projects, and LCC establishment developed vigorously among cities in China from then on [8]. Shanghai promotes the application of energy saving buildings vigorously, and Chongming eastern tidal in Shanghai is expected to be the second no emission region by building wetland park, eco-agriculture zone [9]. Hangzhou puts more focus on urban transport via proposing program of urban traffic week, and advances the concept of "low carbon economy-low carbon building - low carbon traffic - low carbon lifestyle - low carbon environment-low carbon society" to establish an ideal LCC [10].

3 Establishment of LCC Controlling Index System

3.1 Establishment Principles

The controlling indices play a vital role in measuring the level of LCC development and promoting GHG reduction. In this paper, the controlling index system was built acting up to the following principles [11-13]: scientificity and praticability, unity of multi-levels, pertinence and comparability, dynamics and stability.

Controlling index system should reflect the connotation and essence of LCC scientifically and precisely, and select corresponding indices according to the level of difficulty. Numerous factors should be reckoned with during the construction and development of LCC. Besides, many subsystems constituted the evaluation system, so varies indices should be chose for different subsystems. The ones extract from indices impacting LCC should be able to reflect the principal aspect and characteristics, and also be comparable to show representative and catholicness at the same time. Due to the dynamic characteristic of development of LCC, selection of index system should possess dynamics for reflecting dynamic change of LCC. Synchronously, the indices should have stability in a certain period for analyzing the trend of development.

3.2 Controlling Index System of LCC

On the basis of establishment principles and involving practical indices such as regenerated energy, green traffic, green building, combined heat and power generation (CHP) and so on, the controlling index system concludes includes 3 second-grade indices and 24 third-grade indices under the first-grade of controlling index system of LCC development. As shown in Table 1.

3.3 Index Introduction

This article selected indices which are comprehensive and practical, and the account for the typical indices are as follows.

Gravity of Regenerated Energy: Energy is the impetus and input terminal of urban development, and transformation of energy type from the headstream is the most basic and efficient way to promote LCC accordingly.

Oil Energy Efficiency: In the year 2010, the total consumption of energy in our country is 3.26 billion SCE, and the proportions of nuclear power, wind power, water power and solar energy are low, so oil energy is still the principle source of energy use. Consequently, enrichment of oil energy utilization is the key role for realizing low carbon development.

Spreading Extent of CHP: CHP (combined heat and power generation) means the power plant realizing heat supply to customers by steam working while generating power. CHP has no heat loss, can reduce coal consumption, and rise productivity greatly up to 85% further enhance labor productivity.

Clean Energy Traffic: The expansion of urban results in increase of traffic distance while the transportation of the certain area is not perfect or lag, leading to huge demand of private car and ever-rising of carbon emission. It is inevitable and necessary for practicing green traffic, improving operating efficiency of public traffic and promoting popularization of clean energy private car, clean energy bus and clean energy taxi.

Low Carbon Building: Indices such as proportion of buildings having thermal barrier, plantation of wall and roof, utilization rate of solid brick in architecture and shadow rate of buildings are selected based on the practical experiences of LCC development home and abroad. Proportion of buildings having thermal barrier and shadow rate of buildings not only can comfort living environment, but also can reduce the energy consumption efficiently. Hollow bricks hold enormous advantage

Table 1. Controlling Index System of Low-carbon City

Target Layer	Rules Layer	Indicator Layer
Controlling Indices of Low-carbon City	Structure Emission Reduction	Gravity of Regenerated Energy
		Proportion of Clean Energy Bus
		Proportion of Clean Energy Private Car
		Proportion of Clean Energy Taxi
		Coverage Rate of Energy Saving Equipment
		Shadow Rate of Buildings
		Proportion of Buildings Having Thermal Barrier
		Gravity of Green Packing
		Gravity of Energy Saving and Transformation in Scenic Spot
		Reconstruct Rate of Commercial Center
	Technology Emission Reduction	Application Rate of Carbon Capture Technology
		Utilization Ratio of Oil Energy
		Operating Efficiency of Public Traffic
		Resource Utilization of Rubbish
		Utilization of Solid Waste in Industry
		Utilization of Building Waste in Industry
		Plantation of Wall and Roof
		Utilization Rate of Solid Brick in Architecture
		Spreading Extent of CHP
		Integrated Application of Technologies
	Supervision Emission Reduction	Supervision on Energy Conservation in Industry Department
		Supervision on Popularize of Tax Preference Policy
		Spreading Extent of Low-carbon Consumption
		Cooperation between Government and Enterprise

comparing with solid bricks at many points such as compressive strength, heat-resistant, sound insulation, moisture resistance, fireretardancy and corrosion resistance. Thus to develop utilization of hollow bricks instead of solid bricks energetically is efficient to propel the green building forward.

Application Rate of Carbon Capture Technology: The difference between low carbon revolution and industrial revolution is that low carbon revolution has no core technology for support but a passive revolution taking emission reduction as rigid restraint. Nowadays, it is innovation in traditional technology and extensive use of it that can promote energy saving and emission reduction widely.

Spreading Extent of Low-carbon Consumption: At the present time, the research and development of low carbon technology is still relatively low than overseas. As the core of LCC, low carbon technology has seriously impede the development of low carbon city and low carbon economy, for the import and transfer of low carbon technology which has higher efficiency from overseas is very difficult.

Integrated Application of Technologies: It is of importance and efficiency for innovation of low carbon technology to realize integrated application and combination of technologies instead of focusing on a certain technique.

Cooperation between Government and Enterprise: Establishment of LCC could not only rely on innovation and development of low carbon technique, nor could simply depend on government or enterprise, but should rely upon the cooperation of various sources to realize LCC more systematically and efficiently.

4 Summary

On the basis of traditional evaluation index system of LCC from precedent achievements related and selecting indices summarized from practical experiences home and abroad, the article established a controlling index system from structure emission reduction, technology emission reduction and supervision emission reduction, including indices such as gravity of regenerated energy, oil energy efficiency, spreading extent of CHP, clean energy traffic, low carbon building, application rate of carbon capture technology, spreading extent of low-carbon consumption, integrated application of technologies and cooperation between government and enterprise. It is the first time to establish a controlling index system in such a point of view, hoping to fill the gap in this field and provide a basis for promoting LCC development more efficiently and practically.

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Analysis on the Effectiveness of Public Participation for EIA in the Power Transmission and Transformation Project

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Abstract. The current of public participation for environmental impact assessment in the power transmission and transformation project was investigated to find out problems existing in the public participation. Suggestions are put forward such as formulating laws or regulations, improving the transparency of information and increasing the effectiveness for public participation. Efficiency management model of public participation in EIA was applied in the power transmission and transformation project. The main body, time, ways and effects of the public participation for EIA in the power transmission and transformation were analysis.

Keywords: power transmission and transformation, environment impact assessment, public participation, effective management model.

1 Introduction

The electromagnetic pollution problems caused by high voltage power transmission and transformation (PTT) facilities got more and more attention from domestic and foreign media. Whether the electromagnetic field produced by PTT facilities will affect our daily life has become the focus of the public. That is why the transformer substation or high-voltage transmission line construction is usually opposed by the residents near residential area [1, 2]. It has proven that many disputes about the PTT project relate to public participation [3]. Obviously, public participation plays an important role in the PTT project in environmental impact assessment.

When the PTT system transmitted high voltage, power frequency magnetic field, power frequency electric filed and radio interference will appear around the lines and transformer substation [4]. These cases have detrimental influence upon the people lives [5]. In our country, environmental impact assessment in the PTT project mainly aims at influence factors, including noise, power frequency electromagnetic field, radio interference, ecological environment and so on [6, 7].

The paper investigated current of public participation in PTT of environmental impact assessment in our country, to find out the problems existing in the public participation and put forward relevant suggestions and measures. According to the efficiency management model (EMM) of public participation in EIA, we studied the public participation in PTT project briefly.

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2 Public Participation in PTT of EIA in China

2.1 Public Participation in EIA in China

The public participation in EIA means the public have the rights to participate in all decision activities related environmental interests through certain legal approaches and procedures, including making documents, review and monitoring of EIA. The purpose is to make the public get information about the project and accept it, which could improve the project both in social benefits and environmental benefits [8]. Meanwhile, the public can maintain their lawful rights and interests by participation [9]. The measure of environmental impact assessment public participation in the interim is proclaimed in 2006, which a milestone that environmental impact assessment of public participation [10].

2.2 Public Participation in the PTT of EIA

The public participation in the PTT project of environmental impact assessment is consistent with other construction projects. The construction units or authorized organizations survey the public opinions by ways of doing the questionnaire to local residents, posting notices in residential area and reporting through media. And those works must be finished when the environmental impact statement is drawn up. It is the most commonly used methods for the project to visit local residents and do questionnaires so seek public comment [5, 10].

3 Problems Existed in Public Participation in EIA of PTT

In the construction of PTT project in the EIA, the public often can't participate in project effectively and existed many problems.

3.1 Lack of a Sound Law System

At present, there is no law related to public participation in our country, just some regulations and measures in departments. “500kv EHV Transmission and Distribution Project Environmental Impact Assessment of Electromagnetic Radiation Technical Specifications” (H/T24-1998) is taken as the solution to the standard of the electromagnetic radiation. But the number of law and regulation related to the EIA are less, especially are lack of the regulations about the part of public participation.

3.2 Information Asymmetry

Because of the different cultural degree, people are lack of related law and regulations about EIA. The public can’t gain enough basic information about the project. Sometimes, the government, the construction unit or the EIA institution will not open or open incompletely the basic material [5]. The inclusive information has confused the power-frequency electric field and power-frequency magnetic field produced by high frequency electromagnetic radiation or the project of PTT, and caused people misunderstanding [11]. This lead to some PTT projects being boycotted by local public, making the project cannot be implemented smoothly.

3.3 Low Effectiveness

(1) The public participation main body is delimited unclearly. (2) Public participation in time lag. (3) Public participation form simplification.

For the problems of China's power transmission project for Public Participation in EIA. Suggestions are put forward such as formulating laws or regulations, improving the transparency of information. And we try to improve the effectiveness by using EMM of public participation for EIA in the PTT project.

4 EMM of Public Participation in EIA of the PTT Project

EMM of public participation in EIA provided decision support to managers to improve public participation in environmental impact assessment [12]. On account of the corresponding legislations of China's "Environmental Impact Assessment Law", "Interim Measures for Public Participation in Environmental Impact Assessment" and "500kv EHV Transmission and Distribution Project Environmental Impact Assessment of Electromagnetic Radiation Technical Specifications", the components of the EMM, which include the main body, domain, approaches and impression of public participation, were analysis.

4.1 EMM of Public Participation in EIA

The main body, intervention time, approaches of public participation should be determined immediately while the final decision of the project was laid down. The EIA practitioners need to keep balance between the public comments and feedbacks and the specific circumstances of the project, thus come to a satisfactory implementation of specific programs [12].

4.2 Main Body of Public Participation

The masses participated in the environmental impact assessment for the transmission and distribution project, including the masses affected by the projects, professionals, government departments and the members of society or organizations who interested in the projects.

We designated the people who lived within the scope of influence as the main body of public participation. According to the frequency electric field, frequency magnetic fields, radio interference and noise factor in the transmission and distribution project, the investigation area should be designated, and the main body of public participation could be determined. Transmission and distribution project impact factor survey (500kv.e.g.) is shown in Table 1.

We choose the people who lived in the area with radius of 2000m from the substation as the main body of the public participation. The people who influenced by all the factors, including power frequency electric field, power frequency magnetic field, radio and noise, should be investigated peculiarly.

Table 1. The impact factor of the PTT project

Project	Survey factor	Survey scope
Transformer substation	Power frequency electromagnetic field	Area with the radius of 500m from the substation
	Radio interference	Area with the radius of 2000m from the substation
	Noise	sensitive areas cover 1m outside the substation to 200m perimeter
Transmission line	Power frequency electromagnetic field	30m strip on both sides of transmission line corridor area
	Radio interference	50m strip on both sides of transmission line corridor area
	Noise	30m strip on both sides of transmission line corridor area

4.3 Intervention Time

Power Transmission Project impact assessment procedures: (1) Research the national legal documents and documents related to the project. (2) The valuation factors such as power frequency electric field, radio interference, water, gas, noise filtering should be chosen out for EIA. (3) The scale of transmission and distribution projects should be determined. The energy and resource used in the construction and the environmental characteristics of the area where the project construction should be surveyed carefully, thus the level of environmental impact assessment should be determined. (4) Through the analysis of the transmission project and the investigation of the environmental status, the practitioners try to predict the scope, time, content of the EIA. (5) Evaluation the environmental impact scope, extent and nature of the power transmission project. (6) Draw the conclusion that if the power transmission projects hold environmental feasibility. (7) Submit the measures for the transmission construction project to mitigate the environmental impact. (8) The environmental impact assessment should be complete.

Base on EMM of public participation in EIA, Chen has got the result that the stage that the public want to participate in, which are shown in Figure 1.

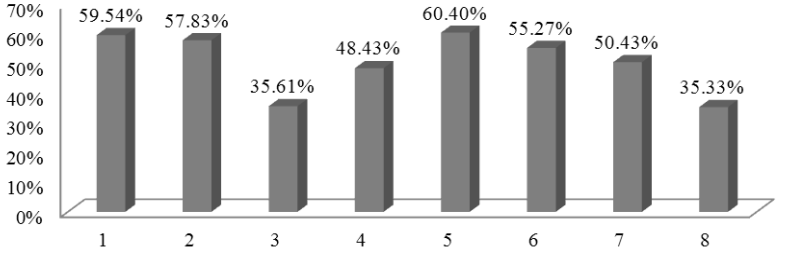

Fig. 1. The stage that the public want to participate

More public hope to take part in environmental impact assessment process, and is mainly involved in the program (1), (2), (4), (5), (6) and (7). Begin of these programs can be chosen as the involved time for public participation. The public participated in EIA to the power transmission project comprehensively can get a thorough understanding of the construction projects and give more constructive and targeted suggestions. When the project was at the stage of completion acceptance, the public should also participate in, examination and supervision, the power transmission project to ensure that the environmental impact mitigation measures can be implemented effectively.

4.4 Public Participation Form

In Power Transmission Project Environmental Impact Assessment, the common approach is to use public participation survey form. For the transmission construction project, which demands high public acceptance, and we choose the approaches public accepted. According to Chen [12], 32.57% of the public will participate in EIA regardless of the time and way. 46.57% of the public are willing choose the form of questionnaire and 37.43% are willing to participate in the forum or demonstration. Only 28.86% want to participate in the hearing. The results show that more people hope to participate in the EIA through the simple approach as the questionnaire. Considering the information of the power transmission project is inadequate, we adopt the form that combined forum with the questionnaire, which allows the public to learn more information about project and power frequency electromagnetic fields, radio interference and other factors affect the scope of the investigation.

4.5 Public Participation Effects

Decision-making model was determined, through evaluation of the effects of public participation, to test the effectiveness of management decision-making. The public support comprehensive index was applied in environmental impact assessment to express the results of public participation, and then test whether decisions taken by the management requirements the initial decision-making [13].

5 Outlook

This qualitative assessment of the environmental impact of effective decision-making model is applied to power transmission projects, and the subject of public participation, time, channel and interactive relationship between them can be further studied.

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Linking Perceived Value, Customer Satisfaction, and Purchase Intention in E-Commerce Settings

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Abstract. With the expanding of information technology, e-commerce is becoming more and more important for enterprises to obtain competitive advantage. This paper sheds light on the consumer behavior of online shopping and specifically investigates the relationships between perceived value, customer satisfaction, and purchase intention in e-commerce. By using survey data from college students, we apply the structural equation modeling technique to analyze the relationships among the variables. The findings indicate that perceived value significantly influences customer satisfaction. Additionally, perceived value, and customer satisfaction are significant predictors of customer purchase intention. Meanwhile, the findings also provide evidence that customer satisfaction plays a partial mediating role in the relationship between perceived value and purchase intention. Finally, this paper discusses the implications and highlights some future research directions.

Keywords: perceived value, customer satisfaction, purchase intention, e-commerce.

1 Introduction

Interest in behavioral intentions of customers has grown dramatically in the last decade, as more researchers and practitioners have become aware of the value of customer loyalty. Considerable studies have focused on service quality and customer satisfaction as the significant determinants of purchase intention [1]. In recent years it has been recognized that consumer behavior is better understood when analyzed through perceived value [2]. To date, most existing empirical research on customer perceived value and its consequences is based on traditional service [3]. Hence, further empirical studies and conceptualization of perceived value, especially in e-commerce, are needed.

This paper aims to develop a relationship model that incorporates perceived value, customer satisfaction, and purchase intention in e-commerce. Specifically, the objective were (1) to investigate the impact of perceived value on purchase intention; and (2) to test the mediating effect of customer satisfaction in the relationship between perceived value and purchase intention.

The rest of the paper is structured in four parts. The first section provides the theoretical background and sets out the research hypotheses. The second section explains the research method and the next section explains the data analysis carried out. Finally, the results, managerial implications, and some possible future research directions are discussed.

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2 Theoretical Background and Hypotheses

2.1 Theoretical Background

Perceived value is the consumer's overall assessment of the utility of a product (or service) based on perceptions of what is received and what is given [4]. In recent years, perceived value has been emphasized by the researchers of information technology field and the findings indicated that customer perceived value is crucial in attracting and retailing customers [5]. Despite the interest is increasing, empirical operationalization of perceived value remains unsettled. We believe that the investigation of consumer-perceived value and its consequences may be particularly interesting in e-commerce settings.

Satisfaction is the summary psychological state. Customer satisfaction can be defined as the customers' evaluation of a product or service in terms of whether that product or service has met their needs and expectations [6]. Purchase intention represents the possibility that consumers will plan or be willing to purchase a certain product or service in the future [7]. It is important to understand customers' purchase intentions because customers' behavior can usually be predicted by their intention [8]. Online purchase intention, an important predictor of actual buying behavior, refers to an outcome of criteria assessment of consumers regarding website quality, information search, and product evaluation [9, 10].

2.2 Research Hypotheses

Customer value impacts customer loyalty and is the driving force behind customer attraction, retention, and repurchase [11]. Some research findings suggested that behavioral intentions and commitment were significantly influenced by customer perceived value [3]. Wang et al. (2004) which focused on China's telecom industry also indicated that perceived value has a positive effect on purchase intention [12, 13]. Lin and Wang (2006) revealed that customer satisfaction of mobile commerce is consumer's total response to the purchase experiences [13, 14]. Increasing customers' satisfaction with website information through high quality product provisions has a significant positive influence on customers' intention to make a reservation online [15]. Based on the above analysis, hypotheses are formulated as follows:

H1. Perceived value has a direct and positive effect on customer satisfaction in e-commerce settings.

H2. Perceived value has a direct and positive effect on purchase intention in e-commerce settings.

H3. Customer satisfaction has a direct and positive effect on purchase intention in e-commerce settings.

On the basis of the above discussion, a research model of the relationship among the mentioned variables is proposed which is illustrated in Fig. 1.

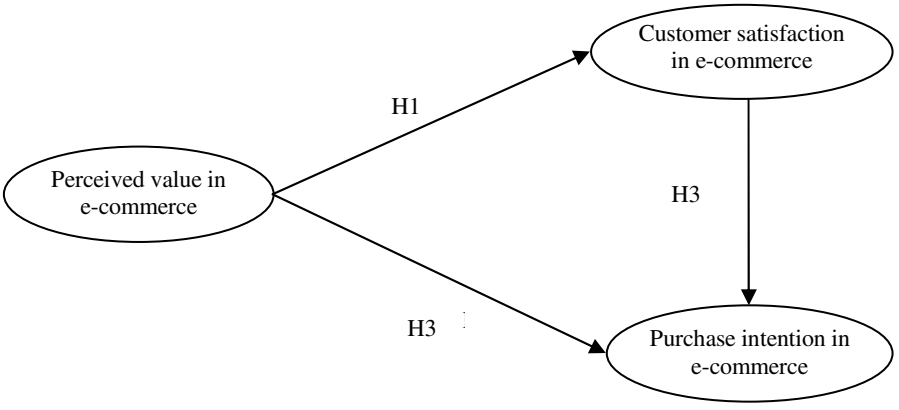

Fig. 1. Proposed Conceptual Model

3 Research Methodology

3.1 Data Collection

The college students were selected as samples in this study. A total of 300 questionnaires were distributed to college students from three universities in Nanchang, China. The survey contained measures of perceived value, customer satisfaction and purchase intention. All responses were assessed on seven-point Likert scales ranging from 1 (strongly disagree) to 7 (strongly agree). Totally 156 questionnaires were recovered, including 113 valid questionnaires. The ratio of questionnaire recovery is 52% and that of valid questionnaires is 37.7%.

3.2 Statistic Methods

Each variable was measured with three items adapted from previous studies. Analysis reveals an acceptable internal consistency for these three constructs (perceived value: alpha=0.753; customer satisfaction: alpha=0.856; purchase intention: alpha=0.729). Confirmatory factor analysis (CFA) was conducted to test the validity of the measurement model, and the structural model was also analyzed to examine the associations hypothesized in the research model.

4 The Empirical Study

4.1 Measurement Model

The measurement model fit is assessed by a CFA, with the results shown in Table 1. The chi-square statistic (χ^2=33.78, *d.f.*=24) is nonsignificant, in addition, the ratio of the chi-square value to degrees of freedom ($\chi 2/d.f.$=1.41) is less than 3. Other fit indices, namely, *GFI* (0.94), *AGFI* (0.90), *CFI* (0.99), *NFI* (0.97), *NNFI* (0.98), and *RMR* (0.040), exceed their respective acceptance levels. Therefore, the measurement

model has a good fit with the data. *T-values* for all the standardized factor loadings of items are found to be significant (p<0.05), and all loadings are larger than 0.5, assuring item reliability (see Table 1). The average variances extracted (*AVE*) of all constructs range from 0.50 to 0.69, above the cut-off value of 0.5, indicating all constructs are satisfactory. The convergent validity of the measurement model appears to be adequate.

Table 1. CFA for the Measurement Model

Constructs and items	Loading	*T-value*	*AVE*
PV (Perceived value)			
PV1	0.70		0.53
PV2	0.70	6.53	
PV3	0.78	7.17	
CS (Customer satisfaction)			
CS1	0.71		0.69
CS2	0.88	8.79	
CS3	0.89	8.84	
PI (Purchase Intention)			
PI1	0.59		0.50
PI2	0.82	6.16	
PI3	0.69	5.57	

4.2 Structural Model

Structural model is used to test the predictive relationships between constructs of the proposed conceptual model. Fig.2 presents the structural model results. As hypothesized, the relationship between perceived value and customer satisfaction was statistically significant ($\gamma_{11} = 0.76$, $p < 0.01$), thus supporting *H1*. As anticipated,

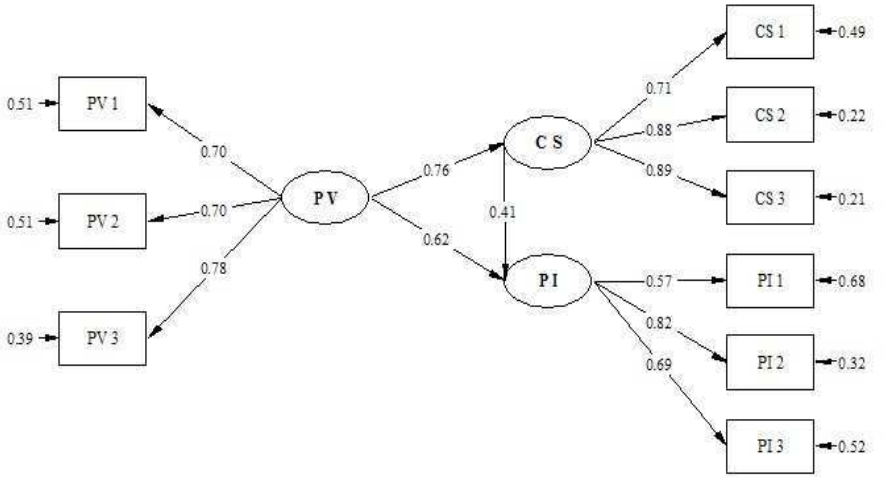

Fig. 2. Results of Structural Equation Modeling

a positive relation between perceived value and purchase intention was significant ($\gamma_{21} = 0.62$, $p < 0.01$). Perceived value has direct effect on purchase intention, thus supporting *H2*. Customer satisfaction was found to have indirect effects on purchase intention ($\beta_{21} = 0.41$, $p < 0.01$), thus supporting *H3*. Additionally, the mediating effect of customer satisfaction in the relationship between perceived value and purchase intention was also found to be significant ($\gamma_{11} * \beta_{21} = 0.31$, $p < 0.01$). The results indicate that perceived value has a strong impact on purchase intention.

5 Conclusion and Discussion

This study proposes and tests a comprehensive model that explicitly articulates the relationships among perceived value, customer satisfaction and purchase intention in e-commerce settings. Firstly, the results indicate that the relationship between perceived value and purchase intention is significant and positive, which indicated that perceived value is a key strategic resource to purchase intention. Secondly, the results show that perceived value will affect customer satisfaction positively. Thirdly, the results indicate that there is sufficient evidence to support a relationship between customer satisfaction and purchase intention. Thus, customer satisfaction plays a partial mediating role in the relationship between perceived value and purchase intention.

The implications of this study are two-fold. First, results indicate that perceived value does not operate in isolation from other sources of advantage and emphasize the need to examine mechanisms by which perceived value contributes to purchase intention. Second, we can affirm that the interrelationship between perceived value and customer satisfaction has been recognized as one of the key drivers of purchase intention in e-commerce settings. Two main limitations of this research should be mentioned. First, empirical samples used in this study mainly came from college students in China and are non-randomly selected, so research data will inevitably be restrained. More types of customers should be studied to further test the views and conclusions presented in this study. Second, the moderating effect of contingency variables on the relationship between perceived value and purchase intention is a key target for future studies, which has significant implication for firms to allocate resources and efforts to retain customers.

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Empirical Analysis of Chinese Construction of Environment Friendly Society

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Abstract. While Chinese rapid economic development, the environmental problem become apparent. It is inevitable choice of building environment-friendly society. Using the status indicators、pressure indicators and response indicators, we establish the evaluation system of environment-friendly society which suit the situation of China. Through the method of principal components, it evaluate current situation and future trends of economic development based on the evaluation system. Finally, it try to provide a reliable policies to protect the resources and build the environment-friendly society.

Keywords: environment friendly society, evaluation system, principal components analysis.

1 Target of Evaluation System

The sustainable development of economic is a huge systematic project, on the one hand requires us to make viable options and put into action, on the other hand requires to evaluate the level of development under the program, track and monitor the process of implementation of strategy, as important parameters of evaluation in economic and social development. Therefore, the evaluation rating system should have the following objectives: (1) evaluate the current operation of economic system (2) monitor trends of economic system state (3) evaluate the environmental potential in the development of economic system (4) provide the basis to optimize capacity of sustainable development in economic.

2 Construction of the Evaluation System

In accordance with the objectives of the evaluation system, the article according to method which is commonly used, establishes three level indicators: state indicators, pressure indicators and response indicators. Due to the difficulty of data collection, we can only use existing statistical data and statistics which is easy to collect to set, adopt 20 secondary indicators constructing evaluation system, in Table 1.

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Table 1. Evaluation of Capacity of Economic Sustainable Development

Level Indicators	Secondary Indicators	Variables	Secondary Indicators	Variables
Status Indicators	Per Capita GDP	x1	Unit GDP energy consumption(Standard Coal)	X5
	Average Wage	x2	Total energy consumption(Standard Coal)	X6
	Registered urban unemployment rate	x3	Total energy production(Standard Coal)	X7
	Tertiary industry of total GDP	x4		
Pressure Indicators	The total discharge of industrial wastewater	x8	Industrial soot emissions	x11
	The emissions of industrial waste gas	x9	Industrial dust emissions	x12
	Industrial solid waste emissions	x10	Sulfur dioxide emissions from industry	x13
Response Indicators	Industrial wastewater discharge standards	x14	Comprehensive utilization of industrial solid waste	x18
	Industrial soot removed	x15	The output value of comprehensive utilization of waste products	x19
	Industrial dust removed	x16	The investment of industrial pollution control	x20
	Industrial sulfur dioxide removed	x17		

3 Principal Components Analysis of Construction of Environment-Friendly Society

3.1 Standardized Method

Based on the evaluation system of table 1, quoting the data in statistical yearbook of China, we build an information matrix X. We make the data of matrix X standardized, uniform dimension among the indicators and make it comparable. Standardized method

is: $Z_{ij} = \frac{x_{ij} - x_j}{S}$, $(i = 1,2,...,n; j = 1,2,...p)$, $\bar{x}_j = \sum_{i=1}^{n} x_{ij} / n$,

$S_j^2 = \sum_{i=1}^{n} \left(x_{ij} - \bar{x}_j\right)^2 / (n-1)$, gain a standardized matrix Z, data omit.

3.2 Correlation Among Indicators

Determining method: calculate correlation coefficient r_{ij} among P indicators with standardized data $r_{ij} = \frac{\sum_{k=1}^{n} Z_{ki} Z_{kj}}{n-1}$ $(i, j = 1,2,..., p)$ .Making use of standardized data, we can obtain the correlation coefficient matrix R, get that there is a certain correlation among all indicators, so there is an overlap between the information reflected, can be used principal components analysis.

3.3 Characteristic Values, Contribution Rates and Cumulative Contribution Rate

Determining method: solve P eigenvalues of Z $\lambda_1 \geq \lambda_2 \geq ... \geq \lambda_p \geq 0$. Eigenvalue λ_k corresponding with eigenvector is $L_K^T = (L_{K1}, L_{K2},..., L_{KP})$ $(K = 1,2,..., p)$, data omit.

3.4 Principal Components Analysis

As eigenvalues of the first and second principal components greater than 1, named PC1 and PC2, and the cumulative contribution rate reached 94.3%, which included information of two components accounted for 94.3% of total information contained in the original variables, the remaining 18 components have little effect on variance, so the first and second components can be extracted as principal components. And we can get principal components matrix of original variables, see table 2.

Table 2. Principal Component Matrix

Variable	Y1	Y11	Y12	Y13	Y14	Y15	Y16	Y17	Y18	Y19
PC 1	0.24	-0.17	-0.23	0.14	0.22	0.245	0.20	0.23	0.24	0.24
PC 2	-0.06	0.45	0.14	0.50	0.27	-0.03	0.02	-0.14	-0.05	-0.04
Variable	Y10	Y2	Y20	Y3	Y4	Y5	Y6	Y7	Y8	Y9
PC 1	0.24	0.24	0.21	0.17	0.17	0.23	0.24	0.24	0.20	0.24
PC 2	-0.01	-0.07	0.27	0.06	-0.39	-0.19	0.09	0.08	0.34	0.01

From table 2, principal component 1 has load factor of larger absolute value in per capita GDP Y1, average wage Y2, total energy consumption Y6, electricity consumption Y7, industrial gas waste emissions Y9, Sulfur dioxide emissions from industry Y10, Comprehensive utilization of industrial solid waste Y18 and comprehensive utilization of industrial solid waste Y20. And it includes all three level indicators, comprehensively reflects economy of Chinese economy, energy consumption, polluted emissions, environmental protection and other aspects of integrated development. Therefore, PC1 cloud look as composite indicators of evaluation of environment-friendly society.

Principal component 2 has load factor of larger absolute value in Tertiary industry of total GDP Y4, total discharge of industrial wastewater Y8, industrial soot emissions Y11 and Sulfur dioxide emissions from industry Y13, three secondary indicators are all pressure indexes, showing that principal component 2 reflects the resources and environmental pressures of China.

3.5 Principal Components Scores

Utilizing principal component eigenvectors and standardized data, to calculate the scores of each principal component, the formula is: $Fi= a1iX11+ a2iX21+\ldots\ldots+ apiXp1$, see table 3.

Table 3. Principal Component Scores

	2001	2002	2003	2004	2005	2006	2007	2008	2009
PC1	-5.34	-4.21	-3.41	-1.78	-0.34	1.13	3.14	4.82	6.00
PC2	-1.10	-1.53	-0.36	0.76	2.48	1.74	0.68	-0.47	-2.21

From table 3, increasing trends in the scores of the PC1, comprehensive description of environment-friendly society in China situation gradually improved.

PC2 score showing first growth, decreased to peak in 2005 and later go down in 2009, Chinese environment-friendly society construction in terms of resources and the environment have greater difficulties.

3.6 Comprehensive Evaluated Index and Ranking

To the variance contribution rate of each principal component as weight, we can calculate weighted averaged number of each principal component, and attain composite scores that reflect capacity of Chinese environment-friendly society, the formula is: $Z = (\Sigma PCSi \times VCi) / CVCa$, which PCSi means principal components scores of i, VCi means variance contribution of i, CVCa means cumulative variance contribution of all principal components. That choosing two components PC1 and PC2, and to its variance contribution 82.39% and 11.94% as weight constructing comprehensive evaluation function as follows: $Z = (0.8236\times PC1+0.1194\times PC2)/0.943$. The information of principal component scores, composite scores, ranking of composite scores and growth rate is in table 4.

Table 4. Composite Scores and Its Ranking

	2001	2002	2003	2004	2005	2006	2007	2008	2009
PC1	-5.34	-4.21	-3.41	-1.78	-0.34	1.13	3.14	4.82	6.00
pc1	0	1.13	0.80	1.63	1.44	1.48	2.00	1.68	1.18
PC2	-1.10	-1.53	-0.36	0.76	2.48	1.74	0.68	-0.47	-2.21
pc2	0	-0.42	1.17	1.13	1.72	-0.74	-1.05	-1.15	-1.73
Composite score	-90.76	-70.96	-57.08	-27.53	0.31	22.92	53.36	78.27	93.61
Composite score	0	19.79	13.87	29.55	27.85	22.60	30.43	24.90	15.34
Composite score rankings	1	2	3	4	5	6	7	8	9

4 Summary

Firstly, PC1 contains all three level 8 secondary indexes in first indexes, contribution rate up to 82.36%. It is building a comprehensive embodiment of environment-friendly society. From Table 4: first, the score of PC1 from 2001-2009 increases year by year; second, PC1 score increases, respectively in 2004 and 2007 reached the crest, but slowed down growth this year. It means China in the economic, energy consumption, pollutant emissions and environmental aspects of integrated development look good, but the trend of slower growth.

Sencondly, PC2 includes 4 secondary indexes, one for the status indicator, the other three for pressure indicators, variance contribution rate of 11.94%. From table 4: first, we can find from 2001-2005 the PC2 is rising, but 2005-2009 it down to the bottom; the second, the increase of PC2 means Chinese environmental pressure always huge, shortage of resources and environmental pollution.

Thirdly, Composite scores: first, composite scores increased year after year and in 2009 reached peak; second, growth rate between 15% to 20%, it means Chinese ability on development of environment-friendly society rising, but there are signs of slow down.

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Construction of Liaoning Green Consumption Pattern to Develop Low-Carbon Economy

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Abstract. Green consumption in real terms fully consistent with the concept of low-carbon economy. It is the concrete form of low-carbon economy in the area of consumer and low-carbon economy development of inner motivation. Developing green consumption pattern in Liaoning province is divided into three levels: governments, businesses and residents. Building green consumption is not only necessary, but also beneficial.

Keywords: Low-carbon Economy, Green Consumption, Consumption Patterns.

1 Introduction

Low-carbon economy, means under the guidance of the concept of sustainable development through technology and innovation, system innovation, industrial restructuring, development of new energy and other means, minimize coal oil, and high-carbon and energy consumption, reduce greenhouse gas emissions to achieve economic and social development and ecological environment protection of an economic win-win development.

2 Consumption Patterns Based on Low-Carbon Economy: Green Consumption

Green consumption, including content is very broad, including not only green products, also includes the recycling of materials, the effective use of energy, environment and protection of species, can be said to cover all aspects of production, consumption behaviour. It mainly refers to: consumption in the community, not only to meet the consumption demand of our generation, health and safety, but also to meet the consumer demand and security of our children and future generations.

This shows that green consumption in real terms fully consistent with the concept of low-carbon economy, it called on the people's consumption activities must be conducive to environmental protection, resource use and improving the overall quality of people, agreed by scholars at home and abroad is the concrete form of low-carbon

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economy in the area of consumer and low-carbon economy development of inner motivation, is a new consumption patterns based on low-carbon economy.

Developing green consumption pattern in Liaoning province is divided into three levels: Governments, businesses and residents. Government consumption is consumption for government procurement, enterprise performance for enterprise production, consumption is reflected in the daily consumption. Following, we disguss on these three expositions.

3 Construction of Government Green Consumption Pattern

3.1 Necessity and Meaning of Green Procurement

China as a developing country, admittedly, its late popularization of green consumption in China, green consumer awareness weaker, it is difficult to quickly developing green consumption pattern. So, first of all, it requires government departments to promote green consumption concept formation and behavior of consumers in mature, starting from their own, within the Government and implementing green consumption pattern, for the whole society to lead by example, so as to promote the development of low-carbon economy.

3.2 Analysis of the Benefits of Green Procurement

Government green procurement of features can general for four a aspects: first, government procurement has stability and full of funds, thus can guarantee procurement activities smoothly; second, government procurement general for concentrated procurement, demand large, demand stability sexual strong, easy supplier provides continued, and stability of service; third, government procurement has strong of planned and must of mandatory, for supplier provides has stability of market expected and potential of transformation power; forth, government procurement has standard, therefore once procurement standard clear and information smooth, supply chamber of commerce provides reached green "threshold" of products, will helps promote green industry market formation.

3.3 Promotion of Liaoning Provincial Government Green Purchase Suggestion

(1) Building government green procurement law system

Mandatory through legislation or on encouraging government green procurement is an international common practice, can provide strong legal support for the implementation of green procurement and system protection. This stage can be considered under the framework of government procurement in existing developed for government green procurement regulations or approaches to China's national conditions, clear green procurement environmental policy objectives, improve and refine current government procurement law.

(2) Develop green procurement standards and inventories

Develop green purchasing standards, green procurement list is the core of implementing green procurement. Public green procurement information can increase the transparency of government green procurement, supervision and management departments. At the same time, demand can facilitate suppliers understand and acquire the relevant information, further developing green production.

4 Construction of Enterprise in Green Consumption Pattern

4.1 Necessity and Meaning of Green Consumption

Green consumer, enterprise in the original materials acquisition, product design, manufacturing, packaging and waste in the whole process based on the “3R” principle, as far as possible "minimize resource consumption reduction, exposed to emissions, waste of renewable resources, and no", to resource consumption and environmental costs as little as possible to secure the highest possible economic, social and ecological benefits.

4.2 The Benefit Analysis of Green Consumption

(1) Changing traditional patterns of industrial development

Past economic development in Liaoning province is characterized by extensive extension development, maintained by high investment and high consumption of high speed, from the perspective of resource bearing capacity, this model of industrial development is unsustainable. Implementation of cleaner production, contribute to the optimal allocation of resources to reduce waste, alleviating resource depletion and the energy crisis, helping to reduce pollution to improve the environment, conducive to sustainable development and the health of the people, this is the modernization of industry of our province and the road to revitalization of the development of a low carbon economy.

(2) Developing green products

Promising market for green products on the market of international trade, those in the process of production and use of environmentally hazardous products is difficult based on, in many countries, environmental labelling of products not only as a new initiative, but as a non-tariff barriers, to limit the import of non-green products of no environmental label, protect their interests. If businesses do not act in Liaoning province, it would be in danger of foreign products, and products out of the predicament of not in our province. Therefore, in order to face the world and join into the international market, enterprises must be guided by the green consumption needs of the international, actively develop production of green products, can only enhance its vitality and competitiveness.

4.3 Recommendations for Improving the Green Production

Improving the green production mode, we can choose from the following five aspects:

First, to simplify products. Complex product structure will result in the production process, product, transport and the management of complex, will also create more waste production, on time and material. At design time, to simplify the part just a decorative, to make use of multifunctional parts to simplify the product structure, saving both the raw materials, reduce waste and environmental pollution.

Second, to improve technology. Should avoid some of the harmful effects of process design and generation of hazardous substances, when you try to avoid using that part regeneration using materials hard process. Consider green design process, thereby reducing the impact on the environment and material waste.

5 Construction of Residents a Green Consumption Pattern

5.1 Necessity and Meaning of the Residents of Green Consumption

Green is the new low-carbon economy advocated by consumer attitudes, encourage consumers to choose green products, encourage multiple consumption, durability, reduce consumption of disposable. At the same time, taking into account the waste of resources in the consumption process, develop a damage or threat to the environment of consumption habits and establish low carbon consumption concept, achieving sustainable consumption, concept deeply rooted in the low carbon economy.

5.2 The Benefit of Residents of Green Consumption Pattern

By green consumption pattern change can save a lot of resources and protection of the ecological environment. Green consumption mode advocate reasonable, and moderate and can continued of consumption concept and consumption behavior, requirements consumer goods production by required resources is can regeneration of, using not regeneration resources production of consumer goods should can cycle using, efforts do in consumption of while must consider to waste of resources of, and adhere consumption "generation inter-just" and "generation within just" of behavior guidelines, implementation people and ecological harmonious, and and environment friendly.

Second: the guiding role played by green demand, promote the development of green industry, concrete implementation of the low carbon economy with runs of carrier. Green demand is stimulated, driving the development of green industry wizards. Because the green managers to update the concept of demand caused by the production enterprises, of green consumption in order to meet consumer demand, must adapt to the green consumer demand for research and development of green products; in order to create a suitable first-class green products, required to change the traditional mode of production, implementation of cleaner production, the use of green technology; in order to win favor with consumers, you must establish a new image. Thus, green mushroom, benign development of the low carbon economy.

5.3 The Recommendations of the Promotion of Green Consumption of Residents

First, through education and guidance of green consumption and raise people's awareness of green consumption. Government, through the green consumer education, to promote green consumption idea consumers, dissemination of knowledge of green consumption, enhance public awareness of environmental awareness and green consumption, establish the scientific concept of consumption, promote resource saving consumption pattern, nature, the pursuit of health, while life in pursuit of convenience, comfort, environment protection, resource and energy conservation.

Second: through the implementation of green-product certification system, guide the public to purchase green products. Green products certification means you can fully trust confirmed that a third party upon the identification of green product standards or technical specifications of products to meet specific activities. Through an independent third party certification, consumers don't Rob commodity information and guide consumers to purchase products in favour of health, environmental protection, so that consumption be the locomotive of the low carbon economy.

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Information Integration of Collaborative Planning, Forecasting and Replenishment (CPFR) Based on Internet of Things

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Abstract. Collaborative Planning, Forecasting and Replenishment (CPFR) is a series of activities and the process. This research aims to looks at the literature of information integration of CPFR and the Internet of Things, and then analyzes the information flow model of CPFR. The paper focuses on the information integration of CPFR based on the environment of Internet of Things.

Keywords: Information Integration; Collaborative Planning, Forecasting and Replenishment (CPFR); Supply Chain Management; Internet of Things.

1 Introduction

With the improvement of supply chain management and development of information technology, the nature of business processes has changed from intra-enterprise to cross-enterprise. Collaborative Planning, Forecasting and Replenishment (CPFR) come into being in this case. The main driving forces for CPFR adoptions there included fierce competition, a shorter product life cycle, offshore production, and the supply chain cost structure.

Information integration in supply chain refers to the sharing of information and knowledge among members of the supply chain, including demand information, inventory status, capacity plans, etc. Information integration efforts between members of the supply chain, in the form of information sharing, synchronized replenishment, and collaborative product design and development, have been cited as major means to improve supply chain performance [1].

When Bill Gates firstly mentioned Internet of Things (IoT) in his "Future" in 1995, the idea could not really achieve because of the restrictions of the technology of network terminals at that time. And nowadays IoT once again debuts and became the focus of national attention. However, IoT is still in a very early stage, and it will take a long time for it to achieve large-scale development in order to let the public enjoy its full functions. This paper mainly studies the information integration of CPFR based on IoT.

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2 Literature Review

In this section, we review the literature on information integration of CPFR and the Internet of Things. The literature review provides the theoretical foundation for this research.

Collaborative Planning, Forecasting, and Replenishment (CPFR) was defined by the Voluntary Inter-industry Commerce Standards (VICS) committee as a way of describing supply chain collaboration [2]. It defined CPFR as "a collection of new business practices that leverage the Internet and EDI in order to radically reduce inventories and expenses while improving customer service." Compared with previous strategic alliances, CPFR concentrated on strongly linking business planning, forecasting, and replenishment through deeper information sharing. CPFR provides a good collaboration alternative based on integrating internal and external business activities.

The concept of IoT was proposed in 1999. At that time, based on Internet, RFID technology, EPC standards and on the basis of the computer Internet, "Internet of Things (IoT)" was constructed to achieve the Internet of global real-time sharing information of the physical items. This is also the first round of IoT boom in 2003. In November 2005, the International Telecommunication Union (ITU) released the "ITU Internet Reports 2005: Internet of Things" and cited the concept of IoT. The report notes that IoT is a technological revolution that represents the future of computing and communications, and its development depends on dynamic technical innovation in a number of important fields, from wireless sensors to nanotechnology [3]. IoT is not technology fantasy but a technological revolution. It makes the goods and services occurring qualitative leap. And these new features would bring users further efficiency, convenience and safety.

3 Information Integration of Collaborative Planning, Forecasting and Replenishment

3.1 CPFR Process Model

CPFR process model is shown in Figure 1 and the process has three major sub-processes-namely planning, forecasting and replenishment — each of which is formed by a number of activities called steps, including 9 steps. The first stage is collaborative programs, including Step 1 and Step 2; the second stage is forecasting, including Step 3 to Step 8; the third stage is replenishment, Step 9.

3.2 Information Flow Model of CPFR

In the three stages of CPFR, New information is generated depending on the data flow analysis and is for use of the next stage. The information generated is shared between all members in supply chain.

In the planning stage, there are two things need to do: the first is to institute exception standard according to historical shipment and POS data, the second is to co-establish joint business planning and project management files according to all the

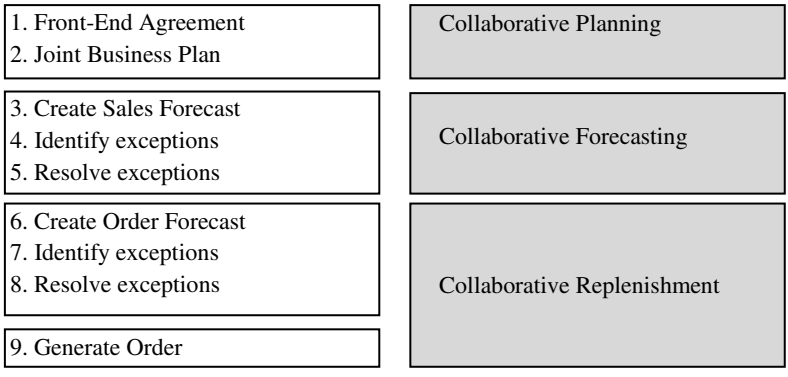

Fig. 1. CPFR Process [4]

partners' own strategic planning and strategy. In the forecasting stage, the first is to constitute sales forecast and identify abnormal items according to the joint business plan, POS data, unusual standards and events; the second is to establish order forecast and identify abnormal project according to POS data, inventory information, sales forecasts, events, history volume of demand, product availability data and project management files. In the replenishment stage, it is necessary to generate orders according to sales forecast and project management.

Whether the information model of CPFR is simple or not is in relation to the arrange ways of CPFR. The ways to arrange the application of CPFR include sharing mode and peer to peer mode. The sharing mode appears to be more flexible than peer to peer mode because in sharing mode all members share the same database without considering the synchronization problems of complex data. The peer to peer made allows each member has its own independent CPFR applications and these applications can be interoperable. But the weakness in this approach is that it is very troublesome to realize the synchronization exchange of data. Clearly, the peer to peer mode is more suitable to type of information-sharing structure of the whole channel, while the sharing mode is more suitable to hub (center) type of information sharing structure. Figure 2 is a simple example of sharing arrange of CPFR.

The sales forecast information flow mode corresponding to Figure 2 is as follows:

1. Send Usage
Event: Generating sales forecasts
Sender: Hub
Receiver: Member A / Member B
Data_ object: sales forecast
Data template: XML model of sales forecast
Req action: Confirming sales forecast
Mode: Real-time
2. Confirm Sales Forest
Event: Receiving sales forecast
Sender: Member A / Member B
Receiver: Hub
Data_ object: sales forecast

Data template: XML model of sales forecast
Req_action: Generating replenishment orders
Mode: Real-time [5]

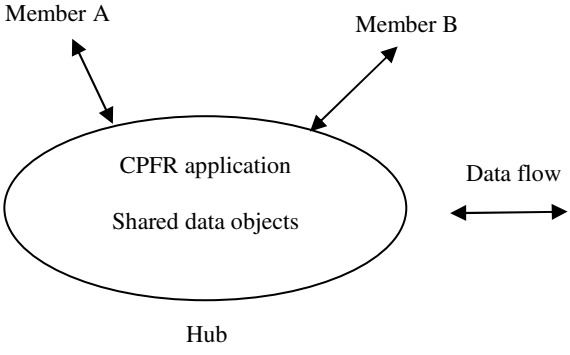

Fig. 2. A simple example of sharing arrange of CPFR [5]

3.3 Information Integration of CPFR

The above information-sharing model can be used to address two key issues of CPFR: the inaccuracy of forecast and abnormal generated by fluctuation in supply and demand. Figure 4 shows the information exchange among members of a traditional

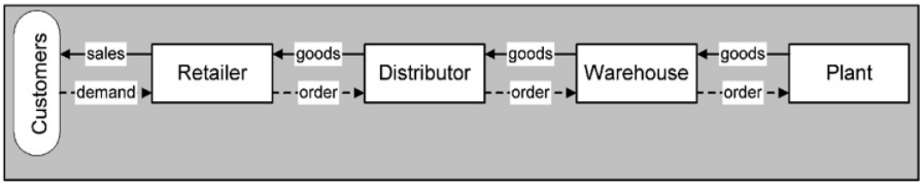

Fig. 3. Information exchange among members of a traditional supply chain [6]

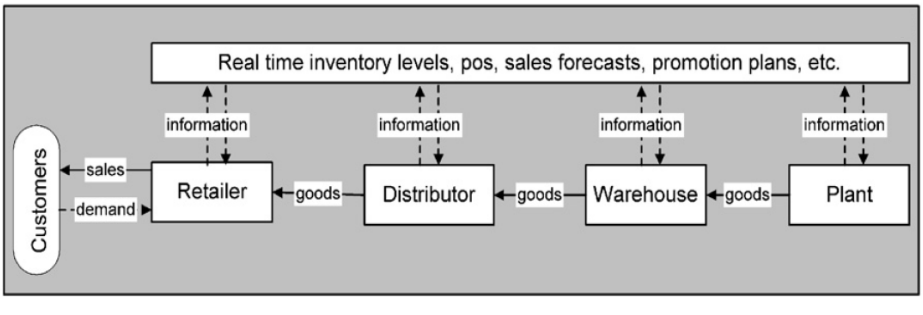

Fig. 4. Information integration of CPFR supply chain [6]

supply chain and Figure 5 shows the information integration of CPFR supply chain [6]. Information integration comprises information sharing and collaborative planning. Information sharing refers to the exchange of critical, often proprietary, information between supply chain members [7]. Under CPFR, inventory levels, POS data, promotion plans, sales forecasts and all other information that may be influential on the market demand are shared between supply chain members.

4 Information Integration of CPFR Based on Internet of Things

4.1 Internet of Things

The Internet of Things is a technological revolution that represents the future of computing and communication, and its development depends on dynamic technical innovation in a number of importation fields, from wireless sensors to nanotechnology [3]. RFID technology, which uses radio waves to identify items, is seen as one of the pivotal enabler of the Internet of Things. RFID technology is gradually applied to supply chain management through arming the "things" in supply chain with RFID devices.

4.2 "Things" in Internet of Things

In the context of "Internet of Things" a "thing" could be defined as a real/physical or digital/virtual entity that exists and move in space and time and is capable of being identified. Things are commonly identified either by assigned identification numbers, names and/or location addresses [8]. The "things" in supply chain include raw materials, semi-finished products, products etc.

4.3 Requirement for "Things" to Be Connected in Internet

In order to guarantee all of the "things" in supply chain could be fitted with RFID devices, the following requirements should be met:

First, in order to connect all the objects and devices including raw materials, semi-finished products and products to large databases and networks, it is crucial to build a simple, unobtrusive and cost-effective system of item identification. RFID offers such functionality.

Second, data collection will benefit from the ability to detect changes in the physical status of things, using sensor technologies. This is what the bar code technology cannot do.

Finally, advances in miniaturization and nanotechnology mean that smaller and smaller things will have the ability to interact and connect. This also contributes all the "things" could be identified. [8]

4.4 Information Integration of CPFR Based on Internet of Things

In the above environment, information integration of CPFR supply chain would change a lot, as is shown in Figure 5 and all of the "things" in supply chain will take on smart characteristics and capabilities. This will give significant benefits to the

integrated information processing. The influences of Internet of to CPFR supply chain management include optimizing supply chain management process, making effective use of resources, realizing truly real-time management, increasing supply chain visibility, improving the transparency of information in supply chain management and making supply chain management to achieve a high degree of agility and fully integrated.

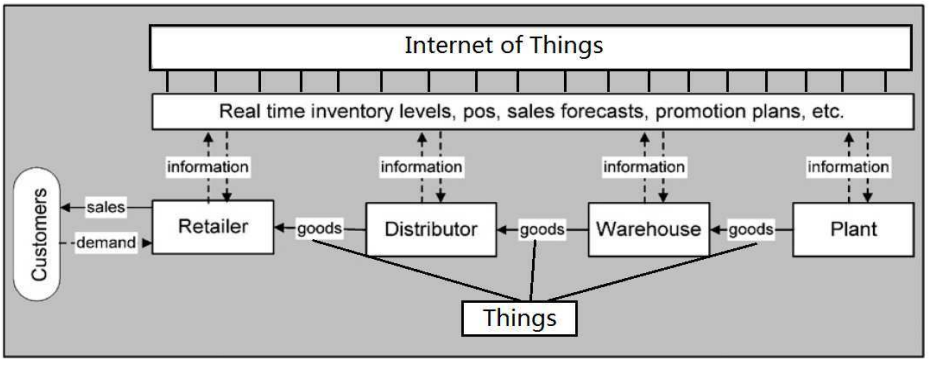

Fig. 5. Information integration of CPFR supply chain based on Internet of Things

5 Conclusion

The information integration in CPFR and the Internet of Things are both focus of research in present-day society. This paper is carried out to make analysis of information integration of CPFR in chain based on the environment of Internet of Things. This analysis aims to provide a new vision to research the Supply Chain Management.

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The Quest into Salary Indexation under the Salary-Point Salary System in Chinese Enterprises

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Abstract. The development of economy is often accompanied by inflation, causing depreciation of employees' salary. Therefore, increasing employees' salary along with inflation to have their employees motivated and establishing a pay system to guarantee the real value of employees' salary are the urgent problems for the Chinese enterprises to address. The author searched into the question with his long-term business management experience and teaching experience in compensation management in university, hoping to make contribution to the optimization of Salary System Design for Chinese enterprises.

Keywords: Inflation, salary-point salary system, Salary Indexation, Real Value of Salary.

1 The Discourse into Salary Indexation

China has witnessed years of rapid economic development, with its economic aggregate soaring, which also bring about structural fissures and make CPI too high. The increase of income for laborers and employees has been insufficient to help them share the outcome of economic prosperity. Instead, their living standards are becoming even lower. Incentives that salaries can give to the employees have gone down, undermining their initiative at work. Staff turnover rate goes up, affecting the enterprise in a negative way. To tackle these problems, enterprises have to raise employees' salaries in direct proportion to the soaring of CPI, avoiding actual depreciation of employees' salaries. One efficient way is to adjust the salary of the employees according to CPI. This is called wages and salary indexation. Throughout the implementation of salary indexation, not only CPI, but also cost-of-living index shall be taken into account so as to make sure the living standard of employees.

CPI is different from cost-of-living index. Since mostly inflation are structural, the scale of price rising of daily necessities are larger than others, rendering cost-of-living index higher than CPI. According to the survey, when CPI goes up by 6%, cost-of-living index would go up by 10%. Therefore, in order to maintain employees' living standards with the adjustment of their actual income, we have to take cost-of-living index into consideration in addition to CPI, using the former as the basis for the salary index adjustment.

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The establishment of salary indexation system is not only the most effective way to ensure the employees' standard of living against inflation and the best way to eliminate the inflation panic of employees, but also to motivate the system to protect the reasonable consumer.

The disadvantage of the establishment of salary indexation is sometimes raising the cost of labor of enterprise.

2 The Discourse into the Salary-Points Salary System

2.1 The Concept of Salary-Point Salary System

Salary-point salary System is a salary scheme that simplifies the implementation of salary indexation. It refers to the economic efficiency of enterprises and employees' salary level of competition in the market, it is according to enterprise payroll to determine the company of the salary-point value; The object is the position of Salary-point salary System, employees' job performance as its basis for determining employees' salary-point count. It is a flexible Salary-point salary System.

2.2 Structure of Salary-Point Salary System

2.2.1 Elements of Salary-Point Salary System

Various kinds of factors can be taken into account when deciding the type of Salary-point salary, but most of them consist of basic salary-point salary, performance salary-point salary and guaranteed salary. Basic salary-point salary includes position-point salary, technique-point salary, degree-point salary and working-year -point salary; Performance salary-point salary is correlated to the performance assessment of employees; while guaranteed salary mostly consists of welfare income.

Basic salary-point salary and performance salary-point salary are paid by the salary -points values and salary -point count defined.

Basic salary-point salary=(position-point count + technique-point count + degree-point count + working-year-point count)×basic salary-point value.

performance salary-point salary = performance salary-point count×performance salary-point value×performance appraisal coefficient of individual employees.

Coefficient of performance appraisal of individual employees is calculated by the corporate management based on business performance evaluation system.

2.2.2 To Determine the Salary-Point Value

Basic Salary-point Value = Amount of basic salary of the entire enterprise/$\sum$ Basic salary-point count of individual employees.

The amount of salary of the entire enterprise is calculated using methods developed in accordance with its strategic needs, average salary paid to employees in the same industry and its actual income.

Performance salary-point Value = Amount of performance salary of the entire enterprise/$\sum$(Performance salary-points of individual employees ×performance appraisal coefficient of individual employees).

Amount of performance salary is determined by its actual income and the performance of its employees during the time of assessment.

2.2.3 To Determine Salary-Point Count

The procedure: A)To achieve the strategic goals of enterprises and establish a scientific and rational managerial and organizational structure. B) To set up positions in discreet in accordance to actual demand. C) To compile the entire job introduction by means of position analysis. D) To set up a job evaluation standards to assess job responsibilities, job intensity, job conditions and job complexity of the technology etc. such as job evaluation, reflecting the difference between labor jobs, reasonable job categories and job files, hence the position salary. E) To set up rules regarding the calculation of employees' technique-points salary, degree-points salary and working-year -point salary. F) To calculate the performance salary-point count according to the level of influence the position shields onto the entire enterprise.

2.3 Strength of the Salary-Point Salary System

The Strength: A) To determine a position-points count that can demonstrate the important role played, enabling the achievement of internal equality. B)Basic salary-point value is to be adjusted in accordance to the change in enterprise focus. C)The determining of performance salary-point value is to help tighten up the benefits of the employees and the enterprise and motivate the employees. D)Through the performance appraisal coefficient of individual employees, individual performance and the performance of the whole enterprise could be combined together so as to enhance the internal cohesion of the enterprise. E) Determined internal basic salary of the whole enterprise and the amount of performance could help reduce manpower. F)Capability and the position is dynamic coupling, providing a correct way to calculate the actual salary. G)Through the setup of position-points salary system, a system of "salary in accordance to the position" could be used to improve the enterprise's internal management processes.

3 The Salary Indexation under the Salary-Point Salary System

Due to the ever-rising price, enterprises have to frequently raise the average salary of the employees so as to maintain their living standards and keep the attractiveness of the enterprise to employees and the stability of the team. Chinese enterprises used to adopt the method of subsidizing on the basis of the original salary. Yet it would be quite difficult to work out the average increase of salary. Therefore, the common practice of enterprises is to raise a certain amount to each employee, which is surely a rough one. It sometimes fails to reach the desired results due to the low frequency of adjustment.

Under the Salary-point salary System, salary indexation has become as easy as to just calculate the basic salary-point value and the performance salary-point value. We can work it out in a short-time using the equation for

The adjusted basic salary-point value = Original basic salary-point value× (1 + cost-of-living index)

The adjusted performance salary-point value = Original performance salary-point value × (1 + cost-of-living index)

Basic salary-point value and performance salary-point value could be used to calculate the basic salaries and performance salaries

The advantage of this method is the simplicity and preciseness of salary indexation. It can also be adjusted due to the change of cost-of-living index and the frequency of work can help reserve employees and motivate them.

4 Conclusion

Because of the salary-point salary System has not yet been widely used in Chinese enterprises and the salary indexation is now under theoretical quest, Salary Indexation under the Salary-points Salary System in Chinese Enterprises needs to be further promoted. More researchers are needed to research and analyze the said study.

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Gender Stereotype in Foreign Media Advertisement: Performance Feature, Function and Mechanism

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Abstract. Gender stereotype in media advertisement is a type of gender stereotype, which presents in media advertisiement. Nowdays, foreign researchers paid attention to the performance feature, function as well as mechanism of gender stereotype, and made abundant achievements. However, there is still some weakness existing in those studies. Therefore, it is imperative for researchers to reform it's research methods, focus on cross-cultural studies, expand the content of studies and strengthen home resaerches. so as to add lots of understanding on gender stereotypes in media advertising for Chinese people.

Keywords: Media advertisement, Gender stereotype, Performance feature, Function, Mechanism.

1 Introduction

Since stereotype was firstly put forward by Lippmann in 1922,lots of scholars in different areas start to pay attention to this concept, which was thougt of as a common view about group members' features and behaviors [1].The view can make people classify group or individual according to simply imagine which include occup, gender and region, and attribute some features to group members.[2]People have different views on group members because of gender, it is gender stereotype that refers to a fixed view about woman and man in social life, especially is a type of fixed view about female and male psychological characteristics.[3] However, gender stereotype have presented in all the aspect of daily life, especially in media advertisenment. As we all known, with the development of science and technology, advertisement have permeated in daily life, and it's content play a important role affecting people's life. However, gender stereotype as a sort of information that advertisement propagandized have been affecting people's gender role identity and gender role socialization.

2 The Feature of Gender Stereotype in Media Adertisement

2.1 Difference on Gender

Gender is production of socialization and is different with sex, it is necessary for individual to modify, study and internalise to get the identification of gender role and

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realize social expection about gender role, which make people bring about gender stereotype of male or female. It is easy to be strengthened by media advertisement, [4] which reflect on some stereotypes on male or female feature, occupitional role and social role et al. On the aspect of the feature, Furnham, et al (1997) suggest that female have some features in media advertisement as following: dependence, compliance and weakness. [5] However, male have some features as following: authority, autonomy and decisiveness. The reasult of Furnham,'s study in accordence with Dwivedy's (2009)[6]. The descripion of gender stereotype on aspect of feature prmote the media advertisement to develop the stereotype about male and female occupiational and social role. However, Sharepour (2005) resort to content analysis method to study on gender stereotype in media advertisement, and got the reasults as following: male can be regard as the members of parliament and government, female used to be thought of as childcares and social workers. [7] Meanwile, others researchers find out female prefer to choice some reliable role rather than profession and occupiation [8-9]. These reasults of studies have presented in Dwivedy's study.

2.2 Difference on Times

Klassen, et al (1993) choice Goffman's theoretical frame to compare gender stereotype in media advertisement in 1972-1977 to 1978-1983 and 1984-1989,and found that traditional gender stereotype in media advertisement have been weakened, the view about equality between the sexes have been srengthened. [10] On analysis of content of 28 advertisements find gender bias have a trendency that is gradually weakened. [11] The trendency reflect on traditional gender stereotype in media advertisement have been changing, [12] which man's production propadanda to woman and woman's production propadanda to man.[13,14] Nowdays, the description about female in media advertisement have modern appearance, and woman increasingly get the right and status as man have.[15]The difference on times have relate with feminist movement. With culture vary from pre-feminism to feminism and post-feminism, the description about female in media advertisement have be objective.

2.3 Difference on Culture

Cutler, et al(1995) indicate that gender role in Asian media advertisements are different with American and European. [16] For instance, the chance that woman are regarded as sex object in Korean media advertisement is fewer than American, but others aspect of description about woman have obvious stereotype. Athought gender stereotype in Japanese media advertisement is very obvious, some female features have present in man. Meanwhile, man can not have common features such as democracy, tolerance, gentleman and serious. As reasult, man and woman always be descibed positively in Japanese media advertisement, but it is behind in American and European. [17] In western media advertisements, more and more female and male role are non-chip-producing orientation. Futher researchs suggest that the description about man and woman is more decorative in American and Dutch than Switzerland. Moreover, there describe man and woman as recreational and familial role in Swiss media advertisement. [18] However, gender stereotype in Germanic media advertisement is fewer than others European cuntries. [19]

3 The Function of Gender Stereotype in Media Advertisement

3.1 Mental and Behavioral Function

Pollay (1986) suggest that advertisement can be able to affect and change people's value. [20] Fraser et al(2002) indicate that advertisement play a important role in the process of child make role identity, and have significate effect on their belief, attitude and behaviors. [21] However, one study show that individual's self-esteem and gender expection will bring out changes when they always be affected by advertisement.[22] There studies show that gender role in advertisement strenghen people's beliefs and behaviors existied in soicety. [23,24] Therefore, the function of gender stereotype in media advertisement mainly reflect on mental and behaviors. To resort to this function, the gender stereotype in media advertisement have effect on society.

3.2 Social Function

Eisend (2010) suggest that gender stereotype in media advertisement have effected and reflected on society by affecting people's mental and behaviors.[25] Moreover, it have reflected on conventional customs and habits.[26,27] Meanwhile, lots of researchers carried out many studies about gender stereotype in media advertisement what affect society such as Maynard et al(1999) emphasis that woman is independent, decisive and rebellious in American advertisement.[28]In Japanese advertisement, the woman is lovely, humor, childishness. The reason for it is American pay attention to individualism, and Japanese keep a watchful eye on collectivism because for difference on cultures. Therefore, gender stereotype in media advertisement reflect on society and culture by study on cross-culture.

4 The Mechanism of Gender Stereotype in Media Advertisement

4.1 Schema Activating

Shema is a type of structure of knowledge about something and some concepts. Fiske (1996) think that the shema can simplify and organize society by generalizing exemple. [29] Therefore, Bem (1981) consider that gender schema is organizational information basing on male and female prototype. And some schemas in people brain can be activated by some information and stimulus. However, the activating will be expanded throught using. [30] Owing to gender stereotype have presented in all the corner of social life, people can receive some informations about gender stereotype. Miller (1997) suggest that some schemas about gender stereotype existing in people's brain will be activated when people were affected by some informations about gender. His study also indicate that activating some structures about gender in people's brain will affect self-evaluation on something about gender.[31] When female features were activated before self-evaluation was activated, people's assessment on female features will be expanded. This reasult is habituated to man. Moreover, others studies got the same reasult which gender schema can activate some informations about gender, and in turn affect people's perception on gender role.[32] Gender stereotype in media

advertisement is a sort of information that people receive in daily life, it will activate gender schema in brain, and have effect on people's perception about gender role.

4.2 Social Comparsion

In the seminal theory of social theory, Festinger (1954) think that people tempt to compare themselves with others who are similar to themselves, and generate accurate evaluations of his or her abilities and opinions.[33] However, there have upward-comparsion and downward-comparsion. To be specific, upward-comparsion refers to people are likely to compare with others who are better off than themselves, and downward-comparsion refers to people are likely to compare with others who are worse off than themselves.[34] Gender stereotypes in media advertisement provide people a chance to conduct upward comparsion. in extremely way.[35] If individual have no internalize some gender features described in advertisement, their self-perception would be jeopardized. [36] Morrison et al (2004) find that the man who look on ideal actors and male model in advertisement have negative body appearance, so as to they can try to put on weight. [37] However, the woman who look on ideal female appearance have negative emotion, satisfaction and self-esteem. [38] To make use of mechanism of social comparsion, individual's gender counter stereotype will be activated, and result in cognitive disorder on gender role norm. Thereofore, in order to maintain cognitive harmonious state, people will resort to all the means to keep gender stereotype.[39] However, to maintain gender stereotype need to study gender role norm that advertisement propadandize, so as to realize self-identity on gender role.

4.3 Social Study

Bandura (1977) emphasis that social study is a reasult that make interaction among environment, behavior and cognition, and it was accomplished by observing others behaviors, attitudes and behavior results. [40] Media advertisenment provide people with ideal gender feature, so as to people can activialy imitate and study gender roles that were propagandized by media advertisenment. For example, the media advertisement have became an main means that children internalize gender stereotype.[41]To be specific, people can acquire some beliefs about gender behaviors and social skills.[42]However, the acquisition is gradually formed by exposing to advertisement in long time. In the process of exposure, it is necessary for individual to pay attention to and internalize gender stereotype. Consequently it will be presented in people's behaviors.However, whether the reasult of behaviors is strengthened or punished will affect future gender role.Therefore, this procedure is the process of social study, which is a important side of acquiring identity of gender role, and a mechanism that gender stereotype in magaize advertisement have effect on individual.

5 Evaluatuion and Outlook

With the development of feminist movement, researchs on gender stereotype in media advertisement have been carrying, and got the reasults such as the description about gender stereotype in media advertisement have diversified development trend.

However, owing to different cultural value, there have different description about gender stereotype in media advertisement on different cuntries and times. Meanwhile, meida advertisement can reflect on cultural value. Thus, some informations of advertisenment that don't be habituated to and reflect on existed cultures can not be identified and accepted by people, and will be eliminated from market finally. Therefore, media advertisement have some feature of existing culture as production of people's practice, it reflect on existing culture. As we all known, once people have created something, it would affect human practice. Thus, media advertisement also affect human practice as production of human practice, and then affect the existing cultural changes.

Media advertisement have effect on individual and social culture by a way of disseminating information. Therefore, to strenghen research on media advertisement is not only relate with heath development of individual, but also social cultural changes and development. However, there are still some weakness existing in those studies, it is necessary to reinforce the study on from following:

5.1 Reform Research Methods

Foreign scholars mainly use content analysis methods to classify and code content of media advertisement in certain period. Moreover, with the analysis on content and type of media advertisement, the researchers find something to which they pay attention. However, the content analysis methods don't accruately reflect on gender stereotype on society, and lack of reliability and validity. Therefore, it is imperative for future study to develop lots of methods that have reliability and validity. Meanwhile, the study should beyond simply reviews on content of materials and analyize the basis of content and it's effect. [43]

5.2 Strenghen Cross-Cultural Study

Nowdays, more and more disciplines have been involving in cross-cultural study of gender stereotype in media advertisement. However, the process of study lack of theoretical fountaion and relible frame of comparsion, so as to lead to limited explains to gender stereotype in media advertisement because don't carry out large-scale comparsion. Therefore, it is necessary to develop a comparative frame that can carry in different cuntries, and pay attention to cultural differences in different countries.

5.3 Broaden Research Contents

These studies pay close attention to the effect of gender stereotype in media advertisement, and ignore audiences' effect to the content of media advertisement, so as to restricts the study on influencing factors and function of gender stereotype in media advertisement. Therefore, the futural study should broaden research contents by insisting on mutidimensions, and form a type of research system about the content of advertisement, social culture, advertiser and audiences and so on. So as to strenghen the study on gender stereotype in media advertisement.

6 Conclusion

In this paper, we find that gender stereotypes in media advertisement have been researched by most of foreign specialists. They always focus on it's expressive characters such as difference on gender, times and culture. Moreover, it also pay attention to the role of gender steretype in media advertising, including individual psychology and social culture. Besides, the function of mechanism of gender stereotype in media advertisement have been attracting lot's of researchers to do study, and got reasults as following: the function of mechanism include schema activating, social comparsion and social study. Althougt foreign studies on gender stereotypes in media advertisement have made abundant achievements, it imperative to pay attention to reform it's research methods, focus on cross-cultural study and broaden research content. So as to be benefitful for our chinese to understand the gender stereotype in media advertisement and promote the development of the study.

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Research of Architecture and Digitization of Emergency Plans for Emergency Incident

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Abstract. For decreasing losing degree of emergency incident, many organizations and governments have established corresponding emergency plans. However, there is no uniform criterion from format to content aspect, and it is not favorable for establishing, updating and maintaining, and inquiring emergency plans. So, many problems appeared in the executing process of plans. Aiming at these problems, a standard architecture of emergency plans is advanced. Then, basic composing factors and management method and establishing flow of emergency plans are analyzed in details. Finally, the necessity of digital plans is analyzed, and the function module of digital plans is confirmed.

Keywords: Emergency incident, Emergency plans, Architecture, Digitization.

1 Introduction

At present, the ability to respond to public emergencies has been greatly improved; one very important reason is that our country has established corresponding emergency plans. The so-called public emergency plans, is subject to plans or overall program for public emergency management, that in order to better respond to emergencies public management entity develop through certain procedures before they occur [1]. Many worldwide scholars have done a lot of meaningful research related to emergency plans. Zongzhi Wu [2] has done some research on classification, grading system, the basic content and test of major accident. Juan-juan Xing [3] has provided the basic framework, systems and method and procedures of emergency plans. Pengzhi Dong [4] and some others have researched the necessity, principle, basis, level and contents of emergency rescue plans for major accidents in cities; and discussed emergency rescue command system, information system and safety culture. Danni Di [5] researched the establishment of digitized plan system on basis of emergencies, and described the architecture of it. But many public emergency accidents showed that quite a few districts' management plans for public emergency accidents did not play its due role. Since the emergency plan itself is a very complicated system, aimed at improving the present research situation and resolving

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the exiting problems in our country, this paper starts with the overall structure, analyzes the basic elements of the plans in detail, then presents the importance of the research on digitized plans and provides function modules for it.

2 Concept and Problems

2.1 The Definition of Emergency Plans

Emergency plans are plans or programs that established in advance against possible major accidents or disasters, to insure rapid, orderly and effective implementation of emergency activities and rescue operations and reduce accidents loss. It makes specific arrangements in advance for emergency organization's responsibilities, staves, technology, equipment, facilities, material, rescue operations, command and coordination and so on, on basis of identifying and assessing potential danger, accident type, the likelihood and process of occurrence, the consequence and the impact of the accident. An emergency plan points out who is responsible for what to do, when to do, how to do, and the corresponding strategies and resources preparation, before, during and just after the accident.

2.2 The Exiting Problems of Emergency Plans

(1) It's difficult to modify and update. Emergency plans will be constantly updated and improved with the change of actual situations and accumulation of experience; the existing emergency plans' storage makes it take high expense to update.
(2) It's not convenient to search. The present regulations, procedures and emergency plans are stored in papers, scattering in different places and its vast amount make it time-consuming to search, and it is worse when you need to search emergency plans of other departments.
(3) It's not convenient to share resources. Although each of the departments has its own job, they have interactions. The present decentralized management mode of emergency plans makes it inconvenient to share resources.
(4) The content of the emergency plans is not complete, so it is not suitable to be applied.
(5) Emergency plans for different accidents lack systematic planning and coordination.
(6) The emergency plans lack dynamic adjustment method, it makes the emergency plans difficult to act according to circumstances.

3 The Architecture and Preparation Procedure of Emergency Plans

The main goal of establishing emergency plans system is to standardize the management of emergency plans and establish unified management standards and procedures for the preparation and implementation of the emergency plans.

3.1 The Overall Structure and Basic Elements of Emergency Plans

The overall structure of emergency plans refers to interconnected, comprehensive, multi-level emergency plan groups that composed of emergency plans of different grades and types, that is, emergency plan system which is "vertical to the end, lateral to the side". The emergency plan system includes national overall emergency plan, national special emergency plan and departmental emergency plan; and local emergency plan includes overall emergency plan, special emergency plan and departmental emergency plan for public accidents of the provincial government, emergency plan for public accidents of city and county government and organizations of political power at the grass-roots level, and emergency plans prepared by enterprises and public institutions according to relevant laws, regulations and the actuality of themselves. In addition, individual emergency plans and operational procedures can be included in the broad sense. The overall structure and interactions of emergency plans are showed in figure 1.

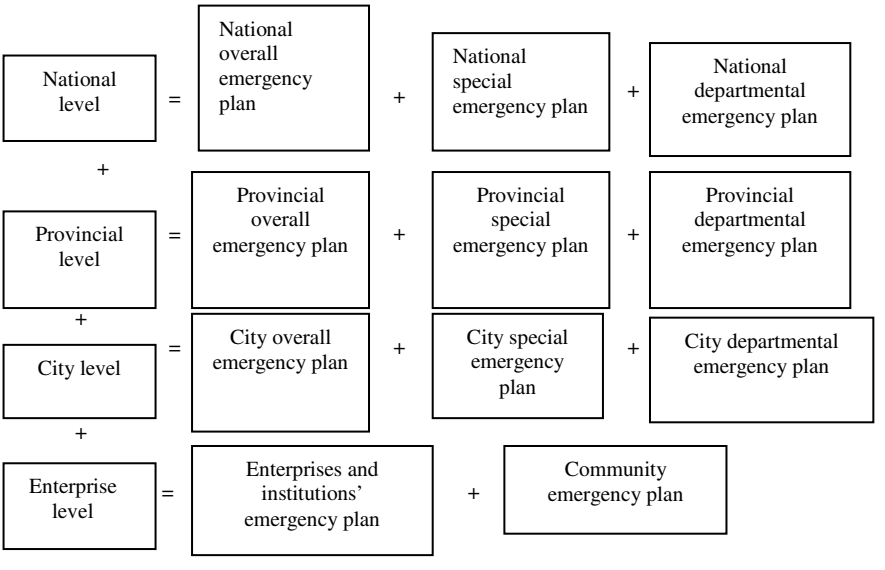

Fig. 1. The overall structure of emergency plans

Emergency plans of different levels and different types vary from each other, but they still have connections. Especially, the overall emergency plans of every government level are the general outlines of the others.

It needs the following basic elements to form a comprehensive emergency plan:

(1) The organizations to prepare the emergency plans. Life management units, counties (city, community), districts (city) governments are agencies responsible for preparing emergency rescue plans according to relevant laws, regulations, ordinances of our country.
(2) The system and responsibility of emergency organizations. Based on the emergency response progress, the emergency organizations should determine the competent authorities and cooperation departments respectively take charge of the occurrence, warning, responding, ending and rehabilitating parts of public emergency accidents; and based on the emergency preparation and support institutions, the emergency organizations should determine the responsibilities of each department involved. While clearing the responsibilities of each department, they should accord with the emergency response mechanisms.
(3) Identify the danger and assess the potential risk. The responsible departments should identify and assess the origin in the emergency accidents areas and divide the danger grades.
(4) Early warning and prevention mechanisms. It should include information detection and report, early warning and prevention actions and warning support system.
(5) The condition of emergency rescue organizing, personnel, equipment, training and drill.
(6) The measures of emergency dispose, evacuation, engineering rescue and medical first aid on-site, etc.
(7) Rehabilitation, accident site cleaning and production recover activities.
(8) Social support and assistance.
(9) The maintenance of emergency plans.

3.2 The Procedure of Preparation Emergency Plans

The purpose of preparing emergency plans is to enhance the scientificity and timeliness of emergency strategies, the normalization of emergency response actions and the authority of emergency command actions. Therefore, while preparing emergency plans, we must follow the scientific progress, identifying potential danger by detection and analyzing information, making choice through designing possible methods to solve problems, researching and determining further activity plans after the occurrence of public accidents on basis of making strategic decisions, modifying and improving the emergency plans over and over again in practice.

Emergency plans' preparation should be based on the progress of the occurrence and development of emergency accidents, that is, the first step is to research the intrinsic mechanisms of it. Only if the essential regulations and characteristics of the accidents are explicit, the emergency plans' preparation would be more specific and operational. The progress of preparing emergency plans is described in figure 2.

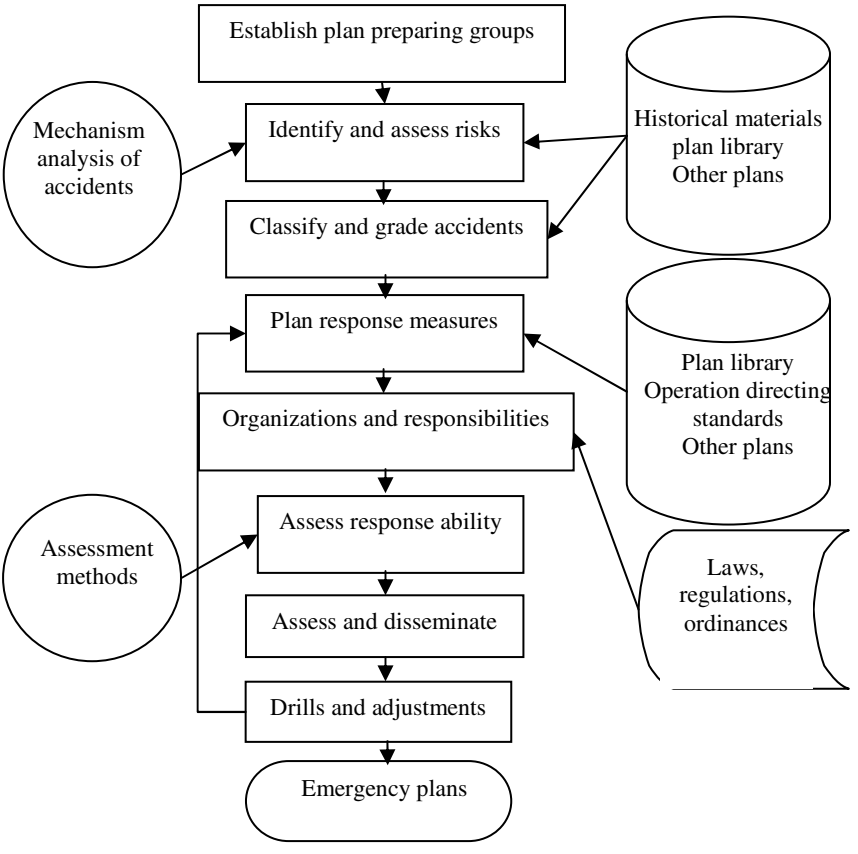

Fig. 2. Flow chart of emergency plans

4 The Informatization of Emergency Plans: Digitized Emergency Plans

4.1 The Significance of Digitized Emergency Plans

Digitized emergency plans are comprehensive, specific, well-targeted, intuitive and efficient emergency plans, prepared with the utilization of computer technology and network information technology. They will make the emergency plans' preparation and implementation progress reach the level of standardization and visibility, shorten their preparation circle, and improve their operability. The significance of digitized emergency plans is mainly reflected in the following four aspects: (1) Emergency plans in text are usually the summary descriptions of the progress and responsibilities of emergency dispose, while digitized emergency plans could establish specific action plans according to the development of every stage of the accidents. (2) Digitized emergency plans can be dynamically adjusted according to the development of the accidents, offer the response procedures and information as detailed as possible, fit

the real situation of the accidents as much as possible, and promptly inform relevant staves and departments with the updated action plans. (3) Digitized emergency plans can not only be flexibly applied in command system to traverse the accumulation of the digitized emergency plans, but also serve as the basis for routine training and drills. (4) It's easier to modify and update the emergency plans afterwards according the action plans under real situations as they are digitized. In a word, digitized emergency plans make the plans' establishment, modification, update and upgrade more convenient and faster.

The main purpose of digitized emergency plans is speed up information's dissemination and actions pace to improve strategies' rationality and scientificalness. In essence, the digitized emergency plans' work is to help make right decisions, quickly convey the instructions and acquire timely and accurate feedback by enhancing information sharing.

4.2 The Function of the Digitized Emergency Plans

From the point of practical needs of emergency management, digitized emergency plan system shall provide the following essential functions:

(1) Function of preparing emergency plans

For a certain type of emergency accident, digitized emergency plans system shall provide relevant emergency plans' quick preparation function and standardized templates to offer personnel a standard procedure to quickly prepare a scientific emergency plan.

(2) Function of managing emergency plans

For the existing emergency plans, they should have the function of being updated and searched. Once an accident happens, they should be quickly understood and can be adjusted dynamically.

(3) The function of managing relevant organizations

There are three types of organizations relevant to emergency dispose: the emergency command centers of each level, expert advisory committees and on-site headquarters. Personnel in these organizations are usually part-time, that is, they have their own full-time work in the routine days, when the emergency accident occurs, they get together immediately and form the emergency organizations according to the requirements of the plans. Therefore, these members should be informed as soon as possible after the accident and work in the state of emergency response. While the progress of dispose, they should be informed with the accident's every new situation at any time.

(4) The function of searching rescue resources

At any time the strategies of rescue actions depend on two important factors: the development tendency of the accident and the situation of the rescue resources for scheduling. Usually governments of each level have their professional system to predict the development tendency of the accident, and the rescue resources available for scheduling are in the charge of each department. Combining information in these two aspects, it will play a great role for the command center to quickly make a right and effective decision.

(5) The function of reporting the accident and disseminating early warning information

Departments and staves should report the newest information of the accidents to the higher-level organizations in accordance with the principle of escalation or to the same level relevant departments and predict the development tendency of the accidents. Accidents are divided into four warning levels. In the progress of reporting , once the system find these main indicators reach a certain level, it will give the warning signs and start the early warning progress.

5 Conclusion

Preparation and managing emergency plans is a very important work in the research of emergency plans. This paper discussed the overall architecture and basic elements of emergency plans and analyzed the significance of establishing digitized emergency plans and its function modes. It will provide a basis for the research of emergency plans. The digitization of the emergency plans is one of the further research directions in the future.

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Appendix

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Design of Waveform Generator Based on GPIB Interface

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Abstract. Firstly, the GPIB technology is introduced in this paper, and then the method of hardware and software designing is discussed in detail. The GPIB interface function is realized by using upD7210. With the specific program, the DDS chip AD9962 is controlled by ARM processor of 32-bit to implement the waveform generation. The waveform generator has been used to build automation test system based on GPIB interface, and the experiments show that the waveform generator has the advantages of high speed, low cost, and excellent dynamic performance.

Keywords: GPIB, Waveform Generator, upD7210, LPC2368.

1 Introduction

GPIB(General Purpose Interface Bus) is a standard interface for programmable measurement instrument. With the general interface, the interconnect problems are resolved, and less then 15 instruments could be linked together by passive cable, and GPIB bus automatic test system could be established cooperating with application software. GPIB interface has been widely used in testing system with flexible and convenient features.

In the automatic test system based on GPIB bus, the waveform generator is usually used to generate excitation signals to drive the measured target, for the test system obtaining the measured output response. It is the one of the important components of automatic test systems. In this paper, GPIB bus technology is used to design the waveform generator, through which the waveform generator could be controlled by the controller in the automated test system. The using of GPIB bus has a great role in promoting the automation of the test system.

2 Design of System

The overall system structure is shown in Fig. 1. It consists of the GPIB interface circuit, ARM microprocessor, the state display unit, DDS circuit and so on.

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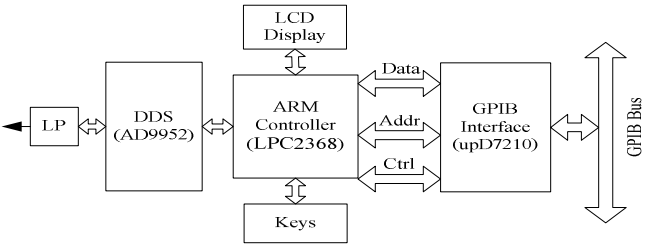

Fig. 1. The System Structure

ARM microprocessor is the core of the system. The primary task of ARM microprocessor is to receive GPIB commands through the GPIB interface, and configure the DDS chip by writing the registers after decoding the command data. The GPIB interface is one of the important instrument measurement buses. With the interface, the instrument could be used to build the automatic test system. The wave style and parameters can also be controlled by push the function buttons on front panel. And the working statuses are displayed in the local LCD.

2.1 The Microcontroller of the System

LPC2368, which is the 32-bit ARM7 processor produced by NXP Company, is selected as the core controller in this paper. The LPC2368 microcontroller is based on a 16-bit/32-bit ARM7TDMI-S CPU with real-time emulation that combines the microcontroller with up to 512 KB of embedded high-speed flash memory. A unique accelerator architecture enable 32-bit code execution at the maximum clock rate ARM7TDMI-S processor running at up to 72 MHz. Advanced Vectored Interrupt Controller (VIC), supporting up to 32 vectored interrupts. It incorporate a 10/100 Ethernet Media Access Controller (MAC), USB full speed device with 4 KB of endpoint RAM, four UARTs, two CAN channels, an SPI interface, two Synchronous Serial Ports (SSP), three IIC interfaces, and an I2S interface. It is ideal for multi-purpose serial communication applications, industrial control, medical systems, protocol converter, and communications [2].

2.2 Design of GPIB Interface

upD7210, a GPIB interface chip designed with LSI, has high-level agreement management ability to complete the function as listener, speaker or controller. And the chip is controlled by reading and writing the internal sixteen 8-bit register. As shown in Fig. 2, the signal port for microprocessor include data bus (D0-D7), register address (RS0-RS2), read/write control (RD, WD), interrupt request (INT), the reset and clock input.

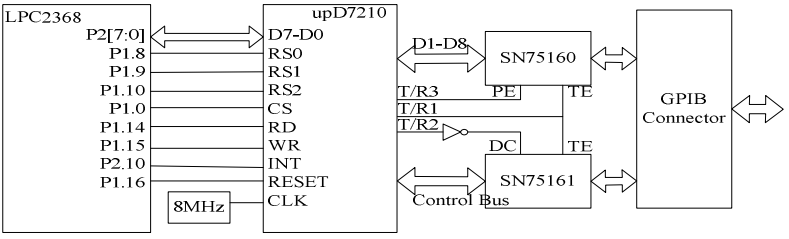

Fig. 2. The Circuit of GPIB Interface

The signals connected between LPC2368 and upD7210 mainly consists of data bus, control bus, address bus. P2[7:0] of LPC2368 is assigned to connect the D[7:0] of upD7210 as data bus. P1 [10:8] is used to control upD7210 internal register address. P1.0 is used as the chip select signal CS. P1.16 is linked to reset port to achieve the soft reset. Read and write signals of upD7210 are connected to P1.14 and P1.15 of microcontroller respectively. And CLK is droved by external active clock source.

There is nineteen signal lines face to GPIB bus, of which sixteen should be communicated with eight data wires, Three-Wire Handshake, five management buses respectively. However, these signal wires can not be connected with the GPIB bus directly, and should be connected with the GPIB bus through tri-state transceiver controlled by another three wire T/R[1:3]. SN75160 and SN75161 are two GPIB protocol transceivers meet the 8-channel bi-directional transceiver with low power consumption, high input impedance. The two transceivers will drive revenue to the GPIB bus signals required drive current and control signal transmission direction, and their output directly to the GPIB bus. SN75160, which is the data bus transceiver, achieves input and output of GPIB bus data through the directional control. SN75161, which is the control bus transceiver, is used to drive the GPIB management lines and handshake wires.

2.3 Design of DDS Circuit

The AD9952 is a direct digital synthesizer (DDS) featuring a 14-bit DAC and operating up to 400 MSPS. DDS schematic structure is shown in Fig. 3[3]. The AD9952 uses advanced DDS technology, coupled with an internal high speed, high performance DAC to form a digitally programmable, complete high frequency synthesizer capable of generating a frequency-agile analog output sinusoidal waveform at up to 200 MHz. The AD9952 is designed to provide fast frequency hopping and fine tuning resolution (32-bit frequency tuning word). The frequency tuning and control words are loaded into the AD9952 via a serial I/O port [4].

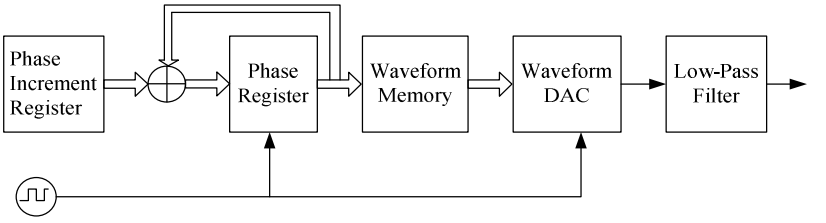

Fig. 3. Direct Digital Synthesis Circuitry

In this paper, AD9952 is controlled by LPC2368 via SPI bus to realize the register settings. The output signal is converted to voltage by the op amp as the output of AD9952 is current type. As the DAC output is a ladder-type signal, low pass filter is used to remove high-order harmonic part, reduce phase noise, and make the output waveform smooth and continuous. The full-scale current is controlled by an external resistor (Rset) connected between the DAC_Rset pin and the DAC ground (AGND_DAC). A resistor of 3.92KΩ is placed at DAC_Rset pin, get the 10mA maximum full-scale output current and achieve the best spurious-free dynamic range (SFDR) performance.

3 Software Design

System software flow diagram is shown in Fig. 4. It mainly contains of four parts, such as system initialization, receiving and decoding the GPIB command message, controlling DDS registers, detecting keyboard input, and displaying statuses.

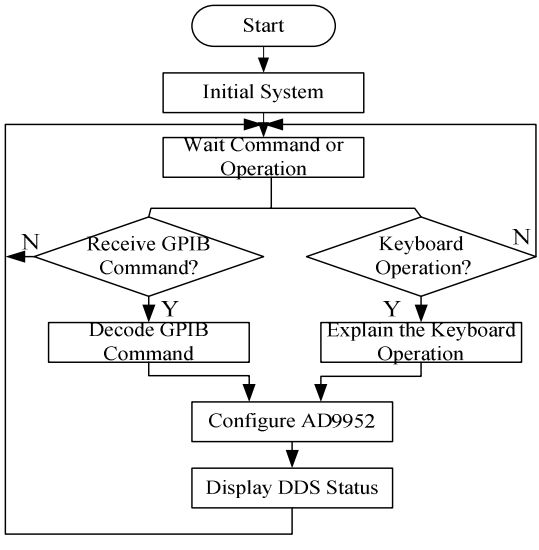

Fig. 4. Flow Diagram of Software

System Initialization. After the hardware or software reset, the system controller configures the stack, interrupts, IO ports and other environment, set the GPIB interface and close the DDS waveform output, to make sure the system running at a stable state through the initialization process.

GPIB Command Reception and Decoding. The controlling of the waveform generator is completed through the GPIB bus. When the controller sends command data to GPIB bus, the waveform generator as a listener should receive the data according to the GPIB address, and decode the message. Then the processor LPC2368 controls the AD9952 to make the appropriate action by SPI bus.

DDS Control Register. AD9952 is controlled via the serial port by LPC2368, so the software first needs to set the port mode, set the baud rate, configure the chip select signal. After receiving the remote control command, or detecting the event of button pressing at front panel, according to the type of command, LPC2368 sets the AD9952's registers to achieve the specific waveform, such as CFR1(Control Function Register 1), CFR2 (Control Function Register 2), ASF (Amplitude Scale Factor), POW(Phase Offset Word) and so on.

Keyboard Input and Status Display. Through the LCD, the instrument can accurately display the current working status, and provides the basis for the operator to control. When the instrument is working alone, the waveform can be controlled through the keyboard on the front panel.

4 Summary

In this paper, a waveform generator with GPIB interface based on ARM is presented, to provide objective signal for building the GPIB automatic test system. The waveform generator can also be used without GPIB bus, in the condition, the status is controlled by keyboard on front panel. Experiments show that the use of DDS chip AD9952 can achieve high resolution, fast conversion speed, to meet the complex requirements of high transmission speed of the occasion.

Acknowledgement. It is a project supported by the scientific research project of Guangxi Provincial Department of Education (201010LX135).

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Migration Law of Heavy Metals in Coal Gangue - Soil System in Mining Reclamation Area

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Abstract. The abstract should summarize the contents of the paper and should contain at least 70 and at most 150 words. It should be set in 9-point font size and should be inset 1.0 cm from the right and left margins. There should be two blank (10-point) lines before and after the abstract. This document is in the required format.

Keywords: mining reclamation area, heavy metal, migration law.

1 Introduction

With the exploitation of coal resources, coal mining subsidence range was increased at rate of 2.7 ~ 4.1× 104 hm2 per year in China [1]. At present, China mainly filled coal mining subsidence area with coal gangue and fly ash. According to statistics, the coal gangue backfilled with was total utilization of about 70% [2]. But in the process of reclamation, as coal gangue usually contained mercury (Hg), cadmium (Cd), lead (Pb), arsenic (As) and other toxic substances, which entered into the surrounding soil and water environment through the leaching role of natural precipitation, and it caused excessive accumulation of heavy metals in soil and water to have serious environmental impacts and health risks.

In recent years, the study of soil in mining reclamation area had attracted extensive attention of scholars at home and abroad [3]. Szcaepanska and Twardowskastudied coal gangue in Poland's Smolnica; the results showed that heavy metal pollution of gangue in surrounding soil was obvious [4]. Panov and Dudik investigated and studied environmental chemistry of heavy metals in Russia's Donbass coalfield and found that Hg, As, Pb, Znand Cd content were over standard in soil around the mine [5]. Yao Duoxi and Zhang Zhiguocarried out research of soil pollution characteristics in Huainan coal mine reclamation; it was showed that the soil had been subject to different degrees of heavy metal pollution [6].

2 Materials and Methods

In this study, the reclaimed gangue and upper covering soil (20cm) in a certain reclamation area were sampled. One part of soil samples and coal gangue samples

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collected was used to determine water content, organic matter, available potassium, available phosphorus and soluble salt; the other part was put in a ventilated, cool and dry place to naturally air dry. After dried, the stones, plant roots and other debris were picked out from the samples, and then according to quartering, the samples were discard the excess part to retain about 300 g. Finally the samples were put in agate mortar for grinding, passed through 200 eye nylon screen mesh for screening. HNO3-HClO4 were used to digest processed samples, and then heavy metals Cd, Cu, Cr, Zn, Ni content were determined using atomic absorption spectrometry(AAS), Hg using atomic fluorescence spectrophotometer.

3 Results and Analysis

3.1 Correlation Analysis of Heavy Metals on the Bottom Covering Soil and Gangue

In order to understand whether the heavy metals content on the bottom covering soil was impacted by heavy metals of coal gangue, correlation analysis of heavy metals on the bottom covering soil and gangue was made, the result were shown in Table 1.

Table 1. Correlation coefficients of heavy metals on the bottom covering soil and gangue

Heavy Metals	Cu	Cr	Zn	Ni	Pb	Cd	Hg
Correlation Coefficients	0.057	0.394	0.133	0.359	0.010	0.822**	0.452

memo: **, * P＜0.01 与P＜0.05.

As could be seen from Table 1, heavy metal Cd of heavy metals on the bottom covering soil and gangue achieved a significant correlation, r=0.822; elements Hg, Cr and Ni reached moderate level of correlation; correlation of elements Zn Cu and Pb was lower. This was showed that if reclamation was filled with coal gangue, heavy metals Cd, Hg, Cr and Ni in coal gangue would migrate to the upper covering soil to produce different degrees of pollution in the soil.

3.2 Migration Characteristics of Heavy Metals from Coal Gangue to Upper Soil

Migration of heavy metals from coal gangue to upper soil was related to soil types, pH, thickness of covering soil, soil physical and chemical properties, climatic conditions (temperature, rainfall, acidity of rainwater and precipitation frequency of acid rain, etc.), biological role, occurrence of trace metals and other factors. In this study, assuming that soil type, pH, climatic conditions and biological role were the same, the

influence factors and their characteristics of heavy metals (Cd, Hg, Cr, Ni) migration from coal gangue to upper soil were discussed.

(1) The determination of influence factors

At first, the influence factors of Cd, Hg, Cr, Ni migration from coal gangue to upper soil were determined by correlation analysis. The results were shown in Table 2.

According to Table 2, it was known that heavy metal Cd content and soluble salt were moderate negative correlation, r=-0.565; therefore, the influence factor of element Cd migration was soluble salt. The correlations of Hg with soluble salt and thickness of covering soil were moderate, and rSS=-0.633, rTCS=0.356; so the influence factors of Hg migration were soluble salt and thickness of covering soil. By analogy, Cr element migration was influenced by thickness of covering soil, available potassium and available phosphorus; Ni element migration was affected by thickness of covering soil, available potassium, available phosphorus and soluble salt.

Table 2. Correlation analysis of the influence factors

Heavy Metals in soil	Thickness of Covering Soil (TCS)	Water Content (WC)	Organic Matter (OM)	Available Potassium (APo)	Available Phosphorus (APh)	Soluble Salt (SS)
Cd	0.273	-0.141	-0.279	-0.101	-0.248	-0.565
Hg	0.356	0.059	0.072	-0.020	0.198	-0.633
Cr	0.433	0.077	-0.187	0.449	-0.374	0.265
Ni	0.541	0.146	0.064	0.532	-0.437	-0.572

(2) Regression analysis

Based on the above determined factors, making using of Spss analysis tool, regression analysis was made and the following models were arrived at:

$y_{soil\text{-}Cd} = 0.765_{coal\text{-}Cd} - 0.01\ SS + 0.702$, $R^2=0.437$;

$y_{soil\text{-}Hg} = 0.435_{coal\text{-}Hg} - 0.99TCS - 0.492SS$, $R^2=0.527$;

$y_{soil\text{-}Cr} = 1.480_{coal\text{-}Hg} - 0.797TCS + 3.473APo + 7.365APh - 616.843$, $R^2=0.871$

$y_{soil\text{-}Ni} = 0.065_{coal\text{-}N}i - 0.071TCS + 0.198APo - 0.289APh + 0.002SS + 31.135$, $R^2=0.81$

From the above regression analysis, it could be seen that the regression coefficients of Cd and Hg migration models were smaller and fitting degrees were poor, so the models

didn't explain the migration law of Cd and Hg in coal gangue - soil system. But the regression coefficients of Cr and Ni migration models were larger which were greater than 0.8, and fitting degrees were better, therefore the models could explain the migration law of Cr and Ni.

4 Conclusions

Through the above analysis, the following conclusions could be drawn:

(1) In the study reclamation filled with coal gangue, heavy metals Cd, Hg, Cr and Ni in coal gangue could migrate to the upper covering soil and resulted in different degrees of pollution in the soil.
(2) Migration model of heavy metal Cr in coal gangue-soil system: $y_{soil\text{-}Cr}=1.480_{coal\text{-}Hg} - 0.797TCS + 3.473APo + 7.365APh - 616.843$; and migration model of heavy metal Ni in coal gangue - soil system: $y_{soil\text{-}Ni}=0.065_{coal\text{-}Ni} - 0.071TCS + 0.198APo - 0.289APh + 0.002SS + 31.135$

Acknowledgement. Project Support: Research on mercury pollution characteristics and the impact of microflora features in the soil surrounding landfill.

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Research on Effect of Woody Plants Remediation Heavy Metal

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Abstract. In this paper, taking a certain mining reclamation area as research object, 12 kinds of woody plants growing well were screened to study effect of Woody Plants Remediation Heavy Metal. The results showed that: removal effects of heavy metals Cu, Cr and Ni by szechwan juniper and poplar were better; removal effects of Zn by prunus persica, osmnthus fragrans and sophora japonica were better; removal effect of Hg by magnolia grandiflora and sophora japonica was better; removal effects of Cd and Cu by cedrus deodara were better.

Keywords: woody Plants, soil heavy metals, remediation effect.

1 Introduction

In recent years, many scholars at home and abroad have carried out the treatment study on soil heavy metal pollution in mining areas, and phytoremediation technology using green plants to transfer, hold, or transform contaminants in the soil is more and more paid attention to by people [1]. At present, hyperaccumulator plants used in heavy metal contaminated soil remediation is mostly herbs, especially annual herbs. These herbs often show low biomass, slow growth, and are vulnerable to threat of weed competition, which are the limiting factor of phytoremediation. For this reason, studies of woody plants remediation soil contaminated by heavy metal have been carrying out at home and abroad. In 2004, Samecka-Cymerman A and other people had used S.viminalis, P.Canadensis and Phragmites communis to constructed wetland to remove eutrophication elements P, nitrate, ammonium, chloride, sulfate, Ca, Mg, K, Fe and heavy metals (Al, Mn, Ni, Sr, V, Zn, Cd , Cu et al.) [2]. Luan Yiling and Jiang Zhiling had studied on heavy metal accumulation ability of plant in Qixia Mountain, the results showed that Paulownia fortunei,Ulmus pumila and Broussonetia papyrifera had relatively higher complex ability to accumulate heavy metal [3].

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2 Materials and Methods

In this study, the root zone soil of twelve woody plants in a certain reclamation area was sampled, and the open ground after the reclamation was selected background reference. The soil samples were put in a ventilated, cool and dry place to naturally air dry. After dried, the stones, plant roots and other debris were picked out from the samples, and then according to quartering, the samples were discard the excess part to retain about 300 g. Finally the samples were put in agate mortar for grinding, passed through 200 eye nylon screen mesh for screening, and sealed into ziplock bag to prepare for determination. HNO3-HClO4 were used to digest processed samples, and then heavy metals Cd, Cu, Cr, Zn, Ni content were determined using atomic absorption spectrometry(AAS), Hg using atomic fluorescence spectrophotometer. The results were in Table 1.

Table 1. Heavy metal content in woody plants root zone soil (mg/kg)

Tree species (TS)	Cu	Cr	Zn	Ni	Cd	Hg
Yulan magnolia (YM)	45.585	319.217	342.699	38.666	0.829	0.470
Magnolia grandiflora(MaG)	44.194	745.913	284.879	46.482	0.720	0.033
Osmnthus fragrans (OF)	44.813	267.689	110.024	37.2677	0.740	0.107
Sophora japonica (SoJ)	46.363	495.390	141.635	43.476	0.838	0.058
Albizia jnlibrissin (AJ)	47.212	392.914	195.123	40.2056	1.070	0.309
Prunus cerasifera (PC)	50.479	398.601	312.503	36.418	0.678	0.090
Prunus persica (PP)	46.378	369.820	109.202	40.120	0.852	0.108
Ligustrum lucidu (LL)	38.935	214.033	442.700	37.933	0.914	0.141
Metasequoia glyptostrobides (MeG)	40.395	269.913	403.999	41.119	0.967	0.102
Szechwan juniper (SzJ)	36.386	191.170	270.510	33.076	0.761	0.146
Cedrus deodara (CD)	32.553	292.247	161.113	33.318	0.559	0.116
Poplar (P)	35.727	201.156	317.459	35.733	0.806	0.104
Background Calue (BV)	51.199	465.582	433.233	49.890	0.615	0.197

3 Results and Analysis

3.1 Heavy Metals Distribution Characteristics in Different Woody Plants Root Zone Soil

According to Table 1, statistical analysis was made; the results were shown in fig. 1.

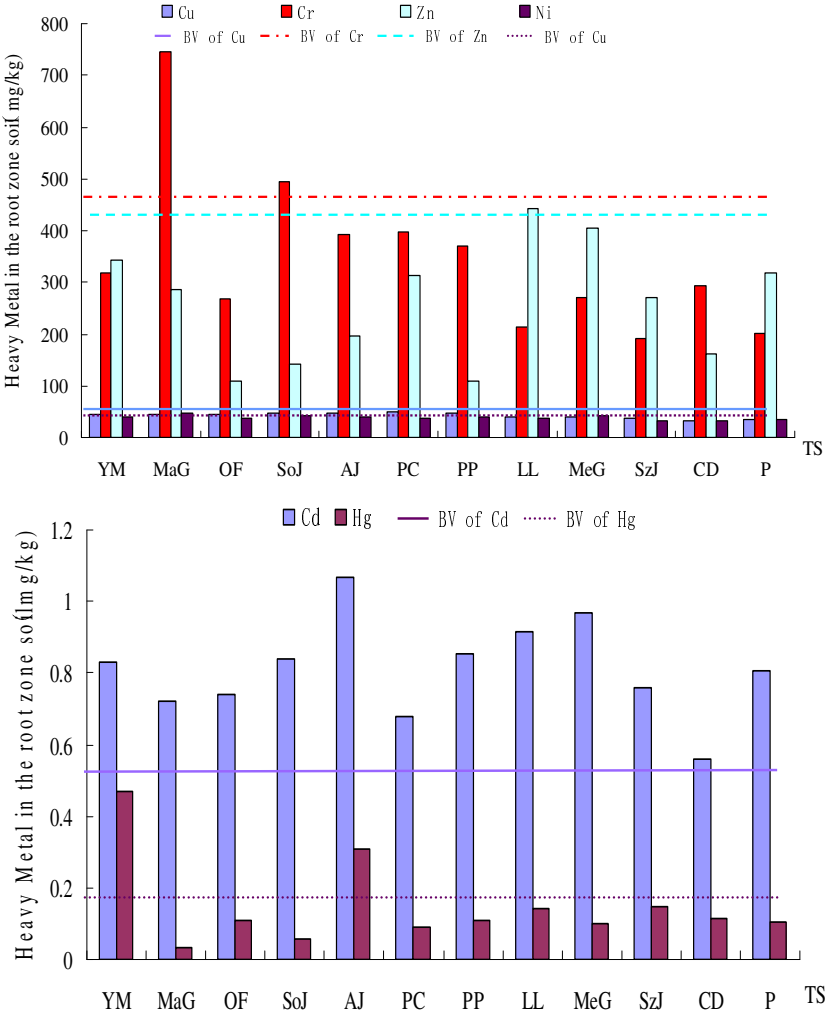

Fig. 1. The change chart of heavy metals content in the root zone soil

In figure 1, it was known that cuprum content in root zone soil: Cedrus deodara <Poplar <Szechwan juniper <Ligustrum lucidu <Metasequoia glyptostrobides <Magnolia grandiflora < Osmnthus fragrans <yulan magnolia <Sophora japonica <Prunus persica <Albizia jnlibrissin <Prunus cerasifer, and Cu levels in all the root zone soil were lower than the background value. Chromium content: Szechwan juniper <Poplar <Ligustrum lucidu <Osmnthus fragrans <Metasequoia glyptostrobides <Cedrus deodara <yulan magnolia <Prunus persica <Albizia jnlibrissin <Prunus cerasifera < Sophora japonica < Magnolia grandiflora; among them, Cr concent in Sophora japonica and Magnolia grandiflora root zone soil were higher than the background value. Zincum content: Prunus persica <Osmnthus fragrans <Sophora japonica <Cedrus deodara <Albizia jnlibrissin <Szechwan juniper <Magnolia

grandiflora <Prunus cerasifera < Poplar <Magnolia grandiflora <Metasequoia glyptostrobides < Ligustrum lucidu, and Zn content in Ligustrum lucidu root zone soil was higher than the background value. Nickel content: Szechwan juniper <Cedrus deodara <Poplar <Prunus cerasifera <Osmnthus fragrans <Ligustrum lucidu <yulan magnolia <Prunus persica <Albizia jnlibrissin <Metasequoia glyptostrobides <Sophora japonica <Magnolia grandiflora, and Ni levels in all the root zone soil were lower than the background value. Hydrargyrum content: Magnolia grandiflora <Sophora japonica <Prunus cerasifera <Metasequoia glyptostrobides <Poplar <Osmnthus fragrans <Prunus persica <Cedrus deodara <Ligustrum lucidu <Szechwan juniper <Albizia jnlibrissin <yulan magnolia, and Hg content in yulan magnolia and Albizia jnlibrissin root zone soil were higher than the background value. While for the cadmium content in the root zone soil, it was only Cedrus deodara that its cadmium content was lower than the background value, the content in the rest root zone soil were higher than the background value.

3.2 Removal Effects of Heavy Metals by Different Woody Plants

Calculating formula of the removal rate of heavy metals in root zone soil was as follows:

$$\text{Removal rate } (\%) = \frac{(C_0 - C) \times 100}{C_0}$$

C_0 - concentration of heavy metals in the soil which is not restored by plants (mg/kg)

C - Concentration of heavy metals in the soil which had been restored by plants (mg/kg)

The results were showed in Figure 2.

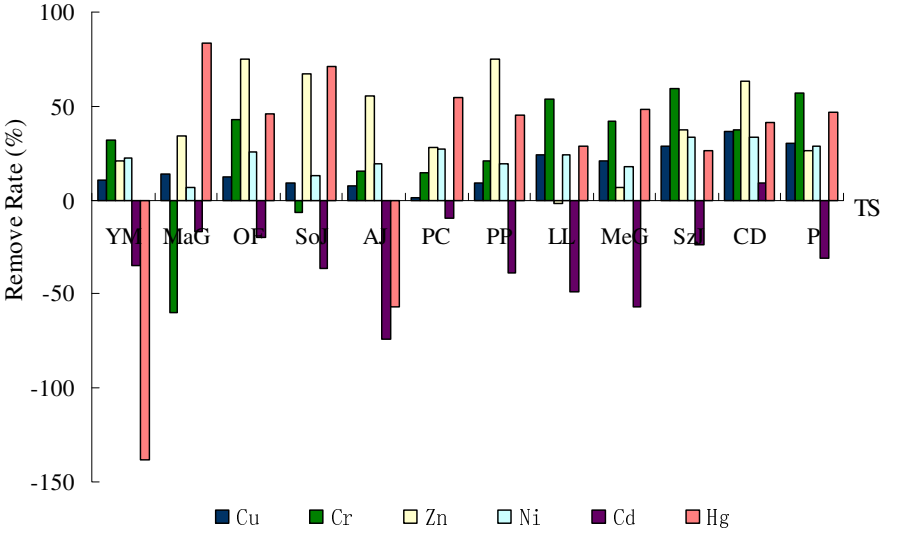

Fig. 2. Removal effects of heavy metals by different woody plants

In figure 2, the removal rate of Cu in different root zone soil was as follows: Cedrus deodara >Poplar >Szechwan juniper >Ligustrum lucidu >Metasequoia glyptostrobides >Magnolia grandiflora >Osmnthus fragrans >Yulan magnolia >Sophora japonica >Prunus persica > Albizia jnlibrissin >Prunus cerasifera. The removal rate of Cr: Szechwan juniper >Poplar >Ligustrum lucidu >Osmnthus fragrans > Metasequoia glyptostrobides >Cedrus deodara >Yulan magnolia >Prunus persica >Albizia jnlibrissin >Prunus cerasiferar. The removal rate of Zn: Prunus persica >Osmnthus fragrans >Sophora japonica >Cedrus deodara >Albizia jnlibrissin >Szechwan juniper >Magnolia grandiflora >Prunus cerasifera >Poplar >yulan magnolia >Metasequoia glyptostrobides >Ligustrum lucidu. The removal rate of Ni: Szechwan juniper >Cedrus deodara >Poplar >Prunus cerasifera >Osmnthus fragrans >Ligustrum lucidu >Yulan magnolia >Prunus persica >Albizia jnlibrissin >Metasequoia glyptostrobides >Sophora japonica >Magnolia grandiflora. The removal rate of Hg: Magnolia grandiflora >Sophora japonica >Prunus cerasifera >Metasequoia glyptostrobides >Poplar >Osmnthus fragrans >Prunus persica >Cedrus deodara >Ligustrum lucidu >Szechwan juniper. While for the removal rate of Cd, it was only cedrus deodara that could remove it.

4 Conclusions

Through the above analysis, the following conclusions could be drawed: removal effects of heavy metals Cu, Cr and Ni by szechwan juniper and poplar were better; removal effects of Zn by prunus persica, osmnthus fragrans and sophora japonica were better; removal effect of Hg by magnolia grandiflora and sophora japonica was better; removal effects of Cd and Cu by cedrus deodara were better. Therefore, poplar, cedrus deodara, szechwan juniper and sophora japonica could be planted to restore soil heavy metal pollution in the study area.

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Evaluation on Watery of "4th Aquifer" in Suntuan Coal Mine

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Abstract. With the use of drilling data of the working surface, we identified the characteristics of lithology, mineral composition and thickness distribution of fourth aquifer (the "4th aquifer") of loose layer bottom in $7_2$11 working surface of Suntuan coal mine. Based on "Prevention and control of water regulation. Coal mine" and the pumping test analysis, the $7_2$11 working surface "4th aquifer" belongs to weak watery. we can prove and correctly evaluate the watery of loose layer bottom of "4th aquifer" in the working surface, which has an important practical significance on reasonable safe mining coal rock pillar type and increasing the recovery rate of coal resources, fully developing and utilizing coal resources. And it provides a reliable basis for mine to achieve a sustained normal safety production.

Keywords: working surface, "4th aquifer", watery, evaluation.

1 Introduction

In the process of mining, analysis and prevention of water damage, is one of the main objects of the study area watery [1.2]. In recent years, some scholars, in the study of Cenozoic fourth aquifer "4th aquifer ", arouse the importance of safe mining coal rock pillar on the first level, and also took consideration of Cenozoic fourth aquifer weathering oxidized zone hydrogeologist characteristics, and they gave the methods of analog simulation, numerical analysis, building coupling model to make sure the projects of different coal rock pillar types and heights [3.4]. In the study of aquifer watery, besides the traditional hydrogeology analytical method, some scholars also took excessive, and according to the characteristics of several hudrogeololgy physics fields, contrasted and covered the shortage mutually, gave a system synthesis to the watery of aquifer [5]. Gao Huajun(2003) evaluated the watery degree with drill hole watering and analyzing water inflowing change. Xia Zhongyang (2007) analyzed the law from four aspects, water leaking hole experiment data and water pumping hole experiment data and its underlying strata, together with watery and structure.

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The $7_2$11working surface is the fourth fully-mechanized working face of the first area in 7_2 coal seam of 81 mining area in Suntuan Coal Mine. Its mineral seam is mainly 7_2 coal seam. It shows, according to the data of $7_2$11 working surface and its eleven drill holes around, that its cainozoic loose bed thickness is 203.00～210.85m, its average thickness is 205.97m, its bedrock face elevation is -176.70～-184.99m, its average elevation is -179.89m. Generally, the working surface bedrock face elevation lessens gradually from southwest to northeast.

2 Data and Methods

2.1 4th Aquifer Lithological Characters

There are , in 7211 working surface and eleven drill holes (25-26$_2$, 26$_2$, 26-27$_2$, Goushui3, 09 water 3) which disclose 4th aquifer. Statistical analysis shows that it mainly comprises light gray, tattletale gray, clay bank, khakee clay sand, coarse sand, silt, layer of grave, clay mixed with gravel, gravel mixed with calcium clay. 26-27$_2$ drill hole also contains thick gravel which mainly comprises quartz and limestone. Its diameter is mainly 5-7cm. And it is difficult to separate and medium rounding. It is mainly filled with clay. From its lithological characters, 4th aquifer contains mainly mud and most of it is spoiled slope wash.

2.2 4th Aquifer Mineral Components

We get 4th aquifer mineral components with x-ray diffraction and electric microscope scanning semi-quantitative analysis, (fig.1-2). It shows that 4th aquifer mineral components are mainly quartz, kaolin, montmorillonite, chlorite, and calcite.

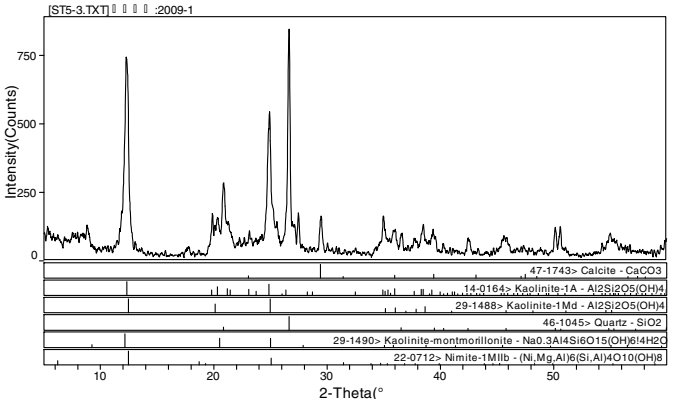

Fig. 1. “4th Aquifer” sandy to stick soil sample XRD ingredient correspondence intensity

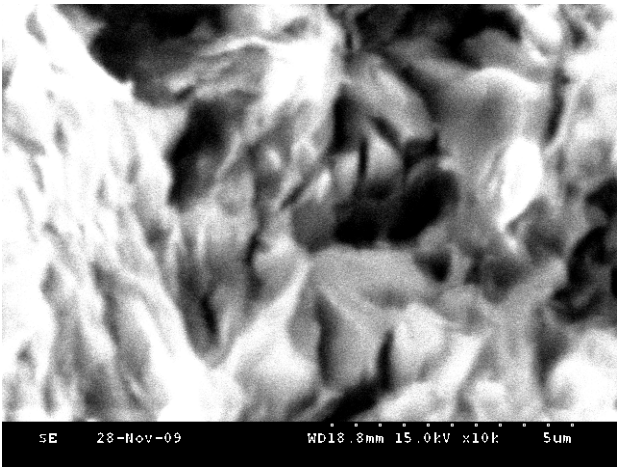

Fig. 2. "4th Aquifer" sandy to stick soil sample scanning electron microscope

2.3 4th Aquifer Thickness Distribution Characters

According to the data of $7_2$11 working surface and eleven drill holes around, it shows that 4th aquifer bottom depth is 203.00-210.85m, and its average is 05.97m. And 4th aquifer position total thickness is 0-29.40m; its average is 6.34m. Its effective thickness is 0～17.80m, and average is 4.45m. Its effective thickness litho logy is mainly gravel layer and sand, clay sand and clay mixed with gravel. The working surface and around doesn't distribute stably. Of the five drill holes (25-262, 262, 267, 26-271, 26-273) in the working surface and around , only 25-262 has clay sand 4th aquifer deposit, other 4 are all lack of 4th aquifer. Therefore, for the working surface designed, most areas lack 4th aquifer.

This replenish hydrology explores 09 water3 and during the course of drilling 4th aquifer and weathering oxidized zone, the simple hydrogeology shows that flushing liquor consumes only in gravel layer of 4th aquifer, for example gravel layer (178.21-183.44m). According to pumping test and related hydrogeological parameter calculation, 4th aquifer and weathering oxidized zone thickness is 33.75m. And in it, 4th aquifer gravel bed thickness is 17.75m, weathering oxidized zone sand stone thickness is 16.00m, specific capacity is 0.029L/sm, osmotic coefficient is 0.089m/d, static level burial depth is 115.46m, elevation is -89.36m. This hole 4th aquifer and weathering oxidized zone $q<0.1$L/sm, which belongs to weak watery and low water permeability.

In conclusion, $7_2$11 working surface 4th aquifer mainly comprises clay sand, coarse sand, silt, layer of grave, clay mixed with gravel, gravel mixed with calcium clay with mud mainly and most of it is spoiled slope wash. 4th aquifer mineral components are mainly quartz, kaolin, montmorillonite, chlorite, and calcite and have strong water proof nature. 09 water 3 pumping test and related hydro geological parameter shows that it is poor aquifer. It can be seen that 4th aquifer distributes especially unstably and most areas lack 4th aquifer.

2.4 Evaluation of 4th Aquifer Watery

According to "Prevention and control of water regulation. Coal mine", the standard of classification of aquifer watery is:

a. pole strong watery, specific capacity q＞5 L/s.m; b strong watery specific capacity 5≥q＞1 L/s.m; c. medium watery, specific capacity 1≥q＞0.1 L/s.m; d. poor watery, specific capacity q＜0.1 L/s.m. According to the definition of specific capacity, we can get $q = \frac{Q}{3.6s}$. Here, q —specific capacity, L/s.m; Q —stable water injection rate, m3/h; s —waterhead stable rise rate, m.

In 2009, we constructed 09 water 3 supplement exploration hole, and took pumping test. The draw water position was in 4th aquifer and weathering oxidized zone. It was mainly to explore 4th aquifer and weathering oxidized zone hydrogeololgy and 7 coal inventory situation, to get its watery, permeability and stable water level. during the course of drilling 4th aquifer and weathering oxidized zone, flushing liquor consumes some, for example gravel layer(178.21～183.44m) in gravel layer of 4th aquifer. Its static level burial depth is 115.46m, elevation is -89.36m. The result is shown in table 1. And according to detail geological report, table 2 has the result of 21-224 hole and its complemented 07 observing 1 and 07 observing 2 4th aquifer observing pumping test and water injection test.

Table 1. $7_2$11 working surface “4th Aquifer”, weathering oxidized zone position pumping test and water injection test hydrology geology parameter computation achievement table

Drilling hole	Test section	M (m)	Static level (m)	S (m)	Recover level (m)	Q (L/s)	q (L/sm)	K (m/d)	R (m)
09-water3	4th Aquifer/ weathering oxidized zone	33.75	-89.36	39.54	-89.36	1.17	0.029	0.089	113.00

Table 2. Sun Tuan coal mine “4th Aquifer” hydrology observation hole statistical table

Hole number	Final hole depth and position (m)	Basement depth (m)	Aquifer name	specific capacity(L/s·m)	osmotic coefficient (m/d)	Drilling position
07-ovserving 1	222.15 Basement under	210.55	4th Aquifer	0.0105	0.278	South boundary of mining area
07-ovserving 2	190.04 Basement under	182.75	4th Aquifer	0.00085	0.021	Outcrop of mining area
21-224	650.50	190.30	4th Aquifer	0.00135	0.02222	102 mining area

Compare Tab.1 and Tab.2, it can be seen that if we draw 4th Aquifer and weathering oxidized zone in a compounded way, its hydrogeological parameter is similar to 4th Aquifer position. So it is sure that in this mining area 4th Aquifer watery index is similar to that of weathering oxidized zone. According to pumping test and water injection test, 4th Aquifer and weathering oxidized zone specific capacity is0.029L/sm, osmotic coefficient is 0.089m/d. And according to "Prevention and control of water regulation. Coal mine", 7211 working surface 4th Aquifer is poor watery aquifer.

3 Conclusions

(1) From its lithological characters, 4th aquifer contains mainly mud and most of it is spoiled slope wash. 4th aquifer mineral components are mainly quartz, kaolin, montmorillonite, chlorite, and calcite.
(2) 4th aquifer distributes especially unstably and most areas lack 4th aquifer. According to pumping test and water injection test, and according to “Prevention and control of water regulation. Coal mine”, $7_2$11 working surface 4th Aquifer is poor watery aquifer.

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Research on Remanufacturing Reverse Logistics Network Optimization under Uncertain Recycling Number

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Abstract. Considering different number of recycling product in the reverse logistics remanufacturing process, by using interval described the uncertain recycling number, a multi-objective remanufacturing reverse logistics LRP integer programming model is established, which based on the two-stage decomposition algorithm of operational research. The design of numerical example results verify the effectiveness of the model and method.

Keywords: Reverse logistics, Remanufacturing, Location - routing problem, Transportation problem, Tabular method.

1 Introduction

The reverse recovery of used products is a basic part of remanufacturing. waste products which generated by User through reverse recycling into the recycling center, for product testing, removing get used parts or recycled materials, enter remanufacturing production system to make parts reengineering and material regeneration, and then reverse back to Suppliers form a remanufacturing reverse logistics network for the purpose of waste products remanufacturing. The most critical decision in recovery is the collection and transport of waste products. Many scholars at home and abroad were studied, literatures[1,2,3] are the deterministic remanufacturing reverse logistics issues of research . However, the biggest difference between remanufacturing reverse logistics network and traditional production distribution network is the uncertain of recovery time, quality, quantity and other factors of the waste, leading to uncertainty supply of materials and affecting remanufacturing production plan. literatures[4-7] respectively do a certain degree of research for these uncertain.

This paper will try to solve the problem is: to the minimum total cost as the goal, facility location recycling center and remanufacturing factories at alternative facilities in remanufacturing reverse logistics network, and then determine the optimal transport routes and numbers between the facilities, finally a numerical example was validated.

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2 Remanufacturing Reverse Logistics LRP Model

In this paper, based on the reference to construct a lever 4 capacity of recycling waste product manufacturing reverse logistics network, In order to facilitate analysis, we give the following assumption and instructions:

① The recycling products abstract in recycling point according to the consumer zoning, and recycling and remanufacturing one type of recovery products
② Without considering the effect of road freight shipping costs, the cost and distance have a simple linear relationship
③ Transport vehicles enough to meet transport task, considering only vehicle transportation

Based on the above assumptions, the variables and parameters are defined as follows:

i-fixed collect point locations of customer zones, i=1,2,…,I
j-potential recycling and disposal center locations, j=1,2,…,J
k-potential remanufacturing factory locations, k=1,2,…,K
r-fixed manufacturer locations, r=1,2,…,R
v{I ∪ J ∪ K ∪ R}-set of all the nodes in network
A_i-recycling number of waste products in customer zones
B_r-demand of manufacturers for recycling products
λ-the punishment coefficient of manufacturer fails to satisfy demand
X_{ij}、C_{ij} -quantity and shipping cost per unit of recycling products shipped from recover points of customer zones i to recycling and disposal center j
X_{jr}、C_{jr}-quantity and shipping cost per unit of available products shipped from recycling and disposal center j to manufacturer r
X_{jk}、C_{jk}-quantity and shipping cost per unit of recycling products to remanufacture shipped from recycling and disposal center j to remanufacturing factory k
X_{kr}、C_{kr}-quantity and shipping cost per unit of remanufacturing products shipped from remanufacturing factory k to manufacturer r
U_j-the maximum productivity of recycling and disposal center j
V_k-the maximum remanufacturing production of remanufacturing factory k
G_j、M_j- fixed cost and disposal cost of waste recycling products in recycling and disposal center j
H_k、N_k- fixed cost and disposal cost of scrapped products in the remanufacturing progress of remanufacturing factory k
α-rate of direct utilization after inspection and maintenance of recycling products in recycling and disposal center
β-rate of remanufacturing in remanufacturing factory
γ-rate of recycling products waste in recycling and disposal center

$$Y_j = \begin{cases} 1 & \text{if a recycling and disposal center is opened at location j} \\ 0 & \text{otherwise} \end{cases}$$

$$Z_k = \begin{cases} 1 & \text{if a remanufacturing facory is opened at location k} \\ 0 & \text{otherwise} \end{cases}$$

In terms of the above notation, the objective function can be described as follows:

$$\min\ W=\sum_{j=1}^{J}Y_jG_j+\sum_{k=1}^{K}Z_KH_K+\gamma\sum_{i=1}^{I}\sum_{j=1}^{J}X_{ij}M_j+(1-\beta)\sum_{i=1}^{I}\sum_{j=1}^{J}\sum_{k=1}^{K}(1-\alpha-\gamma)X_{ij}N_k$$
$$+\sum_{i=1}^{I}\sum_{j=1}^{J}X_{ij}C_{ij}+\sum_{j=1}^{J}\sum_{k=1}^{K}X_{jk}C_{jk}+\lambda(\sum_{j=1}^{J}\sum_{r=1}^{R}X_{jr}C_{jr}++\sum_{k=1}^{K}\sum_{r=1}^{R}X_{kr}C_{kr}) \quad (1)$$

$$s.t \quad \sum_{j=1}^{J}X_{ij}=A_i \quad i=1,2,...,I \quad (2)$$

$$\sum_{j=1}^{J}X_{jr}+\sum_{k=1}^{K}X_{kr}\le B_r \quad r=1,2,...,R \quad (3)$$

$$d_i\le\sum_{j=1}^{J}X_{ij}\le e_i \quad i=1,2,...,I;\ j=1,2,...,J \quad (4)$$

$$\sum_{j=1}^{J}\sum_{k=1}^{K}Y_jZ_k\le 1 \quad (5)$$

$$\sum_{i=1}^{I}X_{ij}\le U_j \quad j=1,2,...,J \quad (6)$$

$$\sum_{j=1}^{J}X_{jk}\le V_k \quad k=1,2,...,K \quad (7)$$

Where, objective function(1) minimizes the total costs including investment costs, disposal costs and shipping costs; Eqs(2) and constrains(3) and(4) show the relationship of supply more than demand in transportation and the number of recycled products is the uncertainty interval in[d_i, e_i]; constrain(5) assure building at most one scale similar recycling and disposal center and remanufacturing factory ;constraints(6) and (7) are maximum disposal capacity constraints on recycling and disposal center and remanufacturing factory.

3 Numerical Example

This paper designed a scrap steel recycling remanufacturing reverse logistics network, which have four collection points of customer zones collected scrap steel to meet the demand of four manufacturers, and six potential recycling and disposal centers and four potential remanufacturing factories, each facility data are shown as table below, According to former data, the number of recycled products aboutA_1 can be derected in[100,200], Other parameters are setted as follow$C_{v*v}=d_{v*v}$, $\alpha=0.6$, $\beta=0.95$, $\gamma=0.1$, $\lambda=0.5$,m=3,n=2.

Table 1. Data on each collection point of customer zones and remanufacturer

Category / Number	A_i coordinate/recycling number (tun)	B_r coordinate /demand (tun)
1	(50,116) / [100,200]	(236,45) / 140
2	(20,80) / 200	(264,124) / 175
3	(64,215) / 100	(168,200) / 160
4	(72,25) / 120	(285,250) / 125

Table 2. Related data about potential recycling and disposal centers

j / Number	Y_j coordinate	G_j /yuan	M_j /yuan	U_j /yuan
1	(40,10)	36000	600	250
2	(80,180)	15000	450	320
3	(85,55)	20000	720	260
4	(172,40)	25000	640	200
5	(108,102)	18000	550	480
6	(47,80)	32000	500	440

Table 3. Related data about potential remanufacturing factories

k / Number	Z_k coordinate	H_k /yuan	N_k /yuan	V_k /tun
1	(224, 96)	38000	800	260
2	(214,230)	55000	760	275
3	(172,20)	46000	840	210
4	(160,132)	42000	660	328

According to the results, we built recycling and disposal center atY_2, Y_3, Y_5, and remanufacturing factory atZ_1, Z_4, then obtain a minimum investment and operating cost and transportation distance to save the total cost .The optimal transport program by tabular method as shown in table 4 with 252966 yuan for the final total cost.

Table 4. Operation result with X_{ij}、X_{jr}、X_{jk}、X_{kr}

taffic	X_{12}^{ij}	X_{15}^{ij}	X'^{ij}_{15}	X_{23}^{ij}	X_{25}^{ij}	X_{32}^{ij}	X_{43}^{ij}
value	60	100	20	195	5	100	120
taffic	X_{23}^{jr}	X_{31}^{jr}	X_{34}^{jk}	X_{51}^{jk}	X_{14}^{kr}	X_{42}^{kr}	others
value	160	140	175	125	125	175	0

4 Conclusions

This paper through the establishment of a scrap steel recycling remanufacturing reverse logistics network, considering the uncertain number of recycling products established remanufacturing reverse logistics LRP model and solved by operations research methods, numerical example analysis shows that the model and algorithm is effective. But only for the single uncertain reverse logistics network with recycling and remanufacturing decision research, many factors with uncertainty, the integration of forward/reverse logistics network is a promising research in the future.

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Application of MMAX2 Tool in Chinese-English Parallel Corpus Building

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Abstract. Corpora of different categories and sizes have been widely explored in linguistic research. As one major type, parallel corpus has been applied particularly to the field of cross-lingual studies, such as translation, contrastive analysis and cross-cultural communication. The building methods of a parallel corpus vary according to different purposes and other relevant factors. In this paper, we introduced a parallel corpus building method by employing MMAX2 tool, which could realize linking-up and annotation at the same time through human labor. We have built a one-to-three Chinese-English parallel corpus with this tool and some lessons have been learned and are wished to be shared.

Keywords: MMAX2 tool, Chinese-English parallel corpus, annotation, alignment.

1 Introduction

Deriving from Latin, the word 'corpus' means 'body', or a body of texts. Simply put by Chalker and Weiner, "a corpus is a collection of spoken and/or written texts" [1]. Shades of definition of the term "corpus" inevitably occur when it is studied by different researchers. In the words of Sinclair "a corpus is a collection of naturally-occurring language text, chosen to characterize a state or variety of a language"[2]. However, others' definitions differ. Baker pointed out that the term "corpus" is usually used to mean "any collection of running texts…held in electronic and analyzable automatically or semi-automatically (rather than manually)"[3]. According to Tognini-Bonelli, a corpus can be defined as a "collection of texts assumed to be representative of a given language put together so that it can be used for linguistic analysis" [4]. "A corpus is not simply a collection of texts. Rather, a corpus seeks to represent a language or some part of a language. The appropriate design for a corpus therefore depends upon what it is meant to represent" [5]. McEnery and Wilson pronounced that a corpus must display four main features: representativeness, finite size, machine-readable form, and a standard reference [6]. "There is an increasing consensus that a corpus is a collection of (1) machine-readable (2) authentic texts (including transcripts of spoken data) (3) sampled to be (4) representative of a particular language or language variety" [7].

Significant progress has been continuously achieved in the field of corpus-based linguistic studies in the past few decades. Generally speaking, "among the areas

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which have benefited from the input of corpus linguistics are lexicography, language teaching, translation, stylistics, grammar, gender studies, forensic linguistics, computational linguistics, to quote but a few" [4].

A parallel corpus is generally understood in the following three ways: (A) Source texts plus translations; (B) Monolingual sub-corpora designed using the same sampling frame and Type; (C) A combination of A and B. In this paper, we the term "parallel corpus" refers to the first type. McEnery, Xiao and Tono pointed out that "for a parallel corpus to be useful, an essential step is to align the source texts and their translations, i.e. to produce a link between the two, at the sentence or word level."[7] Many methods have been developed to build parallel corpora, one of which is through MMAX2. By using this tool, we have built a one-to-three Chinese-English parallel corpus. The term "one-to-three" here means one source text with three parallel target texts, i.e. one Chinese sub-corpus with three English sub-corpora as its translations.

2 MMAX2 Tool

The abbreviation "MMAX2" is short for Multi-modal Annotation in XML, Version 2.0[8]. It is a multi-level annotation and alignment tool developed by EML Research, a private research institute focusing on information technology and its applications.

This annotation and linking-up tool can be modified by users according to their particular research purposes. The tool processed such merits as stand-off annotation, arbitrary multi-level annotation, graphical rendering of relations between markables, permanent user-definable and attribute-dependent markable visualization, multi-dimensional query language, and flexible and customizable display. A "markable" refers to a relatively independent annotated unit which can be as long as paragraphs, or as short as words. MMAX2 tool has a graphical rendering of relations between markables, which means that markable relations can be shown on the operation platform of this software in the way of user-definable and attribute-dependent markable visualization.

This tool provides stand-off annotation, which means that the original text and annotation information are stored separately in different files. No matter how the annotation is done or altered or even deleted, the original text will not be affected, thus remaining intact. This is important especially in the process of building a one-to-three Chinese-English parallel corpus, as any change of the original data will lead to failure of the alignment of the source text with any of its three target texts. However, one setback of this kind of annotation method is that the annotated files are stored in distinct folders and instant output of parallel texts proves to be unavailable. Thus additional work should be done to output the stored information into machine-readable parallel texts.

Using this annotation tool, the text and annotation information are stored in XML form. As most of the present corpus tools only recognize plain text format, it is therefore necessary to convert the XML files into plain texts. However, the XML files are useful in further construction of a web-based query system.

3 Parallel Corpus Building

Roughly speaking, the building of the one-to-three Chinese-English parallel corpus has undergone the following steps: corpus design, data collection, data preparation, annotation and linking-up, and corpus adjustment.

In the corpus design step, we decide what texts are to be used and the purpose of building this parallel corpus. After the designing of the parallel corpus, it comes to data collection and preparation. Proofreading of the electronic texts of the three versions with reference to the paper books is the first thing to do in this step, as there are occasionally mistakes of spelling in the digital version in the course of transforming from the hard copy to the soft one. After this, these e-texts of the three English versions are manually aligned with the Chinese one on the paragraph level. In this process, "<P>" and "</P>" are added respectively in the beginning and at the end of a paragraph as paragraph markers, and then the Chinese and English texts are merged into one text through a computer program and paragraph aligned texts are thus obtained.

After the preparation of the paragraph aligned texts, the next step is to prepare the files for annotation and linking-up on the sentence level. As the Chinese sub-corpus is composed of a literary text, the sentence alignment patterns are highly diverse, and the fact of one source text with three target texts has made it barely possible to align the texts in a normal text processor. Besides, a number of different Chinese and English sentence attributes to mark up. MMAX2 tool has proved to be a sensible option.

Before the corpus annotation and marking up job, the texts which are originally in plain text form have to be converted to be the XML files which were to be used in the following step through MMAX2 tool. This tool has a self-formation function to convert plain text files to annotatable files for the program. As for texts of large quantities, a self-developed program with the function of mass processing is highly recommended. It is pains-taking to realize the annotation and linking-up work through MMAX2 tool as they were done purely by hand. When it comes to long paragraphs, this tool would show an incredibly low speed and the central processor unit of the computer would often be completely occupied which would create a pause in the operation of the system of the computer. It is suggested that computers with a higher rate of processing and a large memory would definitely save time, and computers with dual or multiple processors were preferable. Another solution is to divide long paragraphs into shorter ones with added information indicating the original paragraph information. We adopt a self-developed program to mass convert the long paragraphs into shorter ones.

The original texts and annotation information in MMAX2 tool are stored in separate files. These files are not automatically combined together and thus inadequate for immediate parallel corpus search. These corresponding files should be merged in order to form plain text files for the use of ParaConc and other plain text based corpus tools. In this process, which is termed as corpus adjustment, self-developed software is used to combine the two files to form the parallel corpus.

In order to make the parallel corpus accessible for more interested researchers and scholars, a web-based query platform is set up by transferring annotated and sentence aligned parallel texts in XML form to a database connected with a web platform to

achieve intra-version and inter-version queries. This platform can function well in the intranet environment and is to be connected to the Internet in the future when matters of virtual space and copyright are properly settled. The platform can realize content-based search and sentence feature-based search, the latter of which cannot be realized in the plain text file search.

4 Conclusion

In this paper, we introduced the process of building a one-to-three Chinese-English parallel corpus by employing the MMAX2 tool. Corpora of different categories and sizes have been widely applied in linguistic research. Parallel corpora have been used to facilitate cross-lingual studies. The building methods of a parallel corpus may vary according to different purposes and other factors. The process of building this parallel corpus contains four separate steps: corpus design, data collection, data preparation, annotation and linking-up, and corpus adjustment. The annotation tool MMAX2 can help realize linking-up and annotation with participation of human labor. Software engineering is proved to be efficient when dealing with mass data in a corpus of large scale. It is hoped that the application of MMAX2 tool may facilitate both corpus building and linguistic research.

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Soil Environmental Quality Analysis and Evaluation of Coal Mine Reclamation Area

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Abstract. In the course of mining, the problem of heavy metal pollution in the regional soil caused by gangue dump and fill has become increasingly serious. Therefore, we must analyse and evaluate the soil environment in mine reclamation area and take proper ways to gain the greatest environmental and economic benefits according to their characteristics.

Keywords: reclamation area, soil environment, quality analysis, evaluation.

1 Introduction

In the course of mining, the problem of heavy metal pollution in the regional soil caused by gangue dump and fill has become increasingly serious. The study found that the soil in Huainan mining area has been polluted by Cu, Co, Pb, Zn and other heavy metals. And in some of the mining area it has suppassed the National Soil pollution standards [1-2]. Therefore, we should give adequate attention to the soil pollution caused, for example, by heavy metals of Huainan mining area during the course of gangue dump and fill [3-4]. And we should also take effective measures to control and refine it to make it suitable for arable agricultural land or ecological sites and thus gain the greatest environmental and economic benefits [5-6].

Direct Huainan Coal Mining Subsidence area totals 132.82km 2, which accounts for 5.1% of the total area of jurisdiction. The use of waste rock has been decades-old in Huainan Coal Mining Subsidence area, this study selected Datong wetland area, Xinzhuangzi and Panyi mines typical mine reclamation district three representative reclaimed coal mining subsidence area to carry out soil analysis and evaluation of environmental quality.

Datong wetland ecological area, Xinzhuangzi mine reclamation area and the Panyi mine reclamation areas are located in Huainan mining area, where is a warm temperate semi-humid monsoon climate zone with four distinct seasons, and the annual average temperature there is 15.3 ℃ with annual average precipitation is 926mm, and southeast wind most of the year. Datong wetland ecological area, on the basis of the original topography, makes the finishing respectively of the original coal gangue, garbage and other refuse and chemical region. And its average overburden depth is 20cm. Xinzhuangzi mine reclamation area adopts the gangue and other landfills and the overburden depth is about 60 cm. Panyi mine restoration of

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ecological demonstration area adopts the gangue, life garbage in landfills, and the overburden depth is around 80cm.

2 Data and Methods

2.1 Physical and Chemical Properties Analysis

By analyzing the physical and chemical properties of different soils reclaimed after coal mining subsidence area we get the conclusion that reclaimed soil moisture content is in the 6 ~ 9%, and surface soil moisture is generally higher than that of the lower soil, which is generally suitable for crop growth.. Soil bulk density, except for Datong wetland zones, the remaining two reclamation area is basically the surface soil bulk density which is greater than the bottom of the soil. Smaller soil porosity is not conducive to air, moisture, nutrients infiltration which will affect plant growth. As for soil pH, only Datong wetland ecological area exposed area and the gangue Metasequoia forest soil are acidic pH, and the remaining sample point of pH values are greater than 7, the soil is slightly alkaline, which is the highest in Xinzhuangzi Mine Reclamation District. Soil soluble salt, Datong wetland soil soluble salt content is moderate, which is suitable for plant growth; Xinzhuangzi mine reclamation area soluble salt is greater than 11mS/cm, soil salinity is greater, and is not conducive to plant growth; Xinzhuangzi mine reclamation area soluble salt is greater than 11mS/cm, soil salinity is greater, which is not conducive to plant growth; Panyi mine Reclamation of soil salinity is less suitable for plant growth. Of soil organic matter content, the three reclamation area belong to a lack of soil organic matter content of the state. Available Potassium content, Datong reclamation of soil available K content is higher than the lack of state, and show a certain spatial distribution. Xinzhuangzi Mine Reclamation, moderate levels of soil available K content, which is higher than the bottom surface of soil. Xinzhuangzi Mine Reclamation District available phosphorus content in soil profileis relatively similar, which belongs to the middle level; Panyi mine reclamation area available phosphorus content in soil profiles belongs to the relative lack of status. Total nitrogen content, Datong wetland soil total nitrogen content belongs to middle level, Xinzhuangzi mine and Panyi mine surface layer of soil rich in nitrogen concentrations are at the level of soil nitrogen content in the deep part of the middle class. Cation exchange capacity CEC, Datong wetland soil cation exchange capacity decreases from the surface to the next turn; Xinzhuangzi mine reclamation area cation exchange capacity of surface soil cation exchange capacity is higher than the bottom of the soil content; Panyi mine reclamation area cation exchange capacity spatial distributes from shallow to deep showing increasing trend.

2.2 The Polluted Situations Caused by Heavy Metal in Soil at Different Reclamation Area

Soil samples will be measured by the mean concentration of trace elements in Huainan and in China and the background elements in soils. from that we can see, reclaimed soil as in the heavy metal elements in addition to outside elements Cu, Cr, Mn, Zn, Ni, Pb,

Cd and Hg were higher than the national and Huainan soil background values. With the national soil quality standards (GB 15618-1995) comparison we can see that the study area three soil Cd content and the Pan a mine reclamation area Cr content in mine reclamation area Xinzhuangzi Zn content exceeded the national soil environment quality standards; at the same time, in different regions and different sampling depth reclamation, the soil content of heavy metals is some different. In which heavy metals Cr, Mn, Zn, Cd, Hg in the three levels of soil reclamation area are more different, which is the elements in the coal gangue in the sex-related migration. Overall monitoring results show that the Huainan coal mine subsidence areas and reclamation of soil heavy metal pollution in varying degrees, should be further strengthened on the reclaimed soil monitoring and analysis of heavy metals, as well as be measured to restore the contaminated soil.

2.3 Evaluation of Accumulation

Accumulation index is a the quantitative indicators proposed by German scientist Muller [5] in 1979 which is a research environment, sediments and other substances in the quantitative indicators of heavy metal contamination, the formula is as follows:

$$I_{geo}=\log_2 [C_n/(1.5\times B_n)] \quad (1)$$

There: C n refers to the element n in the sediment content (measured value); B n refers to the sedimentary rocks (ie, general shale), the geochemical background value; 1.5 is a constant,which is due to consider the diagenesis may give rise to background value changes. Accumulation index is divided into 7, 0 ~ 6, indicating the degree of pollution from non-to very strong. This choice of the background value of soil in Huainan evaluation Where: Cu, Cr, Mn, Zn, Ni, Pb, Cd, Hg and As content of the mean are as follows: 24.20mg/kg, 64.90mg/kg, 416mg/kg, 80.81mg/kg, 25.71mg/kg, 30.47mg / kg, 0.06mg/kg, 0.041mg/kg, 16.81mg/kg. Sediment accumulation index (I geo) classification standards and the degree of pollution in Table 1.

Table 1. Accumulation Index (I geo) and the Classification of the Degree of Pollution

I_{geo}	＜0	＞0～1	＞1～2	＞2～3	＞3～4	＞4～5	＞5
I_{geo} classification	0	1	2	3	4	5	6
degree of pollution	no	no -Secondary	Secondary	Secondary - strong	strong	strong – strongest	strongest

Bring the content value of the reclaimed soil of heavy metals Cu, Cr, Mn, Zn, Ni, Pb, Cd, Hg and Ass into the formula (1), to calculate the value of I geo districts. Base evaluation results show that the accumulation index, the element Cu in the Datong for the wetland ecological zones is basically pollution-free, and no reclamation area in the other two; elements Cr reclamation district in the three is Sino-polluted. Elements of

Mn and As in the three re - Reclamation is pollution-free; element Zn in the Datong wetland ecological area 20 ~ 60cm is free of pollution, in the new Xinzhuangzi mine reclamation area in the surface soil is strong, and in other areas, middle. element Ni in Panyi Mine reclamation area of 0 ~ 20cm and 60 ~ 80cm layer is pollution-free, the rest of the sampling points are free or middle- polluted; element Pb in the Datong wetland ecological zones 0 ~ 20cm, and mine reclamation area in Xinzhuangzi and 40 ~ 60cm layer are of pollution-free, the remaining points are middle or free of pollution; Cd in the Datong for the 20 ~ 40cm layer is middle or strong polluted, the remaining points are strong polluted; elements Hg in the Datong wetland area is mainly middle polluted, Xinzhuangzi mine reclamation area is of Secondary - strong pollution, a mine reclamation area in the Panyi mine -free or no polluted. The degree of pollution of heavy metals (from the mean on the analysis) derived from the macro-analysis of is: Cd> Hg> Zn> Cr> Ni> Cu> Pb> Mn> As. Cd accumulation index is high, three reclaimed soil profile sampling and analysis showed that it is essentially strong pollued, which is the main causative factor of soil reclamation in Huainan mining subsidence for heavy metal pollution.

3 Conclusions

(1) To compare the three reclaimed soil environmental quality monitoring results, we can see that different physical and chemical indicators of soil reclamation areas are different. The overall soil physical and chemical properties of soil of the three reclamation is lower than the physical and chemical indicators of agricultural production.

(2) From the view of the soil content of heavy metals, the Huainan coal mine subsidence area and the reclamation of heavy metals in soil has been polluted in various degrees.

(3) The basic evaluation results show that the accumulation index, derived from the macro-analysis of heavy metal pollution levels (mean analysis) is: Cd> Hg> Zn> Cr> Ni> Cu> Pb> Mn> As, where Cd is the most important predisposing factor of reclamation of soil heavy metal pollution on the

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The Driver Design of PXI-Based Array Signal Source

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Abstract. In order to facilitate the operation of the source array and compose the automatic testing systems, PXI-based driver design is introduced. After studying overall design and PXI-6805, designing communication interfaces and defining communication protocols, the control of array signal source and waveform output was implemented by manipulating PXI-6508 module with VISA and DAQmx. Experiments show that the driver achieves the desired results.

Keywords: PXI, Array signal source, Driver program, VISA, DAQmx.

1 Introduction

The application of array signal relate to numerous national economies and military fields involving communications, sonar, seismic, exploration, radar and so on. But the actual desired signal is rather special (such as linear FM signal with the envelope, real-time multi-wave overlapped signal), the common signal source can not meet the requirements. And in the practical application, it requires several signals to compose the signal array while the common source is only one or two channels. The system would be huge if the signal array is set up with common signal source. Therefore it is need to design the array signal source which is used to simulate the echo signal targeted, for completing signal simulation under different conditions, and offering target signal that a variety of systems need.

2 An Overall Design

According to design requirements, generating 96 array signal source with synchronous trigger and grouped is required, each channel signal output can be controlled independently; each channel can output signals, including sine, sinusoidal overlapped signal, custom signals and FM, envelope signals etc.. So the system is divided into upper and lower machine. The upper machine is implemented by using PXI system for the completion of the signal setting and controlling. The lower machine is realized by a modular way, take DSP as the hardware platform processing core of the signal source, combined with DDS technology using software programming methods to achieve output of the signal source; divide 96 signal into six array signal modules, each array

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signal modules includes 4 sub-modules, the six array signal modules is cased into processing boxes. Processing box is designed using bus mode; the control of the processing box is completed by the digital I/O cards of the PXI chassis.

3 Communications Interface Circuits

The array signal source adopts PXI as the main control device, using the PXI-6508 (96 channel digital IO modules) to realize the control to array signal source. Bus includes address lines, control lines and signal lines. Bus signal is emitted from the PXI-6508 of upper machine, dealing with the motherboard. It is delivered to each module. Implement data transmitting, trigger source choosing, loop controlling, and ID reading.

The data interface is bi-directional IO, with the assistance of the control bus and address bus, to achieve the read and write operations of each module. It adopts APA port of PXI-6508 module. The address interface is write-only port, which is used to select modules address and register address, control bus, data bus complete the read and write operations to a specific register. It adopts BPB port of PXI-6508 module. Among these, BPB7 ~ BPB4 is used to select the module and BPB3 ~ BPB0 used to select the registers of module. The control interface realizes that data is written to the module which corresponding to the address bus, or read the module register data which is selected by address bus to the data bus. It is the driver of read and writes operations that adopts PXI-6508 module's APC port. When doing read and write operations to the array signal source address 0,1,2,3, the control bus uses 8255 mode, doing the other read and write operations, the control bus uses digital IO mode.

4 Communication Protocol

The communication protocol is used to realize the communication between the upper machine and the lower machine of the system

1) Protocol packet structure

First, constituting protocol should confirm the structure of the Protocol packet, and we should take the implementation of the agreement efficiency and reliability into consideration. Conventional protocol message structure includes header, trailer, command, data, data length and verification code. According to the communication task, the design of protocol packet structure is shown in Table 1.

Table 1. Command data structure

Command header	Command 1	Command 2	Length of data area	Data area	Check	trailer
0xA5	xx	xx 4 high byte: model number 1~4 low byte:channel number 1~4	xxxx unit ： byte	xx,xx,xx----xx	CRC8	0x13

5 Driver Design

By calling VISA and the self-included function in Visual C++6.0 development environment, the basic operation to the lower-level hardware is implemented. Finally, the driver is made into a DLL (dynamic link library) for other programs call.

The driver mainly realizes waveform data transmission, trigger settings and relay control. The overall design of the block diagram is shown in Fig. 1.

After having the above hardware preparation and bus definition, the driver can be designed. First, in order to implement the basic I/O operations, PXI-6508 can be operated by a standard VISA function viOut8.

Then in order to operate the signal source module, first open the module resources, which need to open two resources, one is the VISA resource, and the other is DAQmx resource. The operation to the signal source module has two ways, one is VISA (Digital IO mode) operation, and the other is DAQmx mode (8255 mode). VISA operation mainly realizes the trigger control and the relay control, using the VISA way to carry out read and write operation: first writing data to the bus, then set WR signal high and write the address, afterwards set WR signal low, and then set WR signal high, finally set address invalid.

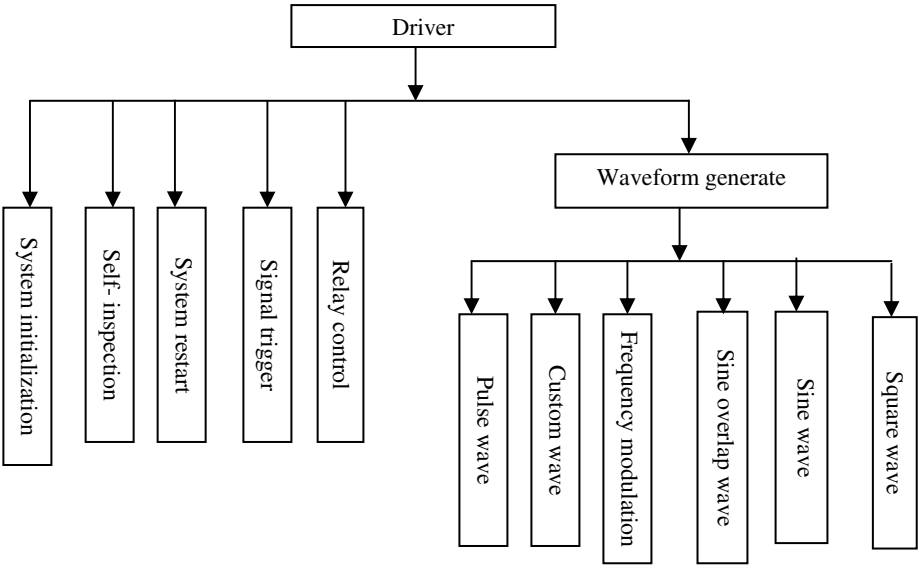

Fig. 1. Driver overall design

The DAQmx operating mode mainly realizes the waveform data transmission, the program flow chart which is operated with DAQmx way is shown in Fig. 2.

The kernel of signal source module is output waveform. Take square wave output for example, by inputting the backplane slot number, channel number, duty cycle, amplitude, frequency, offset, can control the waveform output of one channel independently.

The output of each signal depends on the relay control. Through operating the relay of the signal source module, 16 channel signal output can control independently.

By selecting the trigger source, each signal channel can be output separately or outputs synchronously. There is an internal trigger source and 9 channels external trigger source. Take a sub-module as the operating unit in order to achieve that four channel signal of a sub-module share a trigger source. After operation is completed, it is need close the resources.

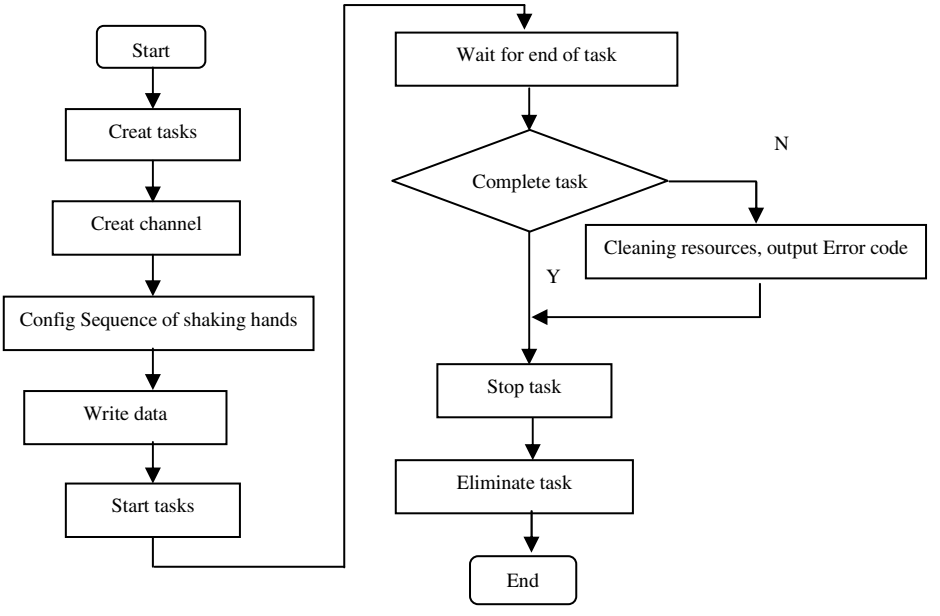

Fig. 2. The operation flow chart with DAQmx way

6 Summary

The test results show that the array signal source can output 96 parallel test signals under the control of the driver program. Fig. 3 is the Step waveform graph which output by using the driver program.

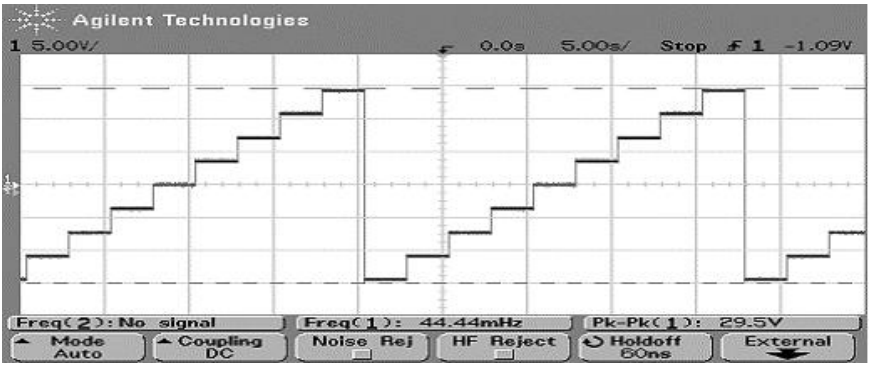

Fig. 3. Step waveform graph

By using the software and hardware co-design technology of embedded system to design the array signal sources in order to meet practical applications requirement including multi-channel, multi-signal, and high-complexity signal synchronization output and so on. Because the array signal source is built on a common hardware platform and the signal synthesis is realized by software programming, it has good flexibility and can promote the application in numerous national and military fields including communications, sonar, earthquake, exploration etc.

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Automatic Testing Systems for Filter Amplitude-Frequency Characteristics Based on LabVIEW

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Abstract. In order to test filter performance rapidly, using VXI module based on LabVIEW platform to implement automatic testing for filter amplitude-frequency characteristics is introduced. Firstly, VISA driver is called by LabVIEW, and function generator module outputs different signals as filter input; Then to measure the output of multimeter module and transfer it to PC for data processing and display. It is improved that the system achieves filter performance test, with operating conveniently and good human-machine interface.

Keywords: LabVIEW, Filter, Automatic Testing Systems, VXI, VISA.

1 Introduction

At present, many instruments are designed for the filter test, such as level oscillator, millivoltmeter, time signal analyzer and sweep frequency instrument, etc. Test method for filter amplitude-frequency characteristics mainly includes measurement(point frequency method) and dynamic measurement (frequency sweeping method).

However, the method above can't finish the comprehensive testing tasks for its' manual operating and computing. There are some problems of these testing mothods. The test precision is comparatively low; It is not convenient to process data and manage information; The test results are not intuitive; The test curve cannot display automatically and the test time is long. The development of science and technology and the needs of the market call for the system of testing quickly and processing data automatically[4].

2 Test Principle of the System

Firstly, VISA driver is called by LabVIEW, and the function generator module outputs different signals as filter input; then to measure the output of multimeter module and transfer it to PC for data processing and display. Apparently, its basic principle is point-frequency method for filter amplitude-frequency characteristics.

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3 The System Hardware Platform

According to the above analysis and take the current condition into account, determining the hardware platform for filter amplitude-frequency characteristics is automatic testing systems based on VXIbus, composition structure is main controlling computer hanging outside, as shown in Fig. 1. This structure consists of general computer interface card of IEEE488, VXI 0-slot module, IEEE488 VXI cable and VXI module. The VXI modules are as follows: The model of VXI 0-slot module is E1406A, function/arbitrary waveform generator module is E1441A, digital multimeter module is E1412A.

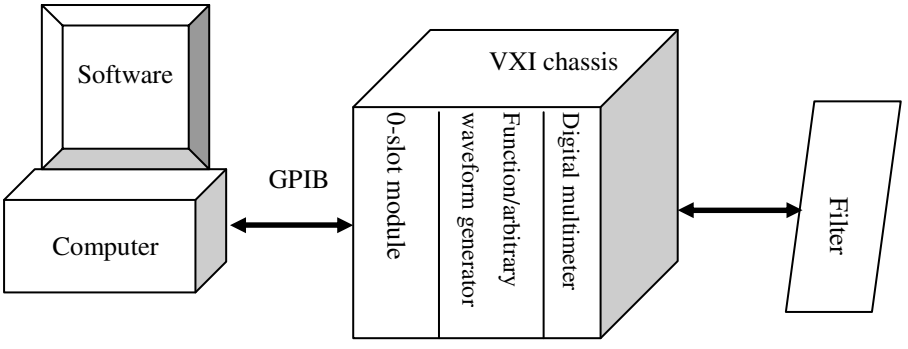

Fig. 1. Structure of automatic testing systems based on VXIbus

4 System Software Designing

The software is developed in LabVIEW 8.5 platform. The LabVIEW platform has outstanding characteristic with virtual instrument of development environment based on graphic programming language, provide a new method for instrument design which construct the virtual instrument by combining the front panel programming intuitively and the flow chart programming[5].

4.1 Program Diagram

Block diagram is equivalent to a high-level programming language background, the program is a central part of LabVIEW programming, achieve the design of block diagram by function module dividing.

4.2 Measurement Program Diagram

The principle of measuring divided into the following steps: (1) Open session for the instrument; (2) Send SCPI command to control instrument; (3) Read data; (4) Close the session. Due to the VISA, the program diagram is simple, clear and strong in transplantable[1]. The principle diagram is shown in Fig. 2.

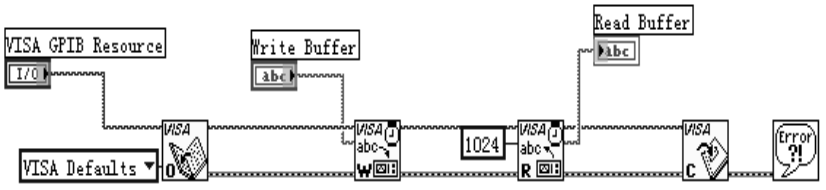

Fig. 2. Principle structure

In the actual program diagram, due to the need of cycled controlling signal generator module to generate sine signals with linear frequency value, meanwhile controlling multimeter to read back the response amplitude of the filter module, the FOR cycle is required. Circulation value can calculate from the scanning the settings on the input panel.

After that, controlling signal generator module and digital multimeter module are needed in order to complete the final testing tasks.

In the actual module controlling on signal generator, SCPI statement "APPL SIN[<frequency >, < amplitude >,<offset>]" can used through VISA to write a desired sine wave of frequency, amplitude and offset value to signal generator. When generating sine wave with continuous linear frequency value, the connection string module is used for writing to instrument with alternated frequency value and remaining character connected [3].

In controlling on the digital multimeter module, SCPI statement "MEAS: VOLT: AC?" can used through VISA to write into instruments, then read the output voltage of the filter. Of course, the type of data read back, needs to be transformed into numeric and stored in the array for display and save, as is electronic form string. The type transformation diagram is shown in figure 4. Among them, the use of conversion module on electronic form to string array will convert a string into an array, and then the index array module is used to read the first element of the array to store into the amplitude array[3].

4.3 Data Display and Storage Function Block Diagram

LabVIEW have an advantage on its rich data graphical display controls and using conveniently. So is easy to output a amplitude-frequency characteristics graph by using LabVIEW. In this design, the XY curve graph for displaying data waveform is applied. X axis represent the frequency value and Y axis represent output amplitude attenuation of filter. XY graphs can't reflect the changing trend of real data as it belong to chart-table display control, so it suitable for the design of one-time data display. In the process, the bound module is used to bind frequency array and amplitude array in clusters as input.

5 The System Test and Analysis

In the test process, filter is used as a test of the object. Among them, the test circuit of passive low pass filter is shown in Fig. 3:

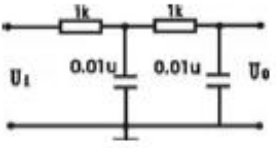

Fig. 3. Passive low-pass filter test circuit

After testing, amplitude frequency characteristics testing curve is shown in Fig. 4

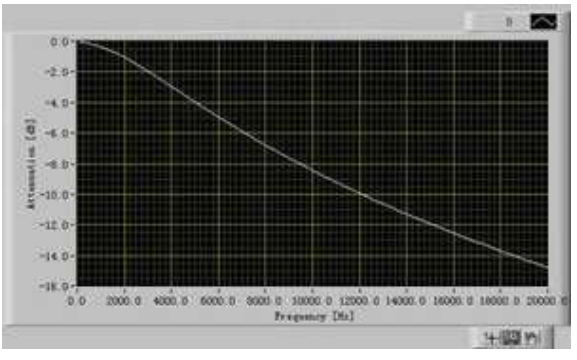

Fig. 4. Amplitude-frequency characteristics test curve of passive low-pass filter

The types of filters can easily get from the amplitude-frequency graph. The analyses are as follows:

As for low pass filter, the system function is Eq. 1[6]

$$H(s)=\frac{U_2(s)}{U_1(s)}=1/[1+3sCR+(sCR)^2]=\frac{1}{(RC)^2}\square 1/[(s+\frac{0.4}{RC})(s+\frac{2.6}{RC})] \tag{1}$$

Vector factors as Eq. 2:

$$H(j\omega)=\frac{1}{(RC)^2}\square\frac{1}{M_1e^{j\theta_1}M_2e^{j\theta_2}}=\frac{1}{(RC)^2}\square\frac{1}{M_1M_2}e^{-(j\theta_1+j\theta_2)} \tag{2}$$

$$\text{Get Eq.3}:\ H(j\omega)=\frac{U_2}{U_1}e^{j\varphi(\omega)} \tag{3}$$

When ω=0, $\frac{U_2}{U_1}\approx 1$,ω=0.4/RC, $\frac{U_2}{U_1}\approx 0.68$,ω=2.6/RC, $\frac{U_2}{U_1}\approx 0.105$

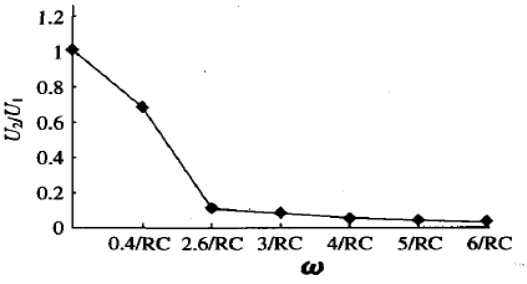

Fig. 5. Theoretical calculating curve of low pass filter amplitude-frequency characteristics

When ω->∞, the ratio of voltages is 0. According to the above analysis, the simple amplitude- frequency characteristics curve can obtain, as shown in Fig. 5. Compare testing with calculating, the amplitude- frequency characteristics curve of low pass filter have the same trend curve. As for high pass, band-pass, band-stop filters, the analysis is the same of low pass filter.

So through experiment, this system can meet the requirements of amplitude-frequency test, and accomplish the basic automatic test amplitude-frequency characteristics of the filter.

6 Summary

This paper realize filter performance test through the amplitude-frequency characteristics measurement. Developing automatic test system that meet engineering application based on LabVIEW environment has high value of engineering application and theory.

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Research on Causes and Countermeasures of Internet Information Alienation

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Abstract. 21st century is the age of quick development of science and technology, also is the information age. People in creating and using internet while also been enslaved by the network, internet information alienation phenomenon occurred. This article based on the concept of internet information alienation, analyze the performance of internet information alienation, explore the causes internet information alienation, so as to find appropriate countermeasures.

Keywords: Information Alienation, Internet, Countermeasures, Causes.

1 Alienation and Internet Information Alienation

The word alienation derived from Germany philosophical terminology, refers to subjects split antithesis in certain development stages, and became external alien force. Hegel believed that absolute ideas through logical development stage, became alienation or external world and then back to itself. Feuerbach's "alienation" to illustrate people how with the help of fantasy alienated his nature to God and worshiped, and that only when people are aware of people is the essence of human being, when the nature of God is the essence of human, in order to eliminate this "alienation", get rid of superstition of God. Marx in the spirit of Hegel's "absolute spirit" alienation and the Feuerbach's humanism alienation in criticizing and inheriting proposed a theory of labor alienation, and pointed out that "objects produced by labor, is the product of labor, as an alien presence, as does not depend on the producer's force, with the Labor opposition" .Review of intellectual development of the alienation, you can see the general meaning of alienation is: subject created the object, but the object is not governed by the principal control, evolution becomes a is not subject to control and even became different strength has been the subject of hostility and control forces.

The so-called internet information alienation, that means creating a internet, using internet access to various information resources, but the internet due to interference by various factors, leading to loss of its original content, gain the initiative, instead become the power of control, domination and control people. Birth internet mission is through various Internet services improve the quality of human life in the world. While it's in the benefit of mankind, however, also brings economic, political, cultural, social, and many other moral issues, derivative such as internet pornography,

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internet fraud and internet rumors of internet alienation. This allows human originally wanted to dominate the internet fall into a passive position, and controlled and dominated by internet. In fact, there is reliance internet technology is a subject for materialized labor in the information society, namely, to new forms tool depend on, from industrial society to "tangible" dependence towards the information age "intangible" of dependence of outstanding performance.

2 Performance of the Internet Information Alienation

2.1 Pollution of Information

For access to information, it appears of internet were a double-edged sword. On one hand, it has changed the traditional way of access to information, the information appear in front of people in a faster and more intuitive way. The other hand, internet less lack the full filter then the traditional media and education such as radio, television, books. Making some junk information presentation in front of people. Today, waste information serious polluted internet environment. Various false information, waste mail, pornography, internet rumors storm came to us. we lost ourselves by turbidity currents before we dodge, unwittingly lost self, lost direction. While many people in the face of all kinds of information, it is difficult to tell what kind of information is a positive one, advanced, real-life, health. So often confused by false information, erosion of negative information, so as to lead to cognitive in their online lives lost.

2.2 Dependent on Information

Internet's greatest advantage is that the information in all directions, convenient, its intervention to speed up the transfer and exchange of information, greatly saves the cost of the economic and social activities, enhance the quality and efficiency of our work, get rapid growth of social wealth. But on the other hand, because of the internet, any person can obtain information at any time, the advantages of internet information resource-rich is normal, too dependent on the internet. Look for information and encounter problems on internet. Answers are sometimes stereotyped, lacking personality. Their creativity and thinking were not very good play. People joke previously written paper is "scissors and paste", and now is the "mouse and keyboard". The phenomenon of plagiarized papers, infringe intellectual property is not at all surprising in today's. Lack independent thinking and independently create for the training of creative talents and the construction of innovative country is very bad.

2.3 Panic Information

Internet information resource more richer people more feel panic, the more huge knowledge base their knowledge is more limited. Always afraid of his own less than others of knowledge, lack of competition in the capital, fear difficult based on the community because the knowledge is not enough in the future. So Seek to explore a lot of information in internet world. But often they don't know what they need, cannot

give their exact location, so they showed a transition for too much on the face of information knowledge, too fast to read and collect information, lack of in-depth understanding, it is difficult to systematize, eventually into the information get to gamble in a panic.

2.4 Information Crime

Information crime is a new type of crime in the information society, it generally refers to intentionally or unintentionally use of information technology harm to society and against citizens' legitimate rights, the acts shall bear criminal responsibility. Its basic types are: information fraud and information theft, information destruction. In which information theft includes piracy, spyware, and hackers; information fraud including card crime, bill crime and program crime; information destruction includes physical destruction and the programs destruction. Establishment of internet platform creates opportunities of crime for people engaged in cyber technology. Some people try to do a internet hacker in line with psychology of fun, arbitrarily modified someone else's account password, enter the site to modify the information of others, or published false information on the internet, have a worse effect.

3 Analysis of the Causes of Internet Information Alienation

3.1 Internet Itself Attractive

Convenient internet is an important reason to attract people. Modern technology of information makes people more and more achieve emancipation from a physical and mental, to quickly access the information directly. Permissive world requires people to hold a lot of information, internet can allow them to get the latest information from around the world never step out of doors. The shortcut most likely to be accepted, resulting in a dependency. Internet information is unbalanced, need to be treated case sensitive, a person lacking distinguish clearly between right and wrong often used by information, resulting in alienation.

3.2 Hindrance on Human Communication Claims in the Internet

According to surveys, Many people tend to choose a internet to evade reality one important reason is that their fascination with the internet when evaluated individual litigation not met. In real life some people is not good at communication and found end-result in the virtual internet world. They freely chat with netter, read, shop, and so on, and consider that internet world more exciting, more rich than reality, so they indulging in network world. As a result, some people has developed internet syndrome, they does not know how to communicate with others when leave the internet and information. the true identity of communication body is obscured by virtual identity in the world of internet, could easily lead to spread of anarchism, personality twist, emotional indifference, depression and other problems, become an important form of information alienation.

4 The Effective Ways to Prevent Internet Alienation

Internet information alienation phenomenon seriously interfered with the exploitation and use of information, hinder the information activities, so we have deeply research and overcome the internet information alienation, information and information technology must give service to human needs, benefit mankind.

4.1 Establish a Correct Concept of Information

Establish a correct concept of information in internet environment. We should adhere to the correct political orientation, organize information, adjustments, update and optimize information according to the needs of people in time on the assumption that promote a healthy, active, progressive culture. Create a lively, personality, open, tolerant information environment. Massive and complex information won't be precipitated, information won't flooded, facilitate the best quality of information, so that useful information accumulate in the brain, and transfer passed in society, upgrade in internet communication.

4.2 Strengthening the Construction of Internet Laws and Regulations

There requires specification of laws and regulations in virtual internet world. The people will create, disseminate and use information whatever they want to if there are no laws, regulations, guidance. The personality and human will be alienated. Therefore, we should be coordinated and solved to use integrated law, policy and other means.

4.3 Strengthening Internet Information Filtering

With the proliferation of internet information and the foregrounding of information security issues, control becomes a need for internet information. Internet information filtering choose correlative information or eliminate irrelevant information from a large number of dynamic flow information to use certain standards and tools based on the user's information needs.

4.4 Strengthening Cooperation on Legislation of Global Information

With the global economy information unceasing enhancement the information activities have infiltrated into all aspects of social life. That triggered information security, computer crime, intellectual property protection and a series of complex information alienation. These issues relate to state security and political interests, it can't solve only depend on one national or one organize, need to control by legal means at the international level. Determination of the international law or international conventions will promote and protect international competition and cooperation in science and technology.

In short, internet information alienation as if a double edged sword, how to allow its benefits to the greatest and disadvantage to reduction to the minimum? We will look for the root of information alienation, research control from multiple angles,

control effectively information alienation. Therefore internet will became treasure of information, not became the source of pollution of information, dependent on information, panic information, information crime.

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A Research on Green Communication from the Perspective of Low-Carbon Economy

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Abstract. Global warming is becoming increasingly an important issue that concerns the economies and development of every country nowadays. Low-carbon economy draws the attention from the globe after the United Nations Summit on the Climate Change. Being an essential part of national economy, the communication industry comes up with the concept of eco-communication in order to adapt to the new trend and solve its own problems.

Keywords: low-carbon economy, eco-communication, issues.

Introduction

People are gradually realizing the environmental problems caused by the energy we use with the development of human civilization (primitive civilization→agriculture civilization→industrial civilization). The global change brought by increasing concentrations of CO2 in the troposphere have become a focus of environment and is a great threaten to our living environment and sustain development, then low-carbon economy comes into our view. The so-called low-carbon economy is achieved through various means including technology innovation, system innovation, industrial transfer the exploration of new energy etc. It will eliminate the high- consumption energy such as petroleum or coal and the emission of greenhouse gas thus the development of economy and environment will reach a win-win stage under the guidance of sustainable development. The eco-concept is well accepted by humans and industries with the recognition of low-carbon economy. The eco-communication is also brought up. It provides services to the harmonious society supervising and letting down its impair on human body . It is an significant part and the focal point of communication industry.

1 Background

Communications industry occupies an important position in our national economy. The proposition of the green communication concept is main focus on the current outstanding problems.

1.1 Excessive Energy Consumption

In the communications industry, the main energy consumption is power supply, large communications equipment requires 24-hour operation, according to relevant

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statistics, annual consumption of the four major operators in more than 200 billion degrees of power. The consumption of China Mobile's base station is more than 70% of the enterprise. High power-consuming inevitably produce a high heat, then heat dissipation becomes a serious problem. In order to achieve the purpose of cooling and make sure the smooth progress of the machine room, air-conditions also need to work 24 hours a day.

Also mobile phone users are charged huge power consumption, Zhou ZhengHong, from the China Association for Youth Ministry Committee of Experts, said that if mobile phone users do not be cut off timely, each of the additional power consumption will exceed 20 million degrees. Therefore, high energy consumption is increasingly cause for concern, especially in the growing energy shortages, how to save energy, reduce energy consumption has becoming a hot research in communications industry

1.2 Serious Waste of Forest Resources

Services in the communications business, people still using traditional way to printing paper bills, causing serious waste. Data shows that each piece of A4 paper bills calculated at every 5000 A4 paper to consume about 1 cubic meter of wood. Each year Shanghai's annual timber nearly 2 million cubic meters, equivalent to about 3,500 acres of forest. Nationally, more serious waste of forest resources.

1.3 Radiation Damage to Human Body

With the expansion of communications networks, the increasing numbers of base stations, wireless base stations need to focus electromagnetic radiation. Work long hours or live around in the base station radiation will be affected, particularly extremely negative to growth and development of children.

1.4 The Environment has been Heavily Polluted

Communication services must be realized through various kinds of end instruments, namely mobile phones, Little Smart, telephones and so on. Over 500 million mobile phones are produced only in China every year. And so far, used cellphones have reached 20 million at the same time. However people know little about what threats phone components and batteries pose to the environment. The raw and processed materials of phones and their accessories contain many toxic substances, for instance, Arsenic, Cadmium, Plumbum, etc. These chemicals are harmful to the environment if they are not properly discarded. A report from an environmental research organization in America says that phone materials contain lots of persistence and biological cumulative toxic substances (PBT) that can cause cancer and result in diseases on nerve and upgrowth, and that are especially bad for children.

Green Communication rises as the times require, against the background of Low Carbon Economy, because these four issues above turned up in the development of communications industry and restricted this industry from getting far.

2 The Vital Function of Green Communication

2.1 It Can Reduce Energy Consumption and Optimize Energy Usage Structure

Green Communication emphasizes energy saving and emission reducing. The reducing energy consumption of communications industry not only benefits them from cost reduction, but also can lessen energy consumption. Communications industry ought to reform technology and use designed low power consumption base station, aiming at decreasing electrical power cost. At present, Ministry of Industry and Information Technology of PRC has declared a number of guide specifications about energy saving and emission reducing one after another, such as "Electronic Industry Administrative Measures of Energy Management". Meanwhile, many network operators including China Mobile set up leading groups in order to cut energy consumption down.

2.2 It Can Lower Environmental Pollution and Advance Scientific Development

What is more worrying is that the used end instruments, if not properly discarded, can bring serious pollution and a great many undecomposable toxic substances. The abundant used phones and batteries are resource that can be recycled and reused. The effective recycle of them can not only reduce pollution, but also bring us new economic benefit. Western developped countries, represented by the USA, have passed some laws and regulations, asking manufacturers and retailers to be responsible for the used electronics recycle in case of pollution. Recently, Gome, one of China's mobile phone retailers, has announced to start the used mobile phone buy-back plan. That's to say, consumers can change used phones or phone components (say, batteries etc) for unequal vouchers in their chain stores and then they can buy a new one. This tendency will help recycled and reused electronic equipment industry make a great progress, thus circular economy will come into being.

2.3 Reduce the Mobile Phone Radiation, Advocate the Healthy Life

As the improvement of living standard and the importance of healthy life, green communication is an inevitable trend. At present every country has unveiled some related rules to impose restrictions on the mobile phone radiation. There are two criterions about the mobile phone electromagnetic radiation in the world. IEEE, America, Canada, Korea have adopted SAR 1.6 watt per kg and the European Union countries use SAR 2.0 watt per kg. The latter was laid down by the international commission on non-ionizing radiation protection, recommended by the international telecommunication union .and get the nod of the WHO. The amount of radiation will be a very important standard for consumers to measure. More and more equipment manufactures also launch the low radiation mobile phone to attract customers. The other hand, the low radiation has been one of the important development directions on communication technology. Now the reason why 3G is better than 2G is that 3G has low electromagnetic radiation. The rise of CDMA should give the credit to its low radiation. The communication standard in the future will develop towards the low radiation which contributes to the development of communication economy.

3 Prospect of Green Communication

Under the circumstance of financial crisis and environmental degradation, we should take the way of sustainable development and vigorously develop low carbon economy to make "green" popular in every industry. However as an important part of national economy, communication industry also needs innovative thinking and update technology. It also need blend in environmental thinking in the whole industry chain to make the communication industry adapt to the develop trend of low carbon economy and achieve the goal of green communication.

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The State-Owned Forest Enterprise Reform Trend of the Discussion

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Abstract. On the basis of present situation analysis of state-owned forestry enterprise reform, the paper discussed development tendency of state-owned forestry enterprise reform, and emphasized that state-owned forestry enterprise reform had to emancipate the mind, renew the ideas; deepen property right system reform; established perfect legal person government structure and perfect organization system; established science management systems and management mechanism; carry on the advance in technology, and pay attention to the function of science and technology innovation.

Keywords: State-owned forestry enterprise, Reform, Property right, Ideas.

Introduction

Reform is a revolution, the reform is to liberate productivity, and develop the productive forces, and only reform, can we develop. Since the third plenary session, the spring breeze of the reform of the earth, and the national ChuiBian professions the situation of the reform of the raised, and made some achievements, there are also some problems, we should summarize the experience, and learn lessons from the state-owned enterprise reform, this paper discusses the logging, the way and the reform of state-owned forest enterprise forecast the trend, make logging enterprises as soon as possible out and play their due role.

1 The State-Owned Enterprise Reform Process and Result Logging

The third plenary session of the reform of state-owned enterprises, with the all-round development of, as the foundation of the national economy, the state-owned forest industry also began in the enterprise reform. The state-owned forest enterprise reform experiences roughly the profits, contract management and delegate system innovation phases.

1.1 1979-1984, is decentralization concessions in the stage. After the third plenary session of the CPC, the central government has issued a series of expanded enterprise autonomy, and promote the state-owned enterprise document management level of reform. April 1979 working conference of the expanded enterprise autonomy made the decision, in the same year the state council promulgated the state-owned industrial

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enterprises about expanding business management autonomy of the several provisions of the management system reform of files, and to expand enterprise autonomy in sichuan province of pilot. According to the central government policy, to the production enterprise assignment, raw material choose and buy autonomy rights, labor YongGongQuan and products such as a management representative 14. The assignment of the right means the enterprise operator has a certain degree of surplus control and the residual claims, business operators, and the manufacturer's production enthusiasm obviously improved. It is because of this a transitional system, put forward that the reform of state-owned enterprises made the obvious effect.

1.2 1985-1991, is contracted operation stage. Enterprise contract responsibility system based on the reform of state-owned enterprises still restrictions in the original property relationship, and to further promote the management within the level of the system reform of the choice. From 1987 to 1992, the state-owned enterprise through two wheel contracted responsibility system reform. Contracted responsibility system implementation, really at the enterprise and worker to mobilize the enthusiasm, promote the development of national economy.

1.3 1992 to now, is the system innovation phase. In 1993, 14 third session of the CPC central committee for the establishment of a socialist market economic system, decision of some problems, and put forward specific state-owned enterprises establish modern enterprise system target and steps. 1994 years after the establishment of a modern enterprise system of pilot in state-owned enterprises begin. The establishment of a modern enterprise system's goal is to through the property right structure of the state-owned enterprise reform, a "clear property rights, well-defined power, separation, management science" of the modern enterprise. In the modern enterprise property right structure, under the control of the government can't directly to control and manage state-owned enterprise. And in the modern company, right, responsibility and obligation, and by the law by capital contribution and shares constraints. Decision can only be the members of the board of directors is discussed through a vote after, this can avoid chief executive will and the will of the individual for scientific decision, thus lays down the realization of basic provide organization.

The establishment of a modern enterprise system, is the direction of the reform of state-owned enterprises, it is from separating, structure of independent legal property rights, to make the enterprise really into the market, the state-owned enterprise really become independent operation and their own profits and losses, and self development, self-discipline legal entity and the mainstay of market competition. The state-owned forest enterprise is part of the state-owned enterprise, but it has particularity. Main is logging enterprises long production period, risk, making the competitiveness of the funds have made it attractive is weak; Logging enterprises is fundamental industry, and public welfare undertakings, and reform, not easy to straighten up relations; Logging enterprises structure is complex, various content management. Because each enterprise attributes each are not identical, therefore, the reform, the request is not the same; Logging enterprises social strong, internal complex, is a relatively complete small society, and so on. The particularity of the logging enterprises, determines the logging enterprises to establish a modern enterprise system's particularity and complexity.

2 The State-Owned Forest Enterprise Reform the Existing Problems

Logging enterprises in the early period of the reform, whether to delegate or contracted management, all profits mainly around the enterprise's management of reform, not completely change, some state-owned property right relations or state, the collective have the collective camp, bag can't win a deficit cauldron rice, worker not cast off the identity, enthusiasm, has also been aroused. This reform not touch, and no to establish independent ownership of enterprise legal persons of property rights, the problem of indistinction is difficult to be solved. Therefore, must through the reform to solve this problem, causes the enterprise to become a real competition in the market main body and enterprise legal entity. At present, however, logging enterprises reform and unsatisfactory place, some problems.

1.1 The thought idea behind, market consciousness difference. Because of the state-owned forest enterprise, mostly situated in the remote villages, the traditional planned economy thought deeply rooted, which seriously restrict the development of the enterprise. From lumber market change generated fluctuations can see, when wood market, a good nokias hundred good, a temporary benefit covered up the extensive management various defects of the enterprise; Once the sluggish market, and wood, which "stranded by, to," thought, can't try, to dare not to rush, afraid, afraid of strength, take risks have difficulty, have contradiction is not looking for market, but look for the leadership, lie in the body to support, lack of practicing skills and pioneering efforts. This reflects the state-owned forest enterprise worker in the thought idea on adapt to the market economy, the situation in the practical work still lack the ability of controlling frame market.

1.2 The ownership structure is unreasonable, property right is not clear. Mainly displays in industry structure is unreasonable, logging enterprises mainly concentrated in the CaiFaYe; The economic structure is unreasonable, long-term note "perfect" and "complete" and repetitive construction; The product structure is unreasonable, wooden products, not wood products, rough machining, less products and finishing products, low additional product is much less and less, high additional product; The non-public economy's development lag and so on.

1.3 Indistinction ZeQuan, unknown. In the lumber business management, forestry fee collection of use, forestry institutions and personnel division, on such problems as there are a certain responsibilities cross. At the same time, administrative intervention still exist, some local ChongZou even logging, forest "two skins" footsteps. The state-owned forest enterprise director, general manager and to pass the party's organization department at a higher level, specific provisions to appoint its administrative levels. Enterprise and departments still keep direct between administrative subordinate relationship, each department are not willing to give up my own share of the rights and interests. In short, for a variety of reasons, forestry separation is not entirely true.

1.4 Management didn't catch up with, incentive mechanism is not sound. The state-owned forest enterprise management is extensive "disease", many enterprise existence discipline relaxation, waste of serious problems, lack of self monitoring and self-discipline mechanism. Since the reform, and some companies are still not except "at the source of the trouble," business management mechanism to realize no corresponding conversion. At the same time, most of the state-owned forest the

production and operation of enterprises, labor personnel, income distribution, technical progress and forming no incentive mechanism, 'lack of vigor.

All of which the existence of the problem, will force we must increase the intensity of reform, strengthen the leadership, explore way, strengthen the measures, as fast as possible so that logging enterprises out of trouble.

3 State-Owned Forest Enterprise Reform Trend

Because of the particularity of forestry, has also decided the state-owned forest enterprise reform, we must from the particularity of the forestry and the characteristics of the special role of seeking a suitable for logging, enterprise development and its special function new pathway. Not only should learn from the experience of the reform of state-owned enterprises, and can not copy other state-owned enterprise reform measures and approaches.

3.1 Emancipate the mind, renew the idea. Must increase of reform, the iron rice bowl, give up "break, by the thought of, to". Change state-owned forest enterprise "exclusive management", "one" situation, break support ownership boundary, break enclosed forestry business model, increase the proportion of the non-public sectors of the forest, expand the opening degree, walked into the market, understand the market, participate in reform, participate in the competition. Realized from the traditional to the modern forestry forestry, open forestry change.

3.2 Achieve diversification of investment, deepening the reform of property right system. Logging enterprises is to establish a modern enterprise system in process, should give priority to national investment, enterprise employees' investment is complementary, form the state holding company, enterprise shareholding, employee stock ownership DuoYuan of main body of investment. Such already can make it clear property rights, and can realize capital increase debt reduction, expand the amount of capital enterprise. Vigorously develop non-public sectors of the forest enterprise, realize the public ownership and the non-public sector of the economy, and the combination of ecological goals and economic goals combined. In order to achieve forestry developing by leaps and forestry sustainable development, and make the forestry one, two, and three industry coordinated development; Clear property rights, dealing with the relationship between ownership, management, investment and property right, the relationship between the distribution of the dominion, activate the benefit main body, arouse the enthusiasm of each respect.

3.3 Establish and improve the corporate governance structure and improve the organization system. The modern company of the most basic characteristics: it is many contributors, form of joint venture company legal person assets, shareholders have responsible for the debts of the company with its investment shall be limited to the equity; 2 it is enterprise owner and operator separation, the owner "away from" enterprise production and operation activities, has the ability to operate by direct management enterprise operation. It is because of these features, the modern company must set up effective corporate governance structure, through the contributive person (shareholders) on the configuration and control of a company, to ensure that the assets of the exercise of safety and to realize the maximization of interests. Its governance structure including: the shareholders' meeting, board of directors and the board of

supervisors, owners, operators and producers by "three will" between independent, ZeQuan formed distinct, interdependent relationship, and through the law and the articles of association of the company can be established and ensure implementation.

3.4 Establish a scientific management system and operation mechanism. To advocate and encourage enterprises to advantage and products as the core, take the market as the basis, through the acquisition, merger, joint, joint venture, etc, in order to improve the way to promote specialization cooperation level for the purpose of operation organization structure adjustment, at the same time should be vigorously promote the enterprise internal management system, the establishment and perfection of the introduction, create conforms to China's modern national condition the advanced management method, the realization enterprise management all aspects of science. Management to mobilize of enthusiasm, creative, its core is the incentive and restraint mechanisms. Constantly optimize the combination of all kinds of factors of production, enterprise that the resources of the enterprise, make full use of the competition.

3.5 Technology reform, pay attention to the role of science and technology innovation. Adhere to scientific and technological innovation, strengthen the enterprise technical reform efforts, pays special attention to the practical technology promotion, relying on scientific and technological progress, improving the added value of the products. Therefore, in order to deepen the science and technology system reform, strengthen the forestry science and technology innovation power; The establishment of a national forestry science and technology innovation system, promote the basic research; Relying on scientific and technological achievement commercialization, driving the application research and is promotion; Strengthen the forestry industry training to enhance the ability of applied science and technology achievements. Let science and technology play its full role.

In a word, we should be scientific use of resources, scientific management, scientific decision-making for logging enterprises development, establish the system of walking, suitable for China's national conditions logging enterprises the road of development, make logging enterprises representation of glory, and realize the sustainable development of forestry.

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