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Analysis of Transformer Winding Fault based on Short-time Fourier Transform

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Abstract

Winding fault is one of the most important type of transformer failure is an important cause transformer damage and threaten the safe operation of the power grid. This paper analyzes the currently used transformer winding fault detection method drawbacks proposed analytical method based on Transformer Winding Fault short time Fourier transform, and through software emulation further verify the correctness of the method, in order to further enhance the transformer winding fault detection method provides a strong basis.

Keywords: Transformer, Transformer winding, STFT, Pspice.

1. Significance

Frequency response analysis is a failure to detect power transformer winding deformation fast, effective, non-destructive way, with a small output response bias and high stability troubleshooting is widely used. Depending on the nature of the excitation power, frequency response analysis into sinusoidal frequency response method (Sweep Frequency Response Analysis, SFRA) and pulse frequency response method (Impulse Frequency Response Analysis, IFRA). Among them, the sinusoidal frequency response method used more, there have been China's power industry standards and IEC standards. Sinusoidal frequency response in the frequency domain method for direct measurement of winding excitation and response signals, and draw the frequency response curve, and thus less susceptible to outside interference and system stability, but the method is currently offline applications more general detection speed and winding state-based multi-criteria evaluation of the correlation coefficient Chinese power industry standard, has great limitations. Present pulse frequency response for the application method, the excitation signal and the response signal measured in the time domain to achieve the frequency response curve of the acquisition, they use a fast Fourier transform algorithm. However, the fast Fourier transform (Fast Fourier Transform, FFT) suitable for stationary signal processing, when the transient signal-conversion spectrum leakage and fence likely to cause defects such phenomena. Therefore, it is necessary to carry out the new time-frequency analysis method suitable for handling transient signal to obtain the pulse frequency response curve. In this paper, in order to short-time Fourier transform

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algorithm (Short Time Fourier Transform, STFT) handle transient signals in order to obtain the correct winding pulse frequency response spectrum. Short-time Fourier transform is the Fourier transform of an improvement, it is a window-based transformation function, the method is theoretical derivation, simulation and test verification, by this method can improve the pulse frequency response online application and winding state law accuracy assessment.

2. Fundamentals

In general, the short-time Fourier transform, a short window width to provide better temporal resolution, long window width provides better resolution in the frequency domain, according to the Heisenberg uncertainty criteria, short-time Fourier resolution time domain and frequency domain resolution conversion can not optimal, which limits its application. However, due to the focus of this article is to get the correct winding pulse frequency response curve to obtain the curve premise is to obtain accurate signal frequency distribution, as long as possible to ensure adequate frequency resolution while taking certain temporal resolution, which can be obtained without distortion Winding pulse frequency response curve, but also to eliminate the use of fast Fourier transform defects caused.

Signal x (t) is a continuous short-time Fourier transform as defined for formula (1), where ω (t) is a window function:

$$STFT\{x(t)\}(\tau,\omega)=X(\tau,\omega)=\int_{-\infty}^{\infty}x(t)\omega(t-\tau)e^{-j\omega t}dt \tag{1}$$

Signal x (n) is the discrete time Fourier transform as defined for formula (2), in fact, a discrete sample form is continuous form.

$$STFT\{x[n]\}(\mathrm{m},\omega)=X(\mathrm{m},\omega)=\sum_{n=-\infty}^{\infty}x[n]\omega[n-m]e^{-j\omega n} \tag{2}$$

Assuming that the pulse frequency response analysis of the excitation voltage signal Vin (t) and the response voltage / current signal Rout (t) of the short-time Fourier transform respectively, by Vin (τ, ω) and Rout (τ, ω) said, according to define marginal spectrum, the pulse frequency response curve by the following formula (3) to obtain.

$$TF_{IFRA}=\frac{\int_{-\infty}^{\infty}R_{out}(\tau,\omega)d\tau}{\int_{-\infty}^{\infty}V_{in}(\tau,\omega)d\tau} \tag{3}$$

Discrete form of formula (4) below:

$$TF_{IFRA}=\frac{\sum_{m=-\infty}^{\infty}\sum_{n=-\infty}^{\infty}R_{out}[n]\omega[n-m]e^{-j\omega n}}{\sum_{m=-\infty}^{\infty}\sum_{n=-\infty}^{\infty}V_{in}[n]\omega[n-m]e^{-j\omega n}} \tag{4}$$

3. Simulation

In order to verify the feasibility of the method proposed in this paper, according to the literature has established an equivalent circuit model for single-winding transformer, the winding 67 cake constituted by a single cake equivalent circuit model by R, L and C are shown in Figure 1 constitute.

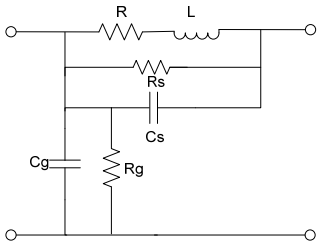


Fig. 1 Equivalent circuit model

Select this article Pspice circuit simulation software for modeling and simulation winding, Pspice software is excellent for circuit transient simulation software, but limited its data processing capabilities, it is difficult to obtain a pulse frequency response curves winding circuit model. Therefore, this article will Matlab software and Pspice software combined use Pspice for circuit transient simulation using Matlab for data post-processing

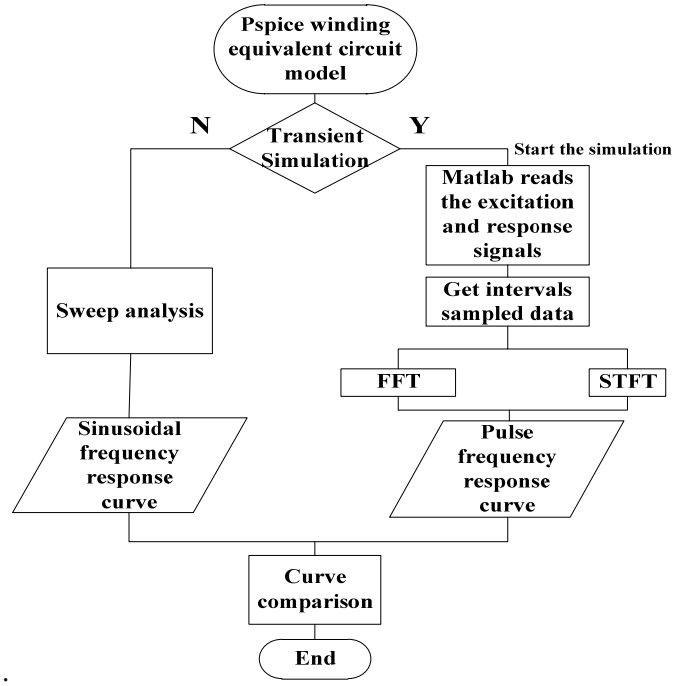


Fig. 2 Simulation Analysis Flowchart

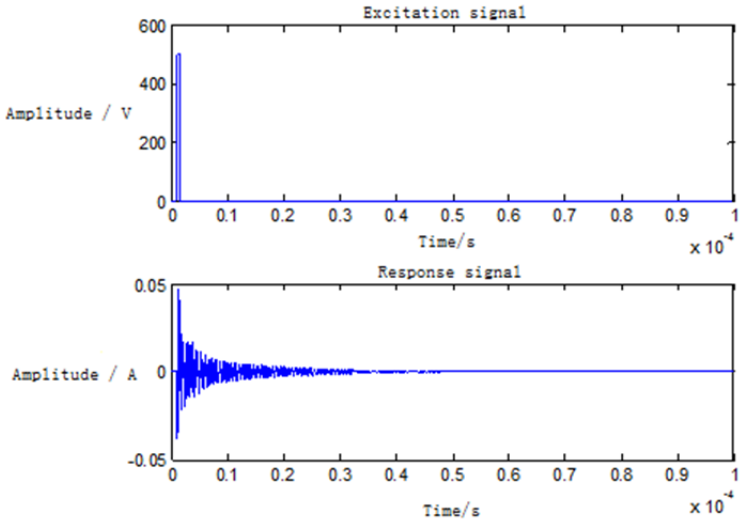
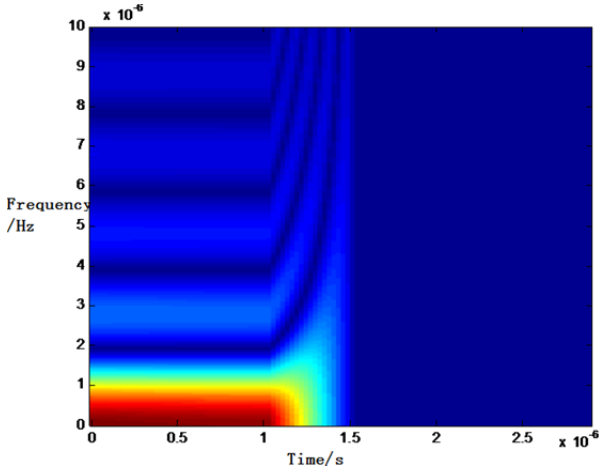
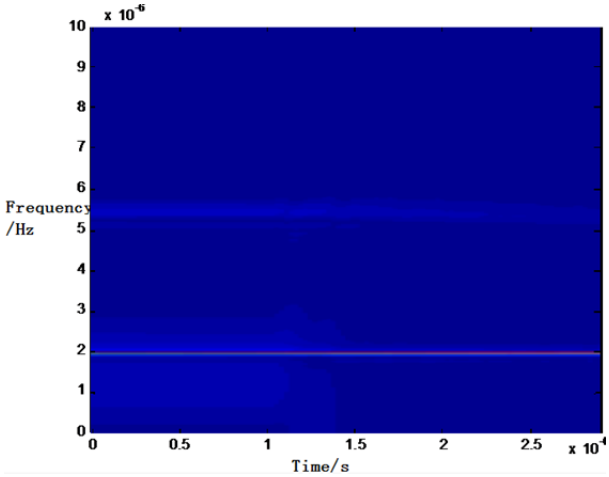


Fig.3 simulation stimulus and response signal waveform



(a)Time frequency chart of response signal



(b)Time frequency chart of excitation signal

Fig. 4 Time frequency chart of excitation and response signals

However, it should be noted that, Pspice software transient analysis using a variable step method to reduce the accumulated error, which can not be obtained, such as when Matlab processed data sampling interval data, therefore, during the pre-conversion frequency, This paper uses a cubic spline interpolation methods, access, etc. Pspice simulation results from the sampling interval data. To test the feasibility of the proposed method, the simulation of the winding equivalent circuit model was swept obtain sinusoidal frequency response curve winding; data processing while using the traditional FFT transform, using short-time Fourier transform Hamming window, the last three results will be compared, the specific simulation process shown in Figure 2.

When the pulse injection coil simulation analysis, select pulse parameters close to the actual test use forefront 10ns, 10ns after the edge, 500ns pulse width, 500V square wave pulse amplitude, pulse frequency response curve of the head-end by injecting excitation winding and a voltage signal in response to current signals. And the excitation voltage signal and the response time of the current signal simulation corresponding STFT frequency is shown in Figure 3 and Figure 4. By the time-frequency transient signals visible mainly in the energy diagram 0-2MHz band. Using short-time Fourier transform, fast Fourier transform to obtain the pulse frequency response curve and get swept sine frequency response curve shown in Figure 5.

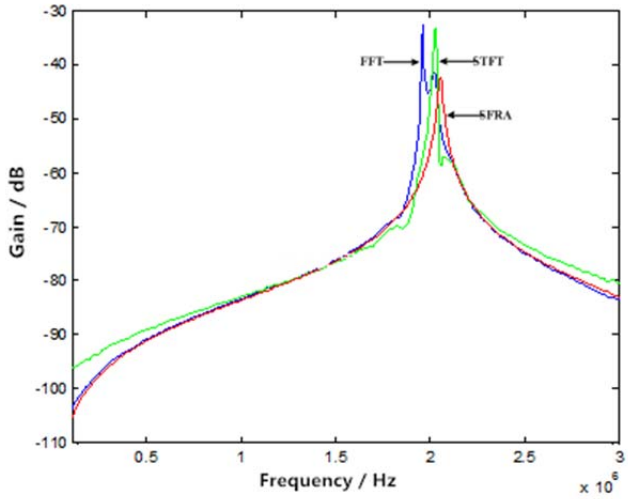


Fig.5 Comparison chart of three kinds of simulation curve

Figure 5 from the simulation results, the pulse frequency after STFT response curve obtained by treatment FFT closer than the original sine winding model frequency response curve, FFT processing result not only deviates from the sinusoidal frequency response curve, and in the vicinity of the resonance point but also more primary resonance point this will seriously affect the assessment of the state of winding deformation.

4. Summary

In this paper, the use of short-time Fourier algorithm to construct a pulse transformer winding frequency response curve, using Pspice software to establish a single winding equivalent circuit model and the transient time domain simulation, the simulation analysis shows that, after a short time Fourier

algorithm processing later, the frequency response curve high definition, less noise, frequency response curve closer to the actual situation, the effect is better than fast Fourier algorithm.

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Research on the Relationship between Steel Core and Aluminum Tubes of Clamp Crimped Size to the Tension Capacity of Overhead Wires Based on X-Ray

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Abstract

Nondestructive detection based on X-ray in the fields of electrical fittings are new technologies which just started in China. The new technology has characters of convenient, fast, accuracy. Transmission lines' tension capacity depends primarily on both the ends of connecting areas of the fittings. Wire tensile capacity depends primarily on both ends of the connecting pipe clamp and steel core size and aluminum crimp size. Crimp size and dimensions of the wire crimp tubes through while changing clamp steel core crimp. Using the X-ray digital imaging technology to detect the clamp steel core actual crimp size and aluminum by setting multiple sets of experiments. To determine the critical wire tension values to meet the requirements for lines' working condition. For wire crimping and quality, the detection has an important significance.

Keywords: X-ray, clamp, steel core Crimped size, Tubes crimped size, Tensile capacity.

1. Introduction

Transmission lines, as an important part of power transmission, play a crucial role in the whole grid. And some wires attached to the remote nobody areas, vile environment, bad weather, poor operating conditions, the operation is difficult to achieve the same substation equipment regular inspections can be closely monitored, and therefore the quality of pre-crimped wire and installation testing has become an important means to control the wire quality and operational stability [1].

Hydraulic crimping, since the crimp material, crimping machines, operator personnel and crimping process, which may lead to unacceptable situation crimping member appears. Current hydraulic crimping quality test primarily visual inspection, measurement and mechanical properties of macroscopic size checks test. But qualified sampling test results and can not guarantee that all qualified crimping member, thus the need for better detection methods [2,3].

At present, the domestic aspect in the detection of this there is no effective detection methods. X-ray digital imaging technology as an ongoing study of the latest technology used in power systems, has

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proven to be effective in its power equipment testing technique that detects intuitive, convenient and fast characteristics makes electrical equipment The test results are more accurate, higher detection efficiency. Currently in the study of the electrical equipment X-ray digital imaging technology focused on the substation equipment such as GIS, tank circuit breakers, surge arresters and other, thus taking into account the technical characteristics of X-ray digital imaging technology, the technology is introduced to the detection of lead research applications.

2. Crimp wire types and related equipment

LGJ-240/30 models of wire in the crimping process steel core insert steel anchors standard length of 100mm, by changing the depth of the steel core insert steel anchors, respectively clamp the wire crimp from 0-100mm. Crimping device parameters to be used showed in Table 1 below.

Table 1 Crimping device parameters

Separate hydraulic clamp	Power source	Rated oil pressure	Rated output	Stamper stroke
TYQ（F）—200t	3-horsepower gasoline engine	80Mpa	2000KN	35mm

In this paper, digital imaging X-ray inspection system is used for the wire crimp quality testing. It includes digital imaging, image processing, guards and auxiliary facilities of the four systems. The system can be realized on electrical equipment defects and risks of non-destructive testing and accurate positioning perspective, which has been widely applied in perspective, detect upcoming production. Using the system for steel core crimp dimensions trans illumination experiments, the system is equipped with a portable X-ray units machine (0.3mV, 3mA, focal spot size of 3.0mm (EN12543), 1.0mm (IEC336)), amorphous silicon flat panel detector (an imaging area of 410mm×410mm image resolution 2.5Lp / mm), the control box, a mobile workstation, and additional data transmission network lines and control cables [4].

X-ray inspection technology after a hundred years of development. From the initial simple film radiographic examination of the development of advanced digital technology for the non-destructive testing methods features. In recent years, X-rays gradually applied in fault detection of electrical equipment, to ensure the safe operation of the wire, tank GIS substation circuit breakers, transforms, and other electrical equipment provide important protection [5-6].

In the study of the steel core crimp sizes trial, insert steel anchor size steel core wire crimp ends 0-50mm same size, the size of the steel core insert steel anchors one end of a normal crimped wire 60-100mm's, the other end of the experimental set according to the size of crimping. Because of the human factor in the crimping process, the actual crimping size there will have some errors. And to get the steel core wire crimp size and relationship to withstand the tension between the need to accurately measure the actual crimping steel core size [7].

X-rays can detect the wire with a convenient, fast and accurate measurement of the steel core crimping size. Set the X-ray machine test parameters appropriately, as shown in Table 2. By changing the size of the measuring wire placement and corresponding software to give the actual size of the steel core is pressed into the steel anchors, as shown in Table 3. The paper listed the steel core crimp size 0mm, 60.44mm X-ray detection diagram shown in Figure 1, shown in Figure 2.

3. X-ray test results

Table 2 X-ray equipment experimental parameters

Instrument species	Ray species	Focal spot size	Tube voltage （kV）	Tube current (mA)	Focal length	Exposure time
Portable	X-rays	3.0mm	60/120	3.0	600mm	8s

Table 3 X-ray inspection of the steel core insert actual size steel anchor

Steel core size		10	20	30	40	50	60	70	80	90	100
A Side		17.15	28.72	34.99	45.61	54.72	119.58	115.16	115.57	112.05	116.12
B Side		13.48	15.11	27.23	51.46	66.58	61.66	70.79	86.98	95.04	112.99

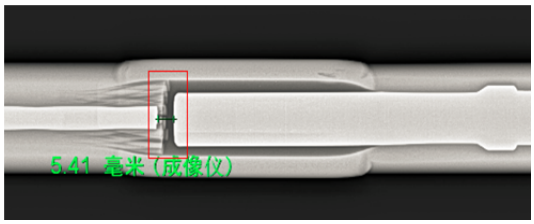

Fig. 1 0mm steel core crimp size of the X-ray detection map

Fig. 2 60.44mm steel core crimp size of the X-ray detection map

4. Tensile testing

ACSR (referred to as ACSR conductors) are stranded by a single or multi-strand aluminum galvanized steel core wire reinforced outside, to ensure safe and reliable operation of ACSR. The need for the steel core aluminum wire and supporting the mechanical properties of the steel anchor Tension pipe fittings, were studied to ensure that it can withstand in the course of tensile load, bending wear, vibration fatigue and multiple load [8-9].

Rally experimental machine model used to 100t / 30 (Shenzhen High-quality testing equipment Limited). Voltage is 380V, the power of 8kW. Stringing project before the start of the project to deal with the actual use of wire, lightning-line and the corresponding hydraulic pipe, with matching steel, according to the operating rules of technology, production testing of specimens. Wire model JL / G1A 240/30, rated tensile strength of 75.19kN. First, the wire tension to 50% of the nominal tension, namely 37.595kN, insurance carrier 120s. Secondly, the wire tension to 95% of the rated tension, namely 71.4305kN,

insurance carrier 60s [10]. The last recording wire or resistance to the most vigorous and the appropriate time when the clamp off - pull curve.

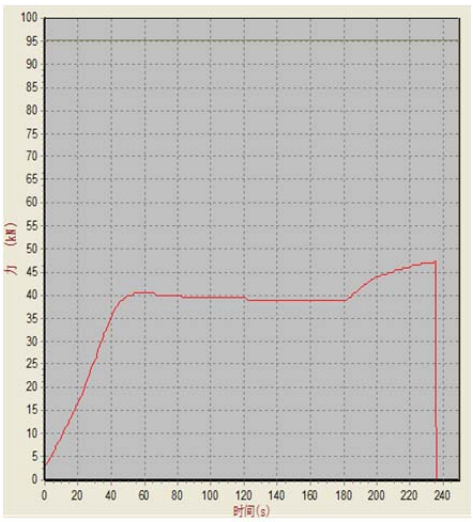

Fig 3 Wires crimped without aluminum mold Rally

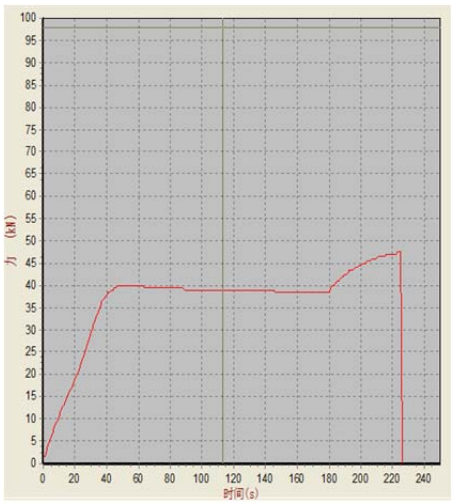

Fig 4 Crimping aluminum waterproof membrane tension wire diagram

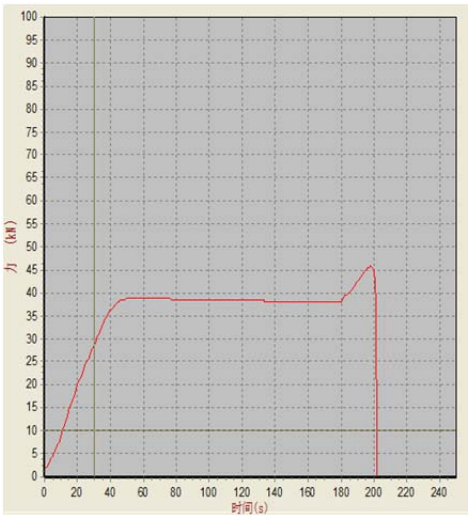

Fig 5 0mm steel core wire crimp pull Figure

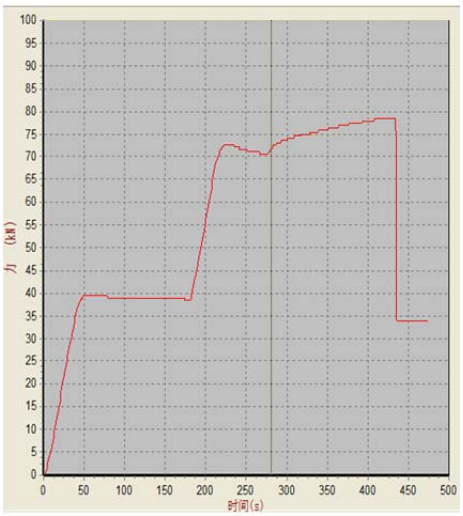

Fig 6 0mm steel core wire crimp pull Figure

From the tensile test results are shown in Table 4. It can be seen that the steel core insertion depth = 0mm, aluminum die alone bear the tension is 46.0kN; aluminum die then only when the amount is 0mm or crimped aluminum waterproof module, steel core alone tension of the 47.5kN. When the steel core insertion depth of 45.61mm, wire tension does not meet the requirements, the steel core insertion depth when 54.72mm, pull wire to meet the requirements, when the steel core steel anchor insertion depth when 86.98mm, wire breaking at the second stage rally, The reason is that the wire crimping preparation, saw blade steel core is caused by injury, does not have universal representation.

Integrated pull-off force ACSR is composed of all steel core wire and the sum of all shares of the aluminum pull-off force, although the elongation of aluminum stocks several times in the elongation of the steel core, but after several tests corrected. This misconception integrated pull-off force is mainly composed of a steel core ACSR pull-off force decisions. As can be seen from Fig. 3 and 5, the steel core

and aluminum die tensile force to bear very close, so no matter when pressed steel core or crimp crimped aluminum mold should seriously in accordance with standard operating procedures in order to ensure ACSR integrated pull-off force.

Table 4 Different size steel core wire crimping Rally results

No.	Insertion depth	50% tension danmage or not	95% tension danmage or not	Maximum tension/kN
1	0	N	A side tubes rupture	46.0
2	13.48	N	B side steel core loss	46.5
3	15.11	N	B side steel core loss	49.0
4	27.23	N	B side steel core loss	56.5
5	45.61	N	A side steel core loss	68.0
6	54.72	N	N	77.5
7	61.66	N	N	78.0
8	70.79	N	N	77.0
9	86.98	N	B side tubes rupture	71.5
10	95.04	N	N	77.5
11	112.99	N	N	78.1

As it can be seen from Figure 3 and Figure 4, when the crimp tubes, waterproof mold serve only serve to prevent moisture from entering the interior of the tube Tension and cause corrosion in the actual application process does not run under tension.

As can be seen from Table 4, in the case of normal crimped aluminum, steel core insert steel anchors a minimum depth of 50mm in order to meet the requirements of the wire tension, less than 50mm, necessarily unqualified lead, we need to re-crimp.

5. Conclusion

By changing the steel core steel anchor insertion depth, combined with the X-ray digital radiographic imaging techniques, to obtain the relationship between the steel core wire crimping overhead lines and the overall size between mechanical load. In the course of the steel core wire crimping crimp dimension of at least 50mm. Steel core aluminum molded crimp connected to overhead wires to pull off the whole force of the basic quite, when aluminum crimp although not withstand tensile force, but it can prevent corrosion and the effects of lead electrical performance. Therefore, in the transmission line project crimping the construction process, construction operators and supervisors must implement the relevant crimping process standards to ensure that the wire crimp quality, ensure the safe operation of the transmission line.

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Application of Improved Differential Evolution Algorithm in Power Purchase Cost Optimization Problem

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Abstract

Under the deregulation of generation market in China, all distributed generators will particular in electric power bidding. Therefore power purchase cost optimization (PPCO) problem has been getting more attention of power Grid Company. However, under the competition principle, they can purchase power from several of power plants, therefor, there exist continuous and integral variables in purchase cost model, which is difficult to solve by classical linear optimization method. An improved differential evolution algorithm is proposed and employed to solve the PPCO problem, which targets on minimum purchase cost, considering the supply and demand balance, generation and transfer capability as constraints. It yields the global optimum solution of the PPCO problem. The numerical results show that the proposed algorithm can solve the PPCO problem and saves the costs of power purchase. It has a widely practical value of application.

Keywords: Power market; Power purchase cost optimization; Improved Differential Evolution; Adaptive parameter

1. Introduction

With the implementation of separating the power plants from grid company and generation bidding in power market in China, it is important for the grid company to optimize the purchasing schedule to reduce the cost of grid company[1-3].

According to the different settlement rules, the objective function of generation-side electricity market is divided to two classes. One is to minimum the cost based on the unified marginal settlement, while the other is minimum cost based on the practical generators bidding[4,5]. The second power purchase cost optimization(PPCO) problem is studied in this paper. The PPCO problem is studied for some years. DUAN established a purchase optimization model considering the generation capability and line loss, and solved this model by penalty function[1]. But he only discussed the PPCO problem on the protection and coordination principle. CHEN et al. established purchase optimization model on the market principle and solved it by Lagrange relaxation method[4]. TAN et al. discussed the multilevel purchase optimization model of long-term, mid-term and short-term electricity market and analyzed the relationship of them, but they did not give the solution method[6]. ZHANG et al. established a purchase optimization model with the constraint of supply and demand balance and constraint of generation capability. They solved this model by the PSO but they did not consider the transfer capability constraint and did not satisfy the constraint of supply and demand balance[2]. ZHANG et al. established a purchase

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optimization model with the constraints of supply and demand balance, generation capability and transfer capability. They solved it with PSO and obtain a satisfied solution[3].

Differential Evolution(DE) algorithm[7,8] is a heuristic global search method which has been employed in many fields such as chemical industry, machine design, information processing, biological information, geophysical inversion[9,10,11]. The DE algorithm has employed to solve the PPCO problem recently, but did not consider the constraints of transfer capability and supply and demand balance[12].

The purchase optimization model is established with the constraint of the supply and demand balance, generation capability, and transfer capability firstly. And an improved DE algorithm with the dynastic mutation factor and crossover factor is proposed secondly. Then the steps of algorithm for the PPCO problem based on the improved DE algorithm thirdly, and the correctness of the proposed algorithm is verified by numerical experiment.

2. Power purchase model

The goal of power purchase optimization is to minimum the cost of purchasing particular quantity of electricity considering some constraints.

The power purchase cost optimization problem can be modeled as follow:

$$\begin{aligned} &MinF,\ F=\sum_{i=1}^{n}C_iP_i \\ &\text{S.T.}\quad \sum_{i=1}^{n}(1-\Delta P_i)P_i=P_d \\ &\quad P_i=0\text{或}P_{i\min}\le P_i\le P_{i\max} \\ &\quad -L_{i\max}\le L_i\le L_{i\max} \end{aligned} \tag{1}$$

where $C_i, P_i, \Delta P_i$ is the electricity price, the purchase quantity of electricity and the line loss of i-th power plant respectively; P_d is the particular quantity of electricity should be purchased; $P_{i\min}$ and $P_{i\max}$ is the minimum and maximum generation capacity of i-th power plant respectively; $L_{i\max}$ is the transmission capacity of the line from i-th power plant to grid company; F is the objective function of power purchase cost optimization.

3. Improved DE algorithm

3. 1. Basic DE algorithm

DE algorithm first initialize is a parallel direct search method which utilizes NP n-dimensional parameter vectors $X^0=\left[x_1^0, x_2^0, ..., x_{NP}^0\right]$ as a population for each generation. The initial vector population is chosen randomly and should cover the entire parameter space. Then DE algorithm updates population by the operation of mutation, crossover and selection.

(1) Mutation

DE generates new parameter vectors by the operation named mutation which add the weighted difference between two population vectors to a third vector.

$$\boldsymbol{v}_i^{k+1}=\boldsymbol{x}_{r1}^k+F(\boldsymbol{x}_{r2}^k-\boldsymbol{x}_{r3}^k) \tag{2}$$

where $x_i^k=(x_{i1}^k, x_{i2}^k, ..., x_{iD}^k)$ is the i-th vector of k-th generation, $r_1, r_2, r_3\in\{1,2,...,NP\}$, $r_1\ne r_2\ne r_3\ne i$, $F>0$ is the mutation factor.

(2) Crossover

In order to increase the diversity of the perturbed parameter vectors, crossover is introduced as follow.

$$\boldsymbol{u}_{ij}^{k+1}=\begin{cases}\boldsymbol{v}_{ij}^{k+1}, rand(ij)\le CR或j=rand(j);\\ \boldsymbol{x}_{ij}^{k}, rand(ij)>CR或j\ne rand(j);\end{cases} \tag{3}$$

where $rand(ij)$ is a uniform random number generator with outcome $rand(ij)\in[0,1]$; CR is crossover factor $CR\in[0,1]$ which has to be determined by the user; $rand(j)$ is a randomly chosen index $rand(j)\in 1,2,...,D$, which ensures that $\boldsymbol{u}_{ij}^{k+1}$ gets at least one parameter from $\boldsymbol{v}_{ij}^{k+1}$.

(3) Selection

To decide whether or not the $\boldsymbol{u}_{ij}^{k+1}$ should become a member of generation $k+1$, it is compared to the $\boldsymbol{x}_{ij}^{k}$ using the greedy criterion as follow.

$$\boldsymbol{x}_{i}^{k+1}=\begin{cases}\boldsymbol{u}_{i}^{k+1}, f(\boldsymbol{u}_{i}^{k+1})<f(\boldsymbol{x}_{i}^{k});\\ \boldsymbol{x}_{i}^{k}, \qquad Otherwise.\end{cases} \tag{4}$$

If the algorithm convergence or the max iteration is achieved, algorithm finish, otherwise, begin the next iteration of mutation, crossover and selection.

3.2 Improved DE Algorithm

The mutation factor F and crossover factor CR is critical to the performance of basic DE algorithm. The large F and CR is beneficial to the global search ability, but it is harmful to the local search ability leading to the poor convegency speed, and vice versa. So we imporve the DE algorithm in the following two ways.

(1) Adaptive mutation factor

The following adaptive mutation factor is introduced in order to improve the global search ability at the early stage and the local search ability at the later stage of the algorithm.

$$F=F_{\max}-\frac{t(F_{\max}-F_{\min})}{T_{\max}} \tag{5}$$

(2) Increasing crossover factor

DENG and RAN[13] propose the following stragegy of increasing crossover factor to achieve the balance between global search ability at the early stage and local search ability in the later stage of the algorithm.

$$CR=(CR_{\min}-CR_{\max})[(\frac{t}{T_{\max}})^2-2\frac{t}{T_{\max}}+1]+CR_{\max} \tag{6}$$

(3) Random mutation

In order to avoid the stagnation of DE algorithm at its last stage, a random mutation method is introduce. If a individual are stagnated in certain iterations, a random mutation is happen in this individual, that is random initializing a individual to replace the stagnated one. The random mutation method is described as follow:

$$\begin{aligned}&if\quad F(x_i^t)=F(x_i^{t+1})=F(x_i^{t+2})=\cdots=F(x_i^{t+p})andF(x_i^t)\ne F^*\\ &then\ x_i^{t+p+1}=x_{\min}+rand(0,1)*(x_{\max}-x_{\min})\end{aligned} \tag{7}$$

Where F^* is global best individual's fitness, p is max stagnation iteration allowed, $(x_{\min},x_{\max})$ is the random search space.

We define the improved DE algorithm, which employ the adaptive mutation factor and increasing

crossover factor strategy, as DE1. And we define the improved DE algorithm, which employ the adaptive mutation factor, increasing crossover factor, and random mutation strategy, as DE2.

4 Solving the PPCO problem with improved DE algorithm

4.1 Strategy for the constraints

The generation and transfer capacity constraints is transformed to boundaries of parameter vector. The balance of supply and demand constraints is considered using the penalty function method and the PPCO problem is transformed from a optimization problem with constraints to a non-constraint optimization problem. The objective function is following:

$$MinF,\ F=\sum_{i=1}^{n}C_iP_i+\alpha\left[\sum_{i=1}^{l}(1-\Delta P_i)P-P_{\exp ect}\right] \tag{8}$$

where $P_{\exp ect}$ is the particular power should be purchased; α is penalty factor; the variables be optimized P_i, is the power purchased from i-th power plant.

4.2 Algorithm steps of improved DE for PPCO

The algorithm steps of improved DE for PPCO problem are following:

Step 1: given the upper and lower boundaries of the variables be optimized P_i, the population NP, the upper and lower boundaries of mutation factor F and crossover factor CR;

Step 2: initialize the population of parameter vector randomly according to the upper and lower boundaries of P_i;

Step 3: calculate the objective function value of P_i, according to formula (8);

Step 4: excute the mutation, crossover and selection according to formular (2),(3),(4) respec-tively, and obtain the next generation population $[\boldsymbol{x}_1^{k+1},\boldsymbol{x}_2^{k+1},...,\boldsymbol{x}_{NP}^{k+1}]$;

Step 5: update the mutation factor and crossover factor according to the formula (5),(6);

Step 6: if the algorithm stagnate certain iterations, random mutation a individual according to the formular (7);

Step 7: calculate the objective function value of P_i, according to formula (8);

Step 8: if the convergency and the max iteration is not achieved, go to step 4, begin next iteration;

Step 9: output the solution, finish.

5. Numerical result and analysis

5.1 Benchmark Results

We use following five benchmark functions to test our improved DE algorithm.

(1) Sphere

$$f_1(x)=\sum_{i=1}^{n}x_i^2,\quad n=30,|x_i|\le 100 \tag{9}$$

(2)Generalized Schwefel's

$$f_2(x)=\sum_{i=1}^{n}(x_i\sin(\sqrt{|x_i|})),\ n=30,|x_i|\le 500 \tag{10}$$

(3)Rastrigr

$$f_3(x)=\sum_{i=1}^{n}[x_i^2-10\cos(2\pi x_i)+10],\ n=30,|x_i|\le 32 \tag{11}$$

(4)Griewank

$$f_4(x)=\frac{1}{4000}\sum_{i=1}^{n}x_i^2-\prod_{i=1}^{n}\cos(\frac{x_i}{\sqrt{i}})=1,\ n=30,|x_i|\le 600 \tag{12}$$

(5)Ackly

$$f_5(x) = -20\exp[-0.2\sqrt{\frac{1}{n}\sum_{i=1}^{n} x_i^2}] - \exp\left(\frac{1}{n}\sum_{i=1}^{n}\cos(2\pi x_i)\right) + 20 + e \text{ , } n = 30, |x_i| \le 5.12 \quad (13)$$

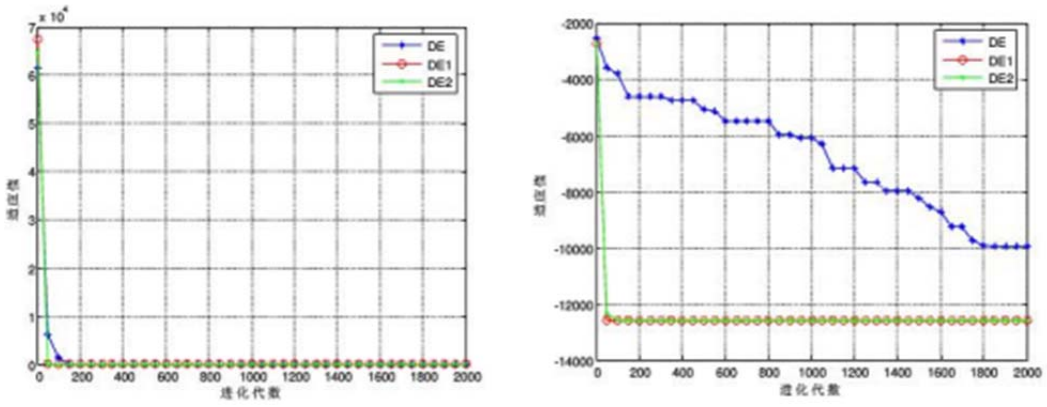
The parameters of standard DE algorithm are set as follows: $CR = 0.9, F = 0.5$. The Parameters of imporved DE algorithm are set as follows: $CR_{\min} = 0.1, CR_{\max} = 0.9, F_{\min} = 0.3, F_{\max} = 1.2$. Both algorithms' number of individuals are 60, max iteration are 2000. The test result are listed in the table 1.

Table 1. Benchmark on DE and improved DE algorithm

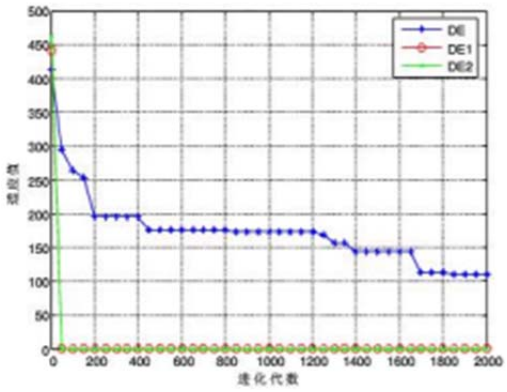
		f_1	f_2	f_3	f_4	f_5
DE	Average	6.47e-31	-9.74e+3	102.02	7.40e-4	5.51e-15
	Stand. dev.	1.33e-39	900.94	35.19	0.0022	1.63e-15
	Best	1.51e-32	-1.12e+4	10.94	0	4.45e-15
	Worst	7.34e-30	-7.43e+3	183.66	0.0074	7.99e-15
	Runtime	85.92	131.89	107.17	118.06	97.97
Improved DE(DE1)	Average	4.98e-5	-1.26e+4	3.32e-5	1.77e04	0.0015
	Stand. dev.	9.42e-5	2.30e+4	5.59e-5	2.29e-4	0.0014
	Best	7.66e-8	-1.26e+4	8.63e-9	8.39e-8	8.85e-5
	Worst	2.43e-4	-1.26e+4	3.08e-4	8.67e-4	0.0055
	Runtime	262.24	260.94	278.27	279.52	284.47
Improved DE(DE2)	Average	4.13e-5	-1.26e+4	1.67e-5	8.23e-05	0.0012
	Stand. dev.	6.81e-5	12.4e-4	6.95e-5	1.34e-4	0.0013
	Best	9.61e-12	-1.26e+4	7.59e-10	2.02e-8	2.14e-5
	Worst	4.72e-4	-1.26e+4	3.01e-4	4.89e-4	0.0050
	Runtime	290.94	274.67	279.70	323.17	267.74

The results listed in table 1 indicate that the both DE1 and DE2 can improve the accuracy of fitness of benchmark functions, while DE2 is better than DE1 at small degree.

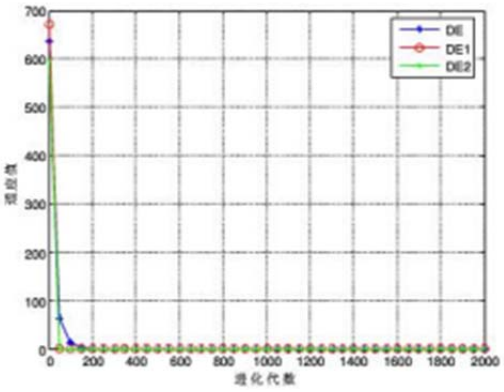
The convergence speeds of DE, DE1, and DE2 are illastrated in figure 1. Figure 1 shows that the convergence speed of DE1 and DE2 is better than DE obviously, while that of DE2 is somewhat better than DE1.



(a) fitness v.s. Iteration of f_1

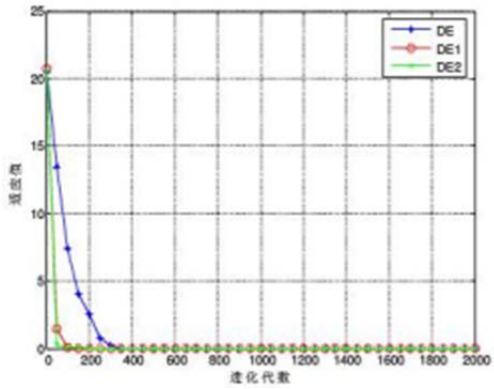


(b) fitness v.s. Iteration of f_2



(c) fitness v.s. Iteration of f_3

(d) fitness v.s. Iteration of f_4



(d) fitness v.s. Iteration of f_5

Fig. 1. Convergency speed of DE, DE1, and DE2 on the different benchmark functions

5.2 PPCO Results

The problem of grid company purchases 200GWh power from 5 power plant is considered. The model of power supply is illustrated as Figure 2.

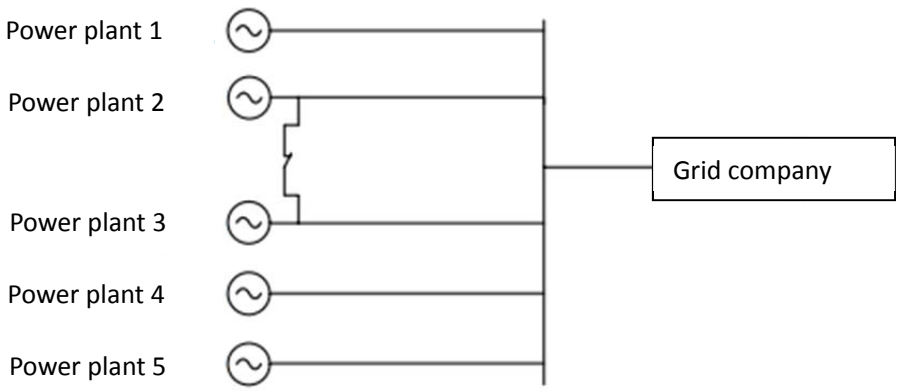


Fig. 2. power supply model of 5 power plants

There is a backup line between plant 2 and 3, which is opened normally. When the line between plant 2 and grid company or between plant 3 to grid is broken, the backup line is closed and the plant 2 and plant 3 share one line to transfer the power. The line loss of the backup line between plant 2 and plant 3 is 0.002.

The emulation program is writen using Matlab m language. The parameters are chosen as following: D=5, NP =40, $F_{\min}=0.3, F_{\max}=1.2$, $CR_{\min}=0.1, CR_{\max}=0.9$, max iteration is 5000. The price, line loss, generation and transfer capability are listed in table 2.

Table 2. Parameters of power supply model of 5 power plants

	C_i (￥/kWh)	ΔP_i	$P_{i\min}/GWh$	$P_{i\max}/GWh$	$L_{i\max}/GWh$
plant 1	0.10	0.0882	43.2	86.4	100
plant 2	0.12	0.0722	21.6	64.8	90
plant 3	0.15	0.0451	21.6	43.2	60
plant 4	0.18	0.0422	14.4	43.2	60
plant 5	0.20	0.0554	14.4	28.8	40

Under the normal condition, that means the transfer capability is larger than the generation capability. The results of purchase optimization under the protection and coordination principle are listed in the table 3, compared with the results of literature [2][3][4]. The results show that the cost of our algorithm is same as that of literature [3], but larger than those of the literature [2][3] slightly, because the results of ours and literature [3] is obtained under the constraint of supply and demand balance restrictively whereas those of literature [2][4] is obtained with some deviation of it.

Table 3. The results of power purchase optimization under the protection and coordination principle

	literature[2]	literature[3]	literature[4]	our results
plant 1	86.4000	86.4000	86.3979	86.4000
plant 2	64.8000	64.8000	64.6384	64.8000
plant 3	35.2963	35.6356	35.2467	35.6356
plant 4	14.4000	14.4000	14.5145	14.4000
plant 5	14.4000	14.4000	14.4549	14.4000
cost/million ￥	27.1825	27.2333	27.19498	27.2333
supply/demand balance	199.6760	200.0000	199.6391	200.0000

The results of purchase optimization under the normal condition and marketing principle are listed in the table 4, compared with the results of literature [2][3][4]. The results show that the cost of our algorithm is same as those of literature [3][4] which are satisfied with the constraint of supply and demand balance restrictively, while the result of literature [2] is not satisfied that constraint restrictively.

Table 4. The results of power purchase optimization under the marketing principle

	literature[2]	liturature[3]	literature[4]	our results
plant 1	86.4000	86.4000	86.4000	86.4000
plant 2	64.8000	64.8000	64.8000	64.8000
plant 3	43.2000	43.2000	43.2000	43.2000
plant 4	20.7218	21.0601	21.0601	21.0601
plant 5	0.0000	0.0000	0.0000	0.0000
cost/million ￥	26.6269	26.6868	26.6868	26.6868
Supply/demand balance	199.6760	200.0000	200.0000	200.0000

Table 5. The results of power purchase optimization under the abnormal condition

	literature [3]		our results	
	protection and coordination principle	marketing principle	protection and coordination principle	marketing principle
plant 1	86.4000	86.4000	86.4000	86.4000
plant 2	64.8000	64.8000	64.8000	64.8000
plant 3	25.2000	25.2000	25.2000	25.2000

plant 4	25.5659	39.7675	25.5659	39.7675
plant 5	14.4000	0.0000	14.4000	0.0000
cost/million ￥	27.6779	27.3541	27.6779	27.3541
Supply/demand balance	200.0000	200.0000	200.0000	200.0000

When the line between plant 3 and grid company is broken, the backup line between plant 2 and 3 is close and the two plants share one transfer line between plant 2 and grid company. The results of purchase optimization under such the abnormal condition are listed in the table 5. The optimization results are same as those of literature [3]. Under the protection and coordination principle is 27.6789 million Yuan(￥), and under the marketing principle is 27.3541 million Yuan(￥) .

The numerical results show that the proposed improved DE algorithm has the advantage of fine global optimize ability. It can be employed to solve the PPCO problem and reduce the purchase cost obviously.

6. Conclusion

An improved DE algorithm, which introduces new update method of mutation and crossover factor to improve the balance between the fine global search ability at the early stage and the fine local search ability at the later stage, is employed to solve the power purchase cost optimization (PPCO) problem with generation and transfer capability constraints. The results of five plants power supply model show that the proposed algorithm can find the global optimum of this PPCO problem and reduce the purchase cost obviously. It has a widely practical value of application.

Acknowledgments

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Automatic Course Scheduling Model Based on Genetic Algorithm

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Abstract

The automatic course scheduling model is established under the circumstances of multiple constraints and multiple objectives, and Genetic Algorithm is also used as the solution. The results show that the model and the algorithm are strongly practical and universal.

Keywords: Timetable Optimization; Course Scheduling; Genetic Algorithm (GA); Fitness Function

1. Introduction

Course scheduling is always one of the major works of the teaching affair administration. With the development of modern education (especially higher education), there are more and more students as well as courses in schools, thus traditional manual course arranging can no longer meet the demand; therefore, the issues of automatic course scheduling emerge at the right moment. At present, most colleges and universities have adopted computer software course arranging system, but the course arrangements of most of the software are designed based on manual operation, which are basically just semi-automatization systems; the course scheduling is realized by large numbers of interactions, thus it cannot generate solution from the original state, and also cannot optimize and adjust the results.

The automatic course scheduling is actually a kind of optimization of Timetabling Problem (TTP). S.Even et al showed in their research in 1975 that course arrangement problem is a kind of NP, which means it is impossible to find out exact solution by any algorithm except “method of exhaustion”. While method of exhaustion has high costs and is time-consuming, so that the present computer cannot bear it. How to carry out scientific and reasonable matching and arrangement according to the course offering of the classes and the existing teaching materials (teacher resources, classroom resources and time resources) has a certain application value in real life, and which can also offer good references to similar issues. Therefore, automatic course arrangement system has long become a research topic for many researchers and software companies. However, the software products in practical operation are few, and the operating results remain to be developed, thus the effectiveness of course arrangement is not satisfying. The author thinks that there are two aspects of problems: 1. the establishment of mathematical model is not complete; 2. the selection of the algorithm, which is often limited to obtain feasible solution and simplify the original problem (such as adopting divide-and-conquer strategy to transfer the problem into several sub-models to solve separately). The results gained by this way are usually easy and feasible but with low efficiency and the globally optimal solution can also not be obtained. How to abstract the course scheduling issue more thoroughly to form a mathematical model which accords with the practices, and search for more excellent and efficient algorithm to solve the automatic course scheduling issues thus improving the teaching efficiency and the teaching order have been the latest development trend.

In recent years, many scholars at home and abroad have conducted researches on the course scheduling

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issurs, and mainly employed evolutionary algorithms (such as Genetic Algorithm, Population-Based Incremental Learning and others) to solve the problem of course scheduling. Some of the research results have been adopted by domestic and foreign software companies, and achievements are made. For example, a domestic researcher used optimization theory and combined with the actual situation of course scheduling in his paper “The Study of Algorithm for Course Arranging Based on Reducing the Classroom Flow”, and achieved good mathematical model and algorithm, the achievement has been employed by a domestic company. It overcame the shortage of the great classroom liquidity in original software algorithm for course scheduling, and improved teaching order. However, the evaluation of the effectiveness of the course scheduling in the paper is too simple (only regard the small classroom liquidity as the objective function) and lack consideration of constraint conditions, thus being worth of improvement. At the same time, the algorithm is ineffective in solving large-scale course scheduling issues (large number of teachers and classrooms and complex course offerings), while the aspect can be broken through by combining genetic algorithm. Among numerous algorithms for solving the course scheduling issues, Genetic Algorithm is an effective one to obtain the optimal solution, and was proposed for the first time by Professor. J.Holland of American Michigan University in 1975, and is a new global optimization algorithm developed in recent years. It borrowed the view of biological genetics, and realized the improvement of the adaptability of individuals through mechanisms of action such as natural selection, heredity and mutation. The point reflected the evolutionary process of “survival of the fittest in natural selection” in the natural world, thus having attracted lots of researchers. It is also rapidly popularized to the aspects of optimization, search and machine learning, etc., and laid a solid theoretic foundation. The paper fully considered the constraint condition and the objective evaluation function of the course scheduling issues, and established a mathematical model suitable for the solution of genetic algorithm.

2. Description of Course Scheduling Issues

In the course scheduling issues, there are kinds of factors should be taken into consideration: teacher resources, the classroom resources and time resources. The constraints below in scheduling should be taken into account:

(1) The same teacher cannot give lectures for two or more classes at the same time;

(2) The same classroom cannot be provided for two or more classes at the same time;

(3) The same classroom cannot be arranged for two or more courses at the same time;

(4) The classroom capacity cannot be less than the number of students of each class;

(5) Other special reinforced regulations of the school and special requirements (such as some teach cannot have class at some day);

The 5 reinforced constraints are taken as the test conditions of feasible solutions. Meanwhile, the practical principle below should be follower in course scheduling:

(1) The courses which are only once a week should be spaced out as possible;

(2) In order to reduce the fluidity of the classroom, all the sections of the same course of the same class should be arranged in the same room as possible;

(3) Try to make the classroom capacity close to the number of students in a class as possible, in order to rationally use the classroom resources;

(4) Correctly evaluate the importance of each course, and arrange better time for main courses so as to improve teaching efficiency;

(5) It is better not to arrange a whole day classes, while there is not in another day, that is to say evenly

arrange the classes.

Set the set of classes as $\{c_1, c_2, \cdots, c_{na}\}$, the set of teachers as $\{t_1, t_2, \cdots, t_{nb}\}$, set of courses as $\{c_1, c_2, \cdots, c_{nc}\}$, and the set of classrooms as $\{r_1, r_2, \cdots, r_{nd}\}$. Due to there are less courses during the weekend and other periods of time, 5 days a week and 4 periods a day are considered, among which:
The first period: the 1-2 classes in the morning; The second period: 3-4 classes in the morning;The third period: the 1-2 classes in the afternoon; the fourth period: 3-4 classes in the afternoon. τ_{ij} is used to represent the week i, and the period j, among which, $i = 12,3,4,5; j = 1,2,3,4$. The following two varieties are introduced in order to make the system automatically choose more effective course scheduling scheme.

(1) Course weightiness α_i, $i = 12,3\ldots, nc$. The course weightiness relies on two principles: 1. The more the total number of students of classes choosing the course, the more important the course is; 2. If there are same students in two courses, it is said that the two courses are relevant; the more relevant courses a course has, the more important the course is. If the total number of courses is nc, the number of students in number i course is m_i. If in the matric $A_{ij} = (a_{ij})_{nc\times nc}$, a_{ij} signifies the number of the same students in course i and j. In real storage, only the items which are $a_{ij} \neq 0$ can be saved, that is using sparse matrix to carry out storage, and the matrix A_{ij} is symmetric matrix with its diagonal element m_i.

If $c_j = \sum_i a_{ij}$ is the column sum of a matrix, in $d_j' = \frac{c_j}{\sum_j c_j}, d_j = \frac{d_j'}{\sum_j d_j'}$, d_j is the normalized weightiness of each course. In fact, through the calculation of weightiness, those courses which do not participate in the course scheduling are also involved into the consideration of weightiness.

(2) The effect value of time interval is $\beta(\omega, \tau, \omega', \tau')$. Generally speaking, the course more than once a week, and the same course with the same class is arranged in the same day or adjacent two days, are all of low efficiency; the specific quantization is: $\beta(\omega, \tau, \omega', \tau') = \begin{cases} 0 & w = w', \tau = \tau' \\ 0.2 & w = w', \tau \neq \tau' \\ 0.5 & |w - w'| = 1 \\ 1 & others \end{cases}$

3. Genetic Algorithm

Genetic Algorithm adopts the cycle process similar to gene evolution, and the calculation steps include: initialize population, fitness evaluation, GA operation. The general algorithm is as flowing:
begin:
$t \leftarrow 0$

initialise $p(t)$

evaluate $p(t)$

while(not terminate-condition) do
begin:
$t \leftarrow t+1$

select $p(t)$ from $p(t-1)$

alter $p(t)$ by GA operators

evaluate $p(t)$

end

3.1 Chromosome Coding

How to make the decoding of the issue become chromosome is the key in genetic algorithm, Professor Holland employed binary string in his work. It is known that, binary coding has serious defect for the function optimization due to the existence of Hamming Cliff. For example, individual 011111111and 100000000 are two adjacent points in representation space, which means that their Euclidean distance reaches the minimal value, but their Hamming distance reaches the highest in Genotype space. One-dimensional real number encoding is the most effective one to solve the problem of function optimization, and meanwhile the topological structure in real-coded genotype space is the same as that of its representation space, thus easily forming better genetic operators. Each chromosome symbolizes the class schedule of each teacher, its structure are as follow: chromosome can be encoded decimal number in the program. The coding scheme is Table 1:

Table 1. coding scheme

Teacher No.	Class No.	Course No.	Number of Periods Per Week	Classroom No.	Time of Class

For example: a teacher's No. is 3012, his teaching class No. is 0811, the No. of his teaching course "Advanced Mathematics" is 2038, the periods in a week is 4; randomly select a classroom which can hold more than 2 classes of students, and randomly generate class time, then the chromosome generated is: 301208112038413160203, in which, 1316, 0203 respectively represent the classroom and the class time----the third period on Tuesday. According to the real number encoding, genetic manipulation is carried out for the last 8 numbers. Each chromosome represents one possible course scheduling result, and the its advantages and disadvantages are decided by using fitness function to evaluate the adaptive value of the chromosome

3.2. Genetic Operator

3.2.1 Initialization

The purpose of initialization is to provide initial population for genetic manipulation in the late stage. In the algorithm, because only one teacher will be operated at a time, the setting of classroom and time should be considered when initializing, which includes the best approximation of the number of students can be held in a classroom (that is to avoid the class with 30 students occupying a classroom which can

hold 200 students), and the rational arrangement of class time, which have been explained in the course scheduling issues.

3.2.2 Selection

Selecting operation is to choose a sort of chromosome with high adaptive fitness in old population, and put it into the matching collection, thus getting prepared to generate new population for chromosomal crossover and mutation operations. The chromosome with high adaptive fitness is more likely to be chosen, and the selection offers the driving force to the genetic algorithm. If the driving force is too strong, Genetic Algorithm will be terminated early; if the driving force is too weak, its convergence process will be too slow. If smaller selective pressure is used in the early process of the algorithm, and breadth-first search is carried out in the search space; big selective pressure is used in the late process of the algorithm, thus limit the search space. There are a lot of ways for selecting operation, such as roulette wheel selection, $(\mu + \lambda)$ selection method, competition selection, steady-state reproduction, sorting and scaling transformation and others. In the research, roulette wheel selection is used, and its fundamental principle is to determine the survival probability of the individual according to the proportion of the adaptive value of each chromosome. The process of selection is to rotate the wheel-disc several times (the rotating times equal to the population size), and select a new individual each time for the new population.

3.2.3 Crossover

Crossover is to select two chromosomes as the parent individuals according the result of operation, and select a random value (set as r) to be compared with crossover rate value presupposed by the system, if $r < t$, then the genes can be exchanged.

3.2.4 Clone

Clone is to copy the chromosomes with high adaptive fitness in a generation to the chiasmatic cistern, thus replacing the chromosomes with low adaptive fitness. Therefore, the ones with high adaptive fitness are kept.

3.2.5 Mutation

Mutation is to randomly change any teaching time in the chromosomes, and randomly select a point in the period to be changed in the setting range. Mutation operation imitates the gene mutation of living creatures caused by various chance factors in the natural genetic environment. Through mutation, the adaptive fitness of the chromosomes can be strengthened or weakened, but mutation ensured the diversity of gene types in the population and makes it possible to search in a space as large as possible, thus making it more possible to obtain optimal solution. Similar to crossover operation, the mutation probability is defined as p, and a random number r generated during the crossover; when $r < p$, the mutation operation should be carried out, vice versa.

In this problem, there are individuals which cannot meet the conditions of feasible solution in the newly generated population, because of lots of the constraints of physical conditions. Therefore, the test conditions of feasible solution is firstly used when gaining a new population to test each individual, thus quickening the speed of generating optimal solution.

3.3. Fitness Function

The setting of fitness function is of great importance in Genetic Algorithm, which directly decides the resulted structure of the algorithm. The effect of time interval, classroom utilization ratio, classroom flow and other factors are integrated to define the fitness function, and meanwhile, the weightiness of each

course is taken into account: $f = \sum_{i=1}^{nc}(\lambda_1 f_1 + \lambda_2 f_2 — \lambda_3 f_3)(g)$, in which, g signifies genic value, f_1, f_2, f_3 respectively mean the values after the uniformization of the effect of time interval, classroom utilization ratio and classroom flow, $\lambda_1, \lambda_2, \lambda_3$ separately represent weightiness and $\lambda_1 + \lambda_2 + \lambda_3 = 1.$

3.4 Stop Condition

In practical operational process, several algorithms can be adopted to forcefully stop the implementation of the algorithm program:

(1) Set the maximum genetic algebra; stop the program when the algorithm reaches to the maximum genetic algebra, and output the last result value.

(2) Set a boundary value of the fitness function; stop the program when fitness value of a generation reaches the boundary value, and output the value of the individual.

(3) The absolute value of the difference between the fitness values of the new individual and the original one should be smaller than the pre-set value.

The whole process of the Genetic Algorithm is as follow:

The first step: randomly generate N values which is tested for feasible solutions as initial population, make t=0;

The second step: use roulette wheel selection method to choose two solutions p_1, p_2 in the population;

The third step: carry out crossover operations to p_1, p_2 and generate new solution C;

The fourth step: carry out mutation operation to several random columns in C;

The fifth step: make sure C is the feasible solution and remove the redundant columns;

The sixth step: if C is the same as an individual of the population, then go back to step two;

The seventh step: choose an individual, whose fitness value is lower than the average, in the population to replace C;

The eighth step: repeat the steps from two to eight until it satisfies the stop condition.

4. Conclusions

Through the research, it is believed that GA is very effective in solving the problems of course scheduling, and the gradual increase of fitness value in the algorithm can cause better scheduling results. Compared with the course scheduling systems by using other algorithms, it shows that the solving of course scheduling problems by GA is not only reflected in the effect of scheduling, but also in accuracy of scheduling which is obviously better than others, especially that it realized totally automatic course scheduling without interactive operation between man and machine; however, it is realized that there are some shortages by using GA to make course scheduling, such as slowness, unpredictable solutions, bad stability and so on. Hence, it is hoped that the effect of course scheduling can be strengthened by using other methods like fuzzy reasoning in the future, in order to realize more satisfied curriculum schedules in shorter period of time. In addition, teacher's course scheduling willingness, the requirements of courses on the types of classrooms, irregular credit hours (like odd number periods) and other factors will be

taken into consideration to improve the model and algorithm, and make it more applicable.

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Design of AutomaticDoor System Based on Single Chip Microcomputer

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Abstract

This design is a kind of control system of automatic door based on infrared. The system uses an infrared sensor to detect changes in the human body radiation of infrared energy, which is converted into electrical signals transmitted to the microcontroller. In this design, the software and hardware combine organically, so that the system can correctly shows the phenomenon required by the designer. In order to ensure correct design results, the designer uses buzzer, LCD and LED lights asindicators**.**

Keywords: STC89C51 microcontroller, pyroelectric infrared sensor, 1602 LCD.

1. Introduction

With the social development, scientific and technological progress and the people's living standards gradually improved, a variety of convenient automatic control system to life has begun to enter people's lives, a microcontroller as the core of the automatic door control system is one of them.

2. Design of whole system

This design is infrared automatic door control system, the system uses an infrared sensor as the sensor, when it detects changes in infrared energy radiated body, be converted into electrical signals transmitted to the microcontroller. Chip as the gate drive. By SCM control system, the door opens automatically when a person can make the door after door closed automatically. The main topic of infrared ray detection and STC89C51 microcontroller-based control system.

3. Design of system’s hardware

3.1. Selection of microcontroller

The system control module mainly STC89C51 as the master chip, STC89C51 SCM is the earliest and most typical product, STC89C51 MCU learning board is an 8-bit microcontroller chip based STC89C52RC system. STC89C52RC is the use of 8051. ISP (In System Programming) in-system programmable chips, the maximum operating clock frequency of 80MHz, 8K Bytes of chip containing 1000 times rewritable read-only program Flash memory devices compatible with the standard MCS-51 80C51 instruction set and pin structure, the chip integrates a generic 8 ISP Flash memory and central processor unit, with in-system programmability (ISP) feature, with the PC side of the control program can be downloaded into the user's code inside microcontroller , eliminating the need to buy universal programmer, but also faster.The MCU pins and peripheral interfaces is shown in Fig. 1.

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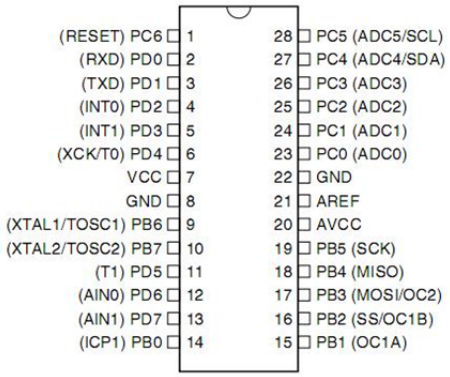

Fig. 1. Pins of STC89C52RC

3.2.Design of sensor

Secondly, through the sensor senses the infrared energy radiated body changes, this design uses pyroelectric infrared sensor, the working principle and characteristics of pyroelectric infrared sensor of pyroelectric infrared sensor as follows:

The body has a constant body temperature, usually 37 degrees, it will issue a specific wavelength of about 10 μ M infrared, passive infrared sensor to detect by about 10 μ M emitted infrared body carried out the work. 10 μ M about infrared emitted by the human body after the Philippine mud Seoul filters on enhanced infrared sensors gather source. Infrared sensor source pyroelectric element, this element is received will be lost when the charge balance infrared radiation temperature changes, outwardly charge, can produce up circuit has been tested and processed by the human presence signals.

3.3. Design of voltage regulator module

Regulator module is an important part of its composition, electronic products, the common three-terminal regulator IC has 79XX series 78XX series of positive voltage output and a negative voltage output. As the name implies, the three-terminal regulator IC is an IC that with only three output pins, which are input and output grounding.It looks like an ordinary transistor, T0-220 the standard package, but also looks like 9013 T0-92 package. 78/79 series peripheral elements to form three-terminal regulator IC power regulators rarely needed, as well as the internal circuit overcurrent protection circuit overheating and the regulator, and to use reliable, convenient, and cheap.

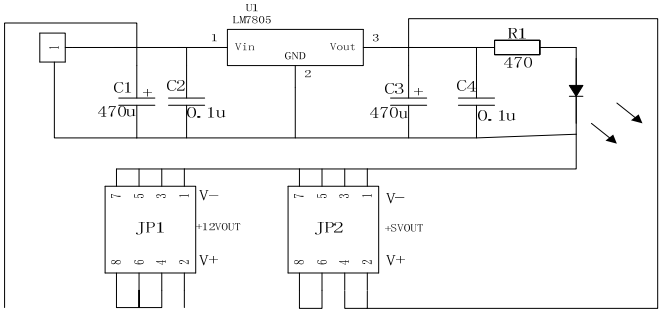

Fig. 2. The circuits of voltage regulator module

The family of integrated voltage regulator IC Part 78 or 79 behind the figures represent the three-terminal integrated voltage regulator circuit, such as 7806 represents the output voltage is positive 6V, 7909 indicates that the output voltage is negative -9V. Because the three-terminal integrated and easy

to use fixed voltage regulator circuit, often used in electronic production.The circuits of voltage regulator module is shown in Fig. 2.

3.4.Design of indicating device

Buzzer is an integrated electronic devicewith DC voltage supply, widely used in computers, printers, photocopiers, alarms, electronic toys, automotive electronics, telephones, timers and other electronic products for sound devices . The design of the main electromagnetic buzzer. Electromagnetic buzzer by the oscillator, the electromagnetic coil, magnet, diaphragm and housing and other components. After the power is turned on, the audio signal generated by the oscillator current through the electromagnetic coil, the electromagnetic coil generates a magnetic field. Diaphragm in the interaction of electromagnetic coil and magnet periodically vibrating sound.

1602 1602 LCD also called LCD 1602 character LCD, which is a display devoted to letters, numbers, symbols, and dot-matrix LCD module. It consists of a number and other 5X7 or 5X11 dot matrix character bits, each dot character bit can display a character, there is a distance between each pitch, spacing between each row also played a character spacing and line spacing effect, using a standard 16-pin interface reset circuit contains a variety of control commands, such as: clear the screen, blinking characters, blinking cursor, display shift and other functions, micro-power, small size, display rich content , ultra-thin lightweight.

4.Software design and debugging

The control system software modules include: system monitoring the main program module, data acquisition module and storage module.

For 51 series, limited system resources, the main program is usually an infinite loop process that is an iterative process subroutine calls. Subroutines and functions are divided into interrupt subroutine calls can be nested and mutually between them, which may interrupt subroutine calling function subroutine.

The control system data acquisition target for the human radiation infrared signal, there is the human presence, with LED lights glow, the LCD screen display "ON" state simulation open, no human presence, LED lights do not emit light, LCD display " OFF ".

After the completion of the overall system design, to be run debugging, troubleshoot software and hardware failures, and to verify the reliability and stability of the system, the system meets the design requirements. Commissioning of the system is divided into two steps: SCM system Commissioning (hardware debugging and software debugging) and the entire control system commissioning and commissioning.

After the program debugging, use the online programmer curing process into the device, so that the whole system is up and running.

5. Conclusions

This design successfully achieves the phenomenon of analog automatic doors. With China's rapid economic development in the metropolis of skyscrapers, in the buildings, hotels, shopping malls, hospitals, offices and other places, automatic doors are everywhere, get universal access. Automatic doors not only bring convenience and out of our staff, so we added a lot of building modern touch, there are many benefits, such as saving air conditioning energy, wind, dust, noise reduction etc.

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An Empirical Analysis of Factors Influencing Effect of Web-based Autonomous Learning of College Students

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Abstract

Through the study, the standardized path coefficients of teacher motivation, factors, and individual factors of learning on College Students' network learning effect are as follows: 1.436, 0.668, 0.517, 0.459. The corresponding countermeasures are put forward: to stimulate and maintain the network course learning motivation of college students; improve the network learning website construction and provide rich network learning resources; establish an effective evaluation of the effectiveness of undergraduates' web-based self-regulated learning resources and assessment mechanism.

Keywords: Network independent study; influencing factors; Learning effect

1. Survey Background

Network self-learning refers to learners' using of the network on their own, active use and regulate their metacognition, motivation and behavior for learning network courses. Network based self-learning for college students, not only a new way of learning, but it is a life-long learning skills. At present, the academic research on network independent learning is less, and the lack of research directly related to their causes. Shengli Jing and Chunlin Kuang proposed how teachers implement RMON in online education platform, also proposed network monitoring technologies and approaches, but no in-depth studies from the students' psychological point of view. Past studies are lack of empirical analysis of independent learning under network environment, there is no in-depth exact analysis of what factors affect the direct cause of the effect of self-learning network, which is an indirect cause and which factor is more important, and thus can not focus and targetedly put forward recommendations of increasing the network independent learning.

2. Research Hypothesis

2.1 Motivation

Motivation refers to an internal motivation directly stimulate students to learn, a need to encourage and guide students to learn. Psychological research shows that a person will conduct behavior; the direct impetus is from the motive. if the students are lack of motivation to learn in network based environment, they would be reluctant to make greater efforts in the study. Munger and Loyd believes there is very close relationship between learning motivation and learning network environment, a positive attitude is better than the negative attitude. Therefore, this study proposed the following hypothesis, H1: Students' Motivation and significant independent network learning outcomes show positive correlation.

2.2Teacher Factor

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Constructivist learning theory: learning is a process of acquiring knowledge. The human knowledge is not given directly by an external stimulus, but the result of the interaction between external stimuli and psychological processes of the subject of knowledge, including certain social background, other people (teachers and learning partners, etc.) as well as a variety of learning resources; among which the role of teachers is more important, teachers can use their wealth of knowledge and experience to play a "cooperative + guide" positive role in students' network learning.

Silvia Schiaffino thought teachers gave guidance to the network self-learning students is necessary, teachers can observe students' online learning, while generate a record on students' online learning conditions automatically. By understanding the students' learning, they can offer proactively different student personalized guidance and help. In the independent learning process, teachers affect students' motivation to learn through monitoring measures, personality and teachers' attitudes towards online teaching. Therefore, this study presents the following hypothesis, H2: inspiration of students' motivation to learn and extent teachers play the role exhibit a significant positive correlation; H3: extent teachers play the role and the effect of network independent learning show a significant positive correlation.

2.3 Network Factors

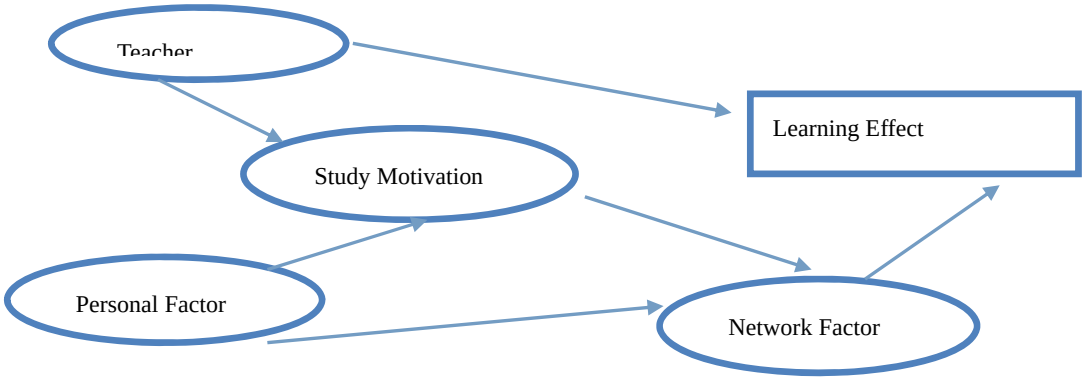
Network environment, including network hardware building level , software building level , convenience and the degree of richness and applicable aspects of online course resources . Good network hardware level ensure that the network bandwidth and stability, providing a good prerequisite and network environment for online learning . Network software construction including material library , network teaching library, teacher courseware library, student gallery, forums and a number of courses have a strong applied component to facilitate teachers and students to use network resources in the autonomous learning. Shih-Chyueh Chuang and Chin-Chung Tsai , by survey to more than 700 Taiwan college students, found that students view seriously to the self-learning process in web-based learning environment , they want a convenient online learning environment. Good network environment for the realization of self-inquiry learning has created favorable conditions. Weihong Kong and Rayleigh Gao(2008) found in the survey, 60.7% of students believe that they are often misguided by interference of resources in the learning process, a waste of time, but not get the corresponding effect; 65.2% students believe online learning resources are not easy to find. Based on the above inquiry, we propose the following hypothesis, H4: good network environment and Students learning exhibits a significant positive correlation.

2.4 Personal factors

Personal factors are mainly reflected in personal self-control, personal family economic conditions, PC professional level and individual major, grade and so on. In general, the stronger the individual's self-control, the longer its network independent learning it takes, the more intense desire to learn, the better corresponding learning; Similarly, a computer skill of college students will also affect the efficiency and effectiveness of the network resources. Students of different individual economic, social and academic background , the preference for online learning are not the same, thereby, affecting their motivation and desire to learn. Accordingly, this study presents the following assumptions, H5: PC skills, self-control and other personal factors exhibit significant positive correlation with students motivation. H6: PC skills, self-control and other personal factors and Students learning show a significant positive

correlation. Based on the above review of the literature, we propose the following research model (see Figure 1)

Figure 1: Theory Model and Hypothesis



3. Sample Data and Research Methods

The survey carried out in three college of Changchun. Specific sample comes from: Changchun university of science and technology, Changchun University, Changchun Normal University. One is the Polytechnic colleges, one is the Normal University, another is a comprehensive colleges, this choice is to make the sample representative. Survey methods are as follows: Firstly, the document of the number of dormitories is founded; survey100 parts per school; and finally randomly draw numbers of the university dormitory

Thus, interviewers make home visits. The survey is taken by combination of quantitative and qualitative surveys to the main survey, discussion, interviews and survey data, supplemented by qualitative research. Which uses random sampling survey, issued 300 questionnaires, 290 valid questionnaires returned, the effective rate of questionnaires is 90.85%. Through statistical sample，the proportion of women outweigh men generally for the reason of liberal arts colleges; all grades of students substantially uniformly distributed, and college students aged between 20-23 years . Therefore, we believe that the survey sample in demographic distribution is reasonable, and thus can be further analyzed.

4. Research Methods

This paper uses qualitative and quantitative analysis of the research. During which the survey qualitative analysis methods include expert interviews and group interviews. Quantitative analysis comprehensively adopt SPSS and AMOS software, using SPSS software to make reliability and factor analysis, SEM model is mainly under path analysis using AMOS software to verify whether the variables have a causal relationship, which causality is and whether influenced by the mediating variables, and "direct" causal relationship with the size of the indirect causal relationship with the "intermediary" variable. Therefore, using AMOS obtain a more accurate and comprehensive analysis of the effect of the rich than individual factor analysis and regression analysis.

5. Questionnaire and measurement

First , formation of questionnaire. All of this research are used a 5-point scale Likert scale (1 = totally disagree, 5 = totally agree). By preliminary data analysis and research, we have designed a preliminary questionnaire. We then conducted a pilot survey of 50 samples and obtained 45 valid samples. SPSSl6.0

software will scale score of the reverse problem, followed by total score from high to low, to find out the level of grouping in the fraction of 27% at the project analysis, t test level of final differences on each topic item; delete insignificant questions of t test results, and finally get five variables 21 question items. Second, the reliability analysis. In the total sample, for example, the reliability of five variables are shown in Table 1, the standard value of each variable were higher than 0.70.

Scholars DeVellis (1991) made the following points: When Cronbach a coefficient ranged between 0.70-0.80 is quite good, the scale has high reference value, can be considered the information about the scale of this questionnaire obtained with high reliability and can be further analysis. Thereby obtaining all the potential variables and their observations. Third, factor analysis. SPSSl6.0 software using observations on every potential variables were used to make principal components factor analysis and orthogonal rotation, remove the questions of low factor loading (less than 0.40). Each question item factor loadings on the corresponding variables are shown in Table l, except A3 (in preparation for employment) and D2 (network hardware level affects your self-learning network) load on the two variables is slightly less than 0.5, the rest of questions of the load on the corresponding variables are greater than 0.5. It proves that each latent variable possess good construction validity.

Table 1: The reliability level of latent variables and the observation index

Variables	Items	Factor Loading	Variables	Items	Factor Loading
Study Motivation Alpha=0.793	A1 Passing Exams	0.845	Teacher Factor	B1 the teacher help a lot in your network learning	0.614
	A2 Interest and hobby	0.774		B2Teachers should instruct students autonomous learning	0.739
	A3 Preparation for work	0.443		B3 Teachers' instruction on students network learning is essential	0.829
	A4 Finish Homework	0.758		B4 Teachers' engagement level affect network learning	0.540
Personal Factor Alpha=0.772	C1 Computer ability affect web-based autonomous learning Network Learning Effect	0.613	Network Factor	D1 Easy access to internet or not affect network learning	0.752
	C2 Family Economy affect web-based autonomous learning Network Learning Effect	0.650		D2 Network Hardware affect online learning	0.456

	C3 Major affect web-based autonomous learning Network Learning Effect	0.668		D3 Richness of network resources affect network learning effect	0.813
	C4 Grades affect web-based autonomous learning Network Learning Effect	0.790		D4 Network construction affect network learning effect	0.765
	C5 Self-control affect web-based autonomous learning Network Learning Effect	0.820	Study Effect	E1 Network learning improve enthusiasm of English Learning	0.581
	C6 Having a computer or not affect web-based autonomous learning Network Learning Effect	0.761		E2 Effect of network learning is hard to measure	0.775
				E3Unaware of the effect of Web-based Autonomous Learning	0.628

First, the formation of a questionnaire. All scales are used in this study, a 5-point Likert scale (1 = strongly disagree, 5 = totally agree). Articles by preliminary data analysis and research, we have designed a preliminary questionnaire. We then conducted a pilot survey of 50 samples obtained 45 valid samples. SPSSl6.0 software will scale use of the reverse problem re-scoring scale score obtained, then the total score in descending order, to find out the level of grouping in the fraction of 27% at the project analysis, final differences in the level of group t test items on each topic, will t test results are not significant problems deleted items, and finally get five variables 21 question items. Second, the reliability analysis. In the total sample, for example, reliability five variables as shown in Table 1, the standard value of each variable were higher than 0.70. Scholars DeVellis (1991) made the following points. Students' self-learning network path analysis

6. Saturated Model

First, establish path analysis diagram on the causal relationship between the five variables (figure omitted), by means of AMOS, standardized estimated path coefficients are shown in Table 2. The results from the output of the model shows that the saturation value of the chi-square is 0, df value is 0, RMR is 0, GFI value is 0.210. According to the evaluation criteria of model fit indices, although the chi-square value and absolute fit index RMR values are relatively small, but 0.210 GFI value (<0.9) is too small, indicating model doesn’t fit well. Thus, the saturation model must be amended. Path coefficient analysis Table 2 shows that, in the six paths, there are two path coefficients (teacher learning motivation factors, personal factors, Motivation) did not reach significance level, indicating that the potential relationship between these two variables does not exist, it should be deleted in the model.

And make the path analysis again (modified path coefficient analysis model is shown in table 3)

Table 2 Network independent study effect saturation model path coefficient analysis table

Path Name	Standardized Path Efficient	Non-standardized Path Coefficient	S.E	C.R	P Value
Teacher Factor-Study Motivation	0.336	0.932	0.592	0.568	0.467
Teacher Factor-Study Effect	0.534	0.741	0.238	2.234	0.000***
Study Motivation-study effect	1.843	8.392	0.326	6.668	0.000***
Personal Factor-Study Effect	0.742	3.331	0.154	2.835	0.005**
Network Factor-Study Effect	0.442	0.557	7.617	2.743	0.007**
Personal Factor-Study Motivation	0.354	0.064	0.558	0.635	0.477

Note: **p<．01，***p<000

Table 3 Analysis of the path coefficient effect correction model of Web-based Autonomous Learning

Path Name	Standardized Path Efficient	Non-standardized Path Coefficient	S.E	C.R	P Value
Teacher Factor-Study Effect	0.521	0.663	0.152	3.428	0.000***
Study Motivation-study effect	1.438	6.205	0.163	8.972	0.000***
Personal Factor-Study Effect	0.464	0.537	0.165	2.817	0.007**
Network Factor-Study Effect	0.672	3,260	0.275	3.463	0.009**

Note: **p<．01，***p<000

7. Correction Model

In general, the chi-square value of the model ought to be as small as possible; RMR absolute fit index should be less than 0.05, the smaller the better; Relative Fit Index CFI should be relatively larger than 0.9,

the closer to 1,the better . Correction model chi-square value is 3.108, and absolute fit index RMR0.053 is normal, relatively fit index CFl0.92 fit better, and therefore in general path model can accept this amendment established. At the same time the value of the revised model GFI 0.892, indicating a good fit of the model. Table 3 shows four paths are significant, so it is founded. From the above analysis of four paths, teacher factors, motivation, personal factors, and network factors affect the efficiency of the network self-learning.

As a result, the network of college students learning motivation among independent study to the effect of the most significant (standardized path coefficient of 1.439), indicating that the stronger university student motivation to learn is, the better network of independent learning would be.

8. Suggestion

First, actively stimulate and maintain a network of college students course motivation. Motivation can play a guiding role in the students' behavior toward specific learning goals, take meaningful learning behavior. Teachers can use the "motivation training", ie to take some strategies to stimulate interest, set goals, improve self-efficacy, and guide students' enthusiasm for the success of expectations and habits attributed to guide through the whole process of learning, inspiration, monitoring, feedback and evaluation, so that students' motivation to get excited, to maintain and strengthen m]. Second, improve the network construction site courses and learning resources. First, there must be a simple and friendly interface, resource classification clear and reasonable course site learning navigation system; There should be a wealth of learning resources online course, does not include aspects of course materials, lesson plans information, teaching material library, work, etc., should also provide relevant teaching resources to meet the different levels and preferences of the student's learning needs. The third is to establish a positive and effective self-learning students' network resource assessment and evaluation mechanisms. Forkosh-Baruch, Mioduser, and Nachmias (2006) proposed the formation of an electronic portfolio for each student is a good way to assess student learning outcomes. EPortfolio primarily as an online tool to assess student learning. Teachers should establish a similar "electronic portfolio" as the evaluation and assessment of student learning results online courses, and student learning outcomes based on continuous feedback to improve learning outcomes evaluation mechanisms. "E-Portfolio" can provide students with personalized assistance, by observing the student's personal information (including test results of learning, network learning, case studies, etc.), to online courses provide learners with an automatic evaluation and assessment results.

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The reliability calculation of transformer based on the QGA optimized for Support Vector Machine

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Abstract

Getting accurate knowledge of the reliability of power transformers, it does not only provide the basis for the state maintenance of the transformer, but also it's significant for improving the operational reliability of the power transformer. In this paper, it is briefly described the reliability of transformer by calculating based on FTA, which experts' experience play a great role, then fit the reliability of a single transformer based on support vector machine, optimizing the weights and threshold of the support vector machine through QGA, which does not only improve the computational rate, but also the reliability is more accurate.

Keywords: Transformer; FTA; Support vector machine; QGA.

1. Introduction

Power transformer is the essential and costly equipment in the power system. Its fault diagnosis is always widely regarded at home and abroad. At present, the transformer condition based maintenance has become the main development direction of maintenance, and transformer for condition based maintenance is accurately calculated the reliability that has an important guiding significance. For a single transformer, through the research on the structure, function and fault mode and effects analysis of equipment and its reliability assessment is still at the starting stage.

In this paper, through the collection of basic data and a large number of experimental data, and the classification, combined with the experience of experts to calculate the reliability of single equipment, but also the reliability of the individual components of the internal transformer can be calculated, which can be provided the basis for condition based maintenance and risk assessment. On the basis of the support vector machine, carries on the fitting to the transformer reliability, so can improve the calcula-tion speed transformer reliability, using quantum genetic algorithm (QGA) to optimize the support vector ma-chine, the reliability of the calculated can reflect the reliability of the current transformer, has very important significance to the safe and reliable operation of the whole power grid.

2. Calculating the Transformer Reliability Based On the FTA

For reliability calculation of transformer, firstly, the equipment foundation information, oil and gas analysis, load conditions, operating environment, test records, fault defect records and other aspects of the data are collected. The amount of information acquired by the larger and more comprehensive and accurate, then the model to calculate the evaluation result is also more accurate.

The calculation process based on the FTA is following.

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(1)According to the equipment function and the structure of system is divided.

Power transformer can be divided into nine system, namely the transformer body, winding, iron core, OLTC, non-electricity protection, cooling system, oil casing, pillow and a non -excitation tap switch et al.

Based on the deep analysis of the transformer in each component failure mode, aiming at the structural characteristics of power transformer, combined with previous to transformer fault information collection, collation, the transformer fault T is divided the body fault A1, winding fault A2, core fault A3, OLTC fault A4, non-faulty electrical protection fault A5, cooling system of A6, A7, A8 oil casing failure pillow, no excitation tapping switch fault A9 of nine categories, where T is the fault tree top event, Aj (j=1,2, 9), Ek (k=4.1,4.2,..., 6.5) forintermediate events of the fault tree, and the Xi (i=1.1,1.2,..., 9.7) is the bottom events are fault tree.

FMEA analysis of transformer, the fault detection method involved the induction, consolidation, will the detection method of the obtained feature parameters as fault feature, and the feature parameters are encoded fault characteristic parameter set can be obtained. On this basis, according to the relationship between the fault modes and fault characteristic parameters of the transformer can be established, the relation between the fault mode and the fault characteristic parameters. Analysis of failure mode and effect of each component in the division of the system from the aspects of fault reason, fault effect, detection means, the application of fault tree theory, carries on the segmentation to the various fault according to the logical relationship established fault tree.

(2)Calculating the weight coefficient of each failure mode and the failure probability

Transformer fault tree top event weight by 1/9 ~ 9 scale, grade two events, bottom weight event and characteristic parameters using 0.1 ~ 0.9 scale. Analysis hierarchy process is calculating to obtain. According to the logical relationship of fault tree model of the transformer and the event, all the minimal cut sets of the fault tree is obtained, which can directly lead to the top event for bottom event is $\{X_{1.1}\}$,

$\{X_{1.2}\}$, ……, $\{X_{9.7}\}$, which the fault probability is $P(X_{1.1})$, $P(X_{1.2})$,……, $P(X_{9.7})$.

The logical relationship and intermediate events as the top event is

$$T = \sum_{i=1}^{9} Ai \qquad (1)$$

Logic relationship between the middle events and bottom events for

$$A_i = \sum_{j=1}^{n} X_{i.j} \qquad (2)$$

Therefore, the probability of transformer faults, namely the unreliability of F (T) for

$$F(T) = P(T) = \sum_{i=1.1}^{9.7} P(X_i) \qquad (3)$$

Considering the different effects of different factors on the upper level, namely the weight coefficient is introduced. The three types can be expressed as

$$P(T) = \sum_{i=1}^{9} \overline{P}_{Ai} W_{Ai} \qquad (4)$$

$$\begin{cases} \overline{P}_{A1} = \sum_{i=1.1}^{1.3} P_{X_i} W_{X_i} \\ \cdots\cdots \\ \overline{P}_{A4} = (\sum_{i=4.1.1}^{4.1.2} P_{X_i} W_{X_i}) \times W_{E_{4.1}} + (\sum_{i=4.2.1}^{4.2.9} P_{X_i} W_{X_i}) \times W_{E_{4.2}} + \cdots + (\sum_{i=4.5.1}^{4.5.13} P_{X_i} W_{X_i}) \times W_{E_{4.5}} \\ \cdots\cdots \\ \overline{P}_{A9} = \sum_{i=9.1}^{9.7} P_{X_i} W_{X_i} \end{cases}$$

（5）

For transformer parts defects, defect frequency is equal to 2, the adjustment coefficient component reliability is multiplied by 0.9, the number of frequent defects is higher than 2, the adjustment coefficient reliability multiplied by 0.8.

In addition, when there is a problem with non-electricity protection of transformer pressure release valve of any visual project and oil level gauge any indicative of a project, the two sub components failure rate is forced to be 0.1.

Combining with weight coefficient and failure probability, the overall reliability of the reliability of the transformer and the various components are calculated. Thus, the reliability for transformer is got.

$$R(T) = 1 - P(T) \qquad (6)$$

According to the above formula to calculate the reliability of the corresponding table, reliability is part of the 220kV transformer.

Table1.Part of the 220kV transformer reliability value

I.

The transformer description	reliability value	The transformer description	reliability value
Dongjiao 1tranformer	0.9732	Haigeng 1 transformer	0.973
Dongjiao 2tranformer	0.9705	Haigeng 2 transformer	0.9688
Dongna tranformer	0.9639	Hongqiao 1transformer	0.9725
wenquan1transformer	0.9748	Hongqiao 2transformer	0.9239
Wenquan2transformer	0.8588	luliang 1transformer	0.9899

The reliability of wenquan 2 transfomer is 0.8588, is due to the relative total hydro carbon as production rate is lower than the limit values exceed the standard, causes the main insulating sleeve. Hongqiao 2 transformer reliability for 0.9239, due to the total hydrocarbon amount due to exceed the standard.

3. Using The Support Vector Machine And Qga To Calculate The Fitting Transformer Reliability

Reliability can be calculated through the method based on FTA transformer, but with a longer time, for 138.79 s, do not use the reliability of real-time calculation of transformer's values, the values of reliability and therefore the use of BP neural network fitting of the transformer, the reliability calculation of value can improve the rate of transformer.

The course of the fault diagnosis is may looked as the course of pattern class [1]. SVM is a new machine study classification algorithm, which is proposed by Vapnik based on the VC dimensions theory of the statistical learning and the minimum principle of the structural risk [2]. The means is superiority to the BP network, especially is the studying for the small samples. Thus, it can get the better extension ability.

Its main thinking finds the biggest classification hyperplane in the linear separable condition. Supposing the samples $(x_i, y_i)_{i=1,2,\cdots,n}$ and $y_i \in \{-1,+1\}$ is output sort, n is the number of the training samples, d is the dimension of input vector. $x_i \in R^d$ is the n dimension input vector that is firstly mapped in a high dimension feature space. Then, SVM is used to process in high feature space. So, two types of classification problems may be denoted as

$$y_i(\omega \cdot x_i + b) - 1 \geq 0 \qquad i = 1,2,\cdots,n \tag{7}$$

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Where, w is the weight vector, b is deviation. The distance between yi= 1 and yi=-1 is classification interval. Basic SVM theory is shown in the Fig.1.

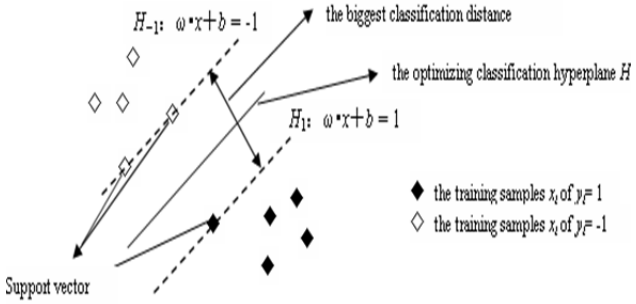

Figure 1. Diagram of SVM theory.

In addition, considering possible existing some samples can not be correctly plotted by the classification hyperplane. Thus, the non-negative relaxation factor $\varepsilon_i, i=1,2,...,n$ is introduced. Then, the constraint condition of the SVM is changed as

$$y_i(w\cdot x_i+b)-1+\varepsilon_i\geq 0,\ \ i=1,2,...,n \tag{8}$$

In the nonlinear instance, the samples $(x_i,y_i)_{i=1,2,\cdots,n}$ are changed by the nonlinear change transition $\varphi(\cdot)$.

$$\begin{aligned}&\min\|\omega\|^2/2+C(\sum_{i=1}^{n}\varepsilon_i)\\&s.t.\ y_i(w\varphi(x_i)+b)-1+\varepsilon_i\geq 0\end{aligned} \tag{9}$$

Where, $C>0$ is the regularization constant that determine the balance of the experiential risk and complexity. By the Lagrange function, the inner product $\varphi(x_i)\cdot\varphi(x_j)$ of the feature space is replaced the kernel function, utilizing (2) and (3) of optimization problem is translated as [3]

$$\begin{aligned}\max_{\alpha}\quad&\sum_{i=1}^{n}\alpha_i-\frac{1}{2}\sum_{i,j=1}^{n}\alpha_i\alpha_j y_i y_j\varphi(x_i)\cdot\varphi(x_j)\\ s.t.\quad&\sum_{i=1}^{n}\alpha_i y_i=0,\ 0\leq\alpha_i\leq C,\ i=1,2,\cdots,n\end{aligned} \tag{10}$$

By getting the solution of (10), the corresponding decision function $f(x)$ is shown as

$$f(x)=\operatorname{sgn}(\sum_{i=1}^{n}\alpha_i y_i K(x,x_i)+b) \tag{11}$$

Where, sgn(x) is the signal function, its results is +1 or -1. $K(x,x_i)=\varphi^T(x)\varphi(x_i)$ is kernel function, n is the number of support vector.

Choosing different kernel function can constitute various SVM classifiers. Existed many kernel functions [4], in this paper, the radial basis kernel function is used as the kernel function of the SVM, which expression is

$$K(x,x_i)=\exp(-\frac{\|x-x_i\|^2}{2\sigma^2}) \tag{12}$$

Where, the parameter σ is the kernel width.

Choosing C and σ for the diagnosis rate of the SVM has great influence on the generalization. Thus, defining proper C and σ of the SVM model can get better classification effect. But, good method has not formed at present. Generally, the every node (namely every parameters pair C and σ) is carried by the cross validation. Or utilizing the gridding searching approach to get the every node, however it is considerable time consuming, and recognition effect is not ideal. Thus for overcoming these defects and

avoiding the blindness for choosing parameters. In this paper, the QGA algorithm is made use of optimizing the SVM parameters.

Quantum genetic algorithm (QGA) is a probability optimization method that bases on the quantum computation theory. The quantum coding characterizes the chromosome is adopted by the quantum genetic algorithm, which can denote the linear combination state of solution. Thus, the better the population diversity, the faster convergence velocity and global searching optimization ability can be got by the QGA. The selection, cross and mutation are utilized to evolve operation by traditional genetic algorithm. However, the quantum gate is respectively affected the every combination state, which has the population small scale and don't influence the method performance. In this paper, the quantum gate of the quantum genetic algorithm is mainly used by the quantum rotation gate $U(T)$. The adjustment operation of the quantum rotation gate is as follows.

$$\begin{bmatrix} \alpha_i^{'} \\ \beta_i^{'} \end{bmatrix} = \begin{bmatrix} \cos\theta_i & -\sin\theta_i \\ \sin\theta_i & \cos\theta_i \end{bmatrix} \begin{bmatrix} \alpha_i \\ \beta_i \end{bmatrix} \tag{13}$$

where (α_i, β_i) is the i-th quantum bit, θ_i is the rotation angle, which the size and direction is confirmed by the universal and irrespective adjustment strategy with this paper problem [5].

The quantum chromosome is composed as the population of quantum genetic algorithm. For the N individuals, the population of the quantum chromosome in length m denotes as $Q(T) = \{q_1^T, q_2^T, ..., q_N^T\}$, where q_k^T （$k = 1, ..., N$） is an individual of the T-th population. And

$$q_k^T = \begin{bmatrix} \alpha_1^T & \alpha_2^T & ... & \alpha_m^T \\ \beta_1^T & \beta_2^T & ... & \beta_m^T \end{bmatrix} \tag{14}$$

Where, α_i^T and β_i^T （$i = 1, ..., m$）all satisfy the normalized condition, that is, for the two parameters α_i^T and β_i^T of the same subscript i satisfying the condition $(\alpha_i^T)^2 + (\beta_i^T)^2 = 1$. T is the evolvement generation of the quantum genetic optimization algorithm. When T=0, all α_i^T and β_i^T are all be defined as $1/\sqrt{2}$ that denote all conditions are linear superposition in the initial searching. The quantum bit is used to realize the decoding of the quantum individual chromosome. Quantum bit can not only at condition 0 or 1, but can denote any superposition state of 0 and 1, which is the different in quantum bit and classical bit. Thus, quantum genetic algorithm can possess more diversities, as the same time, the more wide space also can be searched than classical genetic algorithm.

138 sets of 220kV transformer this paper selects Yunnan Power Grid Co based data as the training sample. Select the number of iterations for the 100 time, the learning rate is 0.1, the training objectives for minimum error is 4E-3, we selected 138 groups of input and output data, selects 128 groups of data from the network training data, 10 sets of data as the network prediction data. Because the dimensional input samples and output between sample and input samples inconsistent internal

dimension is not the same, in order to enable the network to achieve the optimal prediction, before the network training, must carry on the data preprocessing, normalization is completed, after network training finished, the forecasting values must be normalized operation of anti [6-9].

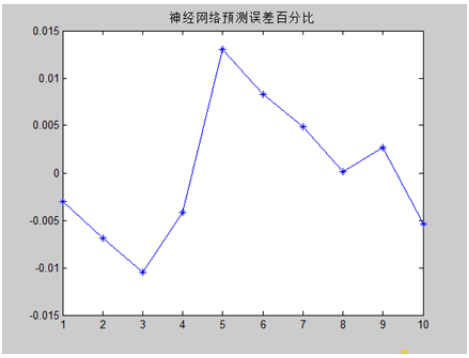

Figure 2. The percentage of SVM prediction error

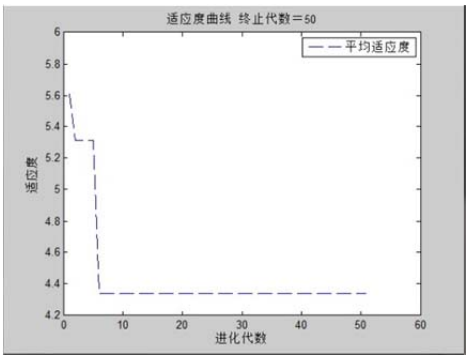

Figure 3. Quantum genetic algorithm fitness curve

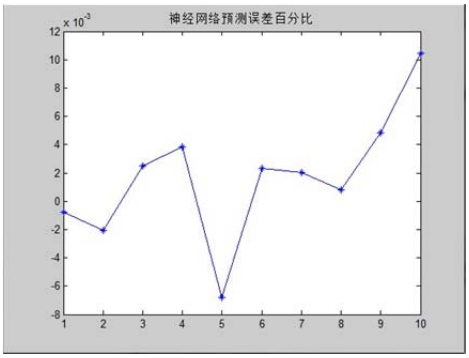

Figure 4. The SVM prediction error percentage by the QGA optimization.

The values of reliability using the SVM of the transformer, time is only 9.34s, to improve the reliability calculation rate has great significance of transformer. As shown above, the basic can be a single transformer reliability is fitted by BP neural network, in line with the basic reliability is calculated based on the FTA, the curve fitting degree is good, the maximal error of 1.347%, 10 group forecast data error absolute value is 0.0937, within the range of acceptable, and can provide certain reference for condition based maintenance of transformer.

As can be seen from the figures, after 6 times iterative optimization, you can get the optimal weights and threshold value, the optimized weights and threshold into BP network reliability need to predict 10 transformers fitted, in line with the basic reliability is calculated based on the FTA, the curve

fitting degree good, the maximum error was 0.108%, 10 groups of absolute value of error and forecast data for 0.0412.

Reliability calculation of power transformer can provide important basis for condition based maintenance, this paper based on the FTA reliability calculation of transformer, indetermination of weight coefficient, expert experience plays a great role, can guarantee the reliability calculated relative accuracy, but with a longer time. SVM is an effective method for fitting with nonlinear network, QGA algorithm with extremal optimization function, this paper uses QGA algorithm to the SVM neural network weight and threshold of the corresponding node for the global optimization, prevent the network into a local minimum, optimize the network, the purpose of improving network convergence can, and then use the optimization calculation of transformer reliable network degree, improves the reliability calculation speed and accuracy.

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The design of Document generator of Scientific research Database of university

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Abstract

The integration scientific research process is an effective approach to enhance research university management level. This paper studied how to generating an document generator and filling up each node with the simulation data according to the data type in scientific research database of university, and provided the necessary support for the simulation and verification of resource models.

Keywords: Document generator; Database; XML.

1. Introduction

The difficulty of the rapid development of information technology in the field off ace provides a new solution to the problem, the various fields in promoting information construction, in order to improve the work efficiency, reduce operating costs, including scientific research field. The construction of information in the field of scientific research into different, stronger comprehensive strength of the school funded more, so put more comprehensive strength, and the difference is used less, the vast majority of business needs manual processing. Manual mode requires teachers a lot of energy, has been unable to meet the development strategy of the school, therefore the informationization construction is the future trend of development of university scientific research[1].

Document generator on scientific research of university is an important part of informationization construction. Optimum design document generator can greatly reduce the researchers faced with non-core business burden, improve work efficiency, and contribute to the scientific, standardized information management of scientific research in Colleges and universities as a process. The research will become the way to strengthen scientific management level of colleges and universities. In the Scientific research Database's Services-based network management system, document generator is to be communicate with each other between management system and managed system[2]. For this purpose, the instance document generator was designed and implemented.

2. General requirements

2.1 Validity

Document generator can listen to the request sent by the server, complete instruction analysis, data acquisition, storage, and other processes, to provide users with effective services for word generation.

2.2 Usability

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High availability can follow the instructions to start the corresponding service. There is no answer facing the operation request, and is unable to provide the related service requests. In the operation of the service, to exclude other problems, not because the system data processing problems lead to a collapse of exit.

2.3 Maintainability

The generator is designed to provide interfaces to the system that changes the system, to provide a variety of solutions to improve the system's ability to modify the system, and to strictly comply with the specifications of the programming, and detailed notes of its business logic.

3. Design and analysis

This study designs the XML instance document generator including user interface (GUI) and execution engine two parts. User interface part of the user to open the Schema XML file, browse the contents of the file, edit the file, generate the XML file, save the file and other functions. Execution engine mainly includes parsing Schema XML file, generating XML file, generating and filling in the simulation data and other functions[3].

3.1 User interface

The user interface uses Swing Java and Awt Java to provide the graphical interface components, the development tool selection Eclipse0. In this paper, the main use of Swing Java components include: the main container (JFrame), the panel (JPanel), text area (JTextArea), button (JButton), menu (JMenu).

The implementation of the user interface (GUI) is briefly introduced. (extends) is the JFrame class, which contains four JPanel as a sub container, and the sub container is about four directions. Results (jtextarea (jtextarea (above which the panel (JPanel) to display the instance generator name and introduced; the following panel (JPanel) contains two button to generate the JButton were used to generate XML document framework and with the simulation data of the instance document. On the left side of the panel (JPanel) contains a dozen and button (JButton) and a text area), the user clicks the button to select to parse the XML schema file, the text area to display the XML schema file content; on the right side of the panel (JPanel) contains a save button (JButton) and a text area, the text area for generating and displaying the content of a document, press the button to save the generated files.

3.2 Execution engine

The main work of the engine is the analysis of the Schema XML file, complete the generation of XML instance document framework and generate simulation data two sub modules. The XML instance document is the root node in the Schema XML file to be the root node to be the root node. The difficulty and focus of the simulation data generation section is to comply with the relevant standards of network management interface definition, for instance, the ID value and the rules for generating the DN value of two parts. In this paper, we use the XML analysis tool Dom4j to implement the engine, the development tool selection Edipse.

Compared with the performance of some other XML analysis package, the performance of Dom4j in a number of tests among the best, performance is very good. In this paper, the function of the instance document generator is a complete process of using Doin4j, which includes the following processes: read XML document, parse the document content, and generate a new XML tree, output XML instance file.

（1）First of all, we must read the XML file to parse, this paper is an example of a document generator to read into the model conversion generated ResultXsdFile.xsd file.

SAXReader reader = new SAXReader();

DOMReader reader = new DOMReaderQ; // Two ways, one of which

Document document = reader.read(new F ile(fiIeN ame));

return document;

（2）The first step in parsing the content of the XML file is to get the root node, and the Doin4j will get the root node's method to be encapsulated in the Document interface, so that the document object returned by the XML object can be obtained from the document.getRootElement file.

（3）The main method of parsing the XML file is to traverse the node in the XML parse tree.

First, the Dom4j supports the way of non recursive traversal of the iterator:

for (Iterator ite = root.elementlterator(); ite.hasNextQ;) {

Element element = (Element) ite.nextO;

}

Secondly, Dom4j also supports user-defined recursive functions to achieve a recursive traversal of the sub node. The main logic is to determine the number of nodes at the current node is not 0, then continue to call the function itself.

Finally, the user can define some Visitor class, which is a visitO method, which implements the logic of a node access, and the visit method automatically implements the recursive traversal of the current node. So we only need to add the defined Visitor (element.accept (yVisitorO new)) to the nodes of interest, and then automatically call the visitO method on the current node.

（4）The result of an instance document is to generate a XML file, Dom4j is constructed by constructing the node, and the method of constructing the attribute values in the memory to construct a XML instance tree. Finally, the XML file is output from the instance tree.

（5）Use Dom4j output of a XML file to create the file before the content, use a bit like StringBuffer Java-like, the first piece of the XML file and property values, and then output into XML file. First use the FileWriter class to define an output file (outfile new = FileWriter FileWriter (result.xml), and then write the document object to the output file (document.write (outfile);).

（6）Dom4j supports the use of XPath to locate a node, and the Dom4j code can use XSLT script to handle the XML document, that is, the Dom4j itself can be used as the XSLT interpreter, using XSLT script to initialize a converter, the converter can convert a XML file to the result file.

3.3 Implementation of engine

In order to implement the two functions of the engine, the implementation process is divided into three steps:

（1）The Schema XML file is parsed to generate the corresponding XML instance document framework, that is, the attribute value of the element in the XML file is empty, this article will be named "modelframework.xml" .

（2）Schema XML file, the purpose of this traversal is to record the type of elements of the elements, such as the relationship between the class, including: the use of HashMap XML for the Schema <element> file in each of the Java record of its type; parse contains the relationship and the file (this article will be named "containedRelation.xml"). The purpose of this step is generated after the simulation data and

provide the basis, mainly in order to solve for each instance is assigned ID value and relationship birthday DNString value of two problems.

（3）Finally, the model_framework.xmr element is filled in the form of semantic information to generate a "instance.xmr - model".

4. Conclusion

In the process of design and development of the system, the paper makes a combination of the development needs, the development and the extensive demand of the University. In the process of software system implementation, the maximum of layered software development ideas are used, and then make sure that the project structure is more clear, so that the system in the future maintenance and other work to create favorable conditions[4]. Its purpose is to provide a convenient software system for scientific research management staff and to create a convenient software system, which can provide a guarantee for the realization of scientific research management.

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Analysis on the quality and economy of major scientific research cooperation projects in Colleges and Universities

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Abstract

This article through the analysis of the quality cost to find out some of the need to pay attention to the quality management of the weak link, through to these weak links to take corresponding measures to improve, so as to ensure the product quality based on the maximum reduce the total cost, so that the quality management system can be more mature and effective.

Keywords: Scientific Research; Cooperation Projects; Quality and Economy.

1. Introduction

With the development of modern scientific research, scientific research is more and more complex and difficult. The limitation of individual study is becoming more and more obvious. University has a dense knowledge resources and scientific research personnel, in the scientific and technological development system plays an important role, such as the three nature science program "Manhattan project", "Apollo program", "human genome project" is a major scientific research activities in universities. The university undertakes the dual task of developing the high level talents and the research and development of major scientific and technological projects. It has very important academic status in the national innovation system. Research University, which is a major scientific and technological project, often represents the achievement level of the front end of the national level, which has important strategic significance to the development of national science and technology[1].

The result of scientific research cooperation is the crystallization of collective wisdom, high technology content, long life cycle, and has a great effect on enhancing the competitive power and improving the economic benefit. The research on the quality and economy of scientific research cooperation projects in universities can obtain the measurement of the value of the resources consumed by the quality. The quality of the economy is not limited to the quality cost, but also includes the increase or decrease of the income or loss caused by the quality level or the increase or decrease of goodwill intangible assets brought by high quality or low quality. In this paper, we focus on the quality cost, quality loss, quality benefit optimization, from the economic point of view to consider the quality of the problem, in order to cause the project to be responsible for the quality of the project, so as to provide more effective support for the quality of scientific research management.

2. Statistical data

Select A, C, B, D four major scientific and technological cooperation projects in the Institute, according to the four major components of the cost of quality and the relevant three level of detail

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accounting. In addition to the quality of the four major components of the main data, the summary of the cost of prevention, identification of cost, internal failure costs and external costs, as well as the quality of the project by the end of June 2015, to ensure the accuracy and timeliness of economic analysis of quality cost. Key financial statistics of the various projects are as follows[2]:

(1) A project:

Total project budget: 400000$, 300000$;

Project to the rate of =300000/400000=75%;

Total cost of quality: 15000$; total project expenditure: 245517$;

The total cost of the project is 15000/245517=6.11%;

Quality costs account for the total amount of the project: 15000/300000=5%;

Quality cost rate: 15000/400000=3.75%;

The total project expenditure accounts for the ratio of the total budget.:245517/400000=61.38%;

(2) B project:

Total project budget: 1000000$, 700000$;

Project to the rate of =700000/1000000=70%;

Total cost of quality: 55731$; total project expenditure: 662697.3$;

The total cost of the project is 55731/662697.3=8.41%;

Quality costs account for the total amount of the project: 55731/700000=7.96%;

Quality cost rate: 55731/1000000=5.57%;

The total project expenditure accounts for the ratio of the total budget: 662697.3/1000000=66.27%;

(3) C project:

Total project budget: 2000000$, 1400000$;

Project to the rate of =1400000/2000000=70%;

Total cost of quality: 70400$; total project expenditure: 741028$;

The total cost of the project is 70400/741028=9.50%;

Quality costs account for the total amount of the project: 70400/1400000=5.03%;

Quality cost rate: 70400/2000000=3.52%;

The total project expenditure accounts for the ratio of the total budget:741028/2000000=37.05%;

(4) D project:

Project allocation: 1000000$;

Total cost of quality: 146731$; total project expenditure: 998494.5$;

The total cost of the project: 146731/998494.5=14.70%;

Quality costs account for the total amount of the project: 146731/1000000=14.67%;

Quality cost rate: 146731/1000000=14.67%;

The total expenditure of the project: 998494.5/1000000=99.85%;

3. Conclusion analysis

The main reason is that the cost of each item is allocated to the cost of prevention and appraisal:

(1) Major scientific and technological cooperation projects are mainly based on technology research, a one-time product, not a lot of manufacturing products. Therefore, in order to guarantee the quality of the product, it is necessary to improve the prevention cost and appraisal cost. Through improving design quality control costs, production quality control costs, the cost of quality management, and project related to the inspection, testing and measuring the cost, enhances the product the one-time success rate, thereby

reducing or avoiding spoilage, rework and repair damage, demotion, unqualified processing, claims, returns, price etc. in interior and exterior fault.

(2) In the research project is still in the production process, quality and cost of the internal and external failure costs are not reflected, the four in the project quality and cost of internal and external failure costs are basically zero, the project without output. Quality cost minimum in the product with certain rate of non-performing products, not the product qualified rate, the higher the better, namely the best quality cost management model is to find the total quality cost lowest unqualified product percentage points, and in this condition to maintain the operation of the production process[3].

4. Measures

Based on the special characteristics of the research project in the quality cost measurement, the major scientific research cooperation projects in the university should reduce the cost of quality management, which need to be analyzed to find out the weak links of quality management and the corresponding measures to improve the quality management[4]:

(1) The control of raw materials and related materials procurement needs to be further strengthened, and the cost of purchasing quality control will be reduced.

(2) The inspection of raw materials and related materials, equipment, etc. also need to be further strengthened, through the improvement of the identification of the cost of the purchase inspection cost to reduce the purchase loss, thereby reducing internal and external failure.

(3) To strengthen communication and exchanges with customers, so that the design of the research project can meet the needs of customers to the greatest extent, so that the internal and external faults can be reduced to a certain extent.

(4) To strengthen the cost of process inspection, the design and development of the project to improve the design of the qualified rate, reduce internal and external failure.

(5) Reasonably determine the auditors and inspectors wage costs, by determining the reasonable wage costs to enhance auditor and inspector working enthusiasm, improve their work efficiency and responsibility, so as to reduce the loss of internal and external fault.

(6) To minimize the cost of quality management and production control, and reduce the total cost of quality by minimizing the cost of prevention.

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Analysis of Transformer Core Vibration Mechanism

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Abstract

Transformer most of the main components of the power system, it can stable operation related to the stability of the entire system, the vibration mechanism analysis of transformer can learn more about the daily work of the state of the transformer, to keep abreast of the transformer operating state, to ensure electricity safe and reliable system is of great significance. Through structural features of the transformer through theoretical system of analysis, the vibration mechanism transformer core vibration analyzes the main reasons transformer core vibration, for operation and maintenance of the transformer reference.

Keywords: Transformer, power system, transformer core vibration, by, commas, and ends with a dot.

1. Background

With the progress of transformer design and manufacturing technology, the core of the pressing process has been improved, so that the gap between the silicon steel laminations and location of the seam becomes very small, so due to the magnetic flux leakage caused by electromagnetic forces affect the core vibration and vibration caused by the magnetostrictive core is negligible compared. On the other hand, improved high magnetic silicon steel core structure of large-scale applications as well, reducing the core flux density, winding vibration caused by the load current increases. Therefore, the transformer core vibration and the vibration is mainly winding vibration. This article will study core transformer vibration.[1]

2. Core Vibration Mechanism

Carrying conductor transformer coil is in the leakage magnetic field, in which the role of the conductor electric power. Electric power transformer coil material mechanical stress, vibration and winding, partly transferred to the other elements of the transformer. At rated current, electric power is not large, but in a short circuit, short-circuit current is much greater than the load current, the sharp increase in electric power, when the dynamic stability winding destruction, will collapse and lead to the occurrence of the transformer windings a major accident. [2-3]During transformer operation, acting on the winding excitation force main are the following:

(1) the interaction between the windings of the load current and the leakage magnetic field, namely the current through the coil, the electromagnetic force and the leakage magnetic field to line cake turns the current generation, where a large electric power to short-circuit currents are most at risk .

(2) between the core material (silicon) magnetostrictive and silicon seams and laminated iron core

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vibration caused by the magnetic flux leakage, which led to the winding core mounted on vibration.

In the several excitation force, the electromagnetic force of the transformer winding is the biggest load current leakage magnetic field arising under, especially electric power short circuit caused by a large current, electric power in such shock, winding is prone loosening and deformation (radial and axial deformation). [4-5]Winding looseness and deformation have a cumulative effect, lead to a greater imbalance in the electric excitation force after short impact process, and a vicious cycle, eventually resulting in winding damage, and even lead to serious accidents.

The distribution of the core magnetic circuit sinusoidal alternating electromagnetic field, its role in the core material (silicon) on the magnetic force will cause vibration silicon occurs. The results show that magnetostrictive phenomenon is the main cause vibration of silicon occurs.

Based on a simplified excitation model, we can get a linear, isotropic magnetic force suffered ferromagnetic medium volume force density

$$\vec{f} = \vec{J} \times \vec{B} - \frac{1}{2}\vec{H}^2 \nabla \mu + \frac{1}{2}\nabla(\vec{H}^2 \tau \frac{\partial \mu}{\partial \tau}) \tag{1}$$

Where $\vec{f}$ is the magnetic force volume force density vector; $\vec{J}$ is the current density vector; $\vec{B}$ is the magnetic induction vector; H is the magnetic field strength; μ is the permeability of the medium; τ is the volume density of the medium.

The first in Eq. (1) is the Lorentz force, the third term used to characterize a magnetostrictive phenomenon. Due to the improved core lamination methods, coupled with the yoke legs and no-wai glass epoxy adhesive tape banding, the electromagnetic force silicon joints and laminations low vibration caused. Thus, the core pressing enough, combined with lower silicon case can be considered close enough vibration depends mainly on silicon core magnetostrictive. Magnetostrictive change cycle is half the supply cycle, so magnetostrictive core vibration caused by the fundamental frequency is twice the frequency of the power. Due to non-linear magnetostrictive core and core flux path along the inner frame and outer frame of different lengths and other reasons, the core vibration and winding vibration is different, the core in addition to the fundamental frequency signal, but also includes higher harmonic components.

Silicon magnetostrictive phenomenon is usually characterized by a magnetostrictive rate ε, in terms of x direction Case, the expression can be written as

$$\varepsilon_x = \Delta l_x / l_x \tag{2}$$

Where ε_x is x direction magnetostrictive rate; l_x is silicon x dimension; Δl_x is silicon x direction of maximum deformation.

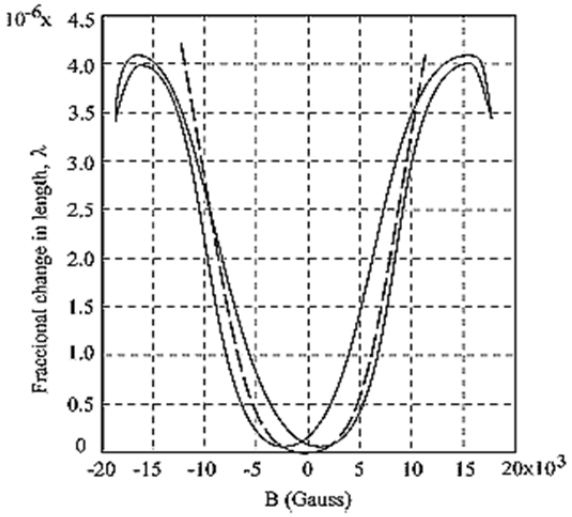

Fig. 1. Magnetostrictive characteristic curve.

The relationship between the dimensional change of ferromagnetic material and the magnetic flux density between the subject shown in Fig. Drawing, the solid curve showing the effect of the hysteresis of the magnetostrictive effect, the dashed line shows the hysteresis is ignored, the ferromagnetic material dimensional change and the relationship between the magnetic flux density. If ignored iron loss and magnetic flux leakage, that is, only consider the impact of the main magnetic flux of magnetostrictive, dotted line can be approximated as a quadratic equation; it is possible to establish a mathematical relationship between the elongation and the magnetic flux density, that is

$$\Delta l \propto B_s^{\,2} \tag{3}$$

That is proportional to the square of magnetostrictive and magnetic induction, magnetic flux density increases, the magnetostrictive greater. The elongation of the magnetostrictive force is proportional to the relationship, and taking into account the relationship between the applied voltage and the magnetic flux density can be launched magnetostrictive force proportional to the square of the applied voltage.

$$\begin{cases} U = \dfrac{2\pi}{\sqrt{2}} fNBS = \dfrac{\omega NBS}{\sqrt{2}} \\ F_c \propto \Delta l \propto B_s^{\,2} \propto U^2 \end{cases} \tag{4}$$

In Eq. (4), U is a winding voltage; f is an electromagnetic field frequency N is winding turns; B is the magnetic flux density; S is the core cross-section; F_c is magnetostrictive force.

Also, because the core magnetostrictive force vibration acceleration is proportional to the size, it is the core vibration acceleration signal proportional to the square of the applied voltage, namely

$$a_c \propto U^2 \tag{5}$$

Eq. (5) can be obtained, so that the core magnetostrictive vibratory voltage varies periodically with

frequency vibration, the frequency of the sinusoidal alternating electromagnetic field, it changes the frequency that it causes a magnetostrictive core the fundamental frequency is twice the vibration frequency of the voltage. Since the core of the nonlinear factors, in addition to the fundamental frequency of the vibration signal core, but also includes higher harmonic components.

3. Conclusions

Combination of the above analysis, we can get the main reason for the transformer core vibration of the following situations:

(1) When loosening or tightening the nut insulation pad displacement, deformation and breakage, core axially compress loose, resulting in silicon steel loose. While loosening silicon steel, silicon steel magnetic attraction between the larger, causing vibration core becomes large.

(2) the weight of the iron core silicon steel sheet bending deformation, leakage magnetic variation of silicon steel laminations between the seams and large, leading to magnetic attraction between silicon becomes large, but also exacerbated the vibration core .

(3) When the core multi-point grounding fault exists, resulting in silicon steel heats up, so that the local flux density core distortion, induced eddy core, core magnetostrictive vibrations caused large.

(4) When the frequency of core natural vibration frequency of the magnetostrictive close, due to resonance leads to the transformer core body vibration surge.

(5) When the core assembly defects, burrs, core vibration will be significantly increased.

(6) When the silicon vibration damage the insulation coating the surface of the silicon surface tension is reduced, thereby causing the magnetostrictive core vibration becomes large; in particular, was severely damaged when the insulating layer will lead to multi-core grounding, temperature, and further enhance the core vibration.

Under normal circumstances, when faulty transformer core, transformer vibration and noise variance is very large, so that both can be identified by the human ear, it can also monitor the operation of the vibration signal transformer further analyze the changes to the core vibration acceleration signal The reaction work.

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The design scheme of collaborative workflow based on scientific research cooperation

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Abstract

To construct the workflow simulation design scheme of scientific research cooperation, to realize the reuse and accumulation of knowledge resources in the collaborative learning process, to meet the needs of the enterprise, organization members, the knowledge filtering, push or recommendation mechanism, in order to support the creation of knowledge collaboration.

Keywords: Knowledge collaboration; Workflow; User.

1. Introduction

With the development of science and technology and the coming of economic globalization, cooperation has become the mainstream of science and technology in order to survive and develop in the environment of market competition and technological change. Research and cooperation of the related activities for the enhancement of the competitiveness of the organization has a strategic significance. On the other hand, the enterprise innovation activities under the knowledge economy background are the following contents, the multi role of knowledge resources, and the knowledge coordination of the organization. Knowledge oriented collaborative multi entity workflow is the organic combination of the traditional workflow management system and knowledge management system. It not only supports and manages the complex business cooperation relationship between enterprises and organizations, but also can manage and control all kinds of knowledge resources in the enterprise, organization's knowledge collaboration process and the whole process of knowledge life cycle.

The combination of service nodes in the workflow of cross organizational multi entity is not only related to the logical sequence of the process service nodes, but also the selection and optimization of the service nodes. Workflow is modeled and validated after running stage is instantiated, the workflow engine needs according to business and resource constraints of each service node services specific binding, if meet the functional needs of candidate services object, how to choose the candidate service object of the same function but different quality of service is the key problem in the selection and optimization of service composition[1].

2. Design principles

In the complex application of scientific research cooperation and knowledge collaboration, some specific business of enterprise and organization can change with the needs of customers and business objectives. For this kind of business collaboration, process designers can not give a fixed structure of the static process template in advance to all segments of a process. Workflow oriented automatic service

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planning, which can meet the needs of users and service nodes in order to meet the needs of users and the service nodes based on artificial intelligence planning techniques and algorithms. According to the requirement of the system, the static process template of traditional workflow is the upper and macro control mechanism to coordinate and coordinate[2].

3. Program construction

3.1 Hardware and software environment

(1) Hardware configuration and development environment

Desktop PC, the operating system is Windows7-64bit, the hardware configuration is i5 Core 760 (OC3.6GHz, 4 core 4 thread), 8G memory and 120GSSD hard drive. Program in Java Eclipse language. Eclipse and simulation program running 64bitJDK-1.7.0.

(2) The application of the program parameters and the application of the algorithm

64bitJVM can be used to set up a large heap memory, this can improve the time and performance of the Java garbage collection mechanism, which can eliminate the effect of JVM on the same algorithm or different algorithm. Vector, matrix, and statistical computing related modules using Commons Math Apache. In this paper, we will try our best to reuse the computation module and ensure the fairness of the horizontal and vertical comparison.

(3) Generation of random numbers

Generation of random numbers using Commons Math RandomDataGenerator open source library of Apache class. Fuzzy QoS indicators of the role of the service object (packet service division, service object triangular number and role (month Gen packet) candidate pool by the pseudo random number generation, in order to ensure each experiment can be repetition and consistency, the simulation program in the part of the value of pseudo random number set fixed random number seed (seed), each run will generate the same random numerical.

3.2 Design parameters

(1) Parameter preset

In the case of 6 process service nodes, SEQ(l,AND(SEQ(2,OR(4,5)),3),6) are selected. The optimization of the target service composition of the combination process is QoSe [0,1], and the optimization direction is maximized. It is worth noting that the target value of the discrete combination optimization problem is normalized and the difference is small, and the sensitivity of the optimization algorithm is put forward[3].

Service object candidate:

So - COUNT= 1000, with fixed number of random number seeds each time to generate 1000 identical service object identification, the corresponding QoS triangular fuzzy number and the corresponding service provider.

Service provider:

SP_COUNT = 4, that is, {0,1,2, 3}.

Service provider co effect matrix:

SP_CO_W = {{1,0, 1,-1},

{0, 0,-1,0},

{0,0,-1,1},

{0,0, 0,1}}。

The role of the process service node (service group):

Roles (service grouping) number is set to 5,BP{0, 1,2,3,4}, PROCESS_NODE_ROLE = {2, 1,3,4, 3,0}。

Role (service group) candidate:

ROLE_SO—COUNT= {S0 (0), SO (L), SO (2), SO (3), SO (4)}, SO (I) represents the candidate service list corresponding to the role (service group). Each element in the array selects SO (I), which is the same as the fixed random number seed, to generate the same data. The number of different roles (service group) in different configuration determines the complexity of the solution space of the service composition optimization problem.

(2) Design measures

Each algorithm is run 100-1000 times, and it is found that the results are stable and have enough power to reach 200 times after many experiments, and the time and accuracy of time and accuracy are achieved. For the optimization problem of a given size, the average execution time and the average execution time of different algorithms can be more effective than the performance cost ratio of the algorithm. The computational cost is calculated by the number of iterations, population size, mutation, crossover and QoS, and the complexity of the algorithm and the characteristics of the algorithm[4].

4. Design outlook

In order to improve the performance of the read - only service, we can directly use the HTTP caching mechanism to add a reverse proxy to the Web server, which can improve the performance, load balance, simple and efficient, and the secure communication of REST interface can be accomplished by using HTTPS SSL. In the implementation of the REST interface of the service components, in order to hide the specific implementation, a simplified interface statement, you can use the Java language Annotation mechanism. Based on REST style resource oriented architecture, the use of URL to express service and information resources, consumers and service users use HTTP to support the representation format (such as XML, JSON, ATOM, etc.), with the help of standard HTTP protocol (PUT, POST, GET and DELETE) to interact, heterogeneous system can achieve the status update based on Web. In addition, HTTP put is idempotent, so in the error state update transaction processing mechanism can also be simplified, safe and retry can be.

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Selection of research cooperation mode based on knowledge collaboration

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Abstract

In combination with the existing knowledge management methods, the practical application value of knowledge collaboration in scientific research cooperation is analyzed, and the corresponding knowledge synergy method is constructed from the perspective of building a knowledge collaborative environment and developing the optimal knowledge.

Keywords: Knowledge collaboration; Scientific research cooperation; Association.

1. Introduction

In the past a long historical period, the scientific research is relatively scattered, the lack of organization of the state, scientific research is the individual's "freedom of research", scientific research achievements are mainly on the "masters" and "inventors" to complete. With the development of modern scientific research, scientific research has become a complex and difficult group activities, and the interaction between individual and scientific research activities directly influences the completion of scientific research project. The importance of scientific research cooperation is being recognized by more and more people, that is, the labor form of the individual and individual, individual and group, group and organization to accomplish the same scientific research task and the plan of cooperation with each other according to plan. Research cooperation in a certain period, focusing on specific research purposes and focus areas and gathered a large number of knowledge resources to get more intellectual achievements.

Knowledge cooperation is the advanced stage of knowledge management. It refers to the main body, object, environment, etc., in time and space, the effective coordination of knowledge, knowledge body or "parallel" or "serial" to work, and to achieve in the appropriate time and space, including physical space and virtual space, to the appropriate object and to achieve the knowledge innovation of "two-way" or "multi direction" (also contains "one-way") multi-dimensional dynamic process. Knowledge cooperation has the characteristics of time, the accuracy of the target (object) and the multi direction of knowledge flow. In the knowledge management stage, which is the main symbol of "knowledge cooperation", most companies take the cooperation and interaction of knowledge through practice, learning, interest and purpose. Knowledge coordination can be considered as a kind of ability, which can transfer the right information to the right people at the right time[1]. Knowledge coordination is a kind of activity, such as collaborative development, collaborative work, etc., in the activities of the members to participate in the efforts of individual knowledge creation, and ultimately the formation of valuable results.

2. The practical application value of knowledge cooperation in scientific research cooperation

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For the research of Knowledge Synergy, the research on the knowledge cooperation is the first proposed by Karlenzig. He believes that knowledge cooperation is an organization strategy, which can dynamically establish the internal and external systems, business processes, technology and relationships to maximize business performance. And Anklam points out the key technology of knowledge collaboration, including online knowledge base, knowledge portal, personal information interaction and collaborative project management. Rosenfled from the perspective of sociology, the social relations network and enterprise cooperation between the network and the enterprise can play a decisive role in the dynamic cluster. Scientific research activity is a complex characteristic, interrelated organization, with the core of collaborative innovation, knowledge innovation as the ultimate goal, is the integration of a number of knowledge resources and collaborative capabilities, and more than one of the knowledge activities of the individual involved in the process. Knowledge cooperation in scientific research activities must be considered in the different time and the influence factors and the mutual influence. Knowledge cooperation in scientific research cooperation is a knowledge activity based on knowledge innovation. Knowledge collaborative source in the original intention of cooperation in scientific research, also serves on the cooperation of the task itself, attached to each partner's knowledge of the subject (individual, group, organization), in the complex characteristics of cooperative research reflects the dynamic game relation of both competition and cooperation, based on incomplete information state knowledge aggregation, collision and activation, interaction, circulation and overflow, the need for the body of knowledge in the knowledge gap, in order to transfer the knowledge resources in the success and efficiency. Research on the effect of knowledge cooperation for scientific research cooperation, the effective use of research knowledge and the effective use of knowledge, can maximize the use of knowledge and innovation cycle, which is not only the driving force of scientific research activities, but also the source of scientific research[2].

3. Related nodes mining in collaborative environment

In the collaborative process, with the development of the knowledge task, the collaborative environment of the knowledge body is changing:

A. (P) can be changed. Including the new main body to participate in the process, and some of the cooperation of the left, the main responsibility of the change, etc..

B. knowledge task (Ktask). Knowledge tasks are partially completed or new knowledge tasks are increased, the schedule time of tasks is changed, and the change of tasks is changed.

C. knowledge (K). The change of knowledge is influenced by the knowledge task and the main body of knowledge. Knowledge task changes brought about the change of knowledge demand, different knowledge tasks are different in the stage of knowledge task, but the change of knowledge subject brings the knowledge source, knowledge acquisition way and knowledge.

D. material environment (MTRenviroment). Including computer hardware, books, work environment changes, etc.

Some factors in the process of cooperation in the direction of the development of the direction of the change, such as: the new knowledge of the main body to add, can enrich the source of knowledge, the content of the task of simplification, so that the whole process is more simple and so on. Some elements of the change will reduce the efficiency of the cooperative, such as computer hardware damage, the loss of knowledge, etc. However, the change of material environment is influenced by the objective factors, and the change of knowledge task is influenced by the task demand department. Therefore, in the process

of cooperation, it is essential to make the change of the two elements in the direction of the cooperative development, i.e., the main body of knowledge and knowledge in the process of cooperation[3].

(1) Mining of subject association

The main body of the association of mining is based on the analysis of Phobby, Pi_Phobby={phbi1, phib2, phbi3, Pi, phbi4... Phbin}, where n is an arbitrary positive integer. First in building collaborative participants P-Net: mutual mapping between the different collaborative subject PI through phbin, find out main Phobby similarity and construct connection between subjects, so as to establish a synergistic activities of single-mode body of knowledge network P-Net '. In collaborative process to carry out, to P-Net 'based, using the existing organization KSN single-mode subject P-Net, by Epp={φ(pi，pj) |pi，pj∈P， Φ=1}, found all the organization and collaborative subjects associated with the presence of the subject.

(2) Selection knowledge association mining

The increase of knowledge in the process of cooperation is closely related with the main body and the carrier, so it is related to analyze the relationship between the knowledge and the main body and the carrier[4]. On the one hand, knowledge association relies on the relationship between the knowledge and the main body information (Kdscber), on the other hand, the knowledge and the carrier association (Kctgry).

4. The discovery of Knowledge Synergy

Knowledge discovery based on knowledge cooperation is mainly based on the knowledge of the main body and the characteristics of the situation, which is rich in information, which is suitable for the organization. One of the most difficult is to find the right person in the body of knowledge. The basic method of the knowledge discovery method based on the comprehensive knowledge of the subject knowledge is as follows:

(1) Extracting the user's knowledge features and key words

According to the user's own description of the user or the system of knowledge characteristics or common words, the establishment of user knowledge feature vocabulary set:

Ks={key1、key2、key3、key4… keyn}

(2)Acquisition of concept sets

According to the characteristics of knowledge and key words, the matching query and semantic ontology reasoning to obtain the concept set.

Firstly, according to the characteristics of Ks, key2, key1,,, the term " Abstract", which is based on character matching in the software term, may include " Abstract mode" and "Abstract control ":

Ks′={ key1、key2、key3… keyn、keyn+1、keyn+2… keym}

Key1, key2, key3... Keyn as the original feature words; keyn+1, keyn+2... Keym is an extension of the query to the character.

Followed by every word in Ks' respectively corresponding to the body. The ontology can be found in the domain ontology, which can be found by manual intervention, and the related ontology is introduced into the system by the analysis of every word in the vocabulary. After obtaining the corresponding ontology Oi, the similarity between them is calculated by the following mapping function: map：keyn→Oi. We can obtain the concept set C2, Cs:Cs={c1, C3, c4... C1, C2, C3, C4, cm}... Cm is composed of Ks' key1, key2, key3... KeyM extracted from the mapping ontology concepts, vocabulary, etc.

(3) The KSN is mapped and found that the initial knowledge of the main network

After the acquisition of the feature concepts of the knowledge body, the Cs is carried out by the character matching technology: c1→{m11、m12、m13…m1i}，c1→{k11、k12、k13…k1j}…cm→{mm1、mm2、mm3…mmi}，cm→{km1、km2、km3…kmj}. In order to obtain the collection of vectors and the collection of knowledge information:

Ms={m11、m12、m13…m1i…mm1、mm2、mm3…mmj}；

Ks={k11、k12、k13…k1i…km1、km2、km3…kmj}

In the formula, M is the number of Cs, I is the number of nodes in each concept map, and j is the number of nodes in each concept map. Ms and Ks in the carrier and knowledge node information is based on the character matching, and not on the semantic level of mining, the obtained node information industry is certainly limited. Therefore, based on the information of Ms and Ks collection nodes, the related formulas are further searched through the related formula described in the knowledge network.

Association through the extended Ms and Ks' by the carrier and main body (Epk= P(ki) + K(pj)),and the relation between knowledge and subject (Epm= M(pi) + P(mj)), to find out the carrier, owner or creator of the carrier, and find out the main body of the association through Epp in P-Net. According to the relationship between the class body of knowledge network description subject in K-net 'association.

(4) To find optimal Knowledge Synergy

After be selected knowledge subject set named K-Net ', the rationality is preliminary estimating and analysis center and betweenness center index, find out optimum knowledge collaborative subjects. According to the degree of centrality index extraction with several objects from K-net 'P1, P2, P3 set P={... Pm} that is the optimal knowledge synergy.

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The Visualized Detection Research of Transmission Line Internal Defects Based on X-ray Digital Radiography

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Abstract

This paper proposes a X-Ray visualized internal defected detection method for high-voltage transmission line. Introduced the CV-1 X-ray digital imaging system composition and working principle, verified the radiographic ability of X-ray digital imaging system for 500kV transmission line, determined the irradiation parameters and methods; According to the internal defects characteristics of transmission line and defect location, simulated transmission lines internal defects detection of steel core wire off shares, steel core surface scratches, inclusions, bulk shares, crimp depth insufficient, and compared with no defects transmission lines under laboratory conditions, obtained the X-ray digital images characteristic of transmission line internal defects. The experimental results show that the detection effectiveness and feasibility of digital radiography for transmission line internal defect and provide a new method and reference basis for the internal defect detection of high-voltage transmission lines.

Keywords: Digital radiography; High-voltage transmission line; Visualization; Defect detection.

1. Introduction

In the power system, as an important part of power transmission, lines play a crucial role in the whole grid. Due to limitations of the environment, urban planning, transmission lines more and more attached to the unmanned areas. Poor environment, poor operating conditions have occurred when the wire off shares, wear and other accidents[1]. In addition, due to the influence of environmental factors, of which the transmission line running difficult to do regular inspections of electrical equipment inside the substation. Although it can be closely monitored, but the effect is not optimistic. The reasons for the early installation of transmission line inspection and accident analysis becomes the control quality and stable operation of the transmission line an important way[2-3].

Recent years, researchers focused on the transmission line of icing hazards[4-8] to study the mechanical properties of the transmission line galloping characteristics[9-11], but rarely inside the wire types and defect detection methods were researched[12-13]. Transmission lines are difficult to find internal defects. Steel core surface scratches, sands mixed and crimping insufficient depth of internal defects seriously reduce the mechanical strength of the transmission lines. That pose a security risk when under a working condition. At the same time, transmission wires carrying capacity will be affected. Traditional method of detecting transmission line only through analysis of test results to determine the

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performance of the transmission wires, transmission lines can not visually check the internal defects[14]. Therefore, a more intuitive, convenient and effective means of transmission line for testing is introduced in this paper. Development of X-ray digital imaging technology has matured in medical science. But the application in the power industry are just beginning. As a popular technology used in power systems, it has proved to be an effective non-destructive testing of electrical equipment. It is intuition, convenience, efficient to test failures, making it accurate to test results with electrical equipment [15].

Based on what we talked above, author used a 500kV high voltage transmission lines (LGJ-400/35) carried out an X-ray radiographic ability test. Obtained a set of optimal parameters for high-voltage transmission line X-ray inspection under laboratory conditions in advance. Each pair of wires common defects were simulated, the detection confirmed the X-ray digital imaging nondestructive testing the technical feasibility and effectiveness of the internal high-voltage transmission line defect detection detection.

2. Introduction of X-ray digital imaging system

LGJ-240/30 models of wire in the crimping process, steel core insert steel anchors standard length is 100mm. By changing the depth of the steel core insert steel anchors. Set the conduction of the clamp and wire crimp for 0-100mm. Crimping device parameters to be used in Table 1 below.

Digital X-ray digital radiography (DR) is a direct digital X-ray photography. The digital imaging plate receives information penetrated by X-ray through the subject workpiece, and then by the crystal circuit inside the digital imaging plate, in accordance with the intensity of the X-ray dose convert it to a current signal, the final digital images will be transmitted into mobile terminal computer. Compared to X-ray computer radiography (CR), DR has the characters of simple, short-time used, small-sized device, high image resolution and so on[16].

Author use X-ray digital imaging detection system for 500kV transmission conductors test, X-ray imaging technology mainly includes digital imaging, image processing, and auxiliary facilities of the systems. The system can realize power equipment defects and risks of non-destructive testing. Position will be affirmed accurately in perspective detection. We use this system in high-voltage transmission lines to simulate the detection experiments. The system is equipped with a portable X-ray units machine (0.3mV, 3mA, focal spot size of 3.0mm (EN12543), 1.0mm (IEC336)), amorphous silicon flat panel detector (an imaging area of 410mm × 410mm image resolution 2.5Lp / mm), the control box, a mobile workstation, and additional data transmission cables and control cables.

3. X-ray wire internal simulated defects detection

First, author used 500kV transmission line (LGJ-400/35) under laboratory conditions to carry out perspective experiments. To assure the detection feasibility of X-rays transmission lines internal defects. Then depending on the type of defects and detect where the location is. Next, author determined test parameters and irradiation method, and use the parameters to simulate the internal steel core wire defects of steel core surface scratches, sand and crimping internal defects.

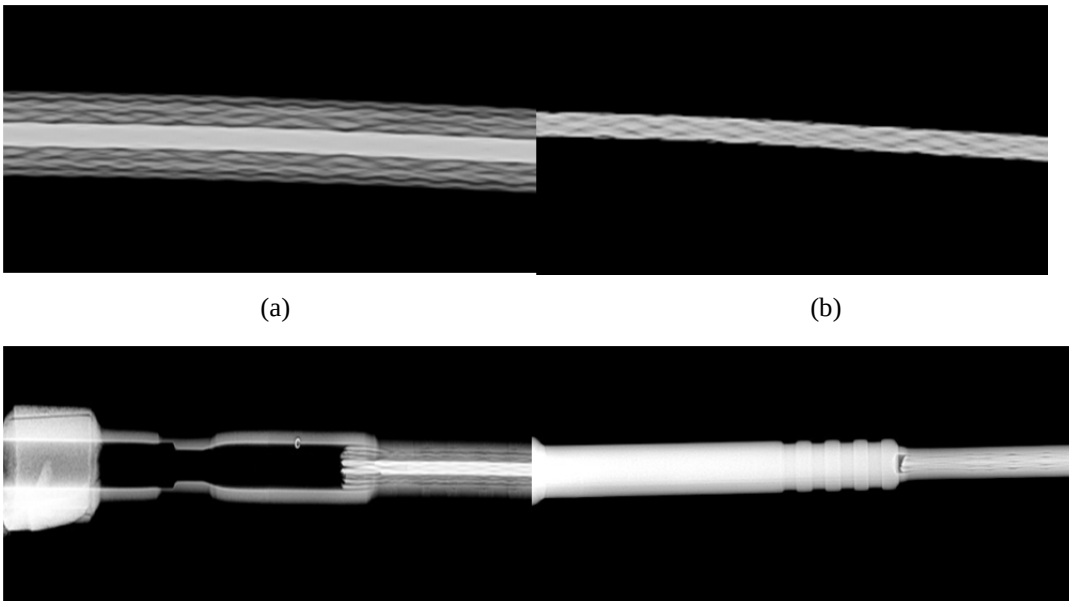
3.1 Transillumination ability test and parameter determination

According to the capacity of transmission conductors through experiments, the main parameters included the tube voltage U, tube current I, focal length F and exposure time T. To verify the transillumination ability, author determines the best picture quality parameters as shown in Table 1, using

the parameters for different sections of wire were obtained through experiments according to the ability of digital image shown in Figure 2:

Tab.1 X-ray detection experimental parameters

parameter	Wire segment	Crimp area
Tube voltage /kV	80~120	120~160
Tube current /mA	3	3
Focal length /mm	700	700
Exposure time /s	8	8



(a) (b)

(c) (d)

Fig.1 X-ray Detected Image of 500kV Transmission Line

Figure 1 (a), (b) is an X-ray digital image conductors, such as (a), because the outside of the steel core has three 500kV transmission line aluminum wire, aluminum wire veins visible under the tube voltage of 80kV , but not shone through the steel core; the steel core in order to detect internal defects, tube voltage must be increased to 120kV, this time outside of the aluminum wire is completely shone through. Whorl steel core is clearly visible, as (b), (c), (d) the picture shows the crimp area X-ray imaging, and FIG steel core wire in the steel anchor at the port off shares, respectively, out of the steel anchor irradiation, (c) to clamp, (d) steel anchor, anchor the steel hard material, shall be adjusted to the tube voltage 160kV to clearly observe the steel core crimp depth. X-ray region of the transmission line and the wire crimp section radiographic X-ray experiments resulting digital image can be seen, the image is clear, good ability transillumination shows X-ray detection for transmission lines is feasible.

3.2 Steel core off shares flaw detection

Steel core wire of the main load-bearing elements, steel core wire off shares of major defects. When the test first test conductor cutting and stripping aluminum envelope, which then cut the steel core; to

ensure the grip strength aluminum envelope, the use of new aluminum envelope re-cut steel core wrapped, simulation result Rally too large steel core strand breakage defects. The obtained digital X-ray image as shown in Figure 2.

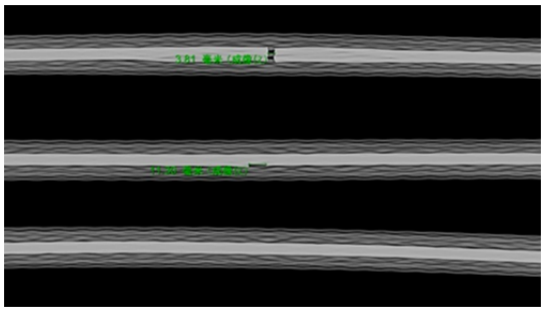
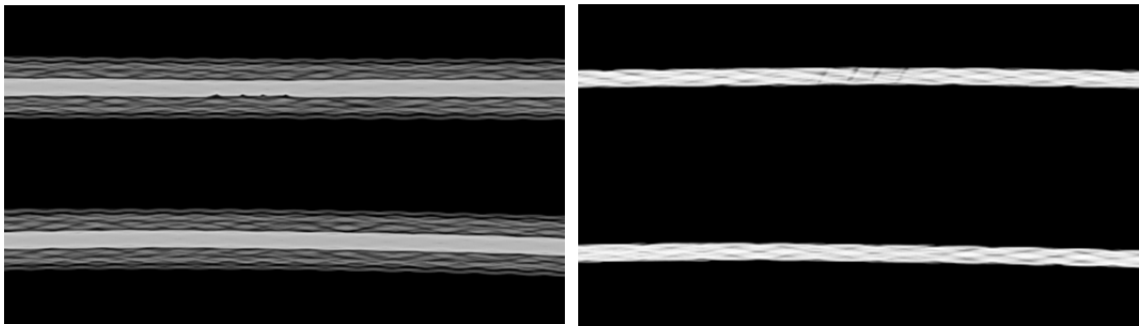


Fig.2 Steel core off shares simulated defect detection

As the Fig.2 showed three conductors, the lowest end of the wire does not have a defect, as a comparative reference; the middle is cut a steel core wire and the fracture set a notch; top of a steel core wire is totally cut, fracture is clearly visible, consistent with the actual analog defects.

3.3 Steel core surface scratches flaw detection

The test conductor being cut off, and the aluminum-clad steel core wire stripping removed, use a file on a steel core surface add four minor scratches (scratch depth of about 1mm, about 4mm, tilt), then new aluminum-clad wire wrapping, analog generated due to manufacturing steel core surface scratches. The resulting digital X-ray image shown in Figure 3. FIG. 3 (a) for the next 80kV tube voltage parallel scratches resulting X-rays imaging, the figure against the wire has obvious scratches gap, (b) for the next tube voltage 120kV vertical scratches resulting digital X-rays on image, FIG defects are consistent with the actual analog defects.



(a) (b)

Fig.3 Steel core surface scratches simulated defect detection

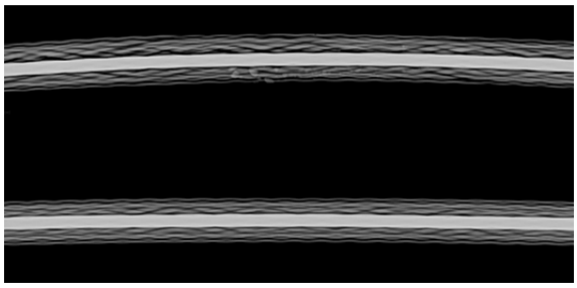


Fig.4 Transmission line inclusions simulated defect detection

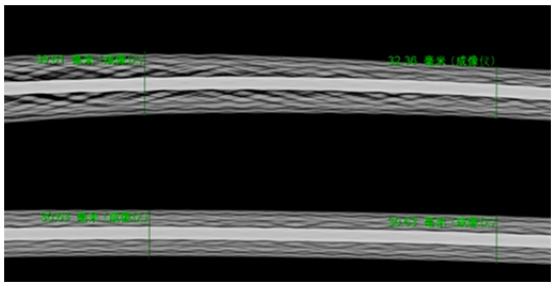


Fig. 5 Transmission line bulk shares simulated defect detection

3.4 Transmission line inclusions simulated detection

The test conductor cutting and re-wrapped after stripping aluminum envelope, fine sand process will be wrapped in aluminum envelope wrapped in layers of cracks in the construction process simulation due to line defects caused by wire inclusions, the resulting X-rays digital images shown in Figure 4. Figure wrapped in aluminum bag lined sand lead to a wider network, point-like defects consistent sand and analog defects.

3.5 Bulk stocks flaw detection

Wire odd lots more serious defect can usually be observed directly, if it is slightly difficult to distinguish scattered shares, shares lead scattered X-rays obtained digital X-ray image as shown, the figure was significantly 6 thick loose strand wires and aluminum-clad wire lines larger gap.

3.6 Crimp insufficient depth detection

Wire crimp substandard quality is the main factors leading to wire accident. Crimp region including crimping wire defect is not enough and insufficiently inserted steel core depth, where hard steel core insertion depth less than direct observation, using X-ray transmission observation is the best means of detecting the defect.

The test conductor being cut off, removed after stripping aluminum-clad steel core wire, insert one end of the steel core steel anchor, reserve 15mm gap, and then wire crimping machine crimping simulate steel core wire insertion depth due to insufficient crimping defects, The obtained digital X-ray image as shown in FIG.6.

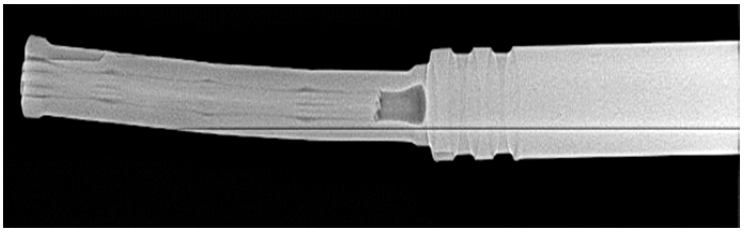


Fig.6 Crimp depth insufficient simulated defect detection

4. Conclusion

1) X-ray digital imaging technology for the transmission wire crimp lack depth, steel core off shares, steel core surface scratches typical inclusions and internal physical defects such as loose shares have certain diagnostic capabilities and detection capabilities, as an internal high-voltage transmission line defectIt provides a new method for detecting and reference;

2) Due to the different material properties and thickness of the detected position of the acquired digital X-ray image quality will be affected, and therefore need to choose the appropriate test parameters required to observe the location and defect characteristics;

3) transmission line defect scratch the surface of the analog detection experiments, due to different illumination angles, X-rays digital image defect acquired very different characteristics, so during defect detection, key monitoring site selection in different illumination direction of multi-faceted observe, get more intuitive digital image, improve the accuracy of detection.

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Research on knowledge flow in scientific research cooperation

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Abstract

In the framework of knowledge flow theory, based on knowledge discovery theory and technology frontier detection method, the system effectively provides data support for scientific and technological decision-making process in scientific research cooperation, and provides an important auxiliary tool for the management of science and technology.

Keywords: Scientific Research Cooperation; Knowledge Quantity; Transformation.

1. Introduction

With the development of modern scientific research, the high degree of differentiation and the high degree of integration and the evolution of the individual independent research limitations become more obvious, scientific research cooperation has become a general trend, and has become a great power to influence and promote the development of science and technology. Such as the three major scientific program of human science, Manhattan project, the Apollo program, the human genome project implementation, is a successful example of cooperation between different research forces. Contemporary scientific research is more dependent on the cooperation and cooperation between the disciplines, inter industry, inter organizational and inter - International, in the aspects of personnel, technology, equipment, capital, scientific research activities are being developed along the large-scale, high investment, cross-border and cross disciplinary direction. The development of knowledge economy makes the scientific and technological management work more and more attention to the measurement of knowledge[1]. In the modern information technology environment, it is required to study the new research system and analysis method to meet the needs of practical work.

2. Knowledge structure evolution in scientific research cooperation

In scientific research cooperation, the knowledge structure of cooperative subjects is different. On the one hand, the strong relationship is easy to generate the community structure, and strengthen the stability of the network of knowledge chain of scientific research cooperation community. In this high density local area network, the cooperation among the members of the cooperative, the mutual trust, expectation and obligation are enhanced, which can obtain the high credibility of the information and the knowledge communication is great. It is helpful for the formation of the nodes of the network. However, under the effect of strong relationship, the knowledge redundancy among the members of the cooperative body is high, and the communication range is limited. On the other hand, the weak relationship forms the open network structure[2]. The new member join in the network growth. The main body of scientific research cooperation is loose, communication frequency is low, and the network elasticity is high. Weak ties will have different resources of the members of the cooperative community, you can set up a cross

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organizational boundaries of knowledge bridge, with a wide range of borrowing, the role of social resources. The weak relationship is the basic attribute of the knowledge chain structure of scientific research cooperation, expanding the information channel selection of the members of the cooperative body, can reduce the knowledge redundancy, and enhance the information exchange between the system and the external environment[3].

3. Construction of knowledge flow measurement

3.1 Overall thinking

The attribute of knowledge is determined, except in very special circumstances, the information resources in the number of properties, including stock and incremental two aspects, that is, the existing information resources and constantly develop the information resources, the total amount of information is constantly increasing. In this process, the value of knowledge is constantly changing. Research and cooperation process is accompanied by the storage, diffusion, utilization and innovation of knowledge, and the change of the target's demand, the value of knowledge will be constantly changing. From the point of view of knowledge value, in the whole system of cooperative system, the value of knowledge is a stock, and the value of the knowledge value of collection, utilization and innovation is the flow of the cooperative system. Based on the causal feedback relationship analysis model, the purpose is to distinguish between the variable nature of scientific research cooperation system, the deep level relationship between variable dynamic change, and more intuitive way to describe the relationship between the function of knowledge management system and the logical causality between the elements of the knowledge management system[4].

3.2 Influence factors

Amount of information: the impact of knowledge on the amount of information on the one hand from the external environment, the external environment, such as the collection of personnel and technology. On the other hand, with the increase of the internal accumulation of the system, the information quantity and time limit of the loss in the target selection process is limited.

Accuracy: the influence factors are divided into static factors and dynamic factors. The static influence factors are the internal knowledge structure of the information system. The dynamic influence factors are the system's diffusion and collection subsystem. The system can use the information knowledge. In the process of use, the accuracy of knowledge is proved to be more comprehensive and the total value of knowledge is more accurate, but the total value of knowledge is limited by the accuracy of the spread of the spread of the classification. In general, the accuracy of the static impact factor is the information, data log and its own characteristics or exogenous variables.

Objective: the objective of the relationship is directly influenced by the change of the amount of the screening of scientific and technological knowledge, and the change of scientific and technological knowledge. System objective relevance is a dynamic process of change, with the knowledge management system of the target project or the continuous progression of decision-making, knowledge of the needs of the target is constantly changing, the target correlation is also changing.

Time decay value: from the analysis of knowledge management system, it can be seen that the time consumption of knowledge value is the product of the time and the time decay coefficient of the system. Time decay itself is a constant, which is determined by the content of the knowledge itself and the data log. The analysis of the time decay coefficient is a huge and complex process. In the system, the effect of

time attenuation value is usually reflected in the system in order to improve the accuracy of information, the value parameters such as correlation and other measures, which lead to the time, because of the time, resulting in the increase in the value of the time decay of intelligence.

Diffusion vanishing value: Knowledge diffusion is the essential link to the collection, storage, and final utilization and innovation, and it can not be used to transform the knowledge value into the system of the system. However, because the value of knowledge can be used in the diffusion process, and in the actual situation, the system can not obtain all the diffusion feedback, so the use of the diffusion subsystem is a cautious process. The value of diffusion is determined by the diffusion of knowledge management system, and the value of the diffusion is the smallest.

3.3 Measure of value of knowledge flow

Taking the knowledge value as the target, the basic index of the measurement of the value of knowledge flow in scientific research cooperation is as follows:

Knowledge value GDI: (T)

Knowledge value change: ∆GDI（t)

Time value: GDI（t)

Time value change: ∆GDI（t)

Knowledge quantity: Ll (T)

Knowledge change quantity: Rl (T)

Target correlation: L2 (T)

Target dependent variable: R2 (T)

Encoding converted vanishing value: L3 (T)

Encoding conversion loss of value: R3 (T)

Target value: L4 (T)Change of target value: R4 (T)

Knowledge acquisition value: L5 (T)

Knowledge acquisition and change: R5 (T)

Target selection: L6 (T)

Objective to screen the change: R6 (T)

Knowledge value time loss: L7 (T)

Knowledge value loss variation: R7 (T)

Knowledge value: L8 (T)

Change of knowledge value: R8 (T)

Knowledge value innovation: L9 (T)

Knowledge value innovation change: R9 (T)

Vlue of knowledge accumulation internal: L10

Value of knowledge accumulated inside the variation:R10 (T)

The corresponding relationship:

$L7(t)=T\alpha$

$R7(t)=\Delta T\alpha$

$L3(t)=Ll(t)\times L2(t)\times L4(t)\times L6(t)$

$R3(t)= R\ l(t)\times R\ 2(t)\times R\ 4(t)\times R\ 6(t)$

$L10(t)=L9(t)\text{一}\ L8(t)$

$R10(t)=R9(t)\text{一}\ R8(t)$

GDI（t)= L9(t)+L8(t)

∆GDI（t)= R9(t)+R8(t)

4. Conclusion

During the process of scientific research cooperation, a large amount of technical knowledge has been created in the process of practice, and the accumulation and development. With the increase of knowledge and the deepening of knowledge, the degree of specialization of production process is increasing, the research and development process is independent from production process. Knowledge production of science and technology has been incorporated into the social production and distribution system with unprecedented breadth and depth. In this paper, we analyze the impact of knowledge change in scientific research cooperation on the change of knowledge value in a micro perspective. In order to provide a new idea for the next time, we can find a way to provide a new way for the value of knowledge[5].

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