International Journal of Computational and Engineering

JUNE 2017 VOLUME2 NUMBER2

Publisher: ACADEMIC PUBLISHING HOUSE
Address: Quastisky Building, Road Town, Tortola, British Virgin Islands
UK Postal Code: VG1110

E-mail: editorial@ij-ce.com
www.ij-ce.com

CONTENTS

Generalized Least Squares Estimate of Error Self-correlation Regression Model Under the Linear Constraint

Xu Rongfei *
Department of Mathematics, Nanjing Normal University Taizhou college, Taizhou, jiangsu, 225300

Abstract: In this paper, we use the generalized least-squares estimator to give the parameter estimation formula of the error self-correlation regression model under linear constraint, at the same time, the size of the sum of squares for residuals of the model is compared to that of the unconstrained, this conclusion has some theoretical and practical value for further research and application of the model.
Keywords: Linear constraint; Error Self-correlation; Regression Model; Generalized least squares estimate.

1. INTRODUCTION

The least squares estimation is often used in the estimation of classical linear regression model parameters, and there is a relatively mature theory [1-7]. The literature[8] discusses the least squares estimate of constraints, for the error self-correlation linear regression model, to estimate its parameters, the error self-correlation is eliminated first[9], then the normal least-squares estimate is applied.At present, there is no literature to study the error self-correlation model parameters in the constraint condition.This paper uses the generalized least squares estimation method[10], and discusses the estimation of the error self-correlation regression model parameters under linear constraints,at the same time, the size of the sum of the residual squares of the model is compared to that of the unconstrained.

2. ESTIMATION OF THE PARAMETERS OF THE ERROR SELF - CORRELATION LINEAR REGRESSION MODEL PARAMETERS WITHOUT CONSTRAINT

Let unconstrained error self-correlation linear regression model

$$\begin{cases} Y_t = X_t\beta + u_t \\ E(u_t) = 0, u_t = \rho u_{t-1} + v_t \end{cases} \tag{1}$$

and Y_t is a $n\times 1$ view vector, X_t is the $n\times p$ column nonsingular design matrix, β is the $p\times 1$ parameter vector that waits for an estimate. u_t is the $n\times 1$ random error vector, and u_t is a form of first-order autoregression,namely $u_t = \rho u_{t-1} + v_t$, among them ρ is known, and $|\rho| < 1$, v_t is the error term that satisfies the classical hypothesis,namely $E(v_t) = 0$, $Var(v_t) = \sigma^2 I_n$.

To estimate the parameter β, now let's use the generalized difference method, steps are as follows.

The last phase of model

$$Y_t = X_t\beta + u_t \tag{2}$$

is

$$Y_{t-1} = X_{t-1}\beta + u_{t-1} \tag{3}$$

Lets multiply both sides of this equation(2) by ρ ,we can get

$$\rho Y_{t-1} = \rho X_{t-1}\beta + \rho u_{t-1} \tag{4}$$

Use(2)minus (4),we get

$$Y_t - \rho Y_{t-1} = (X_t - \rho X_{t-1})\beta + u_t - \rho u_{t-1} \tag{5}$$

by(1), $u_t - \rho u_{t-1} = v_t$ is the error term that satisfies the classical hypothesis.

Let $Y_t^* = Y_t - \rho Y_{t-1}$, $X_t^* = X_t - \rho X_{t-1}$,

the (5) can be expressed as

$$Y_t^* = X_t^*\beta + v_t \tag{6}$$

for (6) using the normal least-squares method, the optimal linear unbiased estimation of the parameters

$$\hat{\beta} = (X^{*\prime}X^*)^{-1}X^{*\prime}Y^* \tag{7}$$

so if we plug $Y_t^* = Y_t - \rho Y_{t-1}$, $X_t^* = X_t - \rho X_{t-1}$ into (7), we get

$$\hat{\beta} = [(X_t - \rho X_{t-1})'(X_t - \rho X_{t-1})]^{-1} \bullet (X_t - \rho X_{t-1})'(Y_t - \rho Y_{t-1}) \tag{8}$$

the equation (8) is an estimation formula for the error self-correlation regression model parameters under unconstrained conditions.

3.THE ESTIMATION OF ERROR SELF-CORRELATION LINEAR REGRESSION MODEL PARAMETERS IN LINEAR CONSTRAINT CONDITION

On the base of the model (1), add the following linear constraints

$$H\beta = c \tag{9}$$

The error self-correlation linear regression model under the linear constraint condition is

$$\begin{cases} Y_t = X_t\beta + u_t \\ H\beta = c \\ E(u_t) = 0, u_t = \rho u_{t-1} + v_t \end{cases} \tag{10}$$

Using the generalized difference method above, the model (9) is converted to

$$\begin{cases} Y_t^* = X_t^*\beta + v_t \\ H\beta = c \\ E(v_t) = 0, Var(v_t) = \sigma^2 I_n \end{cases} \tag{11}$$

The parameters in the model (10) are obtained by the Lagrange multiplier,let

$$L(\beta,\lambda) = (Y_t^* - X_t^*\beta)'(Y_t^* - X_t^*\beta) - \lambda(H\beta - c) \tag{12}$$

here, λ is a $q\times 1$ vector, We take the partial derivative of both sides of this equation with respect to β and λ, and make it zero,we get:

$$\frac{\partial L(\beta,\lambda)}{\partial\beta} = -2X_t^{*\prime}Y_t^* + 2X_t^{*\prime}X_t^*\beta + H'\lambda = 0 \tag{13}$$

$$H\beta - c = 0 \tag{14}$$

by(13),we get

$$\hat{\beta}_c = (X_t^{*\prime}X_t^*)^{-1}X_t^{*\prime}Y_t^* - \frac{1}{2}(X_t^{*\prime}X_t^*)^{-1}H'\lambda \tag{15}$$

I'll put (15) in (14) to get the estimate of λ

$$\hat{\lambda} = 2[H(X_t^{*\prime}X_t^*)H']^{-1}\left\{H[(X_t^{*\prime}X_t^*)^{-1}X_t^{*\prime}Y_t^*] - c\right\} \tag{16}$$

if we put (16) in (15), we get

$$\hat{\beta}_c = (X_t^{*\prime}X_t^*)^{-1}X_t^{*\prime}Y_t^* - (X_t^{*\prime}X_t^*)^{-1}H' [H(X_t^{*\prime}X_t^*)H']^{-1}\bullet\left\{H[(X_t^{*\prime}X_t^*)^{-1}X_t^{*\prime}Y_t^*] - c\right\} \tag{17}$$

we put $Y_t^* = Y_t - \rho Y_{t-1}$, $X_t^* = X_t - \rho X_{t-1}$ in (17), and we get that

$$\begin{aligned} \hat{\beta}_c = {} & [(X_t - \rho X_{t-1})'(X_t - \rho X_{t-1})]^{-1}(X_t - \rho X_{t-1})' \\ & \bullet(Y_t - \rho Y_{t-1}) - [(X_t - \rho X_{t-1})'(X_t - \rho X_{t-1})]^{-1}H' \\ & \bullet[H(X_t - \rho X_{t-1})'(X_t - \rho X_{t-1})H']^{-1} \\ & \bullet\left\{H[((X_t - \rho X_{t-1})'(X_t - \rho X_{t-1}))^{-1} \right. \\ & \left. \bullet(X_t - \rho X_{t-1})'(Y_t - \rho Y_{t-1})] - c\right\} \end{aligned} \tag{18}$$

The equation (18) is the estimation formula for the error self-correlation regression model parameters under linear constraint conditions.

4. THE COMPARISON OF THE SUM OF THE SQUARES OF THE MODEL RESIDUALS

By comparing (7) and (17), we get

$$\begin{aligned} \hat{\beta}_c &= \hat{\beta} - (X_t^{*\prime}X_t^*)^{-1}H'[H(X_t^{*\prime}X_t^*)H']^{-1} \\ &\bullet\left\{H[(X_t^{*\prime}X_t^*)^{-1}X_t^{*\prime}Y_t^*] - c\right\} \\ RSS\,\hat{\beta}_c &= (Y_t^* - X_t^*\hat{\beta}_c)'(Y_t^* - X_t^*\hat{\beta}_c) \\ &= (Y_t^* - X_t^*\hat{\beta})'(Y_t^* - X_t^*\hat{\beta}) \\ &+\{(X_t^{*\prime}X_t^*)^{-1}H'[H(X_t^{*\prime}X_t^*)H']^{-1}(H\hat{\beta} - c)\} \\ &\bullet X_t^{*\prime}X_t^*\{(X_t^{*\prime}X_t^*)^{-1}H'[H(X_t^{*\prime}X_t^*)H']^{-1}(H\hat{\beta} - c)\} \\ &= (Y_t^{*\prime} - X_t^{*\prime}\hat{\beta})'(Y_t^{*\prime} - X_t^{*\prime}\hat{\beta}) \\ &+(\hat{\beta} - \hat{\beta}'c)'X_t^{*\prime}X_t^*(\hat{\beta} - \hat{\beta}'c) \\ &= RSS(\hat{\beta}) + (\hat{\beta} - \hat{\beta}'c)'X'X(\hat{\beta} - \hat{\beta}'c) > RSS(\hat{\beta}) \end{aligned}$$

So we can see that under linear constraints,using the generalized least-squares estimator,the sum of squares for residuals of the error self-correlation regression model is bigger than that under no constraints.

5. CONCLUSION

Through the discussion of the error self-correlation regression model under the generalized least squares method, the formula of estimation of this model parameter is obtained, this formula can be used directly under the precondition of known error related and error correlation coefficient, and compare the magnitude of the sum of squares for residuals of this model with that under no constraints. The study of this paper has some theoretical and practical implications for further study and application of the constraint error self-related regression model.

ACKNOWLEDGMENT

The paper was supported by the taizhou soft science project.

REFERENCES

[1]L.P.Ma. “Regression analysis”. Beijing: Mechanical Industry Press, 2014.1 .

[2]S.G.Wang, M.Chen, L.P.Chen. “Linear statistical model - Linear regression and variance analysis”. Beijing: Higher Education Press, 1999.9.

[3]T.D.Lu, B.Z.Tao, S.J.Zhou. “A linear regression modeling and reconciliation method based on the least-squares method”, Wuhan University Journal.2008.5,33(5):504-

[4]507.

[5]L.Xu, G.S.Liu, Y.Yu, Z.Q.Wu. “The new algorithm for the overall least squares estimation of linear

regression parameters", Surveying and Mapping Engineering. 2015,1.24(1):36-39.
[6]Y.Z.Fan, L.Ling. "The depth weighted least squares estimation and fitting test of linear regression model", Nanjing Normal University Journal.2008,9.31(3): 39-43.
[7]S.J.Ding, W.P.Jiang,Y.M.Yang. "The overall least squares linear regression model and algorithm". Bulletin of Surveying and Mapping. 2012(12):8-10.
[8]G.C.Wen, X.C.Tian. "A multivariate linear regression analysis based on weighted integral least-squares". Qinghai University Journal.2014,8.32(4):84-87.
[9]H.C.Hu, H.J.Cui, Y.S.Qin, K.C.Li, "Modern linear regression analysis method". Beijing: Science Press, 2013.1.
[10]H. Pang. "Econometrics". Beijing: Science Press, 2010.6.
[11]J.H.Hu. "The generalized least-squares estimator for the regression model parameters under linear constraints", Huanggang Vocational and Technical College Journal .2009.6,11(2) :36-37.

Controlling the Depth Distribution of Nanocrystals Embedded in Substrate Fabricated by Ion Implantation

Xiaodong Zhou[1,], Yongmei Wang[2], Qiang Wang[1], Yongsheng Zhou[1], Songfeng Zhang[1], Xiaoyu Zhou[1], Jin Li[1]*
[1] School of Mechanical and Electrical Engineering, Zhoukou Normal University, Zhoukou, 466001, China
[2] School of Physics and Telecommunication Engineering, Zhoukou Normal University, Zhoukou, 466001, China

Abstract: Ion implantation has become a versatile and useful method for fabricating nanocrystals embedded in the near-surface region of a variety of substrates. The depth distribution of nanocrystals embedded in substrates can be well controlled by choosing the energy and fluence of ions according to the stopping and range of ions in matter (SRIM) simulations. The microstructural characterization of the samples was performed by transmission electron microscopy (TEM), in order to detect the embedded nanocrystals.
Keywords: Ion implantation; Nanocrystals; Depth distribution; SRIM; TEM

1. INTRODUCTION

Many experimental techniques have been developed for synthesizing various types of nanocomposite materials. Among the different processing techniques[1–4] used in an attempt to synthesize nanocrystals of uniform size, shape, and depth distribution, ion implantation provides an attractive method of fabricating metal nanocrystals in solids due in part to the spatial controllability.

Ion implantation was first used for this purpose in the 1970s to form Ag and Au nanoparticles embedded in silica glass[5]. In the early work, it was noted that an extremely high local concentration of precipitates was obtained in a thin layer near the specimen surface. This physical configuration is quite different from conventional nanocluster composite glasses made from melt processes, where the particles are relatively uniformly dispersed throughout the bulk. Metal-nanocrystals composites formed by ion implantation exhibit pronounced optical effects, including: 1) absorption due to surface-plasmon resonance and 2) strong third-ordernonlinear optical susceptibility.

In this paper, we have investigated various implantation methods for obtaining a controlled depth distribution of nanocrystals in SiO_2. In particular, we have attempted to form ccontrolled depth distribution of nanocrystals in SiO_2 using different implant/annealing schemes. The implanted profiles of various types of ions in the implanted samples stimulated by SRIM code. The samples were characterized by transmission electron microscopy (TEM).

2. EXPERIMENTAL DETAILS

High purity silica (SiO_2) slides (20 mm × 20 mm × 1 mm) were used as substrates for the implantation of Si^+/C^+ or C^+ ions. The samples were kept rotating in a horizontal plane during ion implantation, with the sample holder being cooled by circulating water. The energy and fluence of ions were chosen according to SRIM simulations (The Stopping and Range of Ions in Matter, SRIM-2006). One set of samples was sequentially implanted firstly by Si^+ ions at 70 keV and 35 keV to fluence of 2.6×10^{17} and 0.8×10^{17} ions/cm^2, which gives a Si excess profile in a broad buried region. Then, the C^+ implantation was performed at 30 keV of energy and 2×10^{17} ions/cm^2 of fluence with the projected range of carbon atoms located around the center of the Si-rich buried region. Another set of samples was implanted only by C^+ ions at energies of 60, 40 and 20 keV to fluencies of 2, 1.2 and 1×10^{17} ions/cm^2, respectively). The implanted profiles of the Si^+ and C^+ ions in the Si^+/C^+ and C^+-implanted samples stimulated by using the SRIM software, respectively.

3. RESULTS AND DISCUSSION

(1) The implanted profiles of the Si^+ and C^+ ions in the implanted samples stimulated by SRIM software

In order to control the depth distribution of SiC nanocrystals fabricated by ion implantation and subsequent thermal annealing, the energy and fluence of Si^+ and C^+ions were chosen according to SRIM simulations. The implanted profiles of the Si^+ and C^+ ions in the implanted samples stimulated by SRIM code as shown in figure 1.

As the sample was sequentially implanted firstly by Si^+ ions at 70 keV and 35 keV to fluence of 2.6×10^{17} and 0.8×10^{17} ions/cm^2, which gives a Si excess profile in a broad buried region. Then, the C^+ implantation was performed at 30 keV of energy and 2×10^{17} ions/cm^2 of fluence with the projected range of carbon atoms located around the center of the Si-rich buried region.

(2) The implanted profiles of C^+ ions in the implanted samples stimulated by SRIM code

In order to obtain a broad profiles of C^+ ions in the implanted substrate, the samples was implanted by C^+ ions at energies of 60, 40 and 20 keV to fluencies of 2, 1.2 and 1×10^{17} ions/cm^2, respectively. The implanted profiles of C^+ ions implanted samples stimulated by using the SRIM code was shown in

figure 2. It can be seen that a broad range of C^+ ions profile can be obtain by the multiple-step ion implantation with different ion energy and fluence.

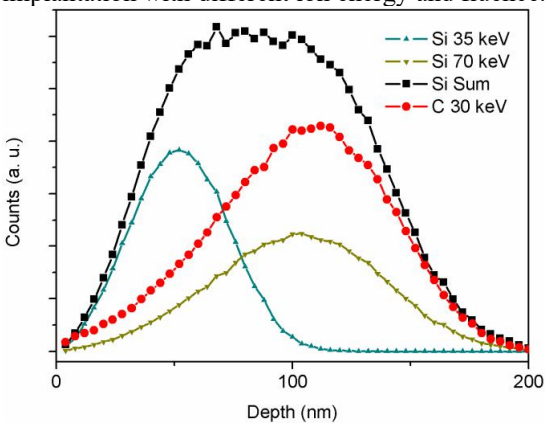


Figure 1 The implanted profiles of the Si^+ and C^+ ions in the Si^+/C^+ implanted sample stimulated by SRIM code

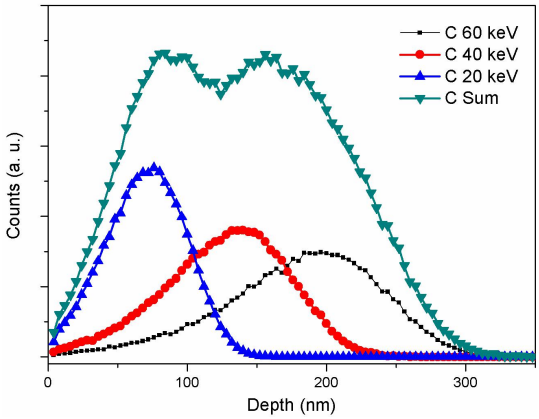


Figure 2 The implanted profiles of the C+ implanted sample stimulated by SRIM code.

(3) Detection and characterization of embedded nanocrystals in SiO_2 substrate by TEM

In order to detect the nanocrystals embedded in SiO_2 substrate, the microstructural characterization of the Si^+/C^+ sequentially implanted and annealed sample was performed by TEM observation. The cross-sectional TEM image of the sample annealed at 1100 °C for 1 hour reveals a complex multilayer structure, as can be seen in figure. 3. A buried layer with a darker contrast locating in the center of the multilayer structure is formed (labeled as region 2 in the TEM image) and many small nanocrystals are observed in the regions above and below the buried layer (regions 1 and 3, respectively).

By comparing the TEM image and the SRIM simulated Si^+ and C^+ implanted profiles, we can find that the region 2 corresponds to the maximum concentration of the implanted C atoms. Therefore, the dark contrast in the buried layer (region 2) can be ascribed to the existence of C clusters. It should be pointed out that the high concentration of carbon in the region 2 also inhibits the precipitation of Si nanocrystals[6, 7]. However, since the concentration of C atoms is well below the Si-implanted one, the formation of nanocrystals in region 1 and 3 is possible. In the previous report [6, 7], these nanocrystals in region 1 and 3 had been identified as Si nanocrystals. However, by statistical measurements on lattice constants of a large number of nanocrystals observed in HRTEM images (not shown here), we found most of the nanocrystals in region 1 and 3 can be verified as SiC and Si nanocrystals. For the buried layer with thickness about 50 nm (region 2), no crystal phase was observed by the TEM and HRTEM observation [7]. This is because the C clusters are very difficult to be detected by TEM due to the existence of SiO_2 substrate.

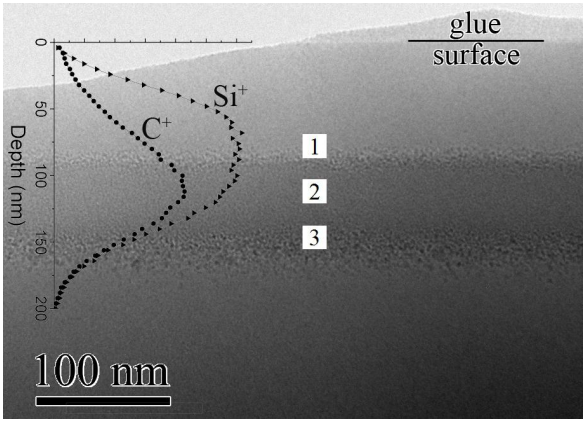


Figure 3 The cross-sectional TEM image of the Si^+/C^+ implanted and annealed sample. The image shows the presence a multilayer structure: a buried layer with a darker contrast locating in the center (region 2), and a high population of small nanocrystals are observed in the regions above (region 1) and below (region 3) this buried layer. The insets show the implanted profiles of the Si^+ and C^+ ions in the implanted samples stimulated by SRIM code.

4. CONCLUSIONS

In this paper, the depth distribution of nanocrystals embedded in SiO_2 substrate can be well controlled by choosing the different energy and fluence of ions according to SRIM software simulation. The implanted profiles of various types of ions with different implant schemes in the implanted samples stimulated by SRIM code. The microstructural characterization of the implanted samples was performed by TEM observation, in order to detect the nanocrystals embedded in SiO_2 substrate.

ACKNOWLEDGMENT

This work was supported by National Natural Science Foundation of China (No. 11405280) and the Youth Fund of Zhoukou Normal University (No. zknuB315203, zknuB3201609).

REFERENCES

[1]M. Epifani, E. Carlino, C. Blasi, C. Giannini, L. Tapfer, and L. Vasanelli, Sol−Gel Processing of Au nanoparticles in bulk 10 B_2O_3−90 SiO_2 glass, Chem. Mater. 2001, 13(5): 1533-1539 .

[2]S. Cho, H. Lim, K. S. Lee, T. S. Lee, B. Cheong, W. M. Kim, and S. Lee, Spectro-ellipsometric studies of Au/SiO_2 nanocomposite films, Thin Solid Films, 2005, 475(1-2): 133-138.
[3]D. Barreca, A. Gasparotto, C. Maccato, and E. Tondello, Silica-sandwiched Au nanoparticle arrays by a soft PE-CVD/RF sputtering approach, Nanotechnology, 2008, 19, 255602 .
[4]V. Ramaswamy, T. E. Haynes, C. W. White, W. J. MoberlyChan, S. Roorda, and M. J. Aziz, Synthesis of nearly monodisperse embedded nanoparticles by separating nucleation and growth in ion implantation, Nano Lett., 2005, 5(2): 373-377.
[5]G. W. Arnold, and J. A. Borders, Aggregation and migration of ion-implanted silver in lithia-alumina-silica glass, J. Appl. Phys. 1977, 48, 1488.
[6]A. Pe´rez-Rodrı´guez, O. Gonza´lez–Varona, B. Garrido, P. Pellegrino, J. R. Morante, C. Bonafos, M. Carrada, and A. Claverie, White luminescence from Si^+ and C^+ ion-implanted SiO_2 films, J. Appl. Phys. 2003, 94, 254.
[7]X. D. Zhou, F. Ren, X. H. Xiao, J. X. Xu, Z. G. Dai, G. X. Cai, and C. Z. Jiang, Origin of white light luminescence from Si^+ /C^+ sequentially implanted and annealed silica, J. Appl. Phys. 2012, 111, 084304.

Research Progresses of Laser Cladding on the Coating Technology of Surface Enhanced

ZHOU Sihua[1],GUO Yanhua[2],Yang Jing[1],ZHOU Xiaodong[2],SUN Xianke[1]
[1]School of Physics and telecommunication engineering, Zhoukou Normal University, Zhoukou 466001, China;
[2]School of mechanical and electrical engineering, Zhoukou Normal University, Zhoukou 466001, China

Abstract: Laser cladding is an advanced surface strengthening technology, the contents of the current research involves many aspects. Then this paper sorted the research results of foreign experts and scholars on laser-cladding, laser cladding technology is introduced from the laser cladding materials, crack control and cladding process parameters. It is pointed out that multi-factor optimization control is the future study goal of the laser cladding technology research, it is the development trend that be used for direct manufacturing technology.
Keywords: Laser-Cladding; Metal Powders; Cladding Coating; Surface Enhanced; Wear Resistance; Crack

1. INTRODUCTION

In the early, Laser cladding technology had studied how to improve the performance of cladding layer, optimize the cladding process parameters and reduce the cladding defects. Later, the main study of laser cladding technology theory, model, coating materials and the elimination of defects.

The laser cladding technology can be formed on the surface of the workpiece material layer of dense structure, and the matrix has a metallurgical combination of metal reinforcement layer, the reinforcement layer according to the different materials with wear resistance, corrosion resistance and high hardness and so on.

At present, the methods of strengthening the metal surface are plasma spraying and high-speed flame spraying [1], electroless plating [2] and magnetron sputtering [3], compared with the laser cladding technology, these methods have the advantages of complicated process, relatively thin layer and low strength.Laser cladding technology has the characteristics of small heat affected zone, small substrate deformation, wide application range, etc. In the case of no mold can be directly on the low cost of the matrix material to quickly create the surface high performance, dense structure of the parts[4].

2.SELECTION OF CLADDING MATERIAL

Researchers at home and abroad had carried out a large number of experimental studies on the selection of cladding materials. They mainly study the three types of self-fluxing powder, ceramic powder and composite powder. Three types of powder cladding are wear-resistant, corrosion-resistant and high Hardness and other characteristics.

2.1 SELF-FLUXING POWDER

The results showed that the hardness of iron-based alloy cladding layer (517HV) is slightly lower than that of iron-based powder and Ni-based powder. The iron-based and nickel-based alloy layers has prepared under the same power and delivery conditions. Less than the hardness of nickel-based alloy coating (531HV), but the nickel-based alloy coating crack tendency is more obvious. Professor Liu[6,7] has studied the Ni-based cladding coating and remelting experiments on 20# steel, Experiments showed that the hardness of the Ni-based NiCrSiB cladding layer was 4 times the substrate reached 806HV, after remelting hardness has been improved to 1076HV, friction and wear experiments showed that after the remelting of the surface wear and crack are reduced.

2.2 CERAMIC POWDER

In the laser cladding material, because the excellent performance of ceramic particles reinforced phase for hardness, wear and corrosion resistance and other aspects , the researchers have been widespread concern.The hard ceramic phase can be added directly to the metal-based powder, and the ceramic phase is dispersed in the cladding layer during the cladding process,this can strengthen the matrix.

The surface laser cladding experiments of ZrO2 to Ni60 alloy powder in the 45 # steel showed that the addition of ZrO2 powder played a role in the refinement of cladding layer by XIANG[8], the mass fraction of ZrO2 is 1% the micro-hardness of up to 1930HV.

2.3 COMPOSITE POWDER

Most of the traditional alloy powder is mainly composed of some elements, single elements are not easy to form a mutual coordination, the researchers began to add a variety of elements together as a powder cladding experimental to study, which is high entropy alloy. High entropy alloy to avoid the formation of brittle intermetallic compounds, with the of advantages of hardness, wear resistance, corrosion resistance, high temperature stability and magnetic aspects [9,10].The FeCrMoMnWBCSi high entropy alloy coating better solve the problem of turbine blade abrasion corrosion by WANG [11] .

3. CRACK PROBLEM

Laser cladding cracks, not only to reduce product quality, but also constitute a fatal safety hazards to the equipment, for the application of cladding technology to industrial production urgent need to solve the problem[12]. Many researchers have

studied the formation of cracks in the cladding layer, had pointed out that the causes of cracks in the cladding layer is complex, and the matrix material, the cladding material and the cladding process have an effect on the generation of cracks [13,14].Cracks can be divided into stress-concentrated cracks, cracks in processing cracks and tissue segregation cracks.The results of QI[15] showed that the accumulation of elements such as Cr, O , Si in the cladding layer and the stomata are the main causes of the crack in the laser cladding of the Fe-based alloy coating.

The addition of rare earth elements [16] or rare earth oxides can serve to refine the structure, improve the melt flow within the bath, reduce its surface tension, play a role in optimizing the organization and improve performance, as shown in Figure 1 and Figure 2.

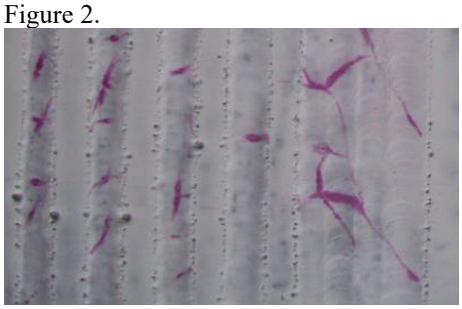


Fig 1 The cladding crack before addition of rare earth elements

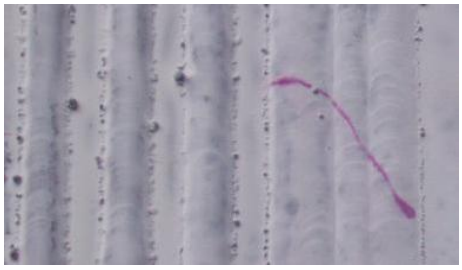


Fig 2 The cladding crack after addition of rare earth elements

La2O3, Y2O3, CeO2 were added to the Ni60 powder by ZHANG [17].The results show that the wear resistance of La2O3 and CeO2 is better than that of the Ni60 cladding layer without adding rare earth oxide, the grain size is uniform and no obvious pores and other characteristics,, the hardness increased HV100~300,Microstructure changes are shown in Figure 3 and Figure 4.

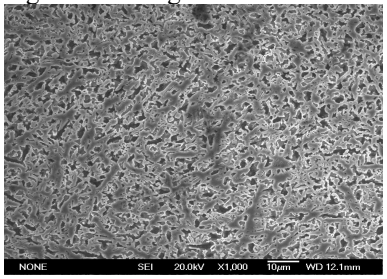


Fig 3 The cladding layer microstructure before adding rare earth elements

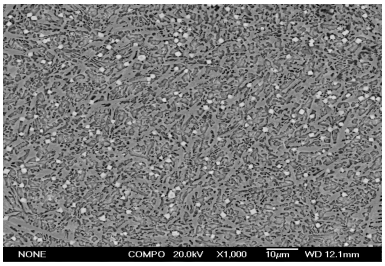


Fig 4 The rare earth elements were added after cladding microstructure

The reason for the crack in the laser cladding layer is the tensile stress, which is due to the difference in thermal expansion coefficient between the cladding alloy and the substrate. So, it is one of the effective ways to reduce the cracking sensitive, that select the material whose thermal expansion coefficient of the substrate consistent with the cladding layer. Both within a certain range of matching principle is

$$-\frac{\sigma_2(1-\upsilon)}{E\times\Delta T}<\Delta a<-\frac{\sigma_1(1-\upsilon)}{E^t\times\Delta T}$$

Where E and E^t are the elastic modulus of the coating and the matrix, σ_1 and σ_2 are the tensile strength of the coating and the matrix, respectively. υ is Poisson's ratio, ΔT is the temperature difference, Δa is the difference in thermal expansion coefficient between the two.

4.SELECTION OF CLADDING PROCESS PARAMETERS

The choice of laser cladding process parameters is appropriate, will directly affect the coating quality and performance [18]. The cladding process is a dynamic process of rapid heat quenching, the amount of powder sent, the scanning speed, laser power, etc., on the cladding morphology, and the matrix of the combination of degrees and defects (such as cracks, stomata) have an important impact. LI[19] has studied the scanning speed on high-carbon ferrochromium laser cladding layer structure and performance, the experimental scanning speeds are set at 1.5 mm/s, 2.0 mm/s, 2.5 mm /s and 3.0 mm/s. The results showed that the cladding layer hardness becomes larger and the texture is refined with the increase of the scanning rate. Increasing the laser cladding power results in an increase in the dilution of the cladding layer, reducing the hardness and abrasion resistance of the coating. In contrast, the combination of the fusion layer and the substrate should be considered, so the laser power should be combined with other parameters. The laser cladding process has an important effect on the morphology and microstructure of the coating

5. CONCLUSION

(1) Laser cladding surface enhancement technology has the characteristics of small workpiece deformation, small heat affected zone and so on. The surface of the workpiece has been improved in

strength, hardness, wear resistance and corrosion resistance.

(2) The problem of cladding cracks, bubbles and other defects in the technology is an urgent need to solve, is to restrict the application of cladding technology to engineering practice. Resulting in cracks and other defects are more complex factors, but also continue to study in depth cladding materials, matrix materials and cladding process of matching problems.

(3) Laser cladding will eventually be applied to direct manufacturing technology, which will be a promising field of application. It is a systematic project including light sources, automatic control, materials and machinery.

ACKNOWLEDGMENT

Supported by National Nature Science Foundation of China(No. 11405280,11547227),Foundation from Education Department of Henan Province (No. 16B140006) and Youth Fund funded (No. ZKNUB2201704).

REFERENCES

[1]K Chokethawai, D G Mccartney, P H Shipway. Microstructure Evolution and Thermal Stability of an Fe-Based Amorphous Alloy Powder and Thermally Sprayed Coatings[J]. Journal of Alloys & Compounds, 2009, 480(2):351-359.

[2]Di Xue, Deng Jing-fa. Amorphous Ni–B Alloy/Ceramic Composite Membrane Prepared by an Improved Electroless Plating Technique[J]. Materials Letters, 2001, 47(s 4–5):271-275.

[3]Liu L, Zhu J B, Hou C, et al. Dense and Smooth Amorphous Films of Multicomponent Feconicuvzral High-Entropy Alloy Deposited by Direct Current Magnetron Sputtering[J]. Materials & Design, 2013, 46(4):675-679.

[4]ZHOU Si-hua, GUO Yan-hua, CHAO Ming-ju, et al.Research of Metal Surface Laser Cladding Processing Technology[J]. Journal of Zhoukou Normal University,2013, 30(5):60-63.

[5]ZHANG Yan-li, YANG Xxiao-yu, HE Bin-feng, et al. Comparison Study on Ni60 and Fe60 Alloy Laser Cladding on 45 Steel Substrate[J].Hot Working Technology, 2015(10):183-185.

[6]ZHANG Xiao-bin , ZANG Chen-feng , LIU Chang-sheng. Ni-Based Laser Cladding-Remelting Layers on 20 Steel and Its High Temperature Abrasive-Wear Behavior[J].Surface Technology,2010,39(1):1-4.

[7]ZANG Chen-feng , ZHANG Xiao-bin ,ZHAO Peng-fei. et al.Ni-Based Y_2O_3 Added Laser Cladding Layer on 20 Steel and Its High Temper at Ureabrasive-Wearbehavior[J].Journal of Materials and Metallurgy,2009, 8(4):297-300.

[8]XIANG Jun , LI Gang , QIU Ling , et al.Microstructure and Performance of Laser Cladded Ni-Based Alloy Coatings Enhanced With ZrO_2 Ceramic Particles[J]. Materials for Mechanical Engineering,2009(2):59-62.

[9]GUO Wei-fan. Progress In High-Entropy Alloy With Multi-Principal Elements[J]. Metallic Functional Materials, 2009, 16(1):49-53.

[10]Zhang Hui, Pan Ye, He Yi-zhu. Synthesis and Characterization of Feconicrcu High-Entropy Alloy Coating by Laser Cladding[J]. Materials & Design, 2011, 32(4):1910-1915.

[11]Wang Y, Zheng Y G,Ke W,et al. Slurry Erosion–Corrosion Behaviour of High-Velocity Oxy-Fuel (HVOF) Sprayed Fe-Based Amorphous Metallic Coatings for Marine Pump in Sand-Containing Nacl Solutions[J]. Corrosion Science, 2011, 53(10):3177–3185.

[12]ZOU Xiao-bin, YIN Deng-ke ,GU Jian-jun. Research on Cracking of Laser Cladding[J].Laser Journal, 2010, 31(5):44-45.

[13]CHEN Zhi-jun, ZHANG Qun-li, et al.Methods of Crack Control forInconel-738 Laser Cladding Layer[J]. Applied Laser, 2013(1):7-13.

[14]LIU Hai-qing, LIU Xiu-bo, MENG Xiang-jun,et al. Crack Formation Mechanism and Controlling Methods of Laser Clad Ceramic Matrix Composite Coatings on Metal Substrate[J].Materials Review, 2013,27(11):60-63.

[15]QI Yong-tian, CAO Run-ping, LI Zhuo-xin. Forming Character and Mechanism of Cracks or Fe-Based Alloy Coatings by Laser Cladding[J]. Applied Laser, 2015(6):639-642.

[16]Wang K L, Zhang Q B, Sun M L, et al. Rare Earth Elements Modification of Laser-Clad Nickel-Based Alloy Coatings[J]. Applied Surface Science, 2001, 174(s3–4):191-200.

[17]ZHANG Guang-yao,WANG Chen-lei,GAO Yuan, et al. Effect of Rare Earth on the Microstructure and Tribological Properties of Laser Cladding Ni-Based Coatings on 6063Al[J]. Tribology, 2015, 35(3):335-341.

[18]WANG Yan-fang, XIAO Li-jun, LIU Ming-xing,et al.Research Progress of Laser Cladding Amorphous Coatings[J]. Laser & Optoelectronics Progress, 2014,7:8-14.

[19]LI Gang, SHEN Jin-ze, HAN Feng. Effects of Different Scanning Speed on the Microstructure and Properties of High-Carbon Ferrochrome Powder Laser Cladding Coating[J].Journal of Liaoning Technical University (Natural Science),2015,34(12): 1414-1418.

Management of Cardiopulmonary Bypass in Cardiac Valve Re-operation by Thoracoscopy

Zhi-Wen Zhong[1], Ming-Jie Mai[2], Ming-Xue Cai[3], Hao Lu[3], Sheng-Jie Liao[1], Xiao-Hui Li[1], Cheng-Feng Huang[1], Hao Wang[3]*
[1] Department of Cardiovascular Surgery, the First Affiliated Hospital of Jinan University, Guangzhou, 510630, China
[2] Guangdong Cardiovascular Institute, Guangdong General Hospital, Guangzhou, 510080, China
[3] Department of Anesthesia, the First Affiliated Hospital of Jinan University Guangzhou, 510630, China

Abstract: Objective To elucidate the management experiences of cardiopulmonary bypass (CPB) in cardiac valve re-operation by thoracoscopy. Methods A retrospective analysis of clinical data of twenty five subjects (8 men and 17 women; mean age of 51.0 ± 12.6 years) was performed. The subjects underwent cardiac valve re-operation by thoracoscopy (11 cases underwent the reoperative mitral valve replacement, in which two cases underwent tricuspid valvuloplasty and one for left atrial thrombus removal, simultaneously; 10 patients underwent the reoperative tricuspid valve replacement and 4 underwent reoperative tricuspid valvuloplasty), with general anesthesia. The peripheral CPB was set up by using the arteria femoralis and femoral vein intubation combined with the superior vena cave percutaneous intubation. All operations were performed with heart-beating or ventricular fibrillation by not clamping the ascending aorta. Results The operation time was 1.8 to 9.5 h (mean time of 3.3 ± 1.6 h), the CPB time was 37 to 154 min (mean time of 96.5 ± 26.9 min). The average value of lowest body temperature (nasopharyngeal temperature) was 32.4 ± 1.5 °C. There were 20 patients who underwent surgery with heart beating, and 5 patients who underwent surgery with ventricular fibrillation. Consequently, 6 patients had perioperative complications (24%) and 3 died (12%). Conclusion The cardiac valve re-operation by thoracoscopy can be performed under peripheral CPB without aortic cross-clamp (ACC).

Keywords: peripheral extracorporeal circulation, cardiopulmonary bypass, cardiac valvular surgery, re-operation, thoracoscopy

1. INTRODUCTION

For the severe adhesion of pleura and heart in the cardiac re-operation, the standard median sternotomy, with extensive wound and more bleeding, would easily injure the aorta, right ventricle and atrial wall, thus to result in hemorrhoea, so much as the bleeding and coagulation dysfunction. Moreover, the sternotomy would possibly injure the unobstructed bridge vessel after coronary artery bypass grafting (CABG). However, the minimally invasive cardiac surgery with less wound under thoracoscopy can lower blood transfusion and wound infection, alleviate postoperative pain and shorten the postoperative hospitalization duration. Therefore, it has been gradually applied in reoperative mitral valve and tricuspid valve surgery, with apparent advantages [1, 2].

It is difficulty under total thoracoscopy assisted cardiac valvular surgery to insert the tubers in vessels, and thus, the cardiac valve reoperation by thoracoscopy shall be performed under cardiopulmonary bypass (CPB). In this study, the management experiences of total thoracoscopy assisted cardiac valve re-operation from twenty five cases were summarized and reported as follows.

2. METHODS

(1)Clinical Data

In this study, the total of twenty five patients underwent thoracoscopic cardiac valve re-operation, including eleven subjects underwent the reoperative mitral valve replacement (in which two cases underwent tricuspid valvuloplasty and one for left atrial thrombus removal simultaneously), ten subjects underwent the reoperative tricuspid valve replacement and four subjects underwent reoperative tricuspid valvuloplasty. There were 8 males and 17 females, with mean age of 51.0 ± 12.6 years (range from 24 to 73), height of 158.5 ± 8.9 cm and weight of 52.2 ± 10.7 kg. Among them, six patients had mitral valve insufficiency (3 accompanied with tricuspid insufficiency and 1 with left atrial thrombus), five patients had mitral stenosis and insufficiency (1 accompanied with tricuspid insufficiency), twelve had tricuspid insufficiency, one patient had tricuspid stenosis and insufficiency and one had tricuspid mechanical prosthetic valve dysfunction.

(2)General Anesthesia

All operations were performed under general anesthesia. In the operating room, the electrocardiogram and pulse oxygen saturation were monitored, and left radial artery was punctured and intubated for real time monitoring of blood pressure. After induction of intravenous anesthesia, the bronchial intubation was performed with left-sided double lumen endobronchial Tube. Fentanyl,

Cisatracurium, Propofol and (or) inhaled sevoflurane were used for maintenance of anesthesia.

(3)Management of CPB

All patients were underwent CPB by using Stockert-III extracorporeal circulation unit, and extracorporeal membrane oxygenation of Medtronic Affinity, with the priming solution (the ratio of colloidal solution to crystalloid solution was 1/2) containing acetated Ringer's sodium (Plasmalyte-A), Succinylated Gelatin Injectim (Gelofusine), heparin (1.5 mg/100 ml) and Methylprednisolone (15 to 30 mg/kg). And warm oxygenated blood cardioplegia was prepared for use if need be. The CPB transfusion tube was precharged and exhausted, the priming fluid was warmed to 35°C. After endobronchial intubation was performed under anesthesia induction, 0.5 mg/kg heparin was given by intravenous infusion, and then the superior vena cave percutaneous intubation was performed from right internal jugular vein (16 or 18 Fr) for CPB superior vena cava drainage.

After systemic heparinization (3 mg/kg), femoral arterial intubation (16 to 20 Fr) and femoral venous intubation (22 to 28 Fr) were set up. Without clamping the superior and inferior vena cava, the vacuum-assist venous drainage (-30 mmHg) and intracardiac suction were adopted to keep the operation field clear. Temperature of CPB was naturally reduced to nasopharyngeal temperature of about 33°C, all operations were performed with heart-beating or ventricular fibrillation by not clamping the ascending aorta. During the process of CPB, the perfusion flow was 60 to 80 ml/(kg·min), blood pressure was 50 to 80 mmHg, pressure of perfusion pump was < 300 mmHg. The routine parameters monitoring included electrocardiogram, radial artery blood pressure, central venous pressure, nasopharyngeal temperature, rectal temperature, blood-gas, electrolyte, pump pressure, hematocrit (HCT), venous oxygen saturation (SvO2), activated clotting time (ACT) and blood tank level. According to the above monitor data, the crystalloid solution or colloidal solution, electrolyte, sodium bicarbonate, concentrated red blood cells and heparin were supplemented, oxygen concentration and air flow were adjusted, and ultrafiltration was performed.

The mitral valve operation was performed from left atrium incision, while the tricuspid operation was performed from right atrium incision. Then the transesophageal echocardiography (TEE) was performed to monitor whether the intracardial air was exhausted or not and to confirm whether the surgical correction was satisfactory or not, the anesthetist adjusted the vasoactive agents to wean successfully from CPB.

3. RESULTS

Twenty five patients underwent peripheral extracorporeal circulation procedures. The CPB for all patients progressed successfully, the venous drainage and perfusion flow were satisfactory. The operation time was 1.8 to 9.5 h (mean time of 3.3 ± 1.6 h), the CPB time was 37 to 154 min (mean time of 96.5 ± 26.9 min). The average value of lowest body temperature (nasopharyngeal temperature) was 32.4 ± 1.5 °C. Twenty patients underwent surgery with heart beating, and five patients underwent surgery with ventricular fibrillation. The overall incidence of perioperative complications (6 cases) was 24% (6/25), including perivalvular leakage of bioprosthesis, left ventricle rupture, secondary thoracoscopic explorations for hemostasis, upper gastrointestinal hemorrhage, cerebral infarction hemiplegy and pulmonary infection. Consequently, three patients (12%) died in the hospital.

4. DISCUSSION

The total thoracoscopy assisted cardiac valve re-operation avoided the risk of separation of heart adhesions during the traditional median sternotomy, however, the management of intraoperative CPB must be guaranteed. Firstly, the peripheral CPB is extremely necessary due to limitation of operation incision and field, and its intubation mode and management were greatly different from conventional CPB. Secondly, the ascending aorta failed to be fully separated, and then the myocardial protection mode including conventionally clamping ascending aorta and perfusing cardioplegic solution couldn’t be performed, therefore, it presents a new set of challenges for myocardial protection during operation.

(1)Peripheral CPB Intubation

Peripheral CPB provided conveniences for thoracoscopic cardiac operation. For the femoral artery intubation, the intubation diameter was determined by patients’ weight. Too-thick intubation could injure the endarterium and affect the distal perfusion of homolateral lower limbs, while too-thin intubation could result in excessive pump pressure and limited perfusion flow. Generally, the femoral artery intubation for an adult should not be less than 16 Fr. For the minimally invasive cardiac surgery under thoracoscopy in different centers, the venous intubation methods were different. Single femoral venous intubation or second-order intubation was applied in purely mitral valve surgery with right atrium not being incised. However, to guarantee the drainage effects, most foreign centers adopted the arteria femoralis and femoral vein intubation combined with the superior vena cave percutaneous intubation [3, 4]. The drainage method of our center was the same as previously described, conventionally, with good drainage effects and fewer complications [5]. To further reduce the trauma, we had ever adopted the sheath catheters of bilateral internal jugular vein for superior vena cava drainage during operation, but with slightly poorer drainage effects for heavier patients [6]. Theoretically, such drainage method could be used in cardiac re-operation, but the superior vena cava couldn’t be easily clamped,

therefore, the superior vena cava percutaneous intubation with better drainage effects was suggested.

(2)Venous Drainage

During the tricuspid re-operation, many of the heart centres often clamped the superior and inferior vena cava by isolation or airbag to keep the operation field clear, both in China and abroad [1, 7]. In the actual application, considering the risks of vascular tear when separating the adhered superior and inferior vena cava, which should not be isolated and clamped, and the vacuum-assist venous drainage and intermittently adjusting the pipe height for air exhaust are adopted to avoid air full of drainage pipe and guarantee good drainage effects. The vacuum-assist venous drainage shall be performed by using the airtight blood tank with pressure protection and monitoring equipment. The negative pressure was adjusted at about -30 mmHg, generally not exceeding -50 mmHg, since the excessive negative pressure will possibly lead to an increase in the damage on erythrocyte membrane, occurrence of microbubbles, and even limitation of venous drainage simply because of adherence to pipe wall.

(3)Temperature Control

With aortic cross-clamp (ACC) of the median sternotomy or aorta balloon block of the minimally invasive surgery, the temperature shall be reduced to the hypothermic level [1]. However, before the peripheral CPB without clamping aorta, the priming fluid in CPB transfusion pipe should be maintained at about 35°C. On one hand, which can prevent low-temperature priming fluid inducing the femoral artery spasm, and then decreasing the CPB flow, on the other hand, which can prevent patients' temperature rapidly reducing, and then leading to ventricular fibrillation. The patients' temperatures in this study were naturally reduced to about 33°C by CPB, during the intracardial operation, the patients' core temperatures (rectal temperature) were maintained at mild hypothermic level, to shorten the cooling and rewarming time, thus, which could shorten CPB and operation time, and promote the postoperative recovery of patients. If ventricular fibrillation was induced, the temperature should be further reduced to about 30°C, after the completion of intracardial operation, electrical defibrillation was performed to recover autonomic cardiac rhythm, and then rewarming could be started.

(4)Myocardial Protection

For the traditional arrested heart intracardiac procedures, the myocardium is protected by hypothermy, blocking of the coronary flow and perfusion of cold cardioplegia. However, during the first cardiac operation by thoracoscopy, the cold cardioplegia can be perfused by two ways. One is that ACC is performed by using Chitwood aortic occlusion clamp and perfusion can be achieved through a tailored lengthening perfusion needle [5]. The other is that the intra-aortic balloon catheter is placed by femoral artery intubation to block the ascending aorta and to perfuse [3]. The myocardial protection by clamping coronary artery perfusion cardioplegic solution is more mature, but it can possibly result in myocardial ischemia reperfusion injury.

By reasonably performing the management strategies of CPB, the technology of non-aortic flow occlusion has been widely applied in pediatric and adult arrested heart intracardiac procedure [8-10]. Some scholars believe that the technology of mild hypothermic beating heart intracardiac procedures could avoid the myocardial ischemia reperfusion and can better protect the myocardium, especially for the critical patients [9]. However, the non-aortic occlusion technology had its limitation. Excessive blood return during intra-cardiac operation can affect the operative field, insufficiency of exhaust technique will possibly result in aeroembolism of extracorporeal circulation, excessive perfusion flow and intra-cardiac sucking will result in increased (5)blood damage.

The cardiac re-operation is characterized by the severe adhesion of heart, difficult isolation and clamping of ascending aorta and complicated operation of the intra-aortic balloon catheter block by femoral artery intubation. Therefore, the non-aortic occlusion technology is of importance in cardiac re-operation. During the intra-cardiac operation of non-aortic occlusion, the myocardium can be always supplied with blood, with better myocardial protection effects. If the intra-cardiac blood return is excessive, the increase in intra-cardiac sucking can help to clearly expose the operation field.

(6)Flow and Air Embolism

Under normal temperature or mild hypothermy, the systemic oxygen metabolism is at the higher level, and thus, higher perfusion flow is needed. For the patients in this study, we adopted the mild hypothermic CPB to maintain heart beating or ventricular fibrillation. There was about 60 ml/(kg·min) pump flow which could be adequate to fully satisfy the oxygen consumption of the body. During operation, the SvO2 and lactic acid were monitored to estimate the patient's oxygen delivery-consumption balance and whether perfusion flow was sufficient or not.

During operation, left chambers of the heart communicated with exterior, which would possibly result in CPB aeroembolism since the ascending aorta was not clamped. Before operation, it was necessary to implement prevention strategies of aeroembolism, and exhaust the air in left cardiac chambers as much as possible. Conventionally, carbon dioxide is blown into the thoracic cavity to exhaust air, the mean of arterial pressure is maintained over 50 mmHg during operation, and Trendelenburg position and other measures can prevent aeroembolism, especially in the brain.

(7)Ultrafiltration

The peripheral CPB with longer pipe shall be provided with more priming fluid than the conventional CPB. For the patients undergoing cardiac re-operation, the whole body capacity was potentially overload due to cardiac dysfunction. To avoid the postoperative edema in parenchymatous organs and reduce the systemic inflammation reactions, ultrafiltration should be performed actively. In this study, the patients with cardiac dysfunction were ultra-filtrated to negative balance. After breaking away from CPB, there was less occurrence of hypoxaemia in one-lung ventilation(OLV), suggesting which had the positive consequence of enhancing the application of ultrafiltration.

5. CONCLUSION

In conclusion, the peripheral CPB without ACC may play a very important role in total thoracoscopy assisted cardiac valve re-operation. The key points of CPB management include maintaining the ability of adequate venous drainage and perfusion flow, and protection of heart, brain and other important organs.

ETHICAL APPROVAL

This study was approved by the human research ethics committee of Jinan University, Guangzhou, China, as well as those of co-operating hospitals and was performed in accordance with the principles of the Declaration of Helsinki.

INFORMED CONSENT

Written informed consent was obtained from all participants.

COMPETING INTERESTS

This work was performed in collaboration with Guangdong Cardiovascular Institute. Ming-Jie Mai is the archiater of Guangdong Cardiovascular Institute. The authors declare that they have no conflicts of interest.

ACKNOWLEDGMENTS

The authors thank Dr. Xiao-Shen Zhang (Heart Centre, the First Affiliated Hospital of Jinan University) for valuable discussion. This study was funded by Science and Technology Planning Project of Guangdong Province, China (Grant NO: 2017A020215134).

REFERENCES

[1]Casselman FP, La Meir M, Jeanmart H, et al. Endoscopic mitral and tricuspid valve surgery after previous cardiac surgery. Circulation, 2007, 116(11 Suppl): I270-275.

[2]Botta L, Cannata A, Fratto P, et al. The role of the minimally invasive beating heart technique in reoperative valve surgery. J Card Surg, 2012, 27(1): 24-28.

[3]Vallabhajosyula P, Wallen TJ, Solometo LP, et al. Minimally invasive mitral valve surgery utilizing heart port technology. J Card Surg, 2014, 29(3): 343-348.

[4]Holzhey DM, Shi W, Borger MA, et al. Minimally invasive versus sternotomy approach for mitral valve surgery in patients greater than 70 years old: a propensity-matched comparison. Ann Thorac Surg, 2011, 91(2): 401-405.

[5]Zhang L, Luo ZC, Zhong ZW, et al. Management of extracorporeal circulation during totally thoracoscopic cardiac operation. Chinese Journal of Extracorporeal Circulation, 2015, 13 (1): 47-49.

[6]Lei Q, Zeng QS, Zhang XS, et al. Superior vena cava drainage during thoracoscopic cardiac surgery: bilateral internal jugular vein sheaths versus one percutaneous superior vena cava cannula. J Cardiothorac Vasc Anesth, 2014, 28(4): 926-930.

[7]Jiang Z, Mei J, Ding F, et al. Application of endovascular occlusion of both caval veins in minimally invasive isolated redo tricuspid surgery through right thoracotomy. Heart Lung Circ, 2014, 23(2): 186-189.

[8]Li XB, Zhang RF, Shen L, et al. The cardiopulmonary bypass management in palliative operations with beating heart for congenital heart disease in children. Practical Journal of Clinical Medicine, 2015, 12 (2): 31-33.

[9]Xiao YB, Chen L, Wang XF, et al. Clinical analysis of 2100 intracardiac open surgeries with beating heart under cardiopulmonary bypass. Chinese Journal of Extracorporeal Circulation, 2006, 4 (4): 210-212, 206.

[10]Wu XM, Feng F, He W. Clinical Analysis of 36 cases who underwent cardiac valve reoperation. Journal of Minimally Invasive Medicine, 2010, 5 (2): 102-104.

Mechanical Properties of Carbon/Epoxy Composites with Embedded SMA Wires

Gu Xuana,Sun Xiaoyua, He Zhenga*, Xu Li-Dana ,LiuJua , Wang Bin-Sheng**
College of Aerospace and Civil Engineering,Harbin Engineering University, Harbin 150001 China

Abstract: Embedding Shape Memory Alloy (SMA) wires in composite structures enables controlling of their mechanical properties. The main aim of this study is to characterize experimentally the mechanical properties of two-layer smart composite structures which are made of one layer of carbon fibers epoxy laminate and one layer of epoxy embedded with SMA wires. A carbon/epoxy layer was first fabricated using vacuum infusion method. Then a SMA/epoxy layer was prepared separately and then laid over the completely cured carbon/epoxy layer using the hand lay-up process. The final structure is smart and has potential of being specifically bent under controlled thermal loading, due to the embedded pre-strained SMA wires. However the temperature was kept constant and there was no thermal excitation of the SMA wires in this experimental study. The configuration of the material constituents through the thickness of the structure renders the cross-section to be unsymmetrical. The specimens were tested in a specially developed unsymmetrical tensile testing machine. From the readings of force from the testing machine and strain gages, the tensile and shear stress–strain relations of the composite materials were obtained. The elastic and shear moduli and also Poisson's ratio of the composite materials were defined and it was observed that, the effective moduli increased with increasing density of SMA wires in the layer. It is concluded that, due to the asymmetrical material variation, finding the mechanical properties via conventional testing machine is not accurate and a special testing machine is needed.
Keywords: SMA; moduli; moduli

1. INTRODUCTION

Using smart materials in composite structures has attracted the attention of many researchers [1]. The application of Shape Memory Alloys (SMAs) as a popular smart material in composite structures has been highlighted in robotic, aerospace, medical and many other branches of industry. The advantage of SMA material is remembering the initial shape once they are heated. This phenomenon is repeatable and the initial shape is trainable. During heat treatment two different phases of martensite and austenite are introduced. Transferring between martensite and austenite phases is the basis of the thermo-mechanical behavior of SMA wires. The first useful constitutive model to simulate the behavior of SMA was first proposed by Tanaka [2]. The kinetic phase transformation is based on an exponential form between stress and temperature. Tanaka's [3] model is then refined by Liang and Rogers [4] and the kinetic phase transformation was proposed to a cosine form. Brinson [5] introduced two different types of martensite in the model of Liang and Rogers [6]. Brinson proposed a model which has two phases of transformation – a stress induced martensite and a thermal induced austenite.
In the last decade a new method was introduced where composite materials were reinforced by embedding SMA wires in the laminate, to form the new Shape Memory Alloy Reinforced Composite (SMARC). Embedding SMA wires in the composite changes the elastic–mechanical behavior of the material to a thermo-mechanical behavior. One such study was done by Su et al. [7] in which they found the elastic coefficient of material as a function of temperature. SMA wires were embedded concentrically in the composite and the constitutive relation between stress and strain was found for different applied temperature. In another study Zheng et al. [8 calculated the thermo-mechanical behavior of SMA/epoxy and derived the linear stress–temperature relation of SMA/epoxy. Many studies are owed to SMA hybrid composite beams such as vibration analysis, buckling and deflection in composite beams. Asadi et al. [9 analyzed the vibration and post-buckling of Euler–Bernoulli SMA reinforced hybrid composite beams. Post-buckling of Timoshenko SMA reinforced composite beams under uniform heating was investigated by Asadi et al. [10].
The main focus of this study is on the determination of mechanical properties of the unsymmetrical potentially-smart composite structures without thermal actuation. It is applicable in conditions where the mechanical properties of the structure are needed before conducting a thermal process. In this study, the composite structures were fabricated by bonding one layer of carbon/epoxy with a layer of SMA/epoxy using the vacuum infusion and hand lay-up processes. The unidirectional carbon/epoxy layer was first fabricated using vacuum infusion process and then cured. Consequently, SMA wires which had been heat treated and trained under precise conditions were hand-laid up in a layer of epoxy and left to cure. The two layers were then

bonded together to form a smart composite structure. Test specimens were then cut from the structure following the recommendation of the ASTM: D3039/D3039M-08 and tested at constant room temperature. At room temperature the SMA wires completely remain in the martensitic phase. From measured forces and strains the mechanical properties for four types of composite structures with different spatial density of SMA wires were defined and compared. To find the shear modulus of elasticity, specimens with 15° fiber orientation were prepared and tested in off-axis tensile tests.

2. METHODOLOGY

A. Heat Treatment and Training of SMA Wire

Before being used, the SMA wires need to be heated at a high temperature. The SMA wires were stretched out as straight as possible in a fixture (Fig. 1) which was then placed in a furnace at 750 °C for 30 min (Fig. 2). The fixture with the wires was then taken out of the furnace and left to cool down at room temperature. Austenite start and finish temperatures were found experimentally to be 45 °C and 60 °C. The training of SMA wires was carried out on a tensile testing machine. The SMA wires, each with length of 25 cm and diameter of 0.5 mm, were strained by 5% using the universal testing machine and then released from the testing machine. The wires were then heated again until have regained their initial length. This procedure was repeated 30 times until the SMA wires were internally programmed. As an example, 5 times repetition of training process of a SMA wire is shown in Fig. 3.

Fig 1 SMA wires straightened in fixture.

Fig 2 Fixture in the furnace.

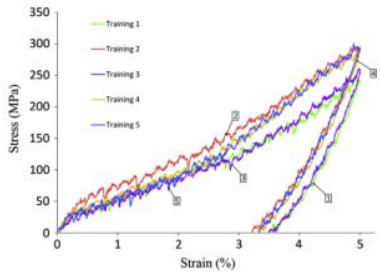


Fig 3 Training of a SMA wire in tensile test machine.

The thermo-mechanical behavior of SMA is unique. After heat treatment and training, a SMA wire is able to transform between austenite and martensite phases. The phases are transformable through a thermal process and its mechanical properties change through phasing. An experimental stress–strain curve for a SMA wire shows hysteresis behavior (Fig. 4). Curve B in Fig. 4 demonstrates the performance of SMA wire for $T > A_f$, where Tis current temperature and Af is austenite finish temperature of SMA wire. From point a tob the material is in an austenite phase while from c to d the material phase changes to martensite. The different slopes of the austenite and martensite curves in Fig. 4 indicate two different moduli of elasticity for austenite and martensite. This characteristic can be utilized in composite material to achieve the tailored material properties by adjusting the temperature of the structure. Curve A in Fig. 4 shows stress–strain behavior of the SMA wire in ambient temperature T ($M_f < T < M_s$), where M_f and M_s are the temperatures of the end of martensite phase and the start of martensite phase, respectively.

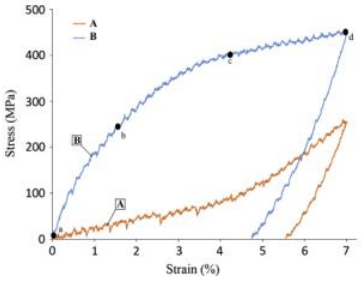


Fig 4. Stress–strain curves for SMA wire with length 25mm and diameter of 0.5 mm; (A) at ambient temperature 23℃ and (B) at temperature of 70 ℃.

B. Fabrication of Smart Composite Structures

The present smart structures are made up of two composite layers. The first layer is a unidirectional carbon fiber epoxy (thereafter called carbon/epoxy) laminate and the second layer is epoxy embedded with SMA wires (thereafter called SMA/epoxy). Four types of smart structures were fabricated, each with different numbers of SMA wires. To fabricate the carbon/epoxy layers unidirectional carbon fibers, type SikaWrap-300c, were laid out on a chemically clean glass plate that had been wiped with mold

release wax. Three layers of peel-ply vacuum infusion mesh and plastic cover were placed over the fibers and then infused with epoxy resin by applying 1-bar vacuum pressure. The epoxy resin had previously been mixed with hardener at ratio of 10:6 carefully. Since the resin and hardener were mixed with a blender, some bubbles appeared in the mixture. Bubbles were sucked out by the vacuum infusion process. Then the carbon/epoxy layer was left to cure completely at ambient temperature for 12 h. The final carbon/epoxy layers were 1 mm thick. For the second layer, the SMA/epoxy layers were made using hand lay-up technique. Four types of SMA/epoxy layers were prepared, each having different SMA-wire spatial density which is defined as the numbers of SMA wires (1, 2, 3 and 8) per 25.5 mm width of the layer. The variation of SMA wire density is important in investigating the effect of SMA wires on the mechanical properties of the smart composite structures. Fig. 5 shows the layout of SMA wires in the 1 mm-thick SMA/epoxy layers. The carbon/epoxy layers were then bonded together to the SMA/epoxy layers to form four smart composite sheets, each measuring 315 mm × 280 mm and 2 mm thick. From each smart composite sheet standard tensile specimens with dimensions 25.5 mm × 210 mm and 2 mm thick were cut using a diamond saw. Four types of specimens had the unidirectional fibers in the specimen axial direction and the rest had the fibers oriented at 15° to the specimen axial direction. The type of specimen with single oriented SMA wire was not fabricated since the density specimen with 1 SMA is not as enough as that affects the reading of strain gages in off-axis testing.

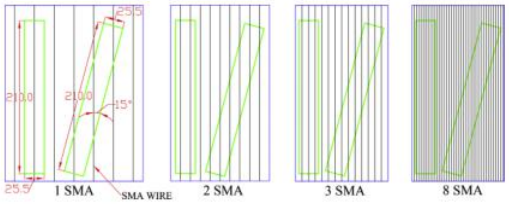


Fig 5 Layout of SMA wires in the tensile specimens.

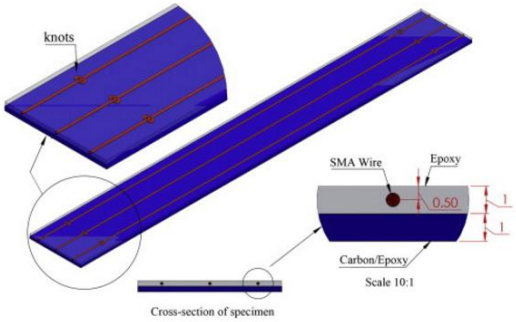


Fig 6a Configuration of SMA wires in epoxy.

Fig 6b Microscope scanning of cross-section of smart composite structure; (A) epoxy layer, (B) SMA wire and (C) carbon/epoxy layer.

The 15°-oriented fiber specimens were used in off-axis tensile tests to determine the shear modulus. Figs. 5 and 6a show the configuration of the SMA wires, direction of carbon fibers, SMA/epoxy layer and carbon/epoxy layer in the smart composite structures. The 0.5 mm diameter of SMA wires was embedded exactly in the mid-thickness of the 1 mm thick epoxy layer (see Fig. 6b). The carbon/epoxy layer was also 1 mm thick. In order to avoid slippage of SMA wires within the epoxy layer and considering weak interface bonding, knots were tied at the ends of SMA wires before embedding them within the epoxy (Fig. 6a).

Fig 7 Unidirectional fibers in direction of tensile loading. Specimen with strain gages.

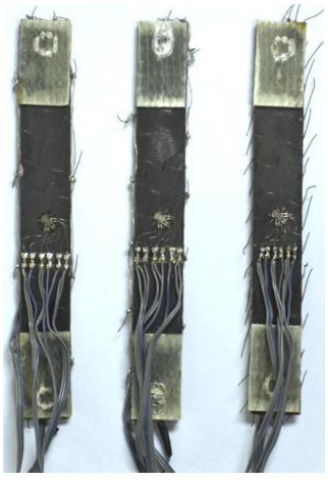


Fig 8 Oriented fibers and SMA wires in the specimens with strain rosettes.

C. Volume Fraction of Fibers in Carbon/Epoxy Layer

The volume fraction of the fibers in the carbon/epoxy layer is calculated using the volume fractionformulation:

$$V_f = \frac{w_f \rho_m}{w_f \rho_m + \rho_f w_m} \quad (1)$$

Where WfandWmare the weights of fibers and matrix respectively.and are the matrix and fiber densities respectively. For a single layer of carbon epoxy.

D. Strain Gage Method

Strain gages, type FCA-3-11 with resistance of 120 Ω, were installed on all specimens to measure the strains under pure tension. Strain rosettes with gages were fixed on both sides of specimens with unidirectional fibers along the tensile loading direction (Fig. 7). Strains in specimens with off-axis oriented fibers and SMA wires were measured by strain rosettes having gages in directions 0°, 45° and 90° to the tensile loading direction (Fig. 8).

3. RESULTS AND DISCUSSION

The SMA wires that were embedded in the epoxy layer of the composite structures were 5% pre-strained. The composite specimens with various numbers of SMA wires were then tested in the specially-developed tensile testing machine. It is observed that, the slopes of the curves from the carbon/epoxy surface are approximately constant and not affected by the numbers of SMA wires too much. However on the SMA/epoxy surface the slopes become steeper as the numbers of SMA wires are increased which indicates that the SMA/epoxy layer has become stiffer when the numbers of SMA wires are increased. The effective stress–strain diagram of composite structures with different embedded SMA wires is shown in Fig. 9.

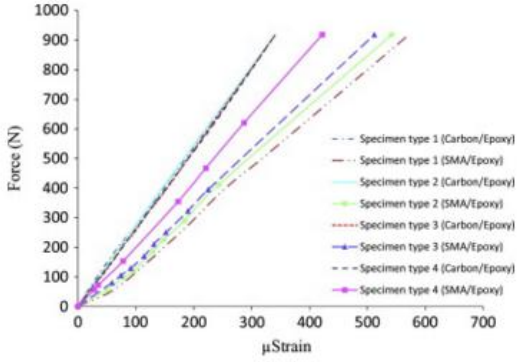


Fig 9 Recorded strain diagram of SMA/epoxy and carbon/epoxy layers.

Fig. 9 shows how the numbers of SMA wires are effective in changing the mechanical properties of the smart composite structures. In order to find modulus of elasticity of SMA/carbon epoxy layer, the elastic moduli of SMA/epoxy and carbon/epoxy layers are individually calculated by curve-fitting the data in Matlab software. The average elastic modulus between the SMA/epoxy and carbon/epoxy values is taken as an effective elastic modulus of the total composite structures (Average stress = Force/Total cross sectional area of the specimen).

The results of the present study were compared to a recent study by Dong et al. In their study, the elastic moduli of unidirectional carbon-glass/epoxy hybrid composites were found and the effect of the fiber volume fractions of carbon/epoxy and glass/epoxy laminas on the mechanical properties of hybrid composite was investigated. They showed that by increasing the volume fraction of the stiffer constituent the total stiffness of the hybrid composite increases. Additionally, the tensile moduli of the hybrid composites are always between the modulus of glass/epoxy and of carbon/epoxy composites. For example, the elastic modulus of a hybrid composite, with 70% volume fraction of carbon fiber in carbon/epoxy lamina and 30% volume fraction of glass fiber in the glass/epoxy lamina, was found to be about 42 GPa for hybrid ratio of 0.5. These findings comparably justify the results that were derived in this study. In another study the effect of embedding pre-strained SMA fibers on the mechanical properties of composites was investigated. It was illustrated that the SMA fiber reinforcement affected the elastic module of composites considerably and the composite samples tended to bend under tension and these are in agreement with the results and findings from the present study.

4. CONCLUSIONS

In this study, four types of composite structures with different density of SMA wires were considered. Composite structures were composed of two layers of carbon/epoxy and SMA/epoxy. Unsymmetrical composite rotates when loaded in tension and constraining the rotation will give rise to bending moments and hence, bending strains. These unwanted strains will introduce errors when calculating for pure tensile properties of the material. Several specimens with different densities of SMA wires were prepared and tested. The results showed that the effective elastic and shear moduli and Poisson's ratios are slightly enhanced by increasing the numbers of SMA wires in the composite structures. It was concluded that, due to the asymmetrical material variation, finding the mechanical properties via conventional testing machine is not accurate and a special testing machine is needed.

ACKNOWLEDGEMENTS

This work is supported by the National Natural Science Foundation of China (No. 11602066) and the National Science Foundation of Heilongjiang Province of China (QC2015058 and

42400621-1-15047), the Fundamental Research Funds for the Central Universities.

REFERENCES

[1]Ghosh P, Rao A, Srinivasa A R. Design of multi-state and smart-bias components using Shape Memory Alloy and Shape Memory Polymer composites[J]. Materials & Design, 2013, 44: 164 - 171.

[2]Feng X, Zhao L, Mi X, et al. Improved shape memory composites combined with TiNi wire and shape memory epoxy[J]. Materials & Design, 2013, 50 (17): 724-727.

[3]Barrie F, Futch D B, Hsu D H D, et al. Effect of phase on debond strength in shape memory alloy reinforced composites[J]. Materials & Design, 2014, 57(5): 98-102.

[4]Sofla A Y N, Meguid S A, Tan K T, et al. Shape morphing of aircraft wing: Status and challenges[J]. Materials & Design, 2010, 31(3): 1284-1292.

[5]Payandeh Y, Meraghni F, Patoor E, et al. Study of the martensitic transformation in NiTi–epoxy smart composite and its effect on the overall behavior[J]. Materials & Design, 2012, 39(11):104-110.

[6]Jani J M, Leary M, Subic A, et al. A review of shape memory alloy research, applications and opportunities[J]. Materials & Design, 2014, 56(4):1078-1113.

[7]Tanaka K. A Thermomechanical Sketch of Shape Memory Effect: One-Dimensional Tensile Behavior [J]. Res Mechanica, 1986, 18:251-263.

[8]Liang C, Rogers C. One-Dimensional Thermomechanical Constitutive Relations for Shape Memory Materials [J]. Journal of Intelligent Material Systems & Structures, 1990, 1(2):207-234.

[9]Brinson L C. One-Dimensional Constitutive Behavior of Shape Memory Alloys: Thermomechanical Derivation with Non-Constant Material Functions and Redefined Martensite Internal Variable[J]. 1993, 4(2):729-742.

[10]Su Z, Mai H, Lu M, et al. Thermo-mechanical behaviour of shape memory alloy reinforced composite laminate (Ni–Ti/glass-fibre/epoxy) [J]. Composite Structures, 1999, 47(1–4):705-710.

The Prevention And Control For The Risk Of The International Settlement Business By T/T Payment

Liang Yingying, Meng Liang
Liaoning University of Technology, School of Economics, No. 169, Shi Ying Street, Guta District, Jin Zhou, Liao Ning Province, China.

Abstract: In recent years, our country has the fast development in the foreign trade . On the choice of the ways of international settlement, also widely used by the original l/c to the procedure is simple, fast, low cost of telegraphic transfer (T/T) settlement. It is because of these characteristics of T/T settlement, determine its actual business operation in the international settlement is a big risk. So the telegraphic transfer (T/T) of the prevention and control measures in the international trade settlement, and has important practical significance
Keywords: international settlement, Risk, T/T Payment

1. INTRODUCTION

As the world economy globalization, the trade among countries is rapidly developing, the competition in international market is more and more fierce, then the means of competition is also increasing. Enterprises under the market economy system as the main body of market competition, if you want to foothold in the international market, must be on the market at home and abroad set up their own comparative advantages, expand market share. In such a diverse world economic backdrop, increasingly fierce competition in international trade, and diversified international settlement way is means of enterprises to expand market share, so enterprise want to have a foothold, will withstand the test of various risks, especially by the settlement process. According to relevant data show that up to billions of dollars every year in our country, expectations of arrears were recovered a large international trade in arrears has seriously affected the healthy development of our country's economy. On the surface, is caused by misoperation, but its fundamental, or because of our country in the face of international trade risk prevention and control of the enterprise on the mechanism of the lack of management, enterprise managers also understanding of international settlement risk prevention and control is inadequate.

2.THE CHARACTERISTICS OF THE TELEGRAPHIC TRANSFER (T/T) BUSINESS

(1) saving time, simple process and low cost

Three kinds of l/c, collection and T/T, in comparison with the method of payment by l/c the method of payment is required to bear the cost of more, for exporters, the need to take notice, negotiation, and pay the cost of such links; For importers, the need to pay the bank charges for opening an l/c and pay a certain amount of the deposit, these will give the importer bring certain pressure on capital turnover; In collection and settlement way, exporters have to pay certain poundage, if the importer refuse to pay payment for goods, so exporters still need bear the return goods brought about by the various fees, if there are any exchange rate changes, also will face to the shrink of profits. By T/T payment, the cost is relatively low, because the bank does not handle trade both sides of the relevant documents in the process of transfer of goods, so many exporters are willing to adopt T/T settlement.

Due to the l/c way to open the l/c and confirm the related procedures, so in the long time; By the method of payment, the exporters after the shipment of the goods, the relevant shipping documents to the remitting bank, the collecting bank collection to the Banks again the documents sent abroad, in the process is relatively complex, also need a long time on the way; Settlement procedures relative to the l/c and T/T and collection, simple procedures, in the time is fast, greatly reduce the risk of exchange rate changes bring.

(2) traders need to control risk by themselves

Compared with the l/c, T/T payment and collection of settlement is based on the premise of commercial credit, look from the possibility of risk, the l/c settlement risk is low, but also beware of importers and financial institutions to set up "soft terms" or find other reasons to refuse to pay payment for goods. Collection and settlement risk is bigger, because the importer, as long as according to the acceptance of draft can carry off the goods when receive payments can only rely on importers exporters of credit; If the importer is the refusal of payment, although the goods were damaged in and of itself, but exporters need bear the return of the goods and related fees, and if a short period of time can't find the right customer, goods can only be sold at a low price, thus bring loss is also a big exporters. T/T settlement risk is probably related to the actual usage, if use T/T before shipment, is advantageous to exporters, whereas good for importers. Today, is used in most of the T/T payment against bill of lading with the T/I

the way of combining the importer can by T/T way to pay part of the payment for goods, goods loading work is done, the rest payment by b/l copy, and many export company will according to the production cost to determine the proportion of the payment in advance, so that even the other party did not pay the balance in loading the goods, export company will not suffer heavy losses.

3.THE TYPES OF RISK IN THE METHOD OF PAYMENT T/T

(1) The Credit Risk Of Trader

International trade is an international trade agreement reached between the seller and the buyer, make trade both sides of the importer to get goods, exporters get payment process. However, once the buyers and sellers in the transaction process of any party against credit, will make the other party directly facing losses, this is we often say the credit risk. Including passive default risk caused by business and between the seller and the buyer because of the bad credit standing risks, mainly includes: importers reason refuse to accept the goods, the importer of refusal or deferred payment; Exporters are not delivered or on the documents in accordance with the provisions of the contract fraud and so on. This kind of risk in international settlement is often have the reputation of both parties. But also can prevent, if on the other side of the credit in good condition, there is no default precedent, is the possibility of risk is very small, and vice versa.

(2) The Risk Of Related Party

At present, in the process of international transport of goods by the carrier related party and in the middle of the clearing system the risk also frequent, against the carrier, mainly because but by original b/l pick up the goods in the international ocean shipping, this will cause the carrier shipment release without collection bill of lading, thus the risk is inevitable. If you choose to see the bill of lading after shipment faxed copy of T/T payment, importers have better relations with the carrier, they will likely malicious diddle goods exporters, exporters money goods two empty it. For intermediate settlement system, although compared with traditional settlement system has made great progress. But do not underestimate risk caused by human factors, embodied in: the operator error, the buyer and the seller; Second, the bank service personnel on the risks of error or settlement system; Three, recover the path does not open, is mainly due to the remitting bank efficiency is not high. And remittance process is not smooth, exporters delay in payment, but increase unnecessary trouble.

(3) The Malicious Fraud Risk

Malicious fraud risk in the process of international trade, is refers to the import and export business of one party at the beginning of trade negotiations is deliberately cheat each other, subjective intent to defraud the other party's property. Because one party has plans to malicious fraud, once happen often swindled side also difficult to recover the loss. The conclusion of the contract, for example, some illegal international merchants to make some companies do not exist, or no trade qualification fiction pretends to fraud by trade qualification. These people are fake company information and legal information with each other after the conclusion of the contract and get the goods. These people are familiar with were tricked into the surrounding countries, aims to drum up business. Connecting link to a commission.

4.T/T PAYMENT RISK PREVENTION AND CONTROL MEASURES

(1) Carriaging The Goods By Using Shipping

In the import and export both sides signed contract before payment will determine the mode of transportation, Marine bill of lading is the proof of ownership of the goods, is the important tool of importers exporters constraints, wait until after the payment to the account release the b/l, for the transfer of the goods. However, air transport and other transport modes of transport documents is not the real right certificate, as long as one can extract the goods to the port importers of goods, some importers shipping documents without the ownership of the goods exporters for fraud. Therefore, under the telegraphic transfer (T/T) the method of payment, using the shipping method, the use of a Marine bill of lading processing goods, can significantly reduce the risk of exporters and settlement.

(2)Try To Be Suitable For Small Payment As Far As Possible

Telegraphic transfer (T/T) this kind of the method of payment is generally applicable to smaller trade business. If the trade volume is larger, and not partial delivery, generally do not use this kind of the method of payment. Because the import and export both sides cannot guarantee final arrangement of goods and payment for goods. Both sides may be due to the changes in the larger market and give up the deal, will lead to the other side, there is a larger loss.

(3)Avoiding Exchange Rate Risk By Using Technology

To prevent due to exchange rate changes to the risk of importers, the importers have the T/T payment can be used in flexible adjustment payment time to avoid risk. It is need to predict importers through the foreign exchange market exchange rates to judgment, to circumvent the risk of foreign trade by changing the payment time. For example, when the settlement currency on downward trend, importers need as of the date of the payment delay; On the contrary, when the settlement currency is on the rise, you will need to shorten the date of payment. This is more favorable to their own.

(4)Strengthening The Credit Investigation Of Exporters Before Signing The Contract

T/T before shipment is a credit for shipping guarantee payment to exporters, importers can be stipulated in the contract by the mass depends entirely on the same amount of goods exporters such as credit, therefore,

in order to guarantee safe receiving, should strengthen the credit investigation of exporters, choose strength credit good exporters. Importers should pay special attention to online trading and deal with new customers, through various channels to client before the contract is signed in sufficient credit investigation, if the customer credit poor, resolute don't adopt T/T before shipment by T/T settlement.

ACKNOLEDGEMENT

The paper is a research result of Liaoning Planning Office of Philosophy and Social Science (L16CJL003): Research on the promotion effect of export technology complexity on the export competitiveness of Liaoning manufacturing industry based on the perspective of technological innovation, and Education Department of Liaoning Province's Basic Scientific Research Projects (JW201615401): Research on the impact mechanism and effect of transnational investment on the export technology complexity promotion -- Based on the perspective of the intermediary effect of technological innovation.

REFERENCES

[1]Business News, Amnesty International Urges Israel to Abandon Expansion of Settlements in East Jerusalem. Politics & Government Business, 2010.

[2]X. The risk and preventive measures of International settlement business. International Trade Law, 2012.

[3]WICHASIN, PIMMADA. A study of risk perception and prevention of international backpackers in thailand. International Journal of Management Cases, 2011.

[4]Xiaomei Chen. From two cases to discuss export enterprises by T/T the balance of risk and its prevention, foreign economic and trade practice, 2013(7).

[5]He Huan. Exporters how to prevent the hidden risk of T/T , modern economic information, 2013 (21).

Recent Research Progress in the Anti-tumor Mechanism of Allicin

Fang Liu, Hongliang Fan
Department of Physiology, Henan Medical College, Zhengzhou, China

Abstract: Tumor is one of the major diseases that seriously affect human health and threaten human life. As a volatile oil substance, allicin is extracted from fresh garlic, and considered to be a complex ingredient includes a variety of allyl organosulfur components. Allicin is the most biological active ingredients in garlic. Allicin possesses a variety of biological functions including sugar-lowering, lipid-lowering, alleviates inflammation, immune-enhancing, to prevent heart vascular disease and other physiological functions. Recent studies have confirmed that allicin also has anti-tumor effect. This article aims to make a further review on its anti-tumor mechanism research.
Keywords: Tumor; Allicin; Mechanism

1. INTRODUCTION

Tumor, especially malignant tumor, is regarded as the most deadly diseases in this world, and seriously affects human health and threatens human life. Therefore, preventing the occurrence of cancer and finding out a new way to treat cancer have been becoming staggering problems for lots of medical workers.

Allicin is a product obtained by extracting from fresh garlic, which is a complex includes a variety of allyl organosulfur components. Allicin is the most biological active ingredient in garlic. The main ingredients of allicin are diallyl disulfide (DADS) and diallyl trisulfide (DATS) [1]. Fresh garlic does not have allicin, but possesses the precursor substance of allicin, named as alliin. Alliin presents in a stable form in garlic with odourlessness. When the garlic is broken, the alliinase is activated to catalyze the conversion of alliin into allicin. Pure allicin is colorless oil, with volatile and specific garlic smell. Allicin is a sulfur-containing compound isolated from garlic bulbs. Because of its hydrophobic, allicin can quickly go through the cell membrane, without destroying the phospholipid bilayer, and easy to bind with the biological complex. Allicin can be quickly absorbed by cells. Allicin metabolites are mainly acetone as well as propyl methyl sulfide (AMS). Metabolic studies find that the absorption of allicin is 95% in the body [2].

Allicin has a series of biological functions, such as sugar-lowering, lipid-lowering, alleviates inflammation, immune-enhancing and so forth. Allicin plays an important role in preventing heart vascular disease and possesses other physiological functions [3-4]. Recent studies have confirmed that allicin has anti-tumor effect as well. In these years, a large number of epidemiological survey datas and experimental studies have shown that allicin with a preventive or therapeutic effect on a variety of tumors. Due to less adverse reactions, allicin has a good clinical application prospects. Allicin may develop into a new drug with anti-tumor and relieving the toxic side effects of chemotherapy.

2. THE ANTI-TUMOR MECHANISM OF ALLICIN

The anti-tumor mechanism of Allicin are multi-faceted, mainly including antioxidation, regulation of gene expression, induction of apoptosis, affecting cell cycle, improving immunity and so forth. A review of its anti-tumor mechanism will be demonstrated as follows.

A.Anti-oxidize Effect

A variety of oxides are cancer-inducing factors. Many cancer promoters or carcinogens lead to excessive production of reactive oxygen species and beyond the ability of cell to clear them, the oxidative damage of DNA molecules has become the starting factor into cancer. The reactive oxygen species (ROS) are collectively composed of molecules and ions with high oxidative activity, including oxygen free radicals and non-free radical active oxygen species such as superoxide anion, hydrogen peroxide, hydroxyl free radicals, nitric oxide and so on. Excessive ROS can cause gene mutations, as well as induce tumors [5-6]. Experiments show that allicin can significantly improve the activity of superoxide dismutase (SOD) in the body, and remove the reactive oxygen free radicals, so as to fight against some of the toxic oxidative damage to the body [7]. Louis et al. found that garlic extracted can inhibit myocardial hypertrophy and apoptosis by norepinephrine-induced in rats, with antioxidant stress. The mechanism mentioned above may be related to the production of NO and H_2S. A large number of reports in the literature, on the one hand allicin can maintain mitochondrial biological function, and then scavenging oxygen free radicals, by maintaining the function of mitochondrial membrane proteins, improving the production of adenosine triphosphate (ATP), reducing the release of cytochrome c and other ways. On the other hand allicin can reduce ROS production and lipid peroxidation, maintain endogenous peroxidase activity, relieve tissue oxidative stress, protect DNA, lipid, protein, and reduce cell carcinogenesis predisposing factors [8].

B. Inducing Apoptosis or Killing the Tumor Cells Directly

Apoptosis and proliferation are the basic phenomena of life. Meanwhile, these two phenomena are considered to be the basic measures to maintain the dynamic balance of the number of cells in the body. Under normal circumstances, cell proliferation and apoptosis are coexisting, coordinating as well as maintaining in a dynamic equilibrium state. The disorder of cell proliferation and apoptosis are important factors in the occurrence and development of tumors. In recent years, epidemiological investigation also found that allicin has anti-tumor activity, which can directly kill tumor cells, inhibit tumor cell proliferation and induce apoptosis; for instance allicin can significantly induce prostate cancer LNCaP cells, mouse melanoma cells B16-F1, human gastric adenocarcinoma SGC-7901 cell apoptosis and so on [9-11].

Allicin on the apoptosis of tumor cells induced is multi-level as well as multi-target [12]. Moyer'studies have shown that allicin can significantly inhibit the expression of epidermal growth factor receptor (EGFR) in human hepatocellular carcinoma cells, and significantly reduce the uptake of EGFR induced by EGF to stimulate human hepatocarcinoma cells, so as to inhibit the growth of cancer cells and promote the apoptosis of cancer cells[13]. Studies have confirmed that allicin significantly time-dependent down-regulation expression levels for both of polβ mRNA and protein in human gastric cancer cells BGC-823 and MGC-803, accompanying with the significant increase of mRNA's expression within Bax, p21, Bcl-xl, IkB protein, while the Selectin E is magnificently decreased. Suggesting that allicin may adjust the expression of polβ in tumor cells to increase the apoptosis of tumor cells and the sensitivity to antitumor agents [14]. Zhang et al. showed that allicin could induce apoptosis by promoting the expression of Bax and Cytochrome C, reducing mitochondrial membrane potential, activating Caspase 3, activating endogenous mitochondrial apoptotic signal transduction pathway. Allicin could promote the expression of Fas and Caspase 8, and induce apoptosis of gastric cancer cells; that is, death receptor pathway is also involved in allicin-induced apoptosis of gastric cancer cells. The mechanism of allicin-induced apoptosis may be related to down-regulation of cell cycle-dependent protein (CDK1) and cyclin B1 (CyclinB1) [15]. It has been reported that allicin (10 mg/L) also enhances the apoptosis of intracellular Nrf2 signaling pathway induces colon cancer cells [16].

C. Block The Cell Cycle of Tumor Cells

Cell cycle includes interphase (G1, S, and G2) and mitotic period (M). Many chemotherapeutic agents can block cells in a period of cell division and lead to apoptosis. In eukaryotic cells, cells get involved in cell cycle regulation are cyclin, cyclin dependent kinase (CDK), cyclin-dependent kinase inhibitors, Rb protein and P53 protein. Many chemotherapy drugs are also by adjusting the expression of a variety of proteins, the cells blocks in a certain period and thus inhibit the development of tumors [17].

Li Yongsheng and other studies have found that allicin can enhance the effect of vincristine on bladder cancer BIU-87 cell proliferation inhibition. Both allicin and vincristine have synergistic anti-tumor effect [18]. The results of immunocytochemistry and Western blot showed that the expression of CDK1 and CyclinB1 protein in the bladder cancer BIU-87 cell line was significantly decreased in allicin combined with vincristine group. This result suggested that the mechanism of block cell cycle triggered and induced apoptosis by allicin may be related to down-regulation expression of CDK1 and CyclinB1.

Wang Chunyan et al. explored the effect and its related molecular mechanism of allicin on HeLa cell cycle [19]. The results showed that allicin inhibited the activation of Wnt signal and down-regulated the expression of key protein β-catenin in cytoplasm, so that the cell cycle progression and HeLa cell proliferation were inhibited.

C. Improve the Immune Function

The body immune function is divided into the specific immunity which is mediated by T lymphocytes and B lymphocyte, the nonspecific immunity which are mediated by monocyte-macrophages, granulocytes, dendritic cells, NK cells, LAK cells, endothelial cells and other stromal cells, and erythrocyte immune system. These cells can release inflammatory factors which against foreign pathogens and damage factors which participate in the inflammatory response. The stable state of pro-inflammatory factors and anti-inflammatory factors is an important condition for maintaining the normal function of the body. The destruction of inflammatory microenvironment can lead to gene mutation and DNA damage in normal cells, taking part in the occurrence and development of tumors [20-22]. Interleukin-1β (IL-1β) is a kind of proinflammatory cytokine, which is widely involved in the process of destruction and edema of human tissue, and its damage is greater than the defense effect.

Allicin played a role in regulating the inflammatory response, and it inhibits proinflammatory factors as well as up-regulation of anti-inflammatory factors, and enhances the body immunity. Allicin reduced the expression of inflammatory cytokines necrosis factor (TNF) and IL-1β, and improved the degree of ulcer congestion and edema of inflammatory bowel disease model mice, moreover, the allicin unites Salad Qin or sulfasalazine pyridine has a stronger result. Li et al. also found that allicin(10 and 25g/ml) did not inhibit the expression of IL-8 [23]. However, after IL-1β-induced Caco-2 (human cloned colonic adenocarcinoma cells) were inhibited by allicin for

12h and 48h, the p38 and JNK signal paths were suppressed, the expression of NF-kB p65 was decreased, the inflammatory response was weakened, and the degree of inflammation damage in the body tissue was improved. Pandurangan et al. in the study on allicin relieving ulcerative colon which is dextran phosphate sodium (DSS-) induced confirmed that allicin can play an anti-inflammatory effect through the mentioned mechanism above to improve the body non-specific immunity [24].

In addition, allicin achieves anti-tumor effect may by blocking the synthesis of carcinogenic substances, increasing cAMP concentration, affecting the activity of DNA polymerase and telomerase within the cells, anti-mutation and other ways as well.

3. CONCLUSIONS

In summary, on the one hand allicin can induce apoptosis by blocking the tumor cell cycle, affecting telomerase activity and other direct effects on tumor cells. On the other hand, by improving the body immunity, anti-oxidation and other means, allicin plays an indirect anti-tumor effect. However, the mechanism of anti-tumor effect of allicin is very complex; also its role in the link and the role of ways are also multifaceted. The anti-tumor mechanism of allicin remains to be further studied.

ACKNOWLEDGMENT

This work was supported in part by a grant from basic and advanced technology research project of Henan province (No.132300410098).

REFERENCES

[1]Mei Siwei, Zhu Hanzhen. “Research Advances in Allicin,” Chinese Agricultural Science Bulletin, 2009, 25(9):97-101.

[2]Chan JY, Yuen AC, Chan RY, et al. “A review of the cardiovascular benefits and antioxidant properties of allicin,” Phytotherapy research: PTR, 2013, 27(5):637-646.

[3]MA Lina, LI Fengjie, CHEN Jian, et al. “Research advances in garlic’s main active ingredients and their pharmacological effects,” Chinese Pharmacological Bulletin, 2014, 30(6):760-763.

[4]Borlingghaus J, Albrecht F, Gruhlke MC, et al. “Allicin:chemistry and biological properties,” Molecules,2014,19(8):12591-12618.

[5]QU Junwen. “Antixoidants in Cancer Prevention,” Electronic Journal of Metabolism and Nutrition of Cancer, 2014, 1(1): 60-64.

[6]WANG Shan,WANG Hui,CHEN Xiao-Yan, et al. “The Circuit Consisting of Sulfiredoxin-peroxiredoxin Axis and Hydrogen Peroxide in Cancer Initiation and Progression,” Chinese Journal of Biochemistry and Molecular Biology, 2015, 31(4): 360-366.

[7]Liu Hao, Cui Meizhi, Dong Juan. “Experimental Study on Antioxidant Delayed Aging Effect of Garlicin,” Chinese Journal of Gerontology, 2006, 26(2):252-253.

[8]Tao Qingxia, Zhang Peng, Wu Cuiying, et al. “Recent research progress in the anti-tumor effect and mechanism of allicin,” Chin J Neurotrauma Surg (Electronic Edition), 2016, 2(6):365-368.

[9]Gunadharini DN, Arunkumar A, Krishnamoorthy G, et al. “Antiproliferative effect of diallyl disulfide (DADS) on prostate cancer cell line LNCaP,” Cell Biochem Funct, 2006, 24(5):407-412.

[10]CHEN Siyuan, HUANG Changzheng, QIAN Yue. “Effect of Allicin on Growth and Apoptosis of Mouse Ascites Melanoma Cell B16-F1,” The Chinese Journal of Dermatovenereology, 2006, 20(1):13-15.

[11]Sharpe JC, Arnoult D, Youle RJ. “Control of mitochondrial permeability by Bcl-2 family members,” Biochim Biophys Acta, 2004, 1644(2-3):107-113.

[12]Oommen S, Anto RJ, Srinivas G, et a1. “Allicin (from garlic) induces caspase-mediated apoptosis in cancer cells,” Eur J Pharmacol, 2004, 485(1-3):97-103.

[13]Moyer JD, Barbacci EG, Iwata KK, et al. “Induction of Apoptosis and cell cycle Arrest by cp-358,774, an Inhibitor of Epidermal Growth Factor Receptor Tyrosine Kinase,” Cancer Res, 1997,57(21):4838-4848.

[14]YIN Chunhui, HUO Shiran. “Antitumor Action of Allicin and Its Mehanisms,” Food Science, 2009, 30(7):270-272.

[15]Cong Lijia, Zhang xiaojie, Fan Hongyan. “Research progress on anti-tumor effects of allicin,” Journal of Jilin Medical College, 2015, 36(3):225-228.

[16]Bat-Chen W, Golan T, Peri I. “Allicin purified from fresh garlic cloves induces apoptosis in colon cancer cells via Nrf2,” Nutr Cancer, 2010, 62(7):947-957.

[17]HOU Xuben, FANG Hao, DU Jintong, et al. “Progress in clinical trails of cyclin dependent kinase inhibitors,” Chinese Journal of New Drugs, 2011, 20(14):1280-1286.

[18]LI Yongsheng, WANG Yunjin, Mu Xiyuan. “Effect of allicin combined with vincristine on proliferation and apoptosis in bladder cancer cell line BIU-87,” Journal of Guangxi Medical University, 2013, 30(1):69-73.

[19]Wang Chunyan, Liu Ling, Nie Dan, et al. “Allicin Inhibites Cell Cycles of HeLa Cells through Wnt Pathway,” Sichuan Medical Journal,2016,37(2):141-143.

[20]HOU Jiajie, SUN Beicheng. “STAT3: The Key Player in the Network of Inflammation and Cancer,” Progress in Biochemisty and Biophysics, 2014, 41(1): 69-78.

[21]WANG Yi, LI Yan, SHEN Beifen, et al. “Inflammation: a driver for tumor development,” J Int Pharm Res, 2014, 41(1): 63-67.

[22]HUANG Bo. “Regulation of immune response and inflammation in tumor microenvironment,” Chin J Cancer Biother, 2012, 19(2): 111-115.

[23]Li C, Lun W, Zhao X, et al. “Allicin alleviates inflammation of trinitrobenzenesulfonic acid-induced rats and suppresses P38 and JNK pathways in Caco-cells,” Mediators Inflamm, 2015, 2015:434692.

[24]Pandurangan AK, Ismail S, Saadatdoust Z, et al. “Allicin Alleviates Dextran Sodium Sulfate-(DSS-) Induced Ulcerative Colitis in BALB/c Mice,” Oxid Med Cell Longev, 2015, 2015:605208.

A Study on Model Building of Chain Finance Ecosystem Based on Symbiosis Theory

Sheng Xin, Pan Wenchao, zhong Zuchang
School of Management, Guangzhou Panyu Polytechnic, Guangzhou, China

Abstract: This research uses the symbiosis theory to build a symbiotic system of the logistics enterprise and financing institution based on the symbiotic unit, symbiotic mode, symbiotic environment and symbiotic interface. Then it builds a model of the supply chain finance business bio system from 3 perspectives including behavior subject, external environment and product system. At last, the study findings are used to interpret the symbiotic relation evolution of logistics enterprise and financing institution in the development process of supply chain finance business in China.

Keywords: Supply chain finance, symbiotic system, symbiotic mode, logistics enterprise

1. INTRODUCTION

Given the economic globalization underway, the supply chain operation efficiency and benefit of enterprises can be increased through effective organization, operation and management of the supply chain (Wang Jing, Li Yilan et al. 2007). There are many participants of the supply chain, including a lot of small and medium sized enterprises, which cannot provide transparent information due to lacking of a sound financing mechanism (Li Dawu, 2001). Those enterprises face great risks and high cost in financing activities. However, with the supply chain operation, the commercial banks can gradually carry out supply chain finance business based on the traditional commercial factoring business. This improves the financing dilemma of small and medium enterprises and is good for improvement of the overall performance of supply chain (Sheng Xin, Chen Gongyu, 2015).

With constant development of supply chain finance business, given the high profitability, it gradually becomes one of the main measures for the logistics enterprises to improve their core competitiveness and profitability (Guo Zhanqin, 2012). Whether a benign interaction relation can be formed between the logistics enterprise and financing institution and whether they are able to develop supply chain finance business in a coordinated way directly pose an impact on the gains of the two parties (Li Yixue, Wang Shouyang, et al. 2010). The industrial symbiosis theory is originated from biology and is now widely used in the study in many fields (Wang Zhenzhen, Bao Xinghua, 2012). This paper uses the symbiosis theory to build the supply chain ecosystem model based on building the supply chain finance symbiosis system and the symbiosis relation on the enterprise level in the development process of supply chain finance (the logistics enterprise and financing institution). This paper also analyzes and interprets the evolution of symbiosis system of the logistics enterprise and financing institution in the development process of supply chain finance business in China.

2. SYMBIOSIS RELATION OF SUPPLY CHAIN FINANCE BUSINESS

A.Symbiosis concept of supply chain finance business

Symbiosis refers to the material correlation of existence between economic subjects. The symbiosis units in a symbiosis relation have hierarchy, on the national level, industrial level and enterprise level. Logistics enterprises and financing institutions are two important participants of the supply chain finance business, and the two coordinate with each other and jointly provide services for the demand side of the supply chain finance business. The symbiosis issues between the two will pose a direct impact on business development. This paper argues that the internal cause that drives formation and development of symbiosis relation in coordinated development of supply chain finance business between the twp. is the resource complementarity between the two during business development and execution. The external cause is the value appreciation of the symbiosis unit and symbiosis system resulting from development of such supply chain finance business.

B.Characteristics of symbiosis of supply chain finance business

(1)Integration: The integration of symbiosis units is different from traditional industrial integration or enterprise integration. The integration of different symbiosis units of supply chain finance business is reflected by the business mode innovation and development to create new values for symbiosis units and realize value appreciation. The symbiosis relation between logistics enterprise and financing institution has a natural integration property. The supply chain finance business dominated by the financing institution is integrated into the business process of logistics enterprise, and the value creation amount of logistics enterprise integrates the contribution made by supply chain finance business.

(2)Interactivity: When the logistics enterprise provides logistics service for the supply chain

finance business of the financing institution, the financing institution can acquire professional and high-quality logistics services from the logistics enterprise. Similarly, the logistics enterprise will have access to part of the business gains of the financing institution. The two are in a reciprocal and interactive relation. The interactive behavior of the symbiosis units should generate new gains. However, due to the heterogeneity of the two symbiosis units, the benefit distribution can be unequal or equal.

(3)Coordination: In the symbiosis relation between the two, coordination refers to both function coordination and quality coordination. The logistics enterprise and financing institution should have an emphasis in terms of function positioning, so as to achieve functional complementation. At the same time, the development quality of the two should match. The too advanced or lagging-behind development quality will influence stability of the symbiosis system.

3. BUILDING OF THE SYMBIOSIS SYSTEM OF SUPPLY CHAIN FINANCE

The elements of a symbiosis system include: symbiosis units, symbiosis mode and symbiosis environment. Those elements will mutually impact and interact with each other to divide the internal structure and symbiosis relation of the symbiosis system (Yuan Chunqing, 1998).

A.Symbiosis unit

The components of a symbiosis system are the symbiosis units in a symbiosis relation. The symbiosis units of the supply chain finance symbiosis system include the logistics enterprise, financing institution, service objects and other enterprises. In particular, the financing institution is the main participant in the business development process of the logistics enterprise. Therefore, this paper will lay an emphasis on the coordinated development between the logistics enterprise and financing institution with close relation in the business development process.

B.Symbiosis mode

Symbiosis mode refers to the way the symbiosis units interact or combine with each other, and is the straightforward reflection of the connection method and strength, material information exchange and energy exchange between the symbiosis units in a symbiosis system. [8] Yuan Chunqing (1998) proposed two categories of symbiosis modes: The symbiosis organization mode and the symbiosis behavior mode, and further divided the two categories. The symbiosis behavior modes proposed in the paper can be divided into parasitism, communalism, asymmetric reciprocal symbiosis and symmetric reciprocal symbiosis. This is subsequently accepted by the scholars. In this paper, the classification method of Yuan Chunqing (1998) is used to divide the symbiosis modes of the supply chain finance into parasitism, communalism, asymmetric reciprocal symbiosis and symmetric reciprocal symbiosis. For the symbiosis system of supply chain finance, when the logistics enterprise is commissioned by financing institution to carry out designated logistics work, there will be parasitism relation between the symbiosis units. The parasitism relation itself does not generate any added value, and is only a transfer process between different symbiosis units. With development of the logistics enterprise and finance business of supply chain, the logistics enterprise will not be completely controlled by the financing institution in the supply chain finance business, and will start to form a two-way selection relation with the financing institution through competition in the market and gradually form a cooperation relation with the latter. In such a case, there will be a communalism relation between them. The communalism mode is beneficial for one of the symbiosis units and non-harmful to the other. With growth of the strength of logistics enterprise, the enterprise will use the control of logistics and information stream in the supply chain operation process to actively carry out business mode innovation and market exploration. However, as limited by funds and other factors, in-depth cooperation with financing institution is required. There will then be an asymmetric reciprocal symbiosis relation between the symbiosis units. The asymmetric reciprocal symbiosis is a symbiosis relation beneficial for both of the symbiosis units, and only the distribution of the value appreciation part is unequal. With further development of the logistics enterprise, some logistics enterprises with rich resources become involved in the finance field, and there will be integration of equal cooperation relation between symbiosis units, and a symmetric reciprocal symbiosis relation is formed. In this mode, the distribution of value appreciation between symbiosis units is equal. The comparison of the four different symbiosis modes is shown in Table 1.

The symbiosis correlation degree of symbiosis units is generally measured using the symbiosis degree. The symbiosis degree reflects the correlation degree of the variation of quality parameter between different symbiosis units, and is generally measured using the relative variation rate of the quality parameter of symbiosis unit. Assume that in the symbiosis mode of supply chain finance there are two symbiosis units, the logistics enterprise L and the financing institution F.

Table 1 Four symbiosis modes of supply chain finance

	Parasitism	Communalism	Asymmetric reciprocal symbiosis	Symmetric reciprocal symbiosis

Characteristics of the symbiosis units	The symbiosis units have different forms. There is two-way correlation between the symbiosis units.	There is great form difference between the symbiosis units. There is two-way correlation between symbiosis units.	There is small form difference between symbiosis units. There is two-way correlation between symbiosis units.	The form variance between the symbiosis units is close to 0. There is two-way correlation between symbiosis units.
Characteristics of symbiosis energy	1. No new energy is generated. 2. There is transfer of energy from the host to the parasite.	1. New energy is generated. 2. One party acquires all new energy. There is no broad-spectrum distribution of new energy.	1. New energy is generated. 2. There is broad-spectrum distribution of new energy. 3. The broad-spectrum distribution is based on the asymmetric mechanism.	1. New energy is generated. 2. There is broad-spectrum distribution of new energy. 3. The broad-spectrum distribution is based on the symmetric mechanism.
Characteristics of interactive relation	Active-positive	Follow-up-positive	Active-follow-up	Active-active
Representative business mode	The financing institution respectively establishes a relation with the customer and logistics enterprise.	The financing institution, customer and logistics enterprise form a three-party contractual agreement.	The financing institution extends credit to logistics enterprises in a centralized manner. The logistics enterprise establishes a relation with the customer.	The logistics and financing institution establishes a relation with the customer.
Cooperation relation	Employment relation	Business cooperation	Credit extension cooperation	Property right integration

Data resource: Adapted from Yuan Chunqing (1998).

The quality parameters of the two are respectively Z_i and Z_j. According to the connotation of the symbiosis degree, the symbiosis degree δ_{ij} of L and F is defined as:

$$\delta_{ij} = \frac{dZ_i/Z_i}{dZ_j/Z_j}$$

Similarly, the δ_{ji} can be obtained. Considering the value selection direction combination of δ_{ij} and δ_{ji}, when $\delta_{ij} = \delta_{ji} > 0$, it means that there is positive symmetric reciprocal symbiosis between the symbiosis units; when $\delta_{ij} \neq \delta_{ji} > 0$, it means that there is positive asymmetric reciprocal symbiosis between the two; when $\delta_{ij} = \delta_{ji} = 0$, it means that there is no relation between the symbiosis units and there is no symbiosis relation. The relation of different value selection ranges of δ_{ij} and δ_{ji} is shown in Table II.

Table 2 Relation of symbiosis degree of symbiosis units in the supply chain finance

	δ_{ji}		
	> 0	$= 0$	< 0
δ_{ij} > 0	Positive reciprocal symbiosis	Positive commensalism	Parasitism
$= 0$	Positive commensalism	Non-symbiosis relation	Reverse commensalism
< 0	Parasitism	Reverse commensalism	Reverse reciprocal symbiosis

C.Symbiosis environment and symbiosis interface

Symbiosis environment is the sum of the economic environment, policy environment and law environment for the symbiosis system. The symbiosis environment impacts the symbiosis system through exchange of information, resource and energy, and is the external factor that forms and impacts development of the symbiosis system. In the symbiosis system of supply chain finance, the government subsidy and control, law and regulation environment, credit mode and the credit market environment are all external environment. According to the effect of impact of symbiosis environment on symbiosis system, the external environment can be divided into the positive environment (good for development of the symbiosis system), neutral environment and reverse environment. For instance, the government

observes the symbiosis phenomenon of the supply chain finance and encourages business development by publishing various preferential policies. This is a positive environment. If the government has no action, it is called the neutral environment. If the government publishes constraining policy, such as prohibiting the non-financing institution from providing financial services, this called a reverse environment. It is clear that the symbiosis environment will pose an impact on development of information and energy exchange between symbiosis units, and further the development of the symbiosis system. Attention should be paid to the symbiosis environment during building of the symbiosis system.

Exchange of energy and information is needed between symbiosis units. The symbiosis interface is the sum of the contact method and mechanism between the symbiosis units. The internal interface in the supply chain finance symbiosis system is the contact mechanism between supply chain finance businesses, including the business mode, information sharing system, risk management standard and customer selection assessment. External interface is the contact mechanism between the participants of the supply chain finance business, including cooperation relation, command arrangement and communication platform. The internal and external interface of the symbiosis system is mutually correlated and influenced. The internal interface serves as the medium and channel of information and energy exchange. External interface influences the operation mechanism of internal interface.

D.Symbiosis system of supply chain finance business

The symbiosis unit, symbiosis mode, symbiosis environment and symbiosis interface constitute a symbiosis system. Those elements play their roles jointly, and impact the dynamic evolution direction of the symbiosis system. The symbiosis system of supply chain finance business is shown in Fig. 1.

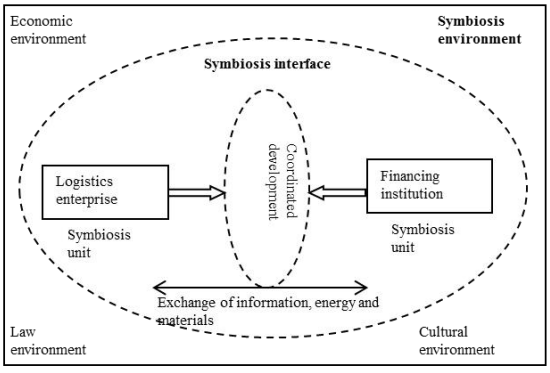


Figure 1 Symbiosis system of supply chain finance business

4.BUILDING OF ECOSYSTEM OF SUPPLY CHAIN FINANCE

The ecosystem is also called the ecosphere. It generally refers to the organic system in which different matter states form a circle in a certain sequence and the maintenance of circle sequence relies on participation of energy. With increasing emphasis laid by enterprises on the strengthening of competitiveness of the joint enterprises on the supply chain by improving the operation efficiency of supply chain, and the relation between enterprises grows closer and closer, the ecosystem is introduced into the industrial research area. This paper the ecosystem refers specifically to the ecosystem of supply chain finance business, in which the stakeholders of the business activity allows the system to create values and share benefits through co-building the value platform and levering the capacity of other participants via the platform. The overall framework of the ecosystem of supply chain finance business is shown in Fig. 2.

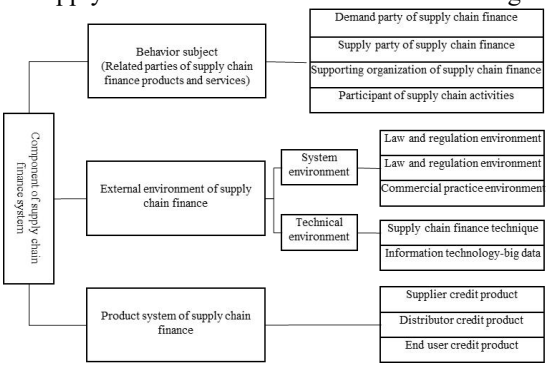


Figure 2 Framework of ecosystem of supply chain finance business

A.Behavior subject of ecosystem of supply chain finance business

Behavior subject is the core and key of the ecosystem and it includes the demand party, supply party, and supporting organization of supply chain finance business and participant of supply chain activities.

(1)Supplier of supply chain finance business is the subject providing finance resources and is also the final risk taker. In China, the practice of supply chain finance has 4 supplier categories: financing institution, logistics enterprise, manufacturing and trading enterprise and internet enterprise. The financing institutions include commercial banks, guarantee institutions and insurance companies, which are main providers of various finance services; the logistics enterprise cooperates with the financing institution based its control over the operation process of supply chain, and provides financial services after obtaining the credit from the bank; the manufacturing and trading enterprises provide financial services for inside of the supply chain, so as to expand the import and export scale or realize sales of the product. The internet enterprise utilizes the trading data resource to cooperate with the financing organization to

provide services for enterprises operating on the network platform.

(2)The demand party of supply chain finance business is the target customer and profit source of business. Due to the uniqueness of operating and credit environment in China, it differs from similar business abroad. The finance business of supply chain in China attaches more importance to satisfying the fund demand of target customers. Therefore, on the supply chain with fund demand and the ability to meet the requirements of the supply party, a great number of small and medium sized enterprises become the demand party of the supply chain finance business.

(3)Supporting organization of supply chain finance business is the third-party organizations that provide various professional services in the business process to guarantee and support smooth operation of supply chain finance business. Common supporting organizations include e-business enterprises, trading platform, various intermediaries, industrial associations and government bodies.

(4)Participant of the supply chain activities includes other participating enterprises of supply chain operation by the demand party. Such enterprises are not directly related to the business. However, their production and operation condition will impact the operation process of the entire supply chain, and will further impact the operation performance of supply chain of the demand party, and therefore is worth attention.

B.External environment of the supply chain finance ecosystem

The external environment of supply chain finance ecosystem mainly includes the system environment and technical environment. The system environment includes the law and regulation environment, industrial monitoring system and commercial practice environment; technical environment mainly includes the supply chain finance technique and information technology-big data. Li Yixue (2007) compared and analyzed the system environment and industrial environment of supply chain finance at home and abroad, and discovered that China was lagging behind in terms of the completeness of legislation, complexity of ownership registration, public property filing system and judicial efficiency. In terms of industrial environment, problems exist in China, including disunity and inability to circulate of bills, skill deficiency and dishonesty of third-party organization, missing of standards for operation process and missing of disposal supporting measures of the collateral security. The factors of the two aspects jointly form the important external reasons that hinder the development of supply chain finance business in China. At the same time, the rise of information level of enterprises and wide application of IT/IS, especially the application of data mining technologies represented by the big data analysis, can increase the information sharing level and reduce business risks.

C.Product system of supply chain finance

The supply chain finance product is the carrier of service provided by the supply party to the demand party, and is the foundation and core of operation of business ecosystem. The common supply chain finance products mainly include the receivables, inventory and prepayment, as shown in Fig. 3.

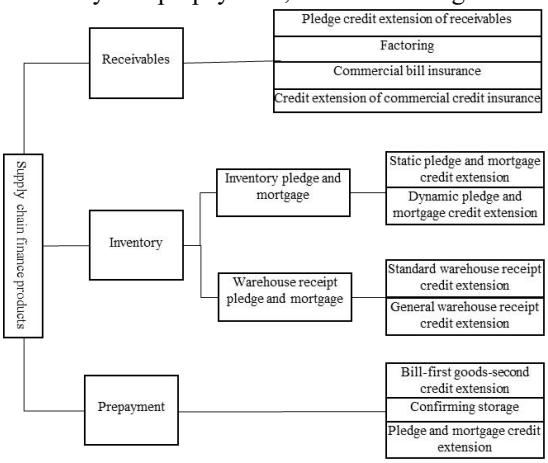


Figure 3 Classification of supply chain finance products

5.SUPPLY CHAIN FINANCE BUSINESS PRACTICE OF LOGISTICS ENTERPRISES IN CHINA-INTERPRETATION BASED ON THE SYMBIOSIS THEORY

According to the study findings of “supply chain finance” project group (2008), the supply chain finance business of logistics enterprises in China can be divided into 3 hierarchies: the commissioned monitoring predominated by banks; financing based on logistics outsourcing; horizontal integration of logistics and finance services [8]. Based on the above hierarchy division, this paper divides the supply chain finance business relations between the logistics enterprise and financing institution into four stages depending on the complexity of supply chain business and closeness of the bilateral cooperation: the commissioned monitoring, financing monitoring, credit extension financing and mixed operation. In particular, credit extension financing and mixed operation respectively relate to the financing based on logistics outsourcing and horizontal integration of logistics and financial services in the business hierarchy of the “supply chain finance” project group (2008). Commissioned monitoring and financing monitoring are breakdowns of commissioned monitoring hierarchy predominated by the banks. In the commissioned monitoring stage, the logistics enterprise is purely engaged in the custodian service. In the financing monitoring stage, the logistics enterprise will provide more services for the financing institution

in terms of information system and commodity value management, in order to obtain more monitoring business. At the same time, logistics enterprises will actively develop customers, and introduce the self-owned customers into the pledge and monitoring financing business system of the bank, so as to expand the business scale. Therefore, in the financing monitoring stage, the two parties have already established closer cooperation relation, and the complexity of monitoring business has also increased. The responsibilities and risks of the logistics enterprises have also increased. The evolution of the four stages is shown in Fig. 4.

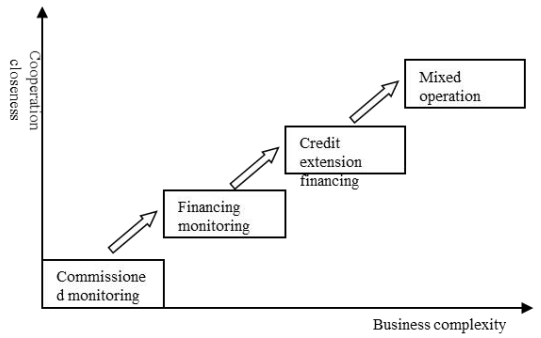


Figure 4 Four stages of business cooperation between logistics enterprise and financing institution

The unique characteristics of the four stages are shown in Table 3.

TABLE 3 Cooperation stages and characteristics of the supply chain finance business symbiosis system

Business cooperation stage	Commissioned monitoring	Financing monitoring	Credit financing	Mixed operation
Cooperation relation	Employment relation	Business cooperation	Credit extension cooperation	Property right integration
Cooperation target	Independent target	Certain common interest	Multi-aspect common interest	Common target
Status comparison	Full control by financing institution	Predomination by financing institution and participation by the logistics enterprise	Reciprocal cooperation	Internal system of the system
Requirement for information sharing	Low	Fair	High	All
Degree of trust	Low	Medium	High	Very high
Business mode	The financing institution respectively establishes a relation with the customer and logistics enterprise.	The financing institution, customer and logistics enterprise form a three-party contractual agreement.	The financing institution extends credit to logistics enterprises in a centralized manner. The logistics enterprise establishes a relation with the customer.	The logistics and financing institution establishes a relation with the customer.
Target customers	Enterprises holding bulk raw materials	Enterprises holding inventory	Manufacturing and circulating enterprises	Customized financial services for targeted enterprises
Risk control	Static monitoring of inventory of logistics enterprises under monitoring of financing institution	Dynamic monitoring of inventory in the cooperation mode of financing institution and logistics enterprise	Comprehensive risk management of logistics enterprises involving participation of financing institution	Finance and logistics integration risk management

Data source: Reorganized by the author.

In the commissioned monitoring stage, the bank transfers all risks to the logistics enterprise through the binding agreement. The two parties are unable to build up a trust relation. The logistics enterprise needs to assume all cost related to the subject matter value while earning the monitoring income. The status of the two parties is completely unequal, with the logistics enterprise having very little

impact on the business and parasitizing the business predominated by the financing institution.

With constant innovation of the financing institution business mode, the logistics enterprise should participate in the business process in a more active and positive manner. For example, the pledge financing monitoring evolved from static warehouse monitoring to the in-transit dynamic adjustment monitoring. The financing institution is required to obtain logistics activity information and grasp the logistics activity process. In the dynamic monitoring process, as the value of the pledge changes constantly, the financing institution pays more attention to measurement of the value of pledge and change trend of its value in the future. At the same time, the logistics enterprise with strength will invest in information system and monitoring measures, and some of the logistics enterprises with capacity provide value added services for financing institutions such as prediction of price trend of the pledge. As such, the parasitism relation between the two has evolved into a commensalism relation.

With growth of the scale and strength of the logistics enterprise, some logistics enterprises actively get involved in innovation of supply chain finance business. As a result, businesses such as tray trading and agent purchasing have emerged. Some logistics enterprises attempt to cooperate with the financing institution to carry out supply chain finance business through obtaining the comprehensive credit extension from the financing institution. Though the logistics enterprise may provide financial services such as financing for customers indirectly, due to the qualification and business property, cooperation with the financing institution is needed. In such a case, the symbiosis relation between the logistics enterprise and financing institution lies between the asymmetric reciprocal symbiosis and symmetric reciprocal symbiosis. Eventually, some logistics enterprises and financing institutions realize integration and merger of property rights and start the mixed operation. Thus, the logistics enterprise and financing institution have combined into one, and provide services jointly for target customers. Then the two have formed a symmetric reciprocal symbiosis relation. For instance, UPSC, a foreign company, has realized property right integration.

6. CONCLUSION

In the coordinated development process of supply chain finance business, the logistics enterprise and financing institution get involved into the supply chain operation by providing financial services. With the control of supply chain operation logistics and information flow of logistics enterprises and based on the credit of core enterprises in the supply chain, they provide services for upstream and downstream enterprises such as financing. The logistics enterprises and financing institution build up a symbiosis system and form different symbiosis modes. The two develop the supply chain finance business in a coordinated manner, thus improving the comprehensive service capacity and profitability of the logistics enterprise.

ACKNOWLEDGEMENT

The research is supported by the National Natural Science Foundation of China (71673064) , Social Sciences Planning Project of the Panyu Polytechnic(2016SK007), Humanities and Social Sciences Planning Project of the Ministry of Education (13YJC630240), Soft Science Project of the Science and Technology Program of Guangdong Province (2013B070206058, 2015A070704054), Outstanding Youth Fund Project of Education Department of Guangdong Province (2014WTSCX040), Soft Science Project of the Science and Technology Program of Guangzhou (2014Y430009).

REFERENCES

[1]Wang Jing, Li Yilan, Sun Haiyan. “Current Situation and Prospect of Supply Chain Information Management Research”. *Journal of Management*, vol.2, pp. 235-242, April 2007.

[2]Li Dawu. “Analysis of Reasons of Financing Difficulty of Small and Medium Enterprises and Countermeasure Selection” . Journal of Financial Research, pp. 124-131, October 2001.

[3]Sheng Xin, Chen Gongyu. “Study on Strategic Selection of Supply Chain Finance Business Innovation – From Perspective of Logistics Enterprise Cluster”. Technoeconomics & Management Research, pp. 14-18, November 2015.

[4]Guo Zhanqin. “Financing Mode for Small and Micro Enterprises Based on Supply Chain Finance – The Third-party Leading Logistics Enterprise as the Platform”. Financial Theory and Practice , pp. 77-79, January 2012.

[5]Li Yixue, Wang Shouyang, Feng Gengzhong. “A New Discipline Orientation – A Brief Introduction to Practical Development and Theory of Logistics Finance”. System Engineering Theory and Practice, 2010 (1): 1-13

[6]Wang Zhenzhen, Bao Xinghua. “Study on Current Development Situation of Industrial Symbiosis Theory and Its Application”. East China Economic Management, pp. 131-136, October 2012.

[7]Yuan Chunqing, Symbiosis Theory: Concurrent Discussion of Small Economy. Economic Science Press, Beijing, 1998.

[8]Research Group of Supply Chain Finance, Supply Chain Finance – New Finance under New Economy. Shanghai Far East Publishers, Shanghai, 2008.

The Impact of Action-based Manipulation on Investment Returns in Stock Market

Yang Yu
Capital Normal University, Beijing, China

Abstract: The paper calculates the abnormal returns of 34 companies through the statistical inference method which is suitable for the application of Event-study methodology. Through all the announcement information analysis, four kinds of positive events are selected as the possible manipulation actions. The paper concludes the pulling mode and selling mode of action-based manipulation during the process of event planning, occurring and reacting. This mode can qualitatively determine whether a favorable event belongs to manipulation.
Keywords: stock manipulation; abnormal returns; event-study methodology; action-based manipulation

1. INTRODUCTION

Action-based Manipulation refers to a series of actions taken by the manipulator himself or their conspiracy to cause counter party make wrong investment decision so as to obtain profits. Action-based manipulation relies on planning action and information disclosure as the means of manipulation, so this paper uses Event-study methodology to research action stock price manipulation.

Event-study methodology is an econometric approach to the study of the effects of events on stock return. Event-study methodology method can be effectively applied to the stock price in the market which is based on the rational hypothesis, namely, if the majority of investors in the market are rational, investors will make appropriate investment decisions according to the nature of the event, thus causing the price fluctuation.

This method was first proposed by Dolley (1933) to study the impact of common stock split on nominal price of stock. Later, Ball and Brown (1968) studied the effect of earnings information on asset prices. Fama et al (1969) made an empirical analysis of the influence on the stock split event excluding dividend increase and other factors, making the Event-study methodology method itself tend to be more perfect. A.Craig Mackinlay systematically expounds the application of Event-study methodology in economics and finance.

2.SAMPLE SELECTION AND EVENT DEFINITION

The paper selects the stocks of 34 listed companies punished by China Securities Regulatory Commission because of stock manipulation or accounting profit manipulation since the establishment of Shanghai and Shenzhen Stock Exchange. The stock price data and the composite index of Shanghai and Shenzhen Stock Exchange are provided by Shenyin Wanguo Securities Research Institute Co. Ltd. The manipulation time is verified by China Securities Regulatory Commission. The time of these four types of events is based on the information disclosure for the first time. This paper defines the following four types of events as manipulating events.

A. The event of distribution policy

Distribution policy has always been one of the factors affecting stock prices. Mature stock markets are mainly cash dividends, and companies with good cash dividend returns are sought after by investors. In emerging markets, low-priced stocks have the features of resistance to dropping as well as large rise scope. Therefore, the manipulators prefer to choose the low-priced stock, and they use its effect to take the methods of a large proportion of stock dividend and stock transfer so as to continuously reduce the high-priced stock and utilize the distribution policy to control stock price. Therefore, this paper defines the distribution policy as one of the manipulation events, and it is found that there are 35 major transfer events involving 23 companies in sample studies.

B. The event of asset reorganization

The asset reorganization is the turning point for enterprise's predicament. In fact, many enterprises have undergone a qualitative change because of the reorganization.

Therefore, investors regard asset reorganization as a major positive and make a trading decision. The act itself is rational. Manipulators often use this kind of investment psychology to conspire with the listed companies or directly plan the reorganization event after obtaining the management and control rights, so as to achieve the purpose of manipulation.

According to the current domestic situation, Asset reorganization includes internal and external reorganization. The internal reorganization is the main controlling shareholders and the listed companies have party transactions to remove the non-preforming assets of listed company for replacement of good-quality assets.

Controlling shareholders use high-quality assets to replace non-performing assets, which seems to have got a loss. But its essence is arbitrage. The asset reorganization is usually substantial in order to maintain or regain eligibility for refinancing.

Others are in order to manipulate stock prices, in this case, reorganization is often deceptive, and the profits of listed companies are maintained by fraud. The external reorganization generally includes part of the stock transfer, the fight for controlling stock and the transfer of control. The transfer of control includes the buyout of the controlling right, the merger of the original controlling shareholder with other enterprises or the original controlling shareholder forming a new company with the controlling stake. These major events occurred 24 times in the study sample, involving 12 companies.

C. The event of conceptual investment

Investment diversification is one of the characteristics of China's listed companies. Price manipulation with conceptual or theme investment is one of the common practices in the A-stock market. In the process of A-stock market development for just ten years, there have been many kinds of conceptual investment, which provide material for stock price manipulation.

The manipulators are willing to use all kinds of media to exaggerate the prospect of investment in a certain field, and then throw out the investment plan for the company in a time. In recent years, major conceptual investment themes include network investment, software investment, communications investment, bio engineering investment, financial investment, investment in western development, conceptual investment in universities and so on. In this study, 37 cases of conceptual investment manipulation events are involved in the manipulation sample, involving 14 companies.

D. The manipulation event of accounting profit

Corporate profits and cash flow are the ultimate embodiment of the enterprise value. Investors pay great attention to the growth rate of the company profit. Once the information get disclosure, it will stimulate investors' motivation. the manipulators sometimes deliberately spread false information of profit growth in the form of market, and sometimes they collude with listed companies to manipulate accounting profit. In this study, there are 13 cases of accounting profit manipulation, involving 9 companies.

3.ESTIMATION OF ABNORMAL RETURNS MANIPULATION

In Event-study methodology, the stock price's response to events is measured by abnormal returns. Abnormal return is a very important indicator which refers to the difference between the actual returns after event and normal expected returns without the occurrence of the event.

$$AR_{it} = R_{it} - E(R_{it} / X_t) \tag{1}$$

Among them, AR_{it} , R_{it} , $E(R_{it} / X_t)$ respectively are expected values of abnormal returns, actual returns and normal returns at t of event window. Abnormal return is used to measure the degree of abnormal stock price response to events and approximate estimates of excess profits are manipulated. The actual return is calculated directly through the closing price of the stock transaction price, and the expected value of the normal return is estimated by the regression model of the stock price in the estimation window and the stock market index. Assume the event window as（$T_1 \le t \le T_2$）, estimation window as（$T_0 \le t \le T_1$）Firstly establish the model of returns rate i , the normal returns rate $E(R_{it} / X_t)$ in estimated event window（$T_1 \le t \le T_2$）,

$$R_{it} = \hat{\alpha}_i + \hat{\beta}_i R_{mt} + \varepsilon_{it} \quad (T_0 \le t \le T_1) \tag{2}$$

To use least squares for the estimation of parameters:

$$\begin{cases} \hat{\beta}_i = \dfrac{\sum_{t=T_0}^{T_1}(R_{it} - \overline{R}_i)(R_{mt} - \overline{R}_m)}{\sum_{t=T_0}^{T_1}(R_{mt} - \overline{R}_m)} \\ \overline{\alpha}_i = \overline{R}_i - \overline{R}_m \\ \sigma_{\varepsilon_i}^2 = \dfrac{1}{T_1 - T_0 - 1}\sum_{t=T_0}^{T_1}(R_{it} - \hat{\alpha}_i - \hat{\beta}_i R_{mt})^2 \end{cases} \tag{3}$$

Among them,

$$\overline{R}_i = \frac{1}{T_1 - T_0 + 1}\sum_{t=T_0}^{T_1} R_{it} \tag{4}$$

$$\overline{R}_m = \frac{1}{T_1 - T_0 + 1}\sum_{t=T_0}^{T_1} R_{mt} \tag{5}$$

Then, to calculate the expected value of normal returns rate $E(R_{it} / X_t)$ in event window $(T_1 \le t \le T_2)$:

$$E(R_{it} / X_t) = \hat{\alpha} + \hat{\beta} R_{mt} \quad (T_1 \le t \le T_2) \tag{6}$$

After calculating the abnormal return of individual stock AR_{it} , the abnormal return is obtained by:

$$CAR_i(\tau_1, \tau_2) = \sum_{i=\tau_1}^{\tau_2} AR_{it} \tag{7}$$

The average abnormal return of N stocks is obtained by formula (8)：

$$\overline{CAR}(\tau_1, \tau_2) = \frac{1}{N}\sum_{i=1}^{N} CAR_i(\tau_1, \tau_2) \tag{8}$$

4. TEST OF ACTION-BASED MANIPULATION

If there is no accumulative abnormal return, the variance of the abnormal returns AR_{it} of stock i is:

$$\sigma^2(AR_{it}) = \sigma_{\varepsilon_i}^2 + \frac{\sigma_{\varepsilon_i}^2}{T_1 - T_0 + 1}\left(1 + \frac{(T_1 - T_0 + 1)(R_{mt} - \overline{R}_m)^2}{\sum_{t=T_0}^{T_1}(R_{mt} - \overline{R}_m)^2}\right) \tag{9}$$

The formula (9) reflects that variance of the abnormal returns AR_{it} of stock i consists of two parts. One part comes from the partial interference in formula, the other part is caused by the estimated error of $\hat{\alpha}_i$ and $\hat{\beta}_i$. When the value of $T_1 - T_0 + 1$ is greater, the second item on the right is approximately 0, that is, the error can be neglected. When there is no cumulative abnormal returns, $AR_{it} \sim N(0, \sigma_{\varepsilon_i}^2)$, then $CAR_i(\tau_1, \tau_2) \sim N(0, m\sigma_{\varepsilon_i}^2)$($m = \tau_2 - \tau_1 + 1$), cumulative abnormal returns are independent of each other, so the average cumulative abnormal return follows a normal distribution, namely $\overline{CAR}(\tau_1, \tau_2) \sim N(0, \frac{m}{N^2}\sum_{i=1}^{N}\sigma_{\varepsilon_i}^2)$. In view of the fact that it is impossible to know $\sigma_{\varepsilon_i}^2$, we use the estimated value $\hat{\sigma}_{\varepsilon_i}^2$ to substitute. We mainly consider the stage of lifting and selling during the manipulation of the listed companies, so we use the right hypothesis.

On the basis of the above theoretical analysis, we can construct the hypothesis test and make a statistical analysis of the influence of stock price manipulation on cumulative abnormal returns.

H_0 :Manipulation events have no effect on cumulative abnormal returns. H_1 : Manipulation of events that leads to positive abnormal returns, that is :

H_0 : $CAR_i(\tau_1, \tau_2) = 0$, H_1 : $CAR_i(\tau_1, \tau_2) > 0$

When H_0 is true,

$$P\left\{\frac{CAR_i(\tau_1, \tau_2)}{\sqrt{m}\sigma_{\varepsilon_i}} \geq Z_\alpha\right\} = \alpha$$

Give significant level α ,

$$\left\{\frac{CAR_i(\tau_1, \tau_2)}{\sqrt{m}\sigma_{\varepsilon_i}} \geq Z_\alpha\right\}$$

It is believed that the manipulation of i listed company leads to positive abnormal returns, otherwise, it is assumed that the manipulation of i listed company has no effect on the cumulative abnormal returns.

H_0 : $\overline{CAR}(\tau_1, \tau_2) = 0$, H_1 : $\overline{CAR}(\tau_1, \tau_2) > 0$.

When H_0 is true,

$$P\left\{\frac{N\overline{CAR}(\tau_1, \tau_2)}{\sqrt{m\sum_{i=1}^{N}\sigma_{\varepsilon_i}^2}} \geq Z_\alpha\right\} = \alpha$$

Give significant level α ,

$$\left\{\frac{N\overline{CAR}(\tau_1, \tau_2)}{\sqrt{m\sum_{i=1}^{N}\sigma_{\varepsilon_i}^2}} \geq Z_\alpha\right\}$$

It is believed that the manipulation of listed companies leads to positive abnormal returns, otherwise, it is assumed that the manipulation of listed companies does not have effect on cumulative abnormal returns.

5. TEST RESULT AND ANALYSIS

The analysis of taking the whole manipulation process as an event can help to understand the influence of manipulation on stock price in general, judge and estimate the excess returns generated by manipulation.

This paper selects 34 listed companies punished by China's Securities Regulatory Commission. The event window is the whole manipulation of stock prices, and normal return is estimated in the estimation window.

In order to more accurately reflect the overall relationship between individual stock and the market, the length of estimation window is for two years. Part of the stock has shorter length because of the short listed time.

The empirical analysis of application of event analysis on manipulation shows that action-based manipulation has a significant impact on stock price, with available manipulation obtaining returns at least 26.7%, a maximum of 213%, the average value of 95.24%.

There are 33 stocks rejecting the null hypothesis in 0.1 significant level; there are 25 stocks rejecting the null hypothesis in 0.05 significant level and 12 stocks in 0.01 significant level, with only Guilin Jiqi stock failing to pass the hypothesis test.

Four types of events defined in this paper is mainly positive event, the study found that manipulation planning of positive event has two basic objectives, one is to raise the stock price, the other is to lure other investors to buy in the high prices so as to achieve manipulation returns. The hypothesis test of method of application Event-study methodology on the above four categories eight kinds of situations on the day($m = 61$), the tenth day($m = 71$), the twentieth trading day($m = 81$)shows that manipulation of events has a significant impact on the stock price.

From $\overline{CAR}$ it can be seen that the rate of manipulation returns continues to rise after the manipulation event. The order is profit packaging, conceptual investment, asset reorganization and distribution policy.

After the manipulation event of the stock market, $\overline{CAR}$ declined gradually, which indicates that stock prices begin to fall. Manipulators utilized other investors' better expectations of the company's value

to sell stocks. The statistics also show that, whether it is manipulate events used to raise stock price or to sell stocks, there appeared obvious abnormal returns on the event day, suggesting that these events related to pre planning or insider information.

REFERENCES

[1]Shefrin, Statman. “The disposition to sell winners too early and ride losers too long: Theory and evidence ,” *Journal of Finance*, vol. 40, pp. 777-790, May 1985.

[2]Amihud, Mendelson. “The effect of beta, bid ask spread, residual risk and size on stock returns,” Journal of Finance, vol. 44, pp. 479-486, May 1989.

[3]Brennan, Subrahmanyam. “Market microstructure and asset pricing: On the compensation for illiquidity in stock returns,” Journal of Financial Economics, vol. 41, pp. 441-464, September 1996.

[4]Glosten, Milgrom. “Bid, ask and transaction prices in a specialist market with heterogeneously informed investors,” Journal of Financial Economics, vol. 14, pp. 71-100, September 1985.

[5]Kyle. “Continuous auction and insider trading,” Econometric, vol. 53, pp. 1313-1335, September 1985.

[6]Easley, O’Hara. “Price, trade size, and information in securities market,” Journal of Financial Economics, vol. 19, pp. 69-90, September 1987.

[7]Haugen, N. Baker. “Commonality in the determinants of expected stock returns,” Journal of Financial Economics, vol. 41, pp. 401-439, September 1996.

[8]Datar, Naik, R.Radcliffe. “Liquidity and stock returns: An alternative test,” Journal of financial markets, vol. 1, pp. 203-203, September 1998.

[9]Chordia, A.Subrahmanyam, R.Anshuman. “Trading activity and expected stock return,” Journal of Financial Economics, vol. 59, pp. 3-32, September 2001.

[10]Amihud. “Illiquidity and stock returns: Cross section and time series effects,” Journal of Financial Markets, vol. 5, pp. 31-56, September 2002.

[11]A. Marathe, H.A.Shawky, “Liquidity and stock returns in emerging equity markets,” Emerging Markets Review, vol. 4, pp. 1-24, September 2003.

Design and Analysis of Improved Hash-based RFID Lightweight Mutual Authentication Protocol

Xiaochun Chen[1,], Yali Shao[1], Yanfang He[1], Zhangbing Li[2]*
[1]Guangdong Polytechnic College, Zhaoqing, 526100, China
[2]Key Lab of Knowledge Processing and Networked Manufacturing, Hunan University of Science and Technology, Xiangtan, Hunan 411201, China

Abstract: Since the existing radio frequency identification (RFID) mutual authentication protocols encounter the challenges such as security risks, an improved Hash-based lightweight mutual authentication protocol is put forward. The proposed protocol exploits one-way Hash function, of the transmitted message and updating dynamic shared key, better overcome the security risks of RFID. In this protocol, database takes on numerous computations, while tag only executes simple XOR, JION and Hash operations. Through BAN logic formal security proof, security performance analysis, efficiency analysis, this protocol can make up for the denial of service attack, updating key and de-synchronization, which are exist in the same kind of RFID. Therefore, the proposed protocol suits large-scale and low-cost radio frequency identification (RFID) system.
Keywords: radio frequency identification (RFID), security risks, authentication protocols, BAN logic, Hash function, dynamic shared key

1. INTRODUCTION

Radio frequency identification (RFID) is increasingly attached importance to recently in industry and academy. As to the standard of RFID, the ISO is under standardized activities to define security extension of EPC global Generation-2 UHF air interface protocol, which applies to RFID secure communication. [1] Armed with its unique advantages, RFID plays an important role in such fields of Internet of things as industrial automation, logistics, retail, medical treatment, transportation and others. Being a wireless communication technology, without RFID system and contacting with target requiring identification, RFID is non-contact automatic identification. [14] RFID system is composed of database, reader and tag. Information is often transmitted by wired media between database and reader, which is called backward transmission; while the wireless transmission between reader and tag is named forward transmission .[2] Compared with traditional bar code, RFID is widely used in many fields because of its merits of overcoming serve environment and distance. However, the mutual authentication protocol of RFID contained security risks that attacks on mutual authentication protocol are only relay operation between legitimate reader and legitimate tag. Leakage of information will expose personal privacy in consumption habit, individual whereabouts and trade secret. To date, there is no international standardized protocol being used in RFID system. Therefore, research on the security of authentication protocol technology is of great significance and practical value.

Scholars from home and abroad have studied on the application and security of RFID authentication protocol.[6,15-17] For example, Hash-lock protocol, proposed by Sarma et al. [3] in 2003 that tag's identification is transmitted in consistent plain-text over the channel. So it is susceptible to traceability attacks, masquerader attacks, replay attacks and distinguishable attacks. In 2004, Weis et al. [4] proposed the random Hash-Lock protocol that reader send query authentication protocol to tag and tag generate random number after receiving request message. Therefore, the tag is undistinguishable. However the real ID in tag is still transmitted in plain-text, so the masquerader attacks, traceability attacks, replay attacks still exist. What's more, among every authentication, database send all the IDs to reader and the amount of information between them is huge. In 2008, Yuan Shuguang [11] proposed improved Hash-Lock protocol, which overcome apparent drawback yet it is incapable of changing secret key. In 2010, Ohkubo [5] proposed Hash-Chain protocol, which can better resist traceability attack, but it is one-way authentication and is vulnerable to masquerader attack and retransmission attack. What's more, this protocol requires two hash functions, which increases the cost of tag. For example, Reference [6] proposed a new pseudo-Kasami code to encrypt and KMAP protocol, which avoids unbalanced logic operation and requires low communication cost and less computational operations, however the KMAP protocol does not have the only one-way encryption to ensure the confidentiality of transmitted data. Reference [7] presented a new RFID based on ECC, which ECDH key agreement protocol to create temporary shared key to encrypt the message that will be send later. The RFID protocol based on ECC performs well in

time complexity, but not well in resisting denial of service attack. The schemes in this Reference[18] are respectively scrutinized, revealing their vulnerability to dsynchronizing, traceability and full disclosure attacks. These improved protocols, more or less have some security vulnerabilities, although they are capable of overcoming apparent flaws, there are lots of potential security risks and disadvantages, such as, imperfect resistance against attacks, huge amount of computation and ineffectiveness. Therefore, the paper introduced lightweight RFID mutual authentication protocol based on Hash function and methods to update dynamic key, and it can also overcome the above-mentioned flaws through theoretical analysis and use BAN logic to prove its security. [8]

2. IMPROVED MUTUAL AUTHENTICATION PROTOCOL

The introduced protocol exploits query-response mechanism. Initially, the secret information K shared by tag and database, related symbols and explanation are presented as Table 1. The specification of protocol is shown in Figure 1. The working details of the protocol are as follows:

Table 1 Symbol Parameters

Symbols	Explanation
$\oplus$	XOR operation
$\|$	Join operation
ID	Unique identifier
H()	Symbolizes Hash function
Rr	Random number produced by reader
Rt	Random number produced by tag
K	Initially shared key
Kold	Secret key by identified successfully last time
Knew	Secret key by identified after being updated

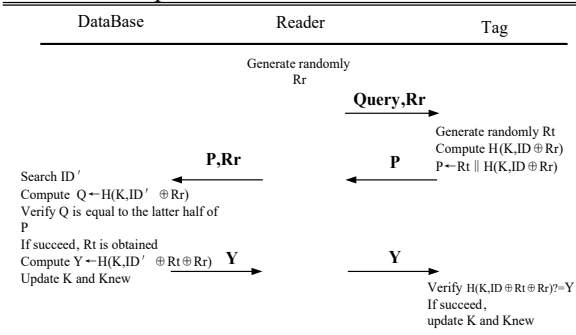


Figure 1 Proposed Protocol

--First, The reader creates a random number Rr as Query authentication requirement to tag.

--Second, After receiving message from reader, the tag generates a random number Rt, and calculates H(K,ID⊕Rr), sends Rt‖H(K,ID⊕Rr) to reader as response message.

--Third, The reader sends Rt‖H(K,ID⊕Rr) coming from tag and its random Rr to database. Among (ID1,ID2,……IDn),database finds and computes H(K,ID'⊕Rr) to see whether its value is equal to received H(K,ID⊕Rr). For hash function and shared key been known, so database computes the random number generated by tag, therefore the protocol avoids transmitting plaintext over the insecurity channel. If the database find that ID' meet the value of H(K,ID⊕Rr) and that prove the tag is legitimate. After that, database updates the shared key, Knew= H(K⊕Rr⊕Rt) and obtains the random number Rr, computing H(K,ID'⊕Rr⊕Rt) and sending the value to reader. If it doesn't exist the case that ID' meets the value, the tag is illegal, so the protocol end.

--Fourth, Reader sends H(K,ID'⊕Rr⊕Rt) which comes from database to tag.

--Fifth, After receiving message, tag begins to compute whether H(K,ID⊕Rr⊕Rt) equals the value of H(K,ID'⊕Rr⊕Rt) that has been received. If they are equal to each other, the authentication succeeds, otherwise not.

3. SECURITY PROOF OF PROTOCOL

BAN logic, discussing security of protocol in an abstract way, is a kind of inference rule used to usual formal analysis and certification.[9] The BAN logic has been used to analyze to variation of the state of subject belief until the end of protocol.

3.1 BAN LOGICAL NOTATION

In the paper, we use the following symbols.

P believes X: P believes as if X is true.

P sees X: P has received a message containing X.

P said X: P believed X and sent it as a part of a message.

P controls X: P has authority over X.

Fresh(X): X is fresh. X has not been sent in a message before the current run of the protocol.

$P \xleftrightarrow{K} Q$:K is the key shared by P and Q. The key is good and will always be known only to P and Q and to any other principal trusted by either of them.

$\langle X \rangle_Y$: Message synthesized by X and secret Y.

$\{X\}_K$: The cipher text of X encrypted by the key K.

3.2 INFERENCE RULES OF BAN LOGIC

BAN logic consists of seven categories which can be divided into 19 logic rues. The inference rules used in the paper are as follows:

Message-meaning rules: The following rule formalizes one of the major semantically principles of BAN logic; for instance, if Jack believes that Jack and Lily knows a public key K, and Jack should to believe that any message Jack receives enciphered with the key K comes from Lily. Jack draws a conclusion that it was produced by Lily and Lily has said it.

$$\frac{P \text{ believes } Q \xleftrightarrow{K} P,\ P \text{ sees } \{X\}_K}{P \text{ believes } Q \text{ said } X} \quad (1)$$

Nonce-verification rule: The following rule conveys the examination that a declaration is recent, therefore, the sender believes in it. If P believes that X is fresh

and Q has said X , hence that P believes that Q believes X.

$$\frac{\text{P believes fresh(X), P believes Q said X}}{\text{P believes Q believes X}} \quad (2)$$

Jurisdiction rule: The following rule expresses that if P believes that X is under the jurisdiction of Q then P believes Q on the truth of X:

$$\frac{\text{P believes Q controls (X), P believes Q believes X}}{\text{P believes X}} \quad (3)$$

Freshness rule: The following rule is significant in expressing the conception of timeliness used as the pivotal principle of authentication. If P believes X is fresh, hence that P believes any message containing X is fresh.

$$\frac{\text{P believes fresh(X)}}{\text{P believes fresh(X,Y)}} \quad (4)$$

3.3 BASIC MODEL

In the process of establishment if idealized model, the transmitted plaintext message has nothing to do with security[10][13]. Regarding database and reader as a subject R, tag as subject T, K in the protocol as initial shared dynamic key, is to finish mutual authentication.

Idealized Model of Protocol:

$T \to R : Rt \,||\, H(K, ID \oplus Rr)$

* MERGEFORMAT (M1)

$R \to T : H(K, ID' \oplus Rr \oplus Rt)$

* MERGEFORMAT (M2)

The abovementioned idealized model can be transformed into BAN logic idealized model, which are presented as follows:

R sees $\mathrm{Rt}, \{ID, \mathrm{Rr}\}_K$ * MERGEFORMAT (M3)

T *sees* $\{ID, Rt', Rr\}_K$ * MERGEFORMAT (M4)

3.4 SECURITY GOALS OF PROTOCOL:

Reader passes judgment on the legitimacy of tag via tag's ID. Tag's authentication on reader is based on the reader's capability to compute the random number Rt of tag through message sent by tag. Therefore, security goals of protocol can be defined as follows:

R believes ID * MERGEFORMAT (O1)

T *believes* Rt' * MERGEFORMAT (O2)

3.5 INITIAL ASSUMPTION OF PROTOCOL

* MERGEFORMAT A1: R *believes* $R \overset{K}{\longleftrightarrow} T$

* MERGEFORMAT A2: T *believes* $R \overset{K}{\longleftrightarrow} T$

* MERGEFORMAT A3: R *believes* T *controls* ID

* MERGEFORMAT A4:

T *believes* R *controls* Rt'

* MERGEFORMAT A5: R *believes fresh*(Rr)

* MERGEFORMAT A6 T *believes fresh*(Rr)

3.6 IINFERENCE PROOF OF PROTOCOL

Authentication: Goal O1.

We can draw a conclusion from rule R1, initial assumption A1 and idealized model M3:

$$\frac{R \text{ believes } R \overset{K}{\longleftrightarrow} T,\ R \text{ sees } \{ID, Rr\}_K}{R \text{ believes } T \text{ said } \{ID, Rr\}}$$

Namely,

R believes T said $\{ID, Rr\}$ * MERGEFORMAT (0)

We can draw a conclusion from rule R11, initial assumption A5:

$$\frac{R \text{ believes fresh}(Rr)}{R \text{ believes fresh} \{ID, Rr\}}$$

Namely,

R *believes fresh*(ID) * MERGEFORMAT (0)

We can draw a conclusion from rule R4, the above-mentioned part (1), (2):

$$\frac{R \text{ believes fresh}(ID),\ R \text{ believes } T \text{ said } (ID)}{R \text{ believes } T \text{ believes } (ID)}$$

Namely,

R *believes* T *believes* (ID) * MERGEFORMAT (0)

We can draw a conclusion from rule R5, the above-mentioned part (3) and initial assumption A3:

$$\frac{R \text{ believes } T \text{ controls } ID,\ R \text{ believes } T \text{ believes } ID}{R \text{ believes } ID}$$

Namely,

R *believes* ID * MERGEFORMAT (0)

So far, we have finished proving target O1.

Now we begin to prove target O2.

We can draw a conclusion from rule R1, initial assumption A2 and idealized model M4:

$$\frac{T \text{ believes } R \overset{K}{\longleftrightarrow} T,\ T \text{ sees } \{ID,\ Rt',\ Rr\}_K}{T \text{ believes } R \text{ said } \{ID,\ Rt',\ Rr\}}$$

Namely,

T *believes* R *said* $\{ID, Rr, Rt'\}$ * MERGEFORMAT (0)

We can draw a conclusion from rule R11, initial assumption A6:

$$\frac{T \text{ believes fresh}(Rr)}{T \text{ believes fresh} \{ID, Rr, Rt'\}}$$

Namely,

T *believes fresh*(Rt') * MERGEFORMAT (0)

We can draw a conclusion from rule R4, the above-mentioned part (5), (6):

$$\frac{T \text{ believes fresh}(Rt'),\ T \text{ believes } R \text{ said } (Rt')}{T \text{ believes } R \text{ believes } (Rt')}$$

Namely,

T *believes* R *believes* (Rt') * MERGEFORMAT (0)

We can draw a conclusion from rule R5, the above-mentioned part (6) and initial assumption A4:

$$\frac{T \text{ believes } R \text{ controls } Rt',\ \text{believes } T \text{ believes } Rt'}{T \text{ believes } Rt'}$$

Namely,

T *believes* Rt' * MERGEFORMAT (0)

So far, we have finished proving target O2.

The analysis process of the improved protocol, we can infer that R believes ID and T *believes* Rt'. To sum up, improved protocol is safe.

4. SECURITY ANALYSIS

1) Confidentiality

In this protocol, among the transmitted data between tag and reader, only random number *Rr* created by reader is plaintext, the rest of which are value of number containing Hash operation. One-way Hash function cannot deduce the original data from the result, which means that there is no point in getting *Rr.* Hence, this protocol possesses a good confidentiality.

2)Traceability

If the adversary eavesdrops messages that have a successful authentication, he could also get the random number *Rr* and Query sent by reader, *Rt‖H(K,ID ⊕Rr)* sent by tag and *H(K,ID' ⊕Rr ⊕Rt)* sent by reader again. Then he could get the message of *Rr2* and Query2 sent by reader, *Rt2‖H(K2,ID2 ⊕Rr2)* sent by tag and *H(K2,ID2' ⊕Rr2 ⊕Rt2)* sent by reader again. Due to different random number and updated dynamic key, different message transmitted every time can effectively avoid traceability attack.

3)Anonymous and undistinguishable tag

During the process of transmitting protocol, all the *ID* of tag have been through XOR operation before transmitting via Hash encryption operation that are *Rt‖H(K,ID ⊕Rr) and H(K,ID' ⊕Rr ⊕Rt),* however, adversary could not get tag's *ID*, so the anonymity of tag can be guaranteed. After every successful authentication, tag and database will update dynamic key. As for the query from reader every time, both use now random number and key, and tag responds differently. Even adversary obtains a number of output of tag, he does not have capability to pass judgment on which output is tag's. Therefore, tag is undistinguishable.

4)Forward security

Although adversary obtains the response message *Rt‖H(K,ID ⊕Rr)* from tag, owning to one-way Hash function, he cannot get message of tag, which turns out to be the protocol's forward security.

5)Replay attack

Attacker conducts the following operation: After reader sending authentication Query, attackers eavesdrop *Rt‖H(K,ID ⊕Rr)* sent by tag, as the reader sends authentication Query again, tag sends the data that has been intercepted last time to reader. Obviously, these data could not pass the authentication. Since every time the random numbers sent by reader are different, the protocol can resist replay attack.

6)Replay attack

Attacker conducts the following operation: After reader sending authentication Query, attackers eavesdrop *Rt‖H(K,ID ⊕Rr)* sent by tag, as the reader sends authentication Query again, tag sends the data that has been intercepted last time to reader. Obviously, these data could not pass the authentication. Since every time the random numbers sent by reader are different, the protocol can resist replay attack.

7)Deceive attack

Attacker disguises as legal reader to send Query, *Rr'* to tag, and tag responds Query, outputting *Rt‖H(K,ID ⊕Rr).* When legal reader sends authentication query, attacker sends tag's response to deceive reader. However, since reader would generate random number *Rr,* during every authentication, *Rt‖H(K,ID ⊕Rr') ≠Rt‖H(K,ID ⊕Rr)*, attacker cannot produce right response of tag.

8)Anti-eavesdropping and anti-forgery

The data transmitted over wireless channel are meaningless random numbers or value of encrypted Hash function. As for attacker, these data are valueless. Therefore, eavesdropping useful content of communication does not exist. Any illegal attacker cannot attack mutual authentication in this protocol.

9)Denial of service attack

Attacker sends a large amount of service request to reader, but the reader queries before authentication, stores the last key that has passed legitimate authentication. Therefore, there is only one datum passing the query and authentication, which could prevent tag from sending lots of responding messages and prevent reader from denying service.

10)DE-synchronization attacks

After finishing authentication of tag, database will update dynamic key but also keep the previous key to avoid in-conformity caused by tag not finishing the authentication of database. Therefore, when tag sends responding message, database uses the current key to conduct authentication first, if authentication does not pass, database exploits the last key to make authentication, or there will be DE-synchronization attack, otherwise, the tag is illegal.

The above mentioned security analysis show us that compared with similar RFID authentication protocol, this improved RFID mutual authentication protocol shows us that its safety performance in the following Tab.2.√ expresses that the protocol possess such safety performance, × expresses that the protocol does not possess such safety performance, ※ expresses that the protocol partly meets such safety performance.

Table 2 Security analysis of protocols

Protocol	Hash-Lock protocol	Random Hash-Lock protocol	Reference [11]	Reference [12]	Reference [13]	Our scheme
Trace-ability	×	×	√	√	√	√

Indistinguishable	×	√	√	√	√	√
Forward security	√	√	√	√	√	√
Replay attack	×	×	√	√	√	√
Deceive attack	×	×	√	√	√	√
Denial of service	×	×	×	×	√	√
DE-synchronization attacks	×	×	×	※	×	√
update dynamic key	×	×	×	×	√	√

5.EFFICIENCY ANALYSIS OF THE PROTOCOL

This paper analyzes efficiency analysis of the protocol from calculated quantity, (memory space) storage capacity and conversational times. Based on the authentication protocol of Hash function, tag and database both have to conduct Hash operation, store shared key. Hash operation's times and memory space of data exert great impact on the efficiency of protocol, meanwhile, the memory space and operation amount will influence tag's cost. If H represents encryption operation of Hash function, R representing random number generator, M represents logic operation, S representing the value of Hash function, L representing the length of *K, ID, Rr, Rt* and S. The tag in this protocol only stores *ID* and shared key, which enormously lower tag's cost. The database stores shared key *K*, all *IDs* and old key. As for every authentication, (∑ID/2)+1 times Hash operation is needed. Hence, this protocol requires a bit amount of operation and fits application that needs low calculated amount.

Table 3 Performance comparison of various protocols

	Memory space		Calculation			Number of sessions
	Tag	Database	Tag	Reader	Database	
Hash-Lock	2L	4L	1H	—	—	4
Random Hash-Lock	1L	1L	1H+1R	(∑ID/2)H	—	3
Reference [11]	3L	2L	3H	1R	((∑ID/2)+1）H	3
Reference [12]	3L	3L	1H	1R	2H	3
Reference [13]	3L	4L	3H+1R+1M	3H+1R	5H+1R+1M	3
Our protocol	3L	3L	2H+1R+1M	1R	(∑ID/2)H +2M	3

From Tab.3, we can see that compared with Reference [11], Reference [12] and Reference [13],the memory space of tag does not change and there is little difference in memory space of database .However, Reference [11], Reference [12] and Reference [13],exist some security flaw. Compared with Reference [13],this protocol is less in calculated amount and could resist synchronization attack; compared with Reference [11] and Reference [12] ,the calculated amount of tag in this protocol is much more . Reference [11] and Reference [12] , their less calculated amount is at the cost security. Nevertheless, the first thing for RFID authentication protocol to be guaranteed is security. Only satisfy security, can other value be found .As for calculated amount of database, the calculated amount of this protocol might be less among other protocols containing relatively improved security, and adds execution efficiency. In the aspect of number of sessions, other protocols are all three times except that random Hash lock requires four times session. Therefore, the improved protocol of this paper embodies better security performance and effective execution efficiency, and fits low-cost, low calculated amount RFID system.

6. CONLUSION

This paper proposes an improved mutual authentication protocol which is based on Hash function and dynamic key, supporting transfer of transfer of ownership of tag and fitting low-cost via analyzing flaws of RFID authentication protocol based on the present Hash function. Such mutual authentication protocol can effectively resist synchronization attack, denial of service attack, man-in-the-middle attack and other attacks, covering the shortage of protocols of the same kind.

On the basis of satisfying security, compared with other protocols has achieved the goal of low-cost and less calculated amount, and has passed BAN logic to prove the security of this protocol. Hence, the new improved protocol has higher practical value. Nevertheless, the optimization of memory space and calculated amount, how to improve retrieval efficiency of database, anti-collision in multi-tag authentication are the problems that will be resolved in the future.

ACKNOWLEDGMENTS

This research is supported by Natural Science Foundation (NSF) of Hunan Province of China, under grant number: 2017JJ2100.

REFERENCES

[1] You Sung Kang, Elizabeth O'Sullivan, Dooho Choi, Maire O'Neill, Security Analysis on RFID Mutual Authentication Protocol, International Workshop on Information Security Applications, 2015,9530:65-74.

[2] ZHOU Yong-Bin, FENG Deng-Guo, "Design and Analysis of Cryptographic Protocols for RFID," CHINESE JOURNAL OF COMPUTERS,2006,29(4):581-589.

[3] Sanjay E. Sarma, Stephen A. Weis, Daniel W. Engels, I. Radio-Frequency Identification: Security Risks and Challenges, CryptoBytes, 2003,6(1):93-98.

[4] Stephen A. Weis, Sanjay E. Sarma, Ronald L. Rivest, Daniel W. Engels, Security and Privacy Aspects of Low-Cost Radio Frequency Identification Systems, Lecture Notes in Computer Science, 2003,2802:201-212.

[5] Miyako Ohkubo, K.outarou Suzuki, Shingo Kinoshita, K (2004) Hash-chain based forward-secure privacy protection scheme for low-cost RFID. Symposium on Cryptography and Information Security, 2010.

[6] Umar Mujahid, Muhammad Najam-ul-Islam, Dr Shahzad Sarwar, A New Ultralightweight RFID Authentication Protocol for Passive Low Cost Tags: KMAP, Wireless Personal Communications, 2016,1-20.

[7] Amjad Ali Alamr, Firdous Kausar, Firdous Kausar, Changho Seo, A secure ECC-based RFID mutual authentication protocol for internet of things, The Journal of Supercomputing, 2016,1-14.

[8] Jinghua Wen, Mei Zhang, Xiang Li, The study on the application of BAN logic in formal analysis of authentication protocols, International Conference on Electronic Commerce,2005,277(6):744-747.

[9] WANG Guowei, JIA Zongpu, PENG Weiping, Improved RFID authentication protocol without severless database, Journal of Henan Polytechnic University(Natural Science), 2016,35(3):408-413.

[10] LI Huixian, Design and analysis of the light-weight mutual authentication protocol for RFID, Journal of Xidian University(Natural Science),2013,42(3):425-430.

[11] YUAN Shu-guang, DAI Hong-yue, LAI Sheng-li, "Hash-based RFID Authentication Protocol," COMPUTER ENGINEERING, vol. 34, no. 12, pp. 141-143, Jun. 2008,

[12] ZHU Hongyan, XIE Xiaoyao, WU Jingchun, "Improved secure Hash-based RFID authentication protocol," Journal of Yangtze University (Natural Science Edition),2016,13(13):39-43.

[13] TAO Yuan, ZHOU Xi, MA Yupeng, ZHAO Fan, Mobile mutual authentication protocol based on Hash function, Journal of Computer Applications, 2016,36(3):657-660.

[14] Stephen A. Weis,Sanjay E. Sarma,Ronald L. Rivest,Daniel W. Engels, Security and Privacy Aspects of Low-Cost Radio Frequency Identification Systems, Lecture Notes in Computer Science, 2004,2802:201-212.

[15] Seyed Mohammad Alavi,Karim Baghery,Behzad Abdolmaleki,Mohammad Reza Aref, Traceability Analysis of Recent RFID Authentication Protocols, Wireless Personal Communications, 2015,83(3):1663-1682.

[16] Masoud Hadian Dehkordi,Yousof Farzaneh, Improvement of the Hash-Based RFID Mutual Authentication Protocol, Wireless Personal Communications, 2013,75(1):219-223.

[17] Minghui Wang; Junhua Pan, RFID authentication protocol design via BAN logic, Journal of Chemical and Pharmaceutical Research, 2014,6(7):708-717.

[18] Umar Mujahid,M. Najam-Ul-Islam,M. Ali Shami, RCIA: A New Ultralightweight RFID AuthenticationProtocol Using Recursive Hash, International Journal of Distributed Sensor Networks, 2015,2015(3):1-8.

Development Tendency and Countermeasures of College Football Teaching

*Feng Li, Lu Liu**
Institute of Physical Education, Huanggang Normal University, Huanggang 438000, Hubei, China

Abstract: This article analyzes the football lessons in Chinese physical education teaching reform, and whether to add football course syllabus for some schools were analyzed, which found that most of China's school has joined the football teaching, this shows that Chinese football has gained the attention of the school; By visiting the relevant scholars, teachers, school leaders, analysis of data: the development of Chinese football teaching in the teachers lack, lack of state funding, it will be very bad for the development of Chinese football. By establishing the mathematical model of grey correlation degree, the demand for Chinese adolescents tend to be analyzed, and put forward: Chinese youth tend to watch the football match, and lack of interest in technology and tactics of study. This paper provides theoretical guarantee for the development of Chinese football, and puts forward relevant effective opinions.
Keywords: Youth football; Grey correlation method; Education mode

1. INTRODUCTION

With world cup ending, it has set off a tide that youth loves football again, and increased their interesting in football teaching, below are research results of Chinese scholars in the aspect. Shi Yue-Feng in the article " Universities football teaching self-organization efficacy study", carried out questionnaire survey on Chinese main cities universities football teaching, and through acquiring questionnaire, handling with data, and then got: in Chinese universities, football popularization rate was still not so high, because students could contact with football only in physical education course, and understanding football, grasping techniques were just a little, which hindered Chinese football development among the people. The paper provided feasible, practical precious opinions for Chinese football development.

The paper makes comprehensive analysis of China each stage school statuses in football teaching aspect, and makes specific prediction on Chinese football future development.

2.FUZZY COMPREHENSIVE EVALUATION METHOD CHINESE FOOTBALL EDUCATION MODE

2.1 Define evaluation indicator set

By consulting literature and relative internet data, it can get football education mode can be concluded into following six types: technical instructed type, theory teaching type, technical guiding type, method explaining type, attacking method type, formation compiling type. According to:

$$U=\{u_1,u_2,\cdots,u_m\},m=1,2,3,\cdots,6$$

Evaluation indicator set is ={technical instructed type, theory teaching type, technical guiding type, method explaining type, attacking method type, formation compiling type }.

2.2 Define evaluation grade set

When studying Chinese football teaching mode, utilize expert evaluation method to define evaluation grade set. According to:

$$V=\{v_1,v_2,\cdots,v_n\},n=1,2,3,4$$

Football teaching mode evaluation grade set is ={Very good, good, general, bad}.

2.3 Define each evaluation indicator weight

Weight main expression method is:

$$w=\{\mu_1,\mu_2,\cdots,\mu_m\},m=1,2,\cdots,6$$

$$\sum_{m=1}^{6}\mu_m=1$$

Among them:

Define evaluation indicator weight method mainly has analytic hierarchy process and normalization method, from which normalization method is as following:

$$w_i=\frac{\frac{C_i}{\overline{S_i}}}{\sum_{i=1}^{n}\frac{C_i}{\overline{S_i}}},(i=1,2,\cdots,m)$$

Among them, w_i is evaluation parameter i monitoring value; $\overline{S_i}$ is evaluation parameter i grade m criterion arithmetic average value , then weight set is: $w=\{w_1,w_2,\cdots,w_m\}$

Here, apply normalization method to carry on weight calculation, football teaching mode evaluation indicator weight is: $w=\{0.04, 0.20, 0.25, 0.30, 0.15, 0.06\}$

3.COMPREHENSIVE ANALYSIS METHOD CHINESE FOOTBALL EDUCATION BASIC INFORMATION

3.1 Chinese football education status

Make specific research on Chinese football education status, by interviewing each region main schools and studying, and analyze whether listing football into syllabus or not.

Table 1 Chinese football listed into syllabus

	Listed into syllabus of physical education	Didn't list into syllabus of physical education	Total
Frequency number	10	5	15
Percentage%	66.7%	33.3%	100%

Table 1 makes research and analysis of Chinese middle students syllabus has football teaching or not, points out that in all investigated schools, the schools that list football teaching into syllabus of physical education account for 66.7%, which is relative satisfying results that China carries out sports teaching reformation in recent years.

Because under the leadership of central party, China further reflects that education system reformation should grasp and harden with two hands in both knowledge and quality, let the policies of middle school student's physical quality to be skilled enough, knowledge storage to be firm and then let China vigorously relieve burden of contemporary middle school students, let their burden to alleviate, and then provide Chinese national physical quality.

Table 2 Football course formation status

	Regulated	Didn't regulate	Will regulate	Total amount
Frequency number	3	7	10	20
Percentage%	15%	35%	50%	100%

according to above Table 2, study on whether listing Chinese football into syllabus of physical education or not, football course regulation status, get that football teaching has already attracted national attention, and there are lots of schools regulate football teaching courses, which provides base for Chinese football development in the youth.

And Table 2 studies Chinese football course regulation status, points out; in acknowledged 20 universities, 3 schools that proportions account for 15% of total amount, which regulate football courses, and receive good effects, and are approved by teachers and classmates, which not only let senior high school stage of most tired in life to be well relaxed, and also strengthen their learning interests.

3.2 Chinese football education goal and evaluation

To let the paper to be more convincing, the paper according to interview and investigate, analyze Chinese football education goal, and get following Table 3:

Table 3 Different evaluation on Chinese football education

	Football technology	Football tactics	Rules of the contest	Teaching the game	Enjoy football
Strong desire	28	20	39	17	24
Have the desire	64	46	66	69	73
It doesn't matter	12	24	34	15	23
Don't need	8	10	6	23	12

In Table 4 and bar figure 1, with regard to China implemented education system reformation, add football teaching evaluation and analysis in Chinese sports teaching, in this investigation, lots of experts and middle school students that accept and support Chinese physical education teaching football reformation, their amount of people are more, in which most of them think it should add football appreciation course, the part of people accounts for over half of the total amount of people, they think football appreciation will let audience to feel presence of football matches, especially for watching world cup one session every four years, which will let people to arouse strong emotion; while approval of explaining football matches rules in football course is next to it, understand football match competition rules provide technical support for people well watching games.

Table 4 Teachers and students teaching main evaluation contents

	Qualified performance	Attendance status	Progress range	Learning attitude	Spirit of collaboration
Frequency number	13	18	27	23	12
Percentage%	13.8%	19.1%	28.8%	25.5%	12.8%
Frequency number	170	150	305	215	76
Percentage%	18.6%	16.4%	33.4%	23.5%	8.1%

By above analysis, it gets that Chinese football teaching education goal mainly is propelling to physical and psychological health, and it is hard to arrive at the purpose of football techniques; in

education, most of students prefer to appreciating football matches; and understanding on football techniques, rules are relative little.

3.3 Chinese football teaching reformation status

For Chinese football education reformation efficiency, the paper studies school leading and teacher's reformation status and supporting rate, and summarize following Table 5.

Table 5 Leaders and teachers supporting rates in football reformation

	Very support	Support	Relative support	Neutral	Don't support	Quite not support
Frequency number	23	59	18	18	0	0
Percentage%	20.1%	57.3%	16.1%	6.1%	0	0

By above Table 5 analysis, it gets that leaders a teachers are mostly showing supports to Chinese football teaching reformation, but only 20% people show very support, which indicates Chinese football teaching still needs to make reformation, only then can let more people to more support physical education teaching.

3.4 Chinese teachers and student's recognition extent

The paper studies on Chinese football teachers' types, student's engagement in football status in one week, and in order to easy to readers to read and compare, it gets following Table 6:

Table 6 Students weekly engage in football extracurricular activities time

	Less than 30 minutes	30-60 minutes	60-90 minutes	Above 90 minutes
Number of people	613	142	81	80
Percentage%	66.9%	15.5%	8.9%	8.7%

Table 6 is statistical table of duration that Chinese youth including primary school, junior high school, senior high school students engage in football extra-curricular activities per week, in the part, it still has 613 youth that accounts for 66.9% of total informant amount, their duration per week that engages in football extra-curricular activities is less than 30 minutes.

In investigation, the part of middle school students put all their leisure time on video games, mobile phone chatting, extracurricular reading and other aspects, which set up a hidden danger for their health; and only 81 people that 8.9% youth engage in football activities duration as 60-90 minutes are still little, which still cannot meet Chinese youth physical quality demands.

Table 7 Statistical table of physical education teacher's opinions on necessity of organizing football course

	Very necessary	Necessary	General	Don't need	Total
Frequency number	107	48	20	0	175
Percentage%	61.2%	27.4%	11.4%	0	100

Table 7 is Chinese physical education teachers to China developing physical education course necessity evaluation statistical conditions, and then find from the table that among Chinese physical education teachers investigation study, 107 teachers think it should add football course into physical education syllabus that accounts for 61.2% of total informants 175 people.

Some teachers think Chinese youth physical health is relative weak, heavy learning life will let their physical and psychological to be damaged, therefore these teachers quite support Chinese football reformation schemes, which provides talents guarantee for Chinese football development.

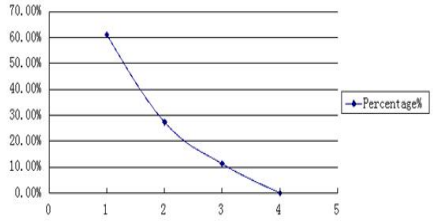


Figure 2 Support for the football reform leadership and teachers

By analyzing Figure 2, it gets that among Chinese faculty, professionals are little, and students weekly football exercise duration is also little, most of students mainly watch matches at ordinary times; teachers are quite support teaching reformation and think it improves Chinese traditional education way.

4.GREY RELATIONAL DEGREE METHOD -BASED CHINESE FOOTBALL COURSE TREND

Chinese students have different trends in football learning, their satisfaction is different. With respect to this, utilize grey relational degree method to establish youth to football course trend to study, which provides precious reference significance in China future physical education teaching reformation.

4.1 Grey relational degree guiding thought

The purpose of grey relational degree analysis is on the basis of system overall development change, if system change and factor change trend are consistent, then the two relational degree is larger; if system change and factor change trend are inconsistent, or exist certain differences, then the two relational degree are small.

4.2 Data processing

Data processing is carrying on artificial analysis of collected data, by some cooperators comprehensive opinions, and then processing obtained data, such method is easier to find relations among data and some cases mutual connections and features, in China, "Chinese education comprehensive statistical yearbook" is most authoritative data source under contemporary environment, therefore through

consulting below Table 8 originated from "Chinese education comprehensive statistical yearbook", general administration of sport of China and relative literature consulted data, it draws following statistical table:

Table 8 Data statistical table

Course content	Football technology	Football rules	Football knowledge	Body building	Football match	Body building	Pass time	Tactics	Coordinate	Cooperation	Others
Percentage%	12.8	12.1	11.6	7.8	20.7	10.2	10.4	7.4	4.2	2.2	1.6
Popularity	15	14	16	14	14	14	13	12	12	10	13
Basic value	4	5	3	4	4	3	5	3	3	3	4
Satisfaction%	10.3	12.9	14.2	11.1	10.9	11.3	11.2	5.2	2.7	2.9	7.0

From above table, it can get conclusions that Chinese youth demands on learning football are different, from which relational degrees on football technology, body building, football rules and watching football match are larger, and youth more focuses on football matches, and its relational degree in these research objects are the largest that is above 1.15.

It shows when Chinese youth engages in football course, they have respective trends, on a whole, youth tends to football technology and football rules grasping status, these youth idols are football masters sportsmen like Beckham、Messi, youth grasping status on football technology and rules provide technical guarantee for their future football development, and meanwhile reserves enough reserve talents for Chinese football, which conforms to contemporary Chinese national conditions of reinvigorating China through talents.

5. CONCLUSION

At first, the paper firstly analyzes Chinese physical education teaching football course status, gets that Chinese football teaching basically has listed into syllabus, and carries out corresponding reformation plan, which shows Chinese football development among youth is very smooth.

Secondly, by above analysis, it can see that teachers and youth relative support football teaching reformation, but still some people show neutral opinions, they think though reformation has been made, talents cultivation aspect problems still exist, contemporary football faculty is not going well, which will hinder Chinese football development.

Finally, the paper establishes mathematical model for youth learning football option trends, by grey relational degree, it gets that youth more tends to watch football matches, and relational degree is 1.19, and trend towards football technology and rules grasping are not so great.

REFERENCES

[1]REN Zhong.The Analysis of the Main Reasons which 2008 Olympic Game U-17 Affect the Reserve Talents Fostering in Athletic Volleyball[J].Journal of Xuchang University, 2006, 25(2):80-83.

[2]LIN Ming, YAN Jie.An Analysis of the Factors That Influence the Development of High Jump in China[J].Journal of Capital College of Physical Education, 2007, 19(5):105-109.

[3]LIU Bang-hua, LI Yan-ling, LI Jing, ZHOU Huai-qiu, LIU Guo-hong.Strategy for Olympic Games and Sustainable Development of Hunan Competitive Gymnastics[J].Journal of Beijing Sport University, 2005, 28(12):1713-1714.

[4]Ye Jiabao, et al..Objective of Chinese sports competitiveness at the 28th Olympic Games and countermeasures to develop athletics continually[J].Journal of Shandong Physical Education Institute, 2002, 18(4):1-5.

[5]ZHOU Guo-hai, YUAN Gui-cai.Case Analysis on Family Cultivating Sport Talents—Taking Snooker Player DING Jun -hui as a Case[J].Bulletin of Sport Science & Technology, 2008, 16(11):27-28.

Under The Background of "One Belt and One Road", The Development Strategy of Modern Logistics Industry in Xinjiang Is Studied

Yun Cao *
School of Vocation and Technology, Xinjiang Education Institute, Urumqi 830043, Xinjiang, China

Abstract: Xinjiang with the unique geographical advantages and government support in the construction of "area" won the strategic position and advantage, and korla is a bridge connecting Eurasia and xinjiang, for the development of modern logistics industry to provide the position advantage of the transportation hub. Therefore, this article analyzed from the discourse of "area" all the way along the "area" strategy for the importance of modern logistics industry development in xinjiang, based on the logistics of the existing problems in xinjiang, and puts forward the "area" under the background of the countermeasures of development of modern logistics industry in xinjiang, to speed up the logistics infrastructure construction in xinjiang and construct information logistics platform and base, using the national policy to establish a logistics hub at the same time, to solve the training of modern logistics industry, to create conditions for boosting the development of modern logistics industry in xinjiang.
Keywords: One Belt and One Road; Modern logistics; Development strategy

1. INTRODUCTION

In September 2016, led by national development and reform committee in xinjiang korla hosted the "area" modern logistics development strategy seminar, in invite government officials, enterprises and experts and scholars at home and abroad at the same time, with "the silk road connected dream, logistics leading across" as the theme carries on the discussion and communication, to use all the way "area" opportunity for the construction of driving the development of logistics industry in xinjiang, xinjiang construct platform for exchanges and cooperation with neighboring countries, so as to realize xinjiang region complementary advantages, resource sharing, and the purpose of win-win cooperation [1]. Therefore, the "One Belt And One Road" background is of great significance to the development of modern logistics industry in xinjiang [2-4]. Therefore, this paper will analyze the strategy of the development of modern logistics industry in xinjiang in the context of "One Belt And One Road".

2.THE "ONE BELT AND ONE ROAD" STRATEGY DISCUSSES THE DEVELOPMENT OF MODERN LOGISTICS INDUSTRY IN XINJIANG

2.1 The "one belt and one road" strategy

Xi jinping, general secretary of the combination of world economic development situation and its own national conditions put forward the strategy of "area", based on the international and domestic development situation of this important strategy, for the future direction of regional foreign trade development of our country have clear guidance [5]. The "area" is the silk road economic belt, with the concept of the ancient silk road in China and countries in Asia and Europe to the established economic and trade zone cover east Asia, central Asia and many European countries, based on regional trade and production factors along the effort to build comprehensive transportation corridor, build investment trade, economy, technology, free trade and the integration of regional strategy. And "way" is refers to the maritime silk road in the 21st century, effective connecting China and southeast Asian countries, realize the connectivity in the sea, the port city of cooperation form economic belt "silk road".

2.2 xinjiang logistics industry development status analysis

(1) The construction of transport infrastructure is imperfect. Xinjiang region of the existing traffic infrastructure construction is not perfect, mainly sold to foreign products structure, low price, large agricultural and sideline products, such as primary products, middle by-product seasonal in the transport process. In xinjiang, however, the existing railway transport line is less, there exists a shortage problem caused tremendous pressure to xinjiang railway transportation, products cannot be shipped out timely and effectively reduce the enterprise's benefit in xinjiang.

(2) The logistics management system is not perfect. The logistics industry in xinjiang is the current traffic management, economy and trade, railway department, but in the middle of the work was not effectively coordinate, lack of effective communication between different departments, lead to logistics management system is imperfect seriously hindered the development of logistics industry in xinjiang.

(3) logistics management technology lags behind the delivery of demand. In the current logistics industry of xinjiang logistics management technology adopted by the lack of a certain market competitiveness, in the logistics information management system of

popularity and universal coverage is low, management mode and management technology for failing to improve and upgrade, lack of logistics information platform construction.

3.THE "ONE BELT AND ONE ROAD" STRATEGY IS AN IMPORTANT ANALYSIS OF THE DEVELOPMENT OF MODERN LOGISTICS INDUSTRY IN XINJIANG

The geographical location and resource advantage of xinjiang in the construction of One Belt And One Road is of great significance to the development of regional economy.

3.1 is conducive to improving the regional economic environment

Xinjiang economic belt in the silk road, unique geographical location, under the drive of the silk road economic belt increases the state and government support and input to the xinjiang, is helpful to optimize the environment of the xinjiang region of the regional economy. At the same time, in every scholar, experts and government officials to discuss next will be more preferential policies conducive to the development of xinjiang region, makes the advantageous natural conditions in xinjiang advantage into competition advantage, "area" all the way to promote the development of modern logistics industry in xinjiang.

3.2 It is conducive to the construction of transport facilities

Silk road economic belt is beneficial to promote the construction of xinjiang traffic facilities and perfect, through the establishment of a transportation network extending in all directions, to implement traffic universal coverage, is conducive to the development of xinjiang Shared other regions and countries. This necessarily requires state and government to increase spending on transport infrastructure construction in xinjiang, and further strengthen the xinjiang region of multiple aspects, such as railway, highway and aviation transportation construction, contribute to the realization of regional economic cooperation and development.

3.3 Is conducive to improving the system of logistics management

Economic development needs a scientific and reasonable system for management, in order to realize the development of xinjiang, the management system of the country will increase in all areas of xinjiang, optimize and reform will also introduce more advanced management means, for each enterprise to carry out the required equipment will also be continuously perfect, it will provide power to the development of logistics industry and the opportunity, with the support of policy and system safeguard, the development of logistics industry in xinjiang will be more standardized, the regional communication will be carried out gradually, coupled with advanced logistics management software and the use of logistics platform and the establishment of the whole industry will be in the direction of the healthy and stable development.

3.4 Helps to optimize the product structure

Based on the analysis of the development of the logistics industry in xinjiang, we know that the existing product structure in xinjiang is mainly agricultural and sideline products, and the product structure is relatively simple. , however, the strategy of "One Belt And One Road" to drive the construction of economic zone in the region, and push the various countries and regions to carry out all kinds of trade activities further, has greatly increased the demand for xinjiang quantity and variety, the pressure to the development of xinjiang logistics industry increases at the same time, also led to the improvement and development of logistics industry, provides the related enterprise innovation and development in xinjiang, help them to plan industrial product structure, strive to resolve strong seasonal the drawbacks of the original product structure in xinjiang, thus starting from optimizing product structure optimization of logistics system, to improve product value and increase the economic benefits of related enterprises and the logistics industry in xinjiang.

4.THE DEVELOPMENT OF THE MODERN LOGISTICS INDUSTRY IN XINJIANG IN THE BACKGROUND OF ONE BELT AND ONE ROAD

4.1 Build logistics transport hub on the basis of advantage

In March 2015, led by the national development and reform commission jointly issued the "push to build the silk road economic belt and the 21st century the vision and action of the Marine silk road", made it clear to xinjiang in the silk road economic belt of the important strategic position, location advantages obviously in the regional economic cooperation and development, to further strengthen the function of the xinjiang region, with the power of xinjiang to the west open important window to deepen between xinjiang and central Asia, South Asia and other countries of the communication and cooperation, to forge a silk road of xinjiang economy to bring the important transportation hub and the core of economic development. Among them, the construction of xinjiang korla has "neighborhood" international logistics park, location convenient transportation, covering an area of big, this is also realizing the important embodiment of the "region", to lead and promote the development of modern logistics in xinjiang and strengthen exchanges and cooperation between the central Asian countries. Therefore, to take measures to the xinjiang region of location advantage into economic advantage, competitive advantage, highlight the hub of channels and xinjiang region, gradually relying on the advantages in building a logistics hub. To give full play to the function of government in the construction of public service in xinjiang and the function, based

on the existing resources endowment structures, collection of information collection, exchange and sharing for the integration of modern logistics industry such as government affairs communication management platform. To fully activate the government in the development of modern logistics industry, from the policy level to strengthen the xinjiang region of all kinds enterprise logistics services, such as to realize the integration of logistics and transportation development. To fully stimulate the industry group in the function and role of modern logistics industry development, release the logistics industry is the enterprise related standards, a vigor of the pricing power, operation process and so on, under the market mechanism to ensure that the logistics enterprise shall have the right to participate in business management, in the "introduction" and "going out" strategy to realize the opening to the outside world to inspire the xinjiang regional logistics hub of the service function and level.

4.2 The development of infrastructure and logistics professionals should be strengthened by using the policy advantages

Xinjiang government should make full use of national preferential policy and regional logistics and regional resources advantages in logistics industry policy support, actively encourage and support the development of modern logistics enterprises. Must first, focus on the world logistics industry, combined with their own logistics development trend of the construction of a precise power logistics framework, fully accurate development of xinjiang region, shipping, aviation, railway and channel construction to build traffic network connectivity, with the help of "area" strategy to promote the logistics industry in xinjiang to improve and upgrade, further strengthen the construction of logistics park with big platform for the construction of the logistics trade. Secondly, connectivity of network construction and retrofit of xinjiang region, combined with geographical advantages to open up new dribble new channel, based on the advanced highway construction accelerate the construction of aviation, strive to build first-class high level of service international airport, to construct a highway, railway, waterway, aviation four one of the three-dimensional transport network. Thirdly, under the background of "area" strategy to speed up the consistent with the market demand of modern logistics professional talent training, on the basis of enhancing logistics talent training in strengthening colleges logistics professional construction, skilled logistics talents oriented to strengthen cooperation between schools and logistics enterprises, actively carry out pre-service training, logistics and logistics industry association, logistics technology and talent cooperation, logistics knowledge lecture and cultivate a batch of modern logistics management professionals.

4.3 actively cultivates the market body to build the modern logistics information platform and base

To highlight the focus of the construction and development of modern logistics industry, in an integrated logistics park construction and professional communities in the construction of logistics center, based on the market need to establish a direct distribution node, while fostering logistics market main body, establish a modern logistics information platform and the base as the center of logistics node network system. First, under the background of "area" should be grasped needs of the construction of the regional economy, in a timely manner to optimize the structure of existing logistics enterprises in xinjiang region, through the joint, corporate restructuring, mergers, acquisitions, etc. to build cross-border, cross-regional logistics system, realize the modern logistics industry scale, intensive development path. To optimize the logistics enterprise business, from a single transport business of positive changes to the third party logistics mode, to establish and expand all kinds of enterprises and cooperation between logistics companies such as railway, aviation, further optimize warehousing, packaging, transportation and other logistics services. Modern logistics industry development in xinjiang under the integrated into the "area" strategy to introduce and support both credibility, strength and service as one of the third party logistics enterprise, promote the development of modern logistics park construction and characteristics of logistics industry. Secondly, informationization, scale and intensive oriented to build modern logistics information platform, strengthen the construction of the logistics enterprise Internet management system, in order to improve the logistics resources utilization efficiency as the goal to strengthen information technology, equipment and management of logistics service, further implement the logistics industry production, circulation and marketing the whole process of modernization and informatization construction.

5. CONCLUSION

In xinjiang in the "area" construction strategy, their high position has a unique geographical advantage and resource advantage, xinjiang "One Belt And One Road" strategy so as to realize the regional economic cooperation and development has brought the huge opportunity, for driving the development of logistics industry in xinjiang. At present, the development of logistics industry in xinjiang in the process of traffic infrastructure construction, logistics management system and logistics management technology and the "area" under the guidance of the development of modern logistics industry, there are gaps. Must therefore, focus on the regional economic environment, traffic facilities, logistics management system and product structure optimization, relying on the advantage to build logistics hub, taking the advantage of the policy to strengthen the construction

of infrastructure and logistics professional talent training, and actively cultivate the market main body to build modern logistics information platform and base, builds the platform for exchanges and cooperation with surrounding countries in xinjiang, the xinjiang region to achieve complementary advantages, resource sharing and cooperation and win-win goal.

ACKNOWLEDGMENT

National social science fund project: "One Belt And One Road" in the context of the development strategy of modern logistics industry in xinjiang, the project number: 16BGL198.

REFERENCES

[1]li qiang. Huang qingbo. "One Belt And One Road" in the background of the 12th division of the corps of trade and logistics development strategy. [B]. Dalian maritime university, 2016.

[2]Cao Yun; Wang; "One Belt And One Road" in the context of "One Belt And One Road", a study of modern logistics professional skills in xinjiang [J]. Shanxi Province, 2016, (03) : 12-23.

[3]daiaran; Xie, s.s., "the development strategy of logistics integration in the context of One Belt And One Road" [J]. Railway procurement and logistics, 2015, (12): 22-25.

[4]wang pepe; Wang zhe. Silk road economic belt economic belt of xinjiang channel, the research [B]. Xinjiang normal university, 2016.

[5]Wei Li; Wu qi.One Belt And One Road background of cultural transformation in xinjiang [B]. Xinjiang university, 2016.

Environmental Fitness Model Analysis of University English Standard Language Ability

Heng Li
School of Foreign Studies, Henan Polytechnic University, Jiaozuo 454000, China

Abstract: To find out the solution and the standard of new environment of college English language ability evaluation system, based on the analytic hierarchy process in considering practicality, professional requirements, needs and improve the culture under the influence factors such as communication, by the Chinese university English standard language ability to comment on the proportion of the main evaluation criteria. This shows that English education environment change, adapt to the characteristics of evaluation indicators of college English standard language abilities for speaking ability, reading ability and the understanding and application ability.
Keywords: Ability to assess; Environmental adaptation; Mathematical model

1. INTRODUCTION

After continuous reform, level of education in China is rapidly improve, however, due to China's education form for English education effect is not good, cause most of the college students' English study becomes the "dumb English", so it is hard to college students' English into practical English. Aiming at these problems, China's education are to reform the English education industry, including a large number of physical environment, social culture environment and spiritual environment, cover a Chinese college students' English level. With the change of education environment, natural mode of college English assessment standard language ability should also have a little change, this article will focus on to adapt to the environment of college English standard language abilities evaluation way carries on the analysis and research.

2. MODEL ESTABLISHMENT

2.1 Construct hierarchical structure

In order to find out China nowadays main evaluation criterions on university English standard linguistic competence evaluation, firstly it should find out most influential aspects to linguistic competence that is finding out main influence factors that affect English standard linguistic competence evaluation. Subsequently, the paper bases on analytic hierarchy process, it makes quantization on university English standard linguistic competence evaluation main evaluation criterions. And then, it establishes target layer, criterion layer and scheme layer relations[1-3].

Target layer: University English standard linguistic competence evaluation.

Criterion layer:scheme influence factors, Y_1 is practicability、Y_2 is professional needs 、Y_3 it then need for exchange 、Y_4 is improve self-cultivation.

Scheme layer: V_1 is oral English ability 、V_2 is reading ability, V_3 is understanding and application ability.

2.2 Construct judgment matrix

In order to get each factor comparison quantified judgment matrix. Now set a_{ij} to represent ratio of β_i and β_j to G influence and get judgment matrix A ,in the paper set judgment matrix between layer two and layer one is A_1 ,element a_{ij} ,divisor α_i, α_j , factor is A_1 , then it has following formula showed judgment matrix A_1

$$A_1 = \begin{bmatrix} A_1 & \alpha_1 & \alpha_2 & \alpha_3 & \alpha_4 \\ \alpha_1 & a_{11} & a_{12} & a_{13} & a_{14} \\ \alpha_2 & a_{21} & a_{22} & a_{23} & a_{24} \\ \alpha_3 & a_{31} & a_{32} & a_{33} & a_{34} \\ \alpha_4 & a_{41} & a_{42} & a_{43} & a_{44} \end{bmatrix}$$

And in above formula, for a_{ij} values defining, we generally adopt 1~9 proportion scale to assign value on influence extent, as Figure 1 shows.

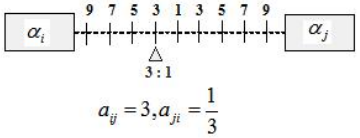


Figure 1 Nine scale assignment schematic diagram

According to lots of experts experiences and refer to lots of documents as well as 1~9 scale setting, it gets paired comparison matrix that are respective as Table 1-5.

Table 1 Comparison matrix G

G	Y_1	Y_2	Y_3	Y_4
Y_1	1	1/3	6	6
Y_2	3	1	2	2
Y_3	1/6	1/2	1	1

Y_4	1/6	1/2	1	1

Table 2 Comparison matrix Y_1

Y_1	V_1	V_2	V_3
V_1	1	1	1/5
V_2	1	1	1/5
V_3	5	5	1

Table 3 Comparison matrix Y_2

Y_2	V_1	V_2	V_3
V_1	1	5	7
V_2	1/5	1	3
V_3	1/7	1/3	1

Table 4 Comparison matrix Y_3

Y_3	V_1	V_2	V_3
V_1	1	6	3
V_2	1/6	1	5
V_3	1/3	1/5	1

Table 5 Comparison matrix Y_4

Y_4	V_1	V_2	V_3
V_1	1	6	5
V_2	1/6	1	4
V_3	1/5	1/4	1

2.3 Consistency test

Use consistency indicator test formula as: $CI=\frac{\lambda_{\max}-n}{n-1}$ .Among them, $\lambda_{\max}$ is comparison matrix maximum feature value; n is comparison matrix order. It is clear that judgment matrix is inversely proportional to CI value[4-6].

$$C=\begin{Bmatrix}1 & 1/3 & 6 & 6\\ 3 & 1 & 2 & 2\\ 1/6 & 1/2 & 1 & 1\\ 1/6 & 1/2 & 1 & 1\end{Bmatrix}$$

$$\xrightarrow{\text{line vector normalization}}\begin{Bmatrix}0.231 & 0.142 & 0.6 & 0.6\\ 0.693 & 0.429 & 0.2 & 0.2\\ 0.038 & 0.215 & 0.1 & 0.1\\ 0.038 & 0.215 & 0.1 & 0.1\end{Bmatrix}$$

$$\xrightarrow{\text{Solve sum by line}}\begin{Bmatrix}1.573\\ 1.522\\ 0.453\\ 0.453\end{Bmatrix}$$

$$\xrightarrow{\text{Normalization}}\begin{Bmatrix}0.393\\ 0.381\\ 0.113\\ 0.113\end{Bmatrix}=W^{(0)}$$

$$CW^{(0)}=\begin{Bmatrix}1 & 1/3 & 6 & 6\\ 4 & 1 & 2 & 2\\ 1/6 & 1/2 & 1 & 1\\ 1/6 & 1/2 & 1 & 1\end{Bmatrix}\begin{Bmatrix}0.393\\ 0.381\\ 0.113\\ 0.113\end{Bmatrix}=\begin{Bmatrix}3.941\\ 3.825\\ 1.145\\ 1.145\end{Bmatrix}$$

$$\lambda_{\max}^{(0)}=\frac{1}{4}\left(\frac{3.941}{0.393}+\frac{3.825}{0.381}+\frac{1.145}{0.113}+\frac{1.145}{0.113}\right)=4.10$$

$$w^{(0)}=\begin{pmatrix}0.393\\ 0.381\\ 0.113\\ 0.113\end{pmatrix}$$

Corresponding maximum feature value and feature vector in successive are:

$$\lambda^{(1)}{}_{\max}=4.32, w^{(1)}{}_1=\begin{Bmatrix}0.314\\ 0.223\\ 0.420\end{Bmatrix}$$

$$\lambda^{(2)}{}_{\max}=4.62, w^{(1)}{}_2=\begin{Bmatrix}0.625\\ 0.259\\ 0.088\end{Bmatrix}$$

$$\lambda^{(3)}{}_{\max}=3.25, w^{(1)}{}_3=\begin{Bmatrix}0.650\\ 0.230\\ 0.113\end{Bmatrix}$$

$$\lambda^{(4)}{}_{\max}=3.41, w^{(1)}{}_4=\begin{Bmatrix}0.614\\ 0.264\\ 0.185\end{Bmatrix}$$

According to $CI=\frac{\lambda_{\max}-n}{n-1}$ it gets RI value.

For judgment matrix C, $\lambda^{(0)}{}_{\max}=4.62, RI=1.04$

$$RI=\frac{4.62-4}{4-1}=0.021$$

$$CR=\frac{CI}{RI}=\frac{0.021}{1.04}=0.02<0.1$$

It shows C inconsistency degree within permissible range, at this time it can use C feature vector to replace weight vector. Similarly, to judgment matrix C_1, C_2, C_3, C_4 ,all passed consistency test by using above principle. Therefore, calculation results from object layer to scheme layer can refer.

Calculation structure is as following:

$$w^{(1)}=(w_1^{(1)}, w_2^{(1)}, w_3^{(1)}, w_3^{(1)})$$

$$=\begin{Bmatrix}0.314 & 0.625 & 0.650 & 0.614\\ 0.223 & 0.259 & 0.230 & 0.264\\ 0.420 & 0.088 & 0.113 & 0.185\end{Bmatrix}$$

$$w=w^{(1)}w^{(0)}$$

$$=\begin{Bmatrix}0.314 & 0.625 & 0.650 & 0.614\\ 0.223 & 0.259 & 0.230 & 0.264\\ 0.420 & 0.088 & 0.113 & 0.185\end{Bmatrix}\begin{Bmatrix}0.393\\ 0.381\\ 0.113\\ 0.113\end{Bmatrix}$$

$$=\begin{Bmatrix}0.353\\ 0.314\\ 0.333\end{Bmatrix}$$

By above analysis, it is clear that in evaluating university English standard linguistic competence process, in case considering practicability, professional needs, the need for exchange and improve self-cultivation as well as other influence factors, it gets China universities English standard linguistic competence evaluation main evaluation criterion proportions, that oral English ability, English reading ability and English understanding and application ability proportions are respectively 0.353 、0.314 and 0.333. Thereupon, after English education environment changing, adapt to its characteristics, it gets University English standard linguistic competence evaluation indicators are oral English ability, reading ability as well as understanding and application ability. Therefore, when evaluating university English standard linguistic competence, it should focus on the three indicators to establish evaluation system.

3. CONCLUSION

Create new environment assessment system for college English standard language ability, based on the analytic hierarchy process in considering practicality, professional requirements, needs and improve the culture under the influence factors such as communication, by the Chinese university English standard language ability to review the main evaluation standard, the proportion of English speaking ability, reading ability and the understanding and application of English ability, respectively, and the proportion of the. This shows that English education environment change, adapt to the characteristics of evaluation indicators of college English standard language abilities for speaking ability, reading ability and the understanding and application ability. As a result, the evaluation system should be established as a key point in evaluating the English language competence of the university.

REFERENCES

[1]Hu Wen-Zhong. New China sixties years' foreign language education achievement and deficiency [J]. Foreign language teaching and research, 2009, (3):163-169.

[2]Fu Chun-Hui, Peng Jin-Ding(2006), University English teaching's formative evaluation and its strategy research [J]. Journal of Hunan Normal University education science , 5(4):123-125.

[3]Huang Hua. Three-dimensional teaching mode university English formative evaluation problem research [J]. Chinese foreign language, 2010, (5):15-21.

[4]Yang Feng-Sheng. Mystery solution in Android application and development [M]. Mechanical industry publishing house, 2011. The dissertation.

[5]Chen Li. Remote education foundation [M]. Higher education press, 2004.

[6]Zhang Pei-Shan. Application research on Handed network learning system in the primary school English teaching [D]. Jinan: Shandong normal university, 2008.

Technical Statistical Analysis of Asian Men's Football Based on Field Division

Huang-fu ShangFeng
Institute of P.E, Henan Polytechnic University, Jiaozuo, 454000, China

Abstract: Football competition venues in the area usually has a strong function sex, according to the division of district is the game area accordingly in the process of stealing the ball, the ball and WeiQiang technology, can effectively analyze the football team against technical characteristics. In the light of the Chesapeake region, Japan, while Iran, Saudi, and Australia in five countries football team in the World Cup in Germany technical index analysis, explores national football technical improvement direction. The results showed that the Japan and Korea teams had weaker individual defense capabilities, while the Australia and Iran teams had stronger individual defenses. However, the two countries, Japan and Korea, have significantly outperformed countries such as Australia and Iran in the use of defensive tactics such as siege and looting. The author thinks that Japan and Korea are weak in their defensive abilities, and that the excellent use of the two countries' defense tactics can make up for the weakness of individual defense.
Keywords: Mathematical statistics; Defensive ability; Help defense tactics

1. INTRODUCTION

"The Chinese football rush out Asia, moves towards the world" is the key to analyze characteristics of world football competitive level in the area of Asia, the Asian football powers mainly for Saudi Chesapeake and Japan in east Asia, west Asia, while Iran, and new joined the Asian football federation of Australia in five countries. A review of Chinese football and the five Asian countries' results shows that the victory is far less than that. In this paper, from the Angle of the sites for Chesapeake, Japan, Saudi, while Iran and Australia in five Asian countries football team in the World Cup in Germany, analysis and research to explore the characteristics of the above five countries football competition, guide to winning.

Wang jun (2011) pointed out that after entering the 21st century, Asian football pattern with slight change, by this slight change and the development of Asian football features were analyzed, and help to the positioning of Chinese football [1]. Jun-bin zhang (2011) pointed out that in the process of football professionalization, China, South Korea and Japan walk in the forefront of the Asia, west Asia countries except Saudi Arabia, in many countries is still in the state of semi professional league [2]. Fatt (2013) analyzed the situation of Chinese super in the previous afc champions league, points out that the entities including China, Japan and South Korea, the three major league in the Chinese super peak under the apparent in [3].

That these people are not aiming at the condition of the district is divided in football field economic indicators in the study, and based on the area of Asian football competition is the focus of this paper studies the characteristics of the research.

2.TECHNICAL STATISTICS ARE DIVIDED INTO VENUES

Rob ball purpose lies in their possession, defensive side of the players in the process of defending against a player of the offensive side pressing defense behavior (4, 5). If a player's defensive side get the ball, argues that the ball is successful, if a player's defensive side didn't obtain possession, thinks rob ball failure, the technical indicators of statistical categories including tackling technology in addition to closing down.

Stealing the ball to tackle football offensive line, in the process of defense, the defense side of the player can according to their own experience at the mercy of the anticipation of its movement, to intercept football scored their weak area defense behavior (4, 5). If a player's defensive side won the tackle football route, as stealing the ball success, on the other hand, seeing it as stealing the ball failure, technical indicators statistical category also includes tackles.

WeiQiang aims to control the initiative, my teammates get football in the process of defense, pressing the offensive players they wont want to have two or more than two, it is also a defensive behavior [4]. If the defenders of the defensive team gain control of the game, they see it as a round of success, and vice versa.

If there is a foul in the process of completing all these defensive techniques, it will be regarded as a statistical area of failure. As a result, the technical statistical indicators for the Asian teams in the World Cup are shown in figure 1.

This paper divides the statistics field into the front and back two sections, the study of the former field is the research object, and the statistical analysis of it. The field is then divided into seven different sections, in accordance with the defensive techniques and the characteristics of the defensive areas. As shown in figure 2:

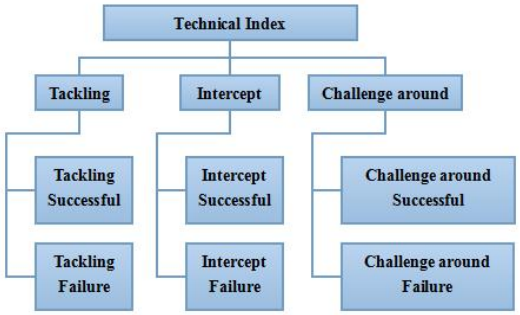


Figure 1 technical statistics

3. TECHNICAL STATISTICS AND ANALYSIS

The study was based on 15 national men's soccer teams from Korea, Japan, Saudi, Iran and Australia in the final stages of the World Cup in Germany. Using the computer video processing technology to handle video in 15 games, the number of technical indexes of three technical indexes was recorded in different fields, including the ball, the ball and the round. Using SPSS software, a single factor variance analysis and LSD multiple comparisons were used to check the differences between the indexes.

3.1 break ball technical statistical analysis

As shown in table 1, the statistical results of the broken ball technology based on the field division:

Table 1 the statistical results of broken balls based on field segmentation

ground	Index	Korea	Japan	Saudi	Iran	Australia	statistic	value
1	Total	13	25	28	18	14	F	1.96
	SR	46.2	48.0	64.3	44.4	35.7	P	<0.05
	$\overline{X} \pm S$	0.72 ± 0.83	1.39 ± 1.29	1.56 ± 1.25	1.00 ± 1.24	0.79 ± 1.06	MC	3>1,5
2	Total	15	8	22	17	17	F	2.45
	SR	66.7	75.0	72.7	52.9	52.9	P	<0.05
	$\overline{X} \pm S$	0.83 ± 0.79	0.44 ± 0.70	1.22 ± 1.00	0.94 ± 0.80	0.71 ± 0.62	MC	3>2,5
3	Total	67	38	56	54	48	F	1.65
	SR	62.7	71.1	75.0	70.4	62.5	P	<0.05
	$\overline{X} \pm S$	3.72 ± 2.10	2.11 ± 1.45	3.11 ± 1.90	3.00 ± 2.06	2.91 ± 1.91	MC	1>2
4	Total	13	10	26	16	15	F	2.88
	SR	92.3	40.0	42.3	56.3	60.0	P	<0.05
	$\overline{X} \pm S$	0.72 ± 0.89	0.56 ± 0.70	1.44 ± 0.78	0.89 ± 0.90	0.75 ± 0.94	MC	3>1,2,5
5	Total	14	12	23	17	16	F	0.89
	SR	57.1	66.7	52.2	41.2	43.8	P	>0.05
	$\overline{X} \pm S$	0.78 ± 1.06	0.67 ± 1.08	1.28 ± 1.27	0.94 ± 1.06	0.79 ± 0.93	MC	NS
6	Total	46	36	47	51	58	F	2.08
	SR	84.8	72.2	66.0	66.7	72.4	P	<0.05
	$\overline{X} \pm S$	2.56 ± 1.69	2.00 ± 1.33	2.61 ± 1.88	2.83 ± 1.34	3.33 ± 1.34	MC	2>5
7	Total	17	30	25	21	33	F	1.67
	SR	64.7	43.3	60.0	38.1	57.6	P	<0.05
	$\overline{X} \pm S$	0.94 ± 1.00	1.67 ± 1.68	1.39 ± 1.09	1.17 ± 1.04	1.79 ± 1.10	MC	1>5
8	Total	103	43	80	64	63	F	3.86
	SR	72.8	67.4	78.8	84.4	79.4	P	<0.05
	$\overline{X} \pm S$	5.72 ± 3.75	2.56 ± 1.58	4.44 ± 1.95	3.56 ± 2.41	4.25 ± 2.42	MC	1>2,4 2>3,5

Note: Total represents Total number; SR is the success rate.

Table 1 illustrates the:

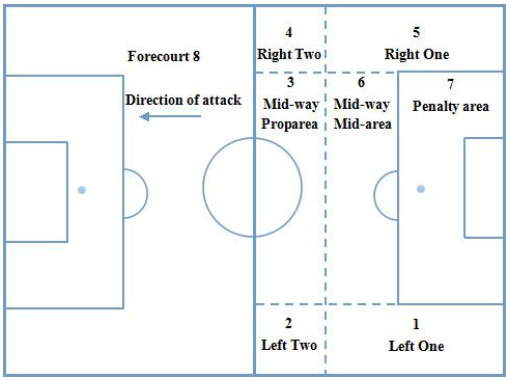


Figure 2 site partitioning schematic

1) the main application area for stealing the ball technology focused on three, six, seven, three regions in the Asia five countries football team ball technology in the middle (three, six, seven area) application number significantly higher than that of two side (one, two, four, five district) area. Among them: Chesapeake football team of stealing the ball technology application, most times Japan football team ball technology application number at least, both minimum and maximum is very significant.

2) was shot opponents in seven area and six area caused by the loss of marks accounted for 17% of the World Cup's goals, in these two areas on the number of stealing the ball technology, Australia football team was significantly higher than that of Japan and Chesapeake two national team, in addition, the Chesapeake, Saudi, and Australia, three national football team in the two areas of defensive success rate is higher, the results confirmed that Australia and Saudi in the two areas have not only high accuracy of stealing the ball.

3) Saudi team ball technology application in the wide area is significantly higher than other teams, characterized by a wide off the team ball ability outstanding advantage, one on the left (1, 2) stealing the ball effect is significantly higher than the right

(four or five area). In contrast, the two countries, Australia and Korea, are more focused on the middle road and less on the side road.

3.2 A statistical analysis of the technique of the ball

As shown in table 2, the result of the technique statistics based on the field demarcation:

Table 2 the statistical results of the technique based on the field division

ground	Index	Korea	Japan	Saudi	Iran	Australia	statistic	value
1	Total	2	5	8	15	8	F	2.80
	SR	50.0	20.0	62.5	46.7	37.5	P	<0.05
	$\overline{X} \pm S$	0.11 ± 0.32	0.28 ± 0.46	0.44 ± 0.51	0.83 ± 1.04	0.54 ± 0.83	MC	4>1,2
2	Total	2	3	7	7	10	F	1.45
	SR	00.0	00.0	42.9	57.1	60.0	P	>0.05
	$\overline{X} \pm S$	0.11 ± 0.32	0.17 ± 0.38	0.39 ± 0.50	0.39 ± 0.61	0.42 ± 0.65	MC	NS
3	Total	7	19	12	21	14	F	2.74
	SR	57.1	26.3	33.3	52.4	35.7	P	<0.05
	$\overline{X} \pm S$	0.39 ± 0.50	1.06 ± 1.11	0.67 ± 0.59	1.17 ± 0.86	0.67 ± 0.87	MC	1>2,4
4	Total	7	10	9	12	10	F	0.40
	SR	28.6	30.0	11.1	58.3	20.0	P	>0.05
	$\overline{X} \pm S$	0.39 ± 0.61	0.56 ± 0.78	0.50 ± 0.51	0.67 ± 0.69	0.54 ± 0.72	MC	NS
5	Total	5	6	12	12	9	F	1.45
	SR	20.0	50.0	33.3	25.0	55.6	P	>0.05
	$\overline{X} \pm S$	0.28 ± 0.46	0.33 ± 0.49	0.67 ± 0.91	0.67 ± 0.69	0.46 ± 0.59	MC	NS
6	Total	5	20	10	18	15	F	2.19
	SR	20.0	35.0	40.0	77.8	66.7	P	<0.05
	$\overline{X} \pm S$	0.28 ± 0.46	1.11 ± 1.57	0.56 ± 0.70	1.00 ± 0.97	0.71 ± 0.81	MC	1>1,4
7	Total	1	6	3	3	7	F	1.49
	SR	100.0	66.7	33.3	66.7	71.4	P	<0.05
	$\overline{X} \pm S$	0.06 ± 0.24	0.33 ± 0.59	0.17 ± 0.38	0.17 ± 0.38	0.33 ± 0.48	MC	1>5
8	Total	26	9	36	29	35	F	4.19
	SR	34.6	44.4	30.6	31.0	28.6	P	<0.05
	$\overline{X} \pm S$	1.44 ± 1.62	0.50 ± 0.71	2.00 ± 1.19	1.61 ± 1.42	1.88 ± 1.15	MC	2>1,3,4,5

Note: Total represents Total number; SR is the success rate.

Table 2 illustrates the:

1) while Iran team in midfield with ball technology significantly more than the other teams, and the success rate is higher, the characterization of the team of outstanding advantage in individual defensive ability.

2) the Korea team in the first, third, sixth and seventh districts of the front and back fields, and the technique of stealing the ball less frequently.

3) Japan team in the middle area (3, 6) ball technology using the number is more, but the success rate is not ideal, the characterization of the team, the characteristics of individual defensive ability is relatively weak.

4. CONCLUSION

The three indicators, such as broken ball technology, the technique of the ball and the technique of the siege technique, reflect the weakness of the individual defense capabilities of the Japan and Korea teams. The cause may be relevant to the country's use of physical form. The Australia and Iran teams are more prominent in their defensive abilities. But the statistics show that the Japan and Korea teams have significantly outdone other teams in the use and scope of the technique. Throughout Asia five men's soccer team in defense system, the tactics for the more significant differences, including Australia and irfan team in the middle area of individual defensive ability is prominent, while Japan and the Chesapeake team and Saudi team use the help defense technology such as WeiQiang make up the lack of personal defense ability, especially in the frontcourt WeiQiang technology aspect, Japan is a major and Chesapeake team, showed a strong offensive.

REFERENCES

[1]Wang jun, the development of Asian men's football[J]. Journal of sports culture. 2011 (8) : 61-65.

[2]zhang junbin. Asian football development analysis [J]. Journal of sports culture. 2011 (9) : 70-72.

[3]yellow light. The Asian football club champions league match the level of the Korean and Japanese football teams [J]. Sports technology. 2013, 34 (3) : 54-57.

[4]Chen Jingfei, wang lei, Lin Jinjiao. The World Cup with Chinese super league football defense technology situation analysis [J]. Journal of hebei institute of sport. 2009, 23 (4) : 71-73.

Analytic Hierarchy Process-based China Modern Aerobics Education Drawbacks and Their Way out Research

Hua-wei Liang
Institute of P.E, Henan Polytechnic University, Jiaozuo 454000, China

Abstract: Aerobics as a kind of sports event that is adapt to all age groups of people and can mold character. To find out causes of them and solutions, the paper firstly through establishing analytic hierarchy process model, solves China modern aerobics education main obstacles when considering multiple influence factors are the low efficiency of education, the lack of features and the lack of overall thought. Then by game analysis and evolution game analysis, it solves government and school optimal strategy on China modern aerobics education problem is that school should positive carry on characteristic education reformation, let students to be interested in aerobics, and government also should carry out coordination, strengthen aerobics education's characteristic education, and strengthen aerobics professional guiding.
Keywords: Aerobics Education; Analytic Hierarchy Process; Evolution Game; Teaching Efficiency

1. INTRODUCTION

With the founding of new China, China strength is increasingly improving, after opening –up and reform, China economy is even rapidly developing, material base is also becoming more and more comprehensive. With improvement of living standards, people pursue is also getting higher, aerobics as a kind of sports event that can build body and also mold character, is a sports event that favored by masses in numerous sports events. By aerobics, it not only can keep fit, but also can let people body shape to become more and more well-balanced and perfect while taking aerobics exercising [1-3]. Fitness aerobics mainly spread in the folk that is used to people's body building and mood cultivating. Therefore, motions of them are mostly simple and easy to learn, and rhythm is slower that is adapt to people of all ages[4]. Among them, it contains many types, but properties base on people self physique improving, character molding, shape perfecting and mental health maintenance. However, such a sports event in university class is rarely selected, what kind of drawbacks appear in China aerobics education process, and how to solve them, the paper will analyze and research on these problems.

2. MOLD ESTABLISHMENTS

2.1 Construct hierarchical structure

In order to analyze China modern aerobics education appeared drawbacks main causes, it should firstly find out main obstacles that let China modern aerobics education to be in dilemma, and find out their influence extents. Therefore, the paper firstly bases on analytic hierarchy process, makes quantization on China modern aerobics education main obstacles sources. Establish target layer, criterion layer and scheme layer relations. Target layer: The main obstacles of Chinese modern aerobics education. Criterion layer: scheme influence factors, r_1 is teaching way monotonous、r_2 is the school subject thought、r_3 is the lack of professional 、r_4 is the sport construction funds.

Scheme layer: p_1 is the low efficiency of education 、p_2 is the lack of features, p_3 is the lack of overall thought.

2.2 Construct judgment matrix

According to lots of expert's experiences and referencing lots of documents as well as 1~9 scale setting.

Use consistency indicator test formula as: $CI=\frac{\lambda_{\max}-n}{n-1}$ .Among them, $\lambda_{\max}$ is maximum feature value of comparison matrix, n is comparison matrix order. It is clear that judgment matrix and CI value are in inverse proportion.

$$C=\begin{Bmatrix}1 & 1/2 & 4 & 4\\ 2 & 1 & 3 & 5\\ 1/4 & 1/3 & 1 & 1\\ 1/4 & 1/5 & 1 & 1\end{Bmatrix}\xrightarrow{\text{Column vector normalization}}\begin{Bmatrix}0.286 & 0.250 & 0.444 & 0.364\\ 0.572 & 0.500 & 0.333 & 0.455\\ 0.071 & 0.150 & 0.111 & 0.091\\ 0.071 & 0.100 & 0.111 & 0.091\end{Bmatrix}$$

$$\xrightarrow{\text{Solve sum by line}}\begin{Bmatrix}1.344\\ 1.860\\ 0.423\\ 0.373\end{Bmatrix}\xrightarrow{\text{Normalization}}\begin{Bmatrix}0.336\\ 0.465\\ 0.106\\ 0.093\end{Bmatrix}=U^{(0)}$$

$$CU^{(0)}=\begin{Bmatrix}1 & 1/2 & 4 & 4\\ 2 & 1 & 3 & 5\\ 1/4 & 1/3 & 1 & 1\\ 1/4 & 1/5 & 1 & 1\end{Bmatrix}\begin{Bmatrix}0.336\\ 0.465\\ 0.106\\ 0.093\end{Bmatrix}=\begin{Bmatrix}3.369\\ 4.562\\ 1.103\\ 0.980\end{Bmatrix}$$

$$\lambda_{\max}^{(0)}=\frac{1}{4}\left(\frac{3.369}{0.336}+\frac{4.562}{0.465}+\frac{1.103}{0.106}+\frac{0.980}{0.093}\right)=4.19$$

$$u^{(0)}=\begin{pmatrix}0.336\\0.456\\0.110\\0.098\end{pmatrix}$$

Judgment matrix is:

$$C_1=\begin{Bmatrix}1&1&1/3\\1&1&1/4\\3&4&1\end{Bmatrix},C_2=\begin{Bmatrix}1&4&4\\1/4&1&4\\1/4&1/4&1\end{Bmatrix},C_3=\begin{Bmatrix}1&5&3\\1/5&1&4\\1/3&1/4&1\end{Bmatrix},C_4=\begin{Bmatrix}1&5&4\\1/5&1&4\\1/4&1/4&1\end{Bmatrix}$$

Corresponding maximum feature value and feature vector are in order as:

$$\lambda^{(1)}{}_{\max}=4.48,u^{(1)}{}_1=\begin{Bmatrix}0.384\\0.384\\0.462\end{Bmatrix}\ \lambda^{(2)}{}_{\max}=3.65,u^{(1)}{}_2=\begin{Bmatrix}0.546\\0.267\\0.093\end{Bmatrix}$$

$$\lambda^{(3)}{}_{\max}=3.57,u^{(1)}{}_3=\begin{Bmatrix}0.524\\0.270\\0.184\end{Bmatrix}\quad \lambda^{(4)}{}_{\max}=4.43,u^{(1)}{}_4=\begin{Bmatrix}0.561\\0.332\\0.264\end{Bmatrix};$$

According to $CI=\frac{\lambda_{\max}-n}{n-1}$ it gets RI value that can refer to Table 1.

Table 1 RI value

n	1	2	3	4	5	6	7	8	9	10	11
RI	0	0	0.58	0.90	1.12	1.24	1.32	1.41	1.45	1.49	1.51

For judgment matrix C, $\lambda^{(0)}{}_{\max}=4.48,RI=1.01$

$$RI=\frac{4.48-4}{4-1}=0.016;\quad CR=\frac{CI}{RI}=\frac{0.016}{1.01}=0.02<0.1$$

It represents C inconsistency extent is within permissible range, now it can use C feature vector to replace weight vector.

Similarly, to judgment matrix C_1, C_2, C_3, C_4, utilize above principle, all pass consistency test.

Calculation structure is as following:

$$u^{(1)}=(u_1^{(1)},u_2^{(1)},u_3^{(1)},u_3^{(1)})=\begin{Bmatrix}0.384&0.546&0.524&0.561\\0.384&0.267&0.270&0.332\\0.462&0.093&0.184&0.264\end{Bmatrix},$$

$$u=u^{(1)}u^{(0)}=\begin{Bmatrix}0.384&0.546&0.524&0.561\\0.384&0.267&0.270&0.332\\0.462&0.093&0.184&0.264\end{Bmatrix}\begin{Bmatrix}0.336\\0.456\\0.110\\0.098\end{Bmatrix}=\begin{Bmatrix}0.372\\0.445\\0.183\end{Bmatrix}$$

By above analysis, it can get that main obstacles for letting China modern aerobics education in dilemma are the low efficiency of education, the lack of features and the lack of overall thought and else, their respectively proportions are 0.372、0.455 and 0.183.

2.3 Aerobics education way out game analysis

In modern aerobics education way out problems, take government and school as influential subjects, so following game analysis can roughly regard government and school as game main parts, their implemented strategies are both two kinds, government strategy is supporting and not supporting.

Set in case government supports institution reformation while institutions don't reform, government earnings is R_1, institutions earnings is 0 ;and school carries on reformation while government don't play supporting roles, institutions earnings is $R_1^{'}$, government earnings is R_2. When both government and school are with positive attitudes, government earnings is R, institutions earnings is $R^{'}$;if both government and institutions are not positive, then the two earnings are 0 .Table 2 is government and school teaching characteristic reformation earnings matrix.

Table 2 Government and school teaching characteristic reformation earnings matrix

		School	
		Reform	Don't reform
Government	Support	$R,R^{'}$	$R_1,0$
	Don't support	$R_2,R_1^{'}$	0,0

Among them, $R>R_1>R_2$, but size of $R^{'},R_1^{'}$ cannot define, therefore the paper will adopt evolution game analysis to analyze government and school teaching characteristic reformation institutionalization practices, and make respectively strategies adjustment.

2.4 Modern aerobics education way out evolution game analysis

Due to government and school positive and negative strategy selection in aerobics education problem are both independent and random, and can carry on repeated games. Therefore, set government supporting school characteristic reformation probability as p, probability that don't support is $1-p$; and school reformation executing probability is q, probability that don't reform is $1-q$. According to Malthusian theorem, it is clear that government strategies support times selection growth rate should be $\frac{\dot{p}}{p}$ that is difference between fitness $E_wI\{f,1-q\}^T$ and average fitness $\{p,1-p\}I\{q,1-q\}^T$. $E_w=[1,0]$, when government support probability is 1, its earnings matrix is $I=\begin{bmatrix}R&R_1\\R_2&0\end{bmatrix}$.

Simplify $\dot{p}=p(1-p)\{1,-1\}I\{q,1-q\}^T$ and get $\dot{p}=p(1-p)[(R-R_1-R_2)q+R_1]$.

Similarly, school strategy of reformation selection times growth rate should be $\frac{\dot{q}}{q}$ that is difference between fitness $E_J L\{q,1-q\}^T$ and average fitness $\{q,1-q\}L\{p,1-p\}^T$. $E_J=[0,1]$, When school reformation probability is 1, its earnings matrix is $L=\begin{bmatrix} R' & 0 \\ R_1' & 0 \end{bmatrix}$

Simplify $\dot{q}=q(1-q)\{-1,1\}L\{t,1-q\}^T$ and get $\dot{q}=q(1-q)\left[R_1'+(R'-R_1')p\right]$

Therefore when $\dot{p}=0,\dot{q}=0$, $(0,0)$, $(0,1)$, $(1,0)$, $(1,1)$ are balance points of school characteristic reformation institutionalization. According to matrix stability, analyze these balance points partial stability, solve partial derivatives of $\dot{p}$ to p, and partial derivatives of $\dot{q}$ to q, matrix is $A=\begin{bmatrix} \partial\dot{P}/\partial P & \partial\dot{P}/\partial q \\ \partial\dot{q}/\partial p & \partial\dot{q}/\partial q \end{bmatrix}=\begin{bmatrix} (1-2p)\left[(R-R_1-R_2)q+R_1\right] & p(1-p)(R-R_1-R_2) \\ q(1-q)(R'-R_1') & (1-2q)p \end{bmatrix}$ A mong them

$$\det A=(1-2p)(1-2q)\left[(R-R_1-R_2)q+R_1\right]\left[R_1'+(R'-R_1')p\right]$$
$$-pq(1-p)(1-q)(R-R_1-R_2)(R'-R_1')$$

$trA=(1-2p)\left[(R-R_1-R_2)q+R_1\right]+(1-2q)\left[R_1'+(R'-R_1')p\right]$ Ta ble 8 is balance point partial stability.

Table 3 Balance point partial stability

Balance point (p,q)	trA		det A		Stability
$(0,0)$	R_1+R_1'	+	$R_1\bullet R_1'$	+	Unstable point
$(0,1)$	$R-R_2-R_1'$	-	$-(R-R_2)\bullet R_1'$	Unknown	Saddle point
$(1,0)$	$R'-R_1$	-	$-R_1\bullet R'$	Unknown	Saddle point
$(1,1)$	$-(R-R_2+R')$	+	$(R-R_2)\bullet R'$	-	Stable point

By above Table 3, it is clear $(0,0)$ point is unstable point, $(0,1)$ and $(1,0)$ are saddle points, evolution stable point is $(1,1)$. Therefore government and school optimal strategy on China modern aerobics education problem is that school should positive carry on characteristic education reformation, let students to be interested in aerobics, and government also should carry out coordination, strengthen aerobics education's characteristic education, and strengthen aerobics professional guiding.

3. CONCLUSION

The paper firstly through establishing analytic hierarchy process model, solves China modern aerobics education main obstacles when considering multiple influence factors are the low efficiency of education, the lack of features and the lack of overall thought, and their respectively proportions are 0.372、0.455 and 0.183. Then by game analysis and evolution game analysis, it solves government and school optimal strategy on China modern aerobics education problem is that school should positive carry on characteristic education reformation, let students to be interested in aerobics, and government also should carry out coordination, strengthen aerobics education's characteristic education, and strengthen aerobics professional guiding.

REFERENCES

[1]BING Zhang, Duo Tang. Application of gray correlation theory for the impact factor analysis of the integrative development of the sports industry and tourism industry. International Journal of Applied Mathematics and Statistics, v 51, n 21, p 148-155, 2013.

[2]CUI Yuan-yuan, ZHENG Xing-hong, 2010. The Research on Objectivity of the Execution Scoring in the 29th Olympic Female Gymnastics Competitions. Sports Sciences Researches, 14(2):71-73.

[3] Xu Rui-fang, 2009. The Research on Objectivity of the E Group of Judges Giving Scores in Beijing Olympic Male Gymnastics Competitions. Sports Sciences Researches, 13(3):50-51.

[4]LI Liang-ping, WANG Yun-liang, SUN Jian, 2006. Objective Analysis of Scoring of Gymnastics in the 10th National Games. China Sport Science and Technology, 42(4):70-71.

Game Theory-based Sports Public Service Supply System Research

Hong Wang
Institute of P.E, Henan Polytechnic University, Jiaozuo,454000, China

Abstract: The paper firstly through establishing analytic hierarchy process model, consider when supplying sports public services, obtained yield returns, policy support, the brand effect and authority as well as social stability and other influence factors, solves sports public services supply's government. Subsequently, according to game analysis and evolution game analysis, it solves government and enterprise supplying public cultural services strategy system evolves from initially unstable point to gradually stable point , so optimal supplying ways is government cooperating with enterprise to supply public services.
Keywords: Game Theory, Evolution Game Theory

1. INTRODUCTION

With constantly development after China opening-up and reform, public services become an important content of Chinese government reformation thought, government reformation on public services will get involve in multiple aspect [1]. Therefore public service will have many contents; expressed forms are also various, from which it can be divided into lowest basic public service, economic aspect service, social welfare service and public security and safety and so on [2]. Lowest basic aspect public service contents refer to nation directly engages or through public input resources and manpower to provide public basic guarantee that uses in production, life, development and entertainment aspects, such as public used water, electricity, gas and traffic supply as well as communication, post and telecommunications, weather and other services perfection. And economic aspect public service contents similarly is up to national directly engagement or through public input resources to supply public and enterprise economic development aspects required all kinds of services that are promoting scientific and technological culture, providing consultations and credit and load as well as all kinds of policies services [3]. Social welfare service is to meet masses directly demands in social activities and serve them, from which it includes children education, promoting science and technological knowledge, providing civil medical treatment and public health as well as social insurance, protecting people location environment and so on, and granting civil state-run education, medical treatment and social as well as other welfare [4]. Therefore, it is to meet public life directly demands. And public security and safety refers to nation provided safety precautions and protection for people, as army, police and fire protection as well as others to guarantee civil personal and property safety. Among them, sports public service is an important part in government public service system, the reason is sports public service directly affects a nation's civil physical quality. A country's sports public service level represents the society people health extent, and also is the reflection of the nation life force. Therefore, the paper researches on optimal supply mode of Chinese sports public services.

2. MODEL ESTABLISHMENTS

Establish hierarchical structure: In order to solve sports public service optimal supply mode, firstly it should find out supplying most influential unit that is government, enterprise, and third department. Therefore, the paper firstly bases on analytic hierarchy process to make quantization on sports public services. Establish target layer, criterion layer and scheme layer relations.

Hierarchical total arrangement and its consistency test: Use consistency indicator test formula as: $CI=\frac{\lambda_{\max}-n}{n-1}$ .Among them, $\lambda_{\max}$ is maximum feature value of comparison matrix, n is comparison matrix order. It is clear that judgment matrix gets closer to consistency and CI value will be smaller.

$$C=\begin{Bmatrix}1 & 1/3 & 3 & 3\\ 3 & 1 & 5 & 5\\ 1/3 & 1/5 & 1 & 1\\ 1/3 & 1/5 & 1 & 1\end{Bmatrix}$$

$$\xrightarrow{\text{Column vector normalization}}\begin{Bmatrix}0.214 & 0.192 & 0.3 & 0.3\\ 0.075 & 0.577 & 0.5 & 0.5\\ 0.121 & 0.115 & 0.1 & 0.1\\ 0.201 & 0.115 & 0.1 & 0.1\end{Bmatrix}$$

$$\xrightarrow{\text{Solve sum by line}}\begin{Bmatrix}1.066\\ 2.22\\ 0.386\\ 0.386\end{Bmatrix}$$

$$\xrightarrow{\text{Normalization}}\begin{Bmatrix}0.2515\\ 0.555\\ 0.0965\\ 0.0965\end{Bmatrix}=U^{(0)}$$

$$CU^{(0)}=\begin{Bmatrix}1 & 1/3 & 3 & 3\\ 3 & 1 & 5 & 5\\ 1/3 & 1/5 & 1 & 1\\ 1/3 & 1/5 & 1 & 1\end{Bmatrix}\begin{Bmatrix}0.2514\\ 0.555\\ 0.0965\\ 0.0965\end{Bmatrix}=\begin{Bmatrix}1.023\\ 2.286\\ 0.376\\ 0.376\end{Bmatrix}$$

$$\lambda_{\max}^{(0)}=\frac{1}{4}\left(\frac{1.023}{0.251}+\frac{2.286}{0.555}+\frac{0.376}{0.0965}+\frac{0.376}{0.0965}\right)=4.01$$;

$$u^{(0)}=\begin{pmatrix}0.272\\0.608\\0.060\\0.060\end{pmatrix}$$

Judgment matrix is

$$D_1=\begin{Bmatrix}1&1&1/3\\1&1&1/3\\3&3&1\end{Bmatrix},D_2=\begin{Bmatrix}1&5&5\\1/5&1&5\\1/5&1/5&1\end{Bmatrix},$$

$$D_3=\begin{Bmatrix}1&5&8\\1/5&1&5\\1/8&1/5&1\end{Bmatrix},D_4=\begin{Bmatrix}1&5&8\\1/5&1&5\\1/8&1/5&1\end{Bmatrix}$$

Corresponding maximum feature value and feature vector are in order as:

$$\lambda^{(1)}{}_{\max}=3.62,u^{(1)}{}_1=\begin{Bmatrix}0.244\\0.244\\0.512\end{Bmatrix}$$;

$$\lambda^{(2)}{}_{\max}=3.31,u^{(1)}{}_2=\begin{Bmatrix}0.657\\0.251\\0.092\end{Bmatrix}$$

$$\lambda^{(3)}{}_{\max}=3.29,u^{(1)}{}_3=\begin{Bmatrix}0.648\\0.204\\0.148\end{Bmatrix}$$;

$$\lambda^{(4)}{}_{\max}=3.33,u^{(1)}{}_4=\begin{Bmatrix}0.648\\0.204\\0.148\end{Bmatrix}$$

According to $CI=\frac{\lambda_{\max}-n}{n-1}$ it gets RI value that can refer to Table 1.

TABLE 1 RI value

n	1	2	3	4	5	6	7	8	9	10	11
RI	0	0	0.58	0.90	1.12	1.24	1.32	1.41	1.45	1.49	1.51

For judgment matrix A, $\lambda^{(0)}{}_{\max}=4.063, RI=0.9$

$RI=\frac{4.063-4}{4-1}=0.021$; $CR=\frac{CI}{RI}=\frac{0.021}{0.90}=0.023<0.1$

It represents C inconsistency extent is within permissible range, now it can use C feature vector to replace weight vector.

Similarly, to judgment matrix D_1, D_2, D_3, D_4, utilize above principle, all pass consistency test.

Calculation structure is as following:

$$u^{(1)}=(u_1^{(1)},u_2^{(1)},u_3^{(1)},u_3^{(1)})$$

$$=\begin{Bmatrix}0.624&0.185&0.252&0.575\\0.234&0.240&0.089&0.286\\0.136&0.575&0.66&0.139\end{Bmatrix}$$

$$u=u^{(1)}u^{(0)}$$

$$=\begin{Bmatrix}0.252&0.575&0.624&0.185\\0.089&0.286&0.240&0.240\\0.66&0.139&0.136&0.575\end{Bmatrix}\begin{Vmatrix}0.577\\0.066\\0.124\\0.253\end{Vmatrix}$$

$$=\begin{Bmatrix}0.612\\0.334\\0.054\end{Bmatrix}$$

Sports public service supply mode game analysis: By above analytic hierarchy process, it is clear that in sports public service supply aspect, government and enterprise are the main parts, and roughly can regard government and enterprise implemented strategies as two kinds that are supply and don't supply. Here set in case that government provides sports public service while enterprise doesn't supply, government earnings is Y_1, enterprise earnings is 0 ;on the contrary when enterprise supplies while government doesn't supply, enterprise earnings is $Y_1^{'}$, government earnings is Y_2, reason is though government doesn't supply services, enterprise supplies while also carries out government system, it supports government policies, it is still beneficial to government. When government and enterprise simultaneous provide sports public services, government earnings is Y, enterprise earnings is $Y^{'}$;If both government and enterprise don't supply, then both earnings are 0. Table 2 is government and enterprise supplies earnings matrix.

TABLE 2 Government and enterprise public cultural services supplying earnings matrix

		Enterprise Supply	Don't suply
Government	Supply	$Y,Y^{'}$	$Y_1,0$
	Don't supply	$Y_2,Y_1^{'}$	$0,0$

Among them, $Y>Y_1>Y_2$, but size of $Y^{'},Y_1^{'}$ cannot define, therefore the paper will adopt evolution game analysis to analyze government and enterprise sports public services supplying practices, and make respectively strategies adjustment.

Sports public service supplying evolution game analysis. The paper thinks that government and enterprise strategy selection in sports public services supply and doesn't supply are both independent and random, and can carry on repeated games. Therefore, set government supplying probability is P, probability that don't supply is $1-P$; enterprise supplying probability is Q, probability that don't

supply is $1-Q$. According to Malthusian theorem, it is clear that government supplying strategy selection times' growth rate $\dot{P}/P$ should be difference between fitness $E_w W\{f,1-Q\}^T$ and average fitness $\{P,1-P\}W\{Q,1-Q\}^T$. $E_w=[1,0]$, when government supplying probability is 1, its earnings matrix is: $W=\begin{bmatrix} Y & Y_1 \\ Y_2 & 0 \end{bmatrix}$

Simplify $\dot{P}=P(1-P)\{1,-1\}DQ,1-Q\}^T$ and get $\dot{P}=P(1-P)[(Y-Y_1-Y_2)Q+Y_1]$

Similarly, enterprise supplying strategy selection times' growth rate $\dot{Q}/Q$ should be difference between fitness $E_J H\{P,1-P\}^T$ and average fitness $\{Q,1-Q\}H\{P,1-P\}^T$. $E_J=[0,1]$, when enterprise supplying probability is 1, its earnings matrix is $H=\begin{bmatrix} Y' & 0 \\ Y_1' & 0 \end{bmatrix}$

Simplify $\dot{Q}=Q(1-Q)\{-1,1\}H\{t,1-Q\}^T$ and get $\dot{Q}=Q(1-Q)\left[Y_1'+(Y'-Y_1')P\right]$

Therefore when $\dot{P}=0,\dot{Q}=0$, $(0,0)$, $(0,1)$, $(1,0)$, $(1,1)$ are balance points of public cultural service supplying. According to matrix stability, analyze these balance points partial stability, solve partial derivatives of $\dot{P}$ to P, and partial derivatives of $\dot{Q}$ to Q, matrix is

$$R=\begin{bmatrix} \partial\dot{P}/\partial P & \partial\dot{P}/\partial Q \\ \partial\dot{Q}/\partial P & \partial\dot{Q}/\partial Q \end{bmatrix}=\begin{bmatrix} (1-2P)[(Y-Y_1-Y_2)Q+Y_1] & P(1-P)(Y-Y_1-Y_2) \\ Q(1-Q)(Y'-Y_1') & (1-2Q)P \end{bmatrix}$$

Among them

$$\det R=(1-2P)(1-2Q)\left[(Y-Y_1-Y_2)Q+Y_1\right]\left[Y_1'+(Y'-Y_1')P\right]$$
$$-PQ(1-P)(1-Q)(Y-Y_1-Y_2)(Y'-Y_1')$$
$$trR=(1-2P)\left[(Y-Y_1-Y_2)Q+Y_1\right]+(1-2Q)\left[Y_1'+(Y'-Y_1')P\right]$$ B

y above table, it is clear $(0,0)$ point is unstable point, $(0,1)$ and $(1,0)$ are saddle points, evolution stable point is $(1,1)$. Therefore, it is clear that government and enterprise supplying public cultural services strategy system evolves from initially unstable point $(0,0)$ to gradually stable point $(1,1)$, so optimal supplying ways is government cooperating with enterprise to supply public services.

3. CONCLUSIONS

The paper firstly through establishing analytic hierarchy process model, consider when supplying sports public services, obtained yield returns, policy support, the brand effect and authority as well as social stability and other influence factors, solves sports public services supply's government, enterprise and the third department respectively occupied proportions as government is 0.612、enterprise is 0.334、third department is 0.054. Therefore, it gets that in sports public service supply aspect, government and enterprise supplies have larger impacts. Subsequently, according to game analysis and evolution game analysis, it solves government and enterprise supplying public cultural services strategy system evolves from initially unstable point $(0,0)$ to gradually stable point $(1,1)$, so optimal supplying ways is government cooperating with enterprise to supply public services.

REFERENCES

[1]Wang Cai-Xing. Shanghai sports public services time and exploration. Sports science and technology, 2008, (2):20-26.

[2]SONG Yi-yan.The Application of Growing Polar Theory in Regional Tourism Cooperation Regional Cooperation in Tourism Development Model of NingZhenYang Town[J]. Journal of Harbin University of Commerce: Social Science Edition, 2007, (6):84-86,90.

[3]LUI Wang, YANG Min. Comparative Advantage, Competitive Advantage and Regional Tourism Planning[J]. Journal of Sichuan Normal University(Social Science Edition), 2006, 33(4):111-116.

[4]Liu Hong-Ming. Dabie Mountain red cultural resource tourism values exploitation research [J]. Hubei social science,2012(5):54-56.

Sports Events Risk Assessment Model Construction

Yan Wang
Institute of P.E, Henan Polytechnic University, Jiaozuo 454000, China

Abstract: Large scale sports events organization needs to adopt all kinds of methods to control and reduce risks in events. Assess risks in events is very necessary to ensure sports events safety operation, propel sports undertakings development. The paper adopts analytic hierarchy process to establish sports events risk assessment model, represents risk degree by quantization value. According to sports events holding forms, risk assessment indicators are mainly events organizational management risk, human resource risk, economic risk, environmental risk, and political risk. By establishing indicators system, it constructs sports events risk assessment model.
Keywords: Analytic hierarchy process; risk assessment; sports events

1. INTRODUCTION

With Beijing Olympic Games hosting, China's large-scale sports events hosting times in recent years have showed growth trend. Sports events promotions to sports industry development become increasingly prominent. And meanwhile sports events also are closely linked to city development, sports events hosting promote city development, city image setting-up, and city competitiveness promotion. But holding large-scale sports events required manpower, material resources, financial resources and other investment are larger. Therefore, successful holding of events relate to investment succeeds or fails, good risk management and risk assessment establishment is the foundation of holding sports events [1-5].

The paper assesses and checks sports events risk by establishing risk assessment mathematical model. Give a warning to sports events ahead of time and provide guarantee for sports events smoothly conduct.

2.SPORTS EVENTS RISK INDICATORS SELECTION PRINCIPLE

2.1 Indicators are measurable

Risk assessment should be able to quantize risks size with data, from which selected relevant indicators in risk assessment should meet measurability principle. For immeasurable indicators, even indicators factors are good; they cannot be regarded as reference. Indicators need to be able to measure or estimate, and use exact quantization value to represent. Measurement method can be exact numerical value, and also quantized mean value that is obtained by expert assessment [6-9].

2.2 Indicators possesses scientificity

Sports events risk assessment covers wider areas, reference indicators have distinction between primary and secondary factors, indicators are mutual affected. Scientific select indicator system is to seize the primary factors, eliminate secondary factors, correct handle relations with classified indicators, let selected indicators to be able to more correct reflect events actual risk degree so as to provide constructive suggestions for improving sports events organizational management[9-11].

2.3 Overall importance

Sports events as a complete system, it needs coordination and cooperation among departments, and meanwhile all aspects risks exist. Indicator system cannot only establish in sports events, but also should ensure to possess completeness, systematic ness and compatibility. For complicated large-scale sports events, it should take the whole indicators into account and plan so that effective give a warning to large-scale sports events risks and make scientific assessment.

2.4 Identity

Indicators selection cannot rely on individual subjective assume, but needs to define through referencing document literature, interviewing with experts and scholars, and combining with sports events actual situations. Establish indicator system by breaking away from sports events are unbelievable, which cannot be approved by experts and scholars, and staff. Identity is the key to ensure indicator system accuracy and completeness; established indicator system can be checked by practice and approved by relevant staff.

3. SPORTS EVENTS RISK INDICATOR SYSTEM COMPOSITION

Sports events risk factors roughly divide into internal cause and external cause the two main factors. Internal cause mainly is sports games relevant organization management, external cause is main composed of natural environment and social environment. Established sports events risk indicator system on this account is as following Table 1.

3.1 analytic hierarchy process calculates indicator weight

Analytic hierarchy process features are simple thoughts, well arrangement, widely application range, algorithm core is weight calculation. It is specially applied to multiple schemes problems and complicated systematic decision-making problems, is a powerful mathematical method that transforms

question into quantitative research. Nowadays, analytic hierarchy process has already widely used in all fields to solve practical problems. Sports events risk assessment gets involved in multiple reference indicators; such decision-making problem applies to analytic hierarchy process. Utilize AHP to solve risk assessment indicators weights, and establish sports events comprehensive risk assessment system.

Table 1 Sports events risk assessment indicator

Target (T)	First level indicator (F)	Second level indicator (S)
Sports events risk assessment	Events organizational management risk	Field equipment risk
		Stadium construction risk
		All departments collaborative risk
		Resource allocation risk
	Economic risk	Events investment risk
		Events benefit risk
		Events budget risk
	Personnel security risk	Athlete injury risk
		Events personnel risk
		Events audience security risk
	External environmental risk	Natural disaster risk
		Events humanistic environmental risk
		Public health risk
		Media risk
		Events political risk

3.2 Construct judgment matrix

Construct judgment matrix by comparing the two relative importances. Such as taking C_i, C_j to make important comparison, the structure is using a_{ij} to express, and then all factors after comparing can get judgment matrix A. Its expression is as following.

$$A=\begin{pmatrix} a_{11} & a_{12} & \cdots & a_{1j} \\ a_{21} & a_{22} & \cdots & a_{2j} \\ \vdots & \vdots & \ddots & \vdots \\ a_{i1} & a_{i2} & \cdots & a_{ij} \end{pmatrix}$$

a_{ij} the two compared importance uses quantized value to express, uses1—9 number to describe, number representative meaning is as following Table 2 show.

Similarly, it establishes judgment matrix on volleyball first level indicator volleyball technique's second level indicator defense success rate, attack success rate and scoring rate of serving, and rest second level indicators respectively constructed judgment matrix is as following:

Table 2 1~9 scale meaning

Scale	Meaning
1	Indicates two factors have equal importance by comparing
3	Indicates the former is slightly more important than the later by comparing two factors
5	Indicates the former is more important than the later by comparing two factors
7	Indicates the former is relatively more important than the later by comparing two factors
9	Indicates the former is extremely more important than the later by comparing two factors
Even number	Represents importance is between two odd numbers
Reciprocal	Represents factors positive and negative comparison order

3.3 Weight vector and maximum feature calculation

Firstly, carry out column vector normalization on first level indicator judgment matrix, secondly solve the sum and make normalization again, it can get weight vector. According to feature value and feature vector relations, it can solve feature value. Implementation method is as following:

$$A=\begin{pmatrix} 1 & 3 & 3 & 2 \\ 1/3 & 1 & 1 & 1 \\ 1/3 & 1 & 1 & 2 \\ 1/2 & 1 & 1/2 & 1 \end{pmatrix} \xrightarrow{Columnvect\ ornormaliz\ tion} \begin{pmatrix} 0.462 & 0.5 & 0.545 & 0.333 \\ 0.154 & 0.167 & 0.182 & 0.167 \\ 0.154 & 0.167 & 0.182 & 0.333 \\ 0.231 & 0.167 & 0.091 & 0.167 \end{pmatrix}$$

$$\xrightarrow{Solvesumby\ line} \begin{pmatrix} 1.840 \\ 0.669 \\ 0.836 \\ 0.655 \end{pmatrix} \xrightarrow{normalizat\ ion} \begin{pmatrix} 0.460 \\ 0.167 \\ 0.209 \\ 0.164 \end{pmatrix}$$

That solved first level indicator weight vector is $w=(0.460\ \ 0.167\ \ 0.209\ \ 0.164)^T$

For maximum feature value calculation, it can get by matrix property:

$$Aw=\lambda_{\max} w$$

Then:

$$Aw=\begin{pmatrix} 1 & 3 & 3 & 2 \\ 1/3 & 1 & 1 & 1 \\ 1/3 & 1 & 1 & 2 \\ 1/2 & 1 & 1/2 & 1 \end{pmatrix}\begin{pmatrix} 0.460 \\ 0.167 \\ 0.209 \\ 0.164 \end{pmatrix}=\begin{pmatrix} 1.92 \\ 0.69 \\ 0.21 \\ 0.16 \end{pmatrix}$$

So: $\lambda_{\max}=\frac{1}{4}(\frac{1.92}{0.460}+\frac{0.69}{0.167}+\frac{0.21}{0.209}+\frac{0.164}{0.164})=4.119$

On above, maximum feature value is $\lambda_{\max}=4.119$.

Weight vector is: $w=(0.460\ \ 0.167\ \ 0.209\ \ 0.164)^T$.

3.4 Consistency test

Consistence matrix: if matrix $A=(a_{ij})_{n*n}$, its element meets $a_{ij}a_{jk}=a_{ik}$,then matrix is consistence matrix. Among them, $a_{ij}>0$, $a_{ij}=1/a_{ji}$. In order to use it to

calculate factor weight, it requires that matrix inconsistency only under acceptable conditions. When problems are relative complicated, we cannot take all factors into account, which causes paired comparison construct judgment matrix instant, judgment matrix cannot arrive at ideal state consistency.

Judgment matrix consistency indicator CI, and judgment matrix consistency ratio CR, its computational method is as following formula: $CI = \frac{\lambda_{\max} - n}{n-1}$

Among them, n represent order number of judgment matrix that is also the number of compared factors: $CR = \frac{CI}{RI}$

Among them, RI represents Random Consistency Index value,as following Table 3show.

Table 3 RI value table

n	1	2	3	4	5	6	7	8	9	10	11
RI	0	0	0.58	0.90	1.12	1.24	1.32	1.41	1.45	1.49	1.51

When $CR \geq 0.1$,it is thought that judgment matrix occurs inconsistency is unacceptable. When $CR < 0.1$, judgment matrix inconsistency is within acceptable range. For indicators consistency test, calculate and get $\mathrm{CI} = 0.03954$, $\mathrm{CR} = 0.044 < 0.1$, so judgment matrix passes consistency test.

Similarly, it can calculate and get all judgment matrix weight vector, maximum feature value, CI and consistency ratio CR, calculated result Table 4 is as following:

Table 4 Judgment matrix calculation result table

Judgment matrix	T	F_1	F_2	F_3	F_4
w	0.460	0.362	0.539	0.595	0.193
	0.167	0.212	0.297	0.277	0.072
	0.209	0.123	0.164	0.129	0.193
	0.164	0.302			0.118
					0.425
$\lambda_{\max}$	4.119	4.175	3.009	3.006	5.072
CI	0.040	0.058	0.005	0.003	0.018
CR	0.04	0.06	0.008	0.005	0.016

3.5 Weight calculation arrangement

Assume that first level indicator weight calculation result is α_m, corresponding affiliated second level indicator weight is β_{nm} ,then second indicator weight in total hierarchy is:

$$w_i = \alpha_i \beta_{ij}$$

By above formula calculating, it gets each indicator weight in total target as following Table 5.

Table 5 Indicator weight calculation result

First level indicator (F)	Weight	Second level indicator (S)	Weight
Events organizational management risk	0.460	Field equipment risk	0.1665
		Stadium construction risk	0.0975
		All departments collaborative risk	0.0566
		Resource allocation risk	0.1389
Economic risk	0.167	Events investment risk	0.0900
		Events benefit risk	0.0496
		Events budget risk	0.0274
Personnel security risk	0.209	Athlete injury risk	0.1244
		Events personnel risk	0.0579
		Events audience security risk	0.0270
External environmental risk	0.164	Natural disaster risk	0.0317
		Events humanistic environmental risk	0.0118
		Public health risk	0.0317
		Media risk	0.0194
		Events political risk	0.0697

4. CONCLUSION

According to analytic hierarchy process calculation, the paper gets the conclusion that it is thought the largest weight in the first level indicator risk is events organizational management risk, secondly is personnel security risk. Therefore, in risk management it should focus on strictly controlling the item operation so that can sharply reduce sports events risk. Larger weights in the second level indicator are field equipment risk (0.1665) ,resource allocation risk (0.1389), athlete injury risk (0.1244)

and stadium construction risk (0.975) .In risk management, it can rely on weight size, make distinction between primary and secondary factors, control potential events risk. By measuring and investigating all kinds of indicators quantization value, it finds out indicator risk index, combining with corresponding weights and can calculate sports events entire risk value. The paper establishes sports events risk assessment mathematical model.

REFERENCES

[1]HUANG Xiao-mao, ZENG Wan-zhou. Research on the Commercialized Operation of Chinese Large Physical Games with the Public Welfare. Sci-Tech Information Development & Economy, 2007, 17(21):137-138.

[2]ZHOU Liang-jun, CHEN Xiao-ying and ZHOU Xi-kuan. Status and Role of Government in Sport Event Exhibition Industry --Taking Shanghai as an Example. Sports Science Research, 2007, 28(4):48-51.

[3]CAI Li-bin, JIA Jun-gang. The Role of Local Government in MICE. Journal of Huazhong University of Science and Technology(Social Science Edition), 2007, 21(5):67-70.

[4]HUANG Lu, FU Xiao-chun. On the Connotation of Sports Events. Journal of Capital College of Physical Education, 2005, 17(6):12-13.

[5]Guo Hong - bo, Zhu Yong. Analysis and Strategic Research on China ' s Current Sports Industry Development. Fujian Sports Science and Technology, 2013(3):3-5.

[6]REN Chunxiang, ZHANG Jie. The Research on Macro-environment of China's Sports Competition Exhibition Match Industry Market. Sports & Science, 2004, 25(3):14-17.

[7]Ye Chaozhong. On the Development of Sports Brokerage in Zhejiang Province. Journal of Anhui Sports Science, 2002, 23(2):30-32.

[8]LU Geng-hua, LIU Xin-min. Study on the Choice of Policy of Sports Industry Development During Construction of Well - off Society in Shaanxi Province. Journal of Xi'an Institute of Physical Education, 2006, 23(5):44-46.

[9]ZHOU Liang-jun, ZHOU Xi-uan. Study on the Theory and Method of International Competitiveness of Shanghai Sport Event Industry. Journal of Guangzhou Physical Education Institute, 2006, 26(5):13-16.

[10]HUANG Hai-yan, ZHANG Lin, LI Nan-zhu. Study on the Role of Shanghai Government in the Operation of Major Sports Competition Events. China Sport Science, 2007, 27(2):17-25.

[11]DONG Jie. Existing Mainly Problems, Reasons and Countermeasures About China Host Mega Sport Events. Sports & Science, 2012, 33(3):42-51.

Macronutrient Intake Assessment under Sports Intervention

Ting Zhang
Sports College, JiLin University, ChangChun, JiLin, China

Abstract: The objective of this article was to determine macronutrient intake using two methods; 24 hour food recalls (24hR) and 3-day food records (3dFR). The second objective was to calculate macronutrient intake by hand and compare results to those obtained using specialized software. It was hypothesized that macronutrient intake estimates using the two methods would be similar (24hFR vs 3dFR), however the way the food records were analyzed would show different results (hand vs software). These hypotheses will be tested by comparing results obtained by 24hFR and 3dFR, as well as results from Food Processor and gram calculations by hand using computer spreadsheets.
Keywords: Macronutrient Intake; Protei; Carbohydrate; Fat

1. INTRODUCTION

In order to get the result as we expect, we assigned students in the lab completed 3dFRs. Briefly, consumption of all food, beverages and supplements were recorded for three consecutive days, including specifics such as portion size and brand name [1]. Students were instructed to include 1 weekend day in the 3dFR. During the lab, students were paired up, or placed into a group of three, and performed the 24hR with each other, as well as analyzing the 3dFRs of the other student [2-4]. The 24hR included all food and beverages consumed from midnight to midnight on the previous day and was performed as described in the Laboratory Manual.

2. METHODS

Hand calculations were performed by looking up and recording the gram amount of protein, carbohydrates, fat and dietary fibre of each food listed in the 24hR. Food composition data was obtained from the USDA Nutrient Data Laboratory website and food labels, and data was compiled using Microsoft Excel spreadsheets. Gram amounts for each macronutrient were totaled and % of energy intake was calculated using 4 kcal/g for protein and carbohydrate, and 9 kcal/g for fat as shown below. Fibre was assumed to be 0 kcal/g.

_____ g protein x 4 kcal/g = _____ % of daily energy intake from protein

The foods listed from in the 24hR and 3dFR were analyzed using the nutritional software Food Processor SQL to obtain average daily intake of protein, carbohydrate, fat as a % of total energy intake, as well as in grams (including dietary fibre).

These results were compared to the Estimated Average Intake (EAR), Recommended Dietary Allowance (RDA), Adequate Intake (AI) where applicable (for gram amounts) and to Acceptable Macronutrient Distribution Range (AMDR) (for % energy). Protein requirements were calculated using body weight and the reference values of 0.66 g/kg for EAR and 0.8 g/kg for RDA for women 18 to 30 years of age as shown:

EAR = ___ kg x 0.66 g/kg = ___ g protein

RDA = ___ kg x 0.8 g/kg = ___ g protein

3. RESULUTS

Table 1 Average Daily Intake of Macronutrients Analyzed Using a Nutritional Software Program Versus Calculations by Hand.

Method	Nutritional Software Program							Hand Calculations						
Macro-nutrient	CHO		Protein		Fat		DF	CHO		Protein		Fat		DF
Units of Measure	g	% TK	g	% TK	g	% TK	g	g	% TK	g	% TK	g	% TK	g
Subject 1	341	53	80	12	101	35	48	348	49	80	13	101	38	47
Subject 2	368	65	85	15	51	20	36	366	65	94	17	45	18	35
Subject 3	326	61	60	11	71	28	19	326	60	60	11	71	29	19

CHO: Carbohydrate; DF: Dietary Fiber; %TK: % of Total Kcalorie Intake. The subjects were Nutrition 301 students (n=3 Females). Subject 1 is 23 years old with a mass of 70 kg, Subject 2 is 19 years old with a mass of 50 Kg, and Subject 3 is 19 years old with a mass of 66.5kg. A 24 hour recall of dietary intake was conducted on each subject and their macronutrient intakes were analyzed via hand calculations and a nutritional software program.

Table 2 Average Daily Intake of Macronutrients as Assessed by a 3-Day Food Record Versus a 24 Hour Recall.

Method	3 Day Food Record Average				24 Hour Recall			
Macro-Nutrient	CHO	Protein	Fat	DF	CHO	Protein	Fat	DF

Units of Measure	g	% TK	g	% TK	g	% TK	g	g	% TK	g	% TK	g	% TK	g
Subject 1	323	54	99	16	80	30	40	341	53	80	12	101	35	48
Subject 2	319	68	73	16	34	16	36	368	65	85	15	51	20	36
Subject 3	278	57	92	19	51	24	13	326	61	60	11	71	28	19

CHO: Carbohydrate; DF: Dietary Fiber; %TK: % of Total Kcalorie Intake. The subjects were Nutrition 301 students (n=3 Females). Subject 1 is 23 years old with a mass of 70 kg, Subject 2 is 19 years old with a mass of 50 Kg, and Subject 3 is 19 years old with a mass of 66.5 kg. Each subject recorded their food intake for three days, and a 24 hour recall was also conducted on each subject. The nutritional software program used to analyze macronutrient intake for both methods was Food Processor.

Daily macronutrient intakes from the 24hR method, determined via hand calculations versus nutritional software analysis varied at most by 2% of gram weight (Table 1). However, a comparison between daily nutrient intakes for the 3dFR and 24hR methods revealed greater discrepancies (Table 2). Carbohydrate intake from the 24hR method was consistently higher across subjects when compared to the 3dFR method (Table 2). Subjects 1 and 3 had higher intakes of fat, dietary fiber and % total Kcalories from fat in the 24hR method (Table 2). Subject 2 also had a higher intake of protein and fat in the 24hR when compared to the 3dFR average (Table 2).

4. DISCUSSION

When 3dFR averages were assessed for nutritional adequacy, carbohydrate intake was above the Recommended Dietary Allowance (RDA) of 130 g1 for all three subjects (Table 2). The RDA for protein intake was determined individually for each subject, based on weight, and intakes for all three subjects met or exceeded the RDA (Table 2). Macronutrient intakes from 3dFR averages for all three subjects were also compared to the Acceptable Macronutrient Distribution Ranges (AMDR). The AMDR for carbohydrate, protein and fat are 45-65%, 10-35%, and 20-35% respectively1. Subjects 1 and 3 were within the distribution range for carbohydrate intake, while subject 2 exceeded the carbohydrate AMDR for her Kcalorie intake. All three subjects were within the AMDR for protein, and subjects 1 and 3 met the AMDR for fat, whereas subject 2 was under the AMDR for fat (Table 2). Dietary fiber intake of all three subjects was compared to the AI for dietary fiber of 25 g/day1. Subjects 1 and 2 exceeded the AI for fiber, while subject 3 did not meet the AI (Table 2). A change that Subject 2 can make in her diet to provide better nutrition is to reduce carbohydrate intake and increase fat intake, preferably with healthy fats found in nuts and fatty fish. Subject 3 can benefit from increasing her dietary fiber intake by consuming more whole grains, legumes, vegetables, and fruits.

When comparing calculation methods for the 24hR method, there was little to no variation between macronutrient intake obtained via the nutritional software program and hand calculations. A possible reason for this is food composition data from the nutritional software program was used for hand calculations for Subjects 1 and 3, while the United States Department of Agriculture (USDA) food composition data was used for subject 2 in determining the gram weight and % total Kcalorie intake for each macronutrient. The use of nutritional software food composition data in hand calculations for two of the subjects may have exaggerated the similarity of intakes between the two analysis methods, because the same food data was used as part of the software calculation.

There was a greater difference in macronutrient and fiber intakes when 3dFR averages and 24hRs were compared. Despite the fact that both are quantitative methods for assessing macronutrient intake1, there are several possible explanations for this discrepancy. Averages for 3dFRs may have been a better representation of typical food intake in subjects than the 24hRs performed, because the 3dFR average took into account three days, as opposed to one. It is possible that subjects had very different eating patterns the day prior to the 24hR than the three days during which food records were kept; three days are more likely to capture typical food intake. To obtain a more accurate representation of typical dietary nutrient intakes, keeping a food record for 3 to 7 days is ideal1. However, deviation from typical food intake can still occur with a 3dFR. For example, subject 3 ate outside the home with greater frequency than her typical food consumption patterns, and subject 1 was ill during the three day record period. This may have affected the 3dFR average for both subjects. Individuals may also alter their typical food intake while keeping a food record, which can compromise accuracy as well. This may explain why subject 2 had a lower total Kcalorie intake when assessed with the 3dFR as compared to the 24hR. Food records also place a larger burden on the subject and require the subject to be literate; although literacy was not an obstacle for the three subjects, a certain level of commitment was required to record all foods consumed for three days. In contrast, the 24hR is a faster method of assessing nutrient intake, with minimal burden to the respondent, however it requires that the individual performing the interview is skilled in asking detailed, non-judgmental questions1. The interviewers conducting 24hRs in this study were still familiarizing themselves with the interview process and this may have affected macronutrient analysis. The 24hR method also relies heavily on memory for foods eaten as well as portion

sizes from the previous day, and as such may not be as accurate as a 3dFR, where the individual has the opportunity to look at labels and record food intake in real time1. Under- reporting food intake is sometimes seen with both methods, particularly if the individual is female or obese1. Another challenge with both methods is that the subject may have difficulty in estimating or measuring portion sizes.

There are also limitations to using a nutritional software program, due to the fact that there is a set list of foods one must select from when inputting data, whether a food record or a 24hR approach is used. As a result, it was not always possible to find the exact foods an individual had consumed via the software program, particularly for uncommon or ethnic foods, and this may have skewed macronutrient intake data.

5. CONCLUSION

Contrary to the hypothesis, results using the two methods (records vs recall) to estimate macronutrient intake revealed greater differences, whereas the comparison between analyses of the food records (software vs hand) resulted in little difference in intakes of carbohydrate, protein and fat. Because adequacy of intake is based on an estimate of "usual" intake, the sources of error need to be considered when using DRIs to make these conclusions. There are various personal and contextual factors that can influence food consumption patterns and collection of data. As such, nutrient deficiency or excess, as well as disease risk cannot be concluded strictly from the two methods discussed, and further biochemical tests are needed for a more accurate clinical assessment.

REFERENCES

[1]Biondo T. Lab 1: Assessment of Macronutrient Intake. In: Wilke M, ed. Lab Manual for Nutrition Laboratory NUTR 301. Edmonton, AB: University of Alberta Press, 2012:15-22.

[2]United States Department of Agriculture. USDA Agricultural Research Service Nutrient Data Laboratory. http://www.nal.usda.gov/fnic/foodcomp/search/.

[3]LI Yu-gang. Construction of the New Pattern of Common University Physical Exercise in Sunshine Sports Program[J]. Journal of Liuzhou Vocational & Technical College, 2012,12(1):32-35.

[4]WU Tian-jiao. Research on Sustainable Development of Sunshine Sports[J]. Bulletin of Sport Science & Technology,2013,21(4):59-60.

Mechanical Optimization Design of Spool Head of Hydraulic Impact Hammer

Heng Luo[1], Ting Xu[2]*
[1] *CNOOC EnerTech-Safety & Environmental Protection Co., Zhanjiang, 524057, China*
[2] *Mechatronic Engineering College, Southwest Petroleum University, Chengdu, 610500, China*

Abstract: Aiming at the oil and gas well drill broken rock needed auxiliary tools for speed condition, the hydraulic impact hammer based on the overall structure, find out the key components of the spool and the hammer head cap, and had carried on the mechanical analysis, put forward the optimization scheme. It had far-reaching engineering significance for speeding up the drilling process of oil and gas well.
Keywords: Hydraulic impact hammer; Valve body; Spool head; Hammer cap; Optimization

1. INTRODUCTION

The hydraulic impact hammer was a widely effective tool to improve the drilling speed by providing impact.There were many literatures about hydraulic impact hammer at home and abroad .Wu Peng, Wei Zhongliang, Zhang Bin, OULIN described the YD-1 type jet impactor, introduced some characteristics of liquid jet hammer[1]; Xie Wenwei, Yang Zeying, Wang Yuewei, Qi Liqiang told the YZX series liquid DTH hammer. The structural parameters of the hydraulic DTH hammer, technical requirements and field application results were described in detail, It also provided considerations to use this series of hydraulic hammer for better[2]. Xi'an Petroleum University Zhang Yuanzhi told the ejection and suction type hydraulic impactor, according to the working principle of the hydraulic impactor, the hydraulic impactor was divided into torsion impactor and axial hydraulic impactor, and the latter was divided into valve type and no valve[3]. The valve axial hydraulic impactor included positive, reverse and double acting. The valveless axial hydraulic impactor was consisted of suction and jet. At present, there were Pan American oil company, Perth company, Smith tool drilling equipment company, Terralog company and PDVSA-Intevep company, Brazil oil company, Amerada Hess company, TU Clausthal, Germany BBJ tool company and Canada Suncor energy company beyond seas, mainly studied all kinds of valve type impact. However, there were many references to introduce the working principle and classification characteristics of the hydraulic hammer[4]. The influence of impact load on key components was seldom mentioned, the impact load was suddenly applied under the impactor of the local stress concentration, contact stress could reach very high values in the instantaneous, so easy to produce micro cracks in rock. Therefore, the optimization design of the key parts of the hydraulic impact hammer is very important. In this paper, the mechanical optimization analysis of the key components in the valve body was carried out, which was of guiding significance for the design of other types of hydraulic impact hammer[8-10].

2. MECHANICAL ANALYSIS OF SPOOL HEAD AND HAMMER CAP

The hydraulic impact hammer was in operation, the valve head and valve hammer cap would hit back and forth, the large impact force was easy to damage structure of the two, this paper uses ABAQUS mechanical analysis of the slide valve, through the analysis of the optimization measures was put forward, and the slide hammer cap of the finite element model was shown in figure 1[5].

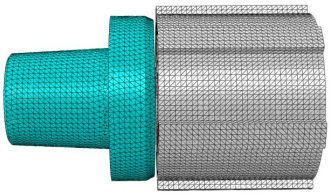


Figure 1 Finite element model of spool head and hammer cap

The force and boundary conditions of the spool head and hammer cap were shown in figure 2. The head of the valve core and the hammer cap were only allowed to move in the direction of Z, according to research, the hydraulic impact hammer in the initial work position generally need to withstand the force of 9.46MPa, so in this mechanical analysis, the load of the model was set at the same time that the pressure of 10MPa was applied at the end of the two, the initial clearance of the spool head and the hammer cap was set to 2mm.The yield strength of the material was set at 450MPa and the tensile strength was 980MPa.

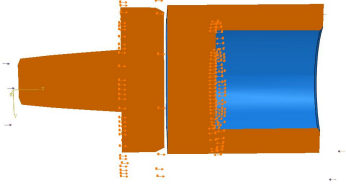


Figure 2 Load and boundary conditions

The simulation process was divided into two steps, The initial step began to take place, the first step

required the spool head and hammer cap relative movement on the Z axis, the direction shown in Figure 2, the moving distance was 1mm. Model analysis results were shown in figures 3 and 4.

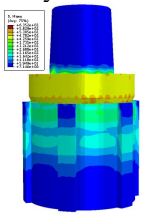


Figure 3 Overall stress diagram

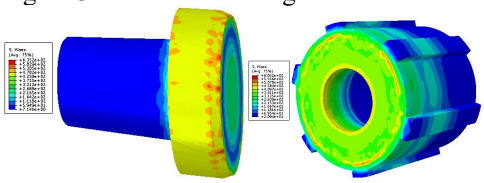


Figure 4 The head of the spool and the hammer cap shall be designed

As can be seen from the above two diagrams, the maximum stress value of the spool head and the hammer cap exceeded the yield limit of the material when subjected to impact. The research was to consider the minimum impact force of the hydraulic hammer under general conditions, so the spool head and the hammer cap need to be optimized.

3. OPTIMIZATION DESIGN OF SPOOL HEAD AND HAMMER CAP

If the better choice of valve head and hammer cap material selection, will increase the cost of the product, so in the optimization design of the spool head and the hammer cap, The idea adopted was that the contact end of the spool head and the hammer cap was embedded into the cemented carbide with higher yield strength and tensile strength, When the contact position was repeatedly subjected to shock and damage, carbide can be replaced directly to reduce maintenance costs.

The changed spool head and the hammer cap were shown in Figure 5[6], and the mechanical calculation of the changed structure was carried out according to the model diagram of Figure 5 to verify whether the spool head and the hammer cap could be protected. The yield strength of cemented carbide was 530 MPa, and tensile strength was 1020 MPa. In the model, the initial gap between the two cemented carbides was 2mm.

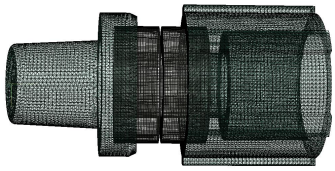


Figure 5 Structural finite element model after modification

The finite element calculations were carried out according to Fig. 5, and the load and boundary conditions of the finite element analysis were shown in figure 6. According to research, the hydraulic impact hammer could withstand the impact force of up to 39 MPa, so for the structure changed, force hammer head and valve cap increased to 40MPa, the other boundary conditions and moving distance were consistent with a model, each moved 1mm in the direction of force.

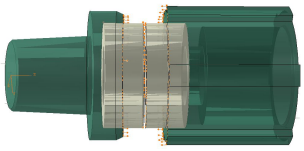


Figure 6 Structural loads and boundary conditions after modification

The above structure was simulated, and the calculation results were shown in figure 7[7].

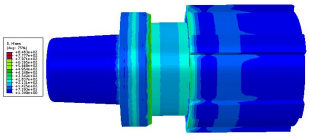


Figure 7 Structural stress nephogram after modification

For the changed structure, stressed the stresses in each of the four parts, as shown in figure 8. It could be seen from the figure, when the force was increased to 4 times ,the stress on the head of the spool and the hammer cap was basically the same as the stress of the original structure. But the stress of cemented carbide had already reached the tensile strength of the material of the spool head and hammer cap. Therefore, the idea of optimal design was feasible.

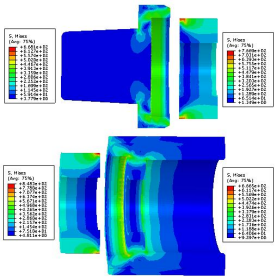


Figure 8 Structural stress nephogram after modification

4.GEOMETRICAL DIMENSION OPTIMIZATION OF CEMENTED CARBIDE

The hard alloy was added on the head of the valve core and the hammer cap to reduce the impact of the impact on the head of the valve. Although it could achieve the replacement of parts, only the replacement of hard alloy, reducing costs, but in practice could not often replace carbide. Therefore, the structure of cemented carbide also need to be optimized.

Under the impact of high pressure liquid, cemented carbide would be eroded. For this reason, the structure of cemented carbide had been changed, the purpose was to reduce stress concentration and fluid erosion. Finite element simulation and optimization, the internal pressure load was 10 MPa, the boundary condition was fixed, because the hard

alloy had the simple structure, so the mesh and boundary load of graph model is no longer used in this paper, and the calculation results are analyzed directly. First of all, it would produce the contact surface for chamfering alloy for avoiding stress concentration, at the first , analyzed the chamfering of the anvil surface, it could clearly see the unchamfered side stress was much greater than the chamfered side from the stress diagram of cemented carbide ,as shown in figure 9. According to the calculation results, it was feasible to chamfer the ends of the inner surface of the alloy.

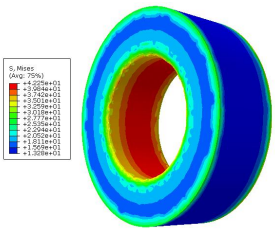


Figure 9 Side slope stress diagram

Because the hard alloy was contacted with the head of the valve core or the hammer cap, it was often washed back and forth by the fluid, so the author thought that the fillet was more helpful to avoid the erosion of the fluid. Therefore, after the above optimization, the calculation of fillet was followed by the results shown in Figure 10. As you could see from the diagram, the fillet design was better than the chamfer design.

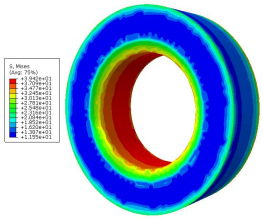


Figure 10 Fillet radius 5mm stress diagram

Comparing the result of the fillet with the result of chamfer, as shown in figure 11. As you could see from the diagram, the overall change of the fillet was much smoother than the stress of the chamfer, and it was not difficult to find the optimum value when the radius of the circle was 5mm.

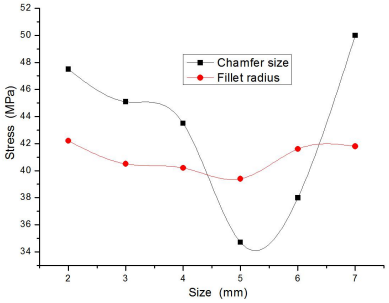


Figure 11 Result comparison chart

5. CONCLUSION

In this article, through the finite element analysis of hydraulic impact hammer, the optimization design, the valve core head and increased ram pile cap of carbide, and through the analysis of the carbide best chamfering radius of 5 mm.

REFERENCES

[1]Wu Peng, Wei Zhongliang, Zhang Bin, “Application of a new jet hydraulic hammer, ” Journal of Changzhou University (natural science edition), 2012,24 (3): 30-34.

[2]Xie Wenwei, Yang Zeying, Su long, Wang Yuewei, Qi Liqiang, “The effective way of high efficiency into the core of cobalt hydro hammer on cobalt,” Exploration Engineering (geotechnical drilling engineering) 2013, 40:80-90.

[3]Zhang Yuanzhi, “Optimum design of suction hydraulic impactor,” Xi'an Petroleum University, 2015..

[4]Li Gensheng, Tian Fu, Jia Sheng, Shou Huaizhong, “History of Hydraulic Percussive Drilling Technology Development and application status”, petroleum machinery, 2014,42 (6): 1-6.

[5]Ai Zhijiu, Wang Yu, Ai Yu, Sun Xu, “PARAMETER SENSITIVITY ANALYSIS ON BI-METALLIC COMPOSITE PIPE PLASTIC MOLDING,” JOURNAL OF THE BALKAN TRIBOLOGICAL ASSOCIATION, 2016, 22(2A) 1971-1982.

[6]Shi Changshuai, Zhu Xiaohua, Deng Juan, Tang Liping, “Analysis of mechanical behavior and hysteresis heat generating mechanism of PDM motor,” JOURNAL OF MECHANICAL SCIENCE AND TECHNOLOGY, 2017, 31(3) 1143-1149.

[7]Shi Changshuai, Zhu Xiaohua, Luo Heng, “Study of DTH Bit-Rock Interaction Numerical Simulation Method and DTH Bit Properties Evaluation,” ARABIAN JOURNAL FOR SCIENCE AND ENGINEERING, 2017, 42(5) 2179-2190.

[8]B. Wu and **H. Shen**, Analyzing and Predicting News Popularity on Twitter, *International Journal of Information Management Corresponding*, Vol. 35 (6), pp. 702-711, 2015

[9]B. Wu and **H. Shen**, Mining Connected Global and Local Dense SubGraphs for BigData, *International Journal of Modern Physics C*, Issue: 27, article ID:1650072, 2016

[10]Wu, B., & Shen, H. (2017). Exploiting Efficient Densest Subgraph Discovering Methods for BigData. IEEE Transactions on Big Data.

Research on Dipping Sonar Front Search Probability Modeling

Li Xinshu [1], Luo Musheng [1], Li Weibo [1]
Naval Aeronautical and Astronautical Institute,Yantai, Shandong, China 264001

Abstract: Aiming at the probabilistic calculation problem of ship-based anti-submarine helicopters cooperative front search, a ship-based anti-submarine helicopter front search probabilistic calculation model is established by means of analytic method. Front search task parameters, the number of troops, search time, dipping sonar average search period and the search speed are the input parameters, and the effective search area under the overlapping dipping sonar detection area is calculated. The probability of discovery is found under the influence of front submarine search area width, number of troops, spacing coefficient and submarine search stealth angle. It is found that there is an optimal spacing coefficient and the best search potential angle when the width of submarine search area is constant, which makes the largest probability of submarine discovery. Double-machine cooperative front search performance is improved significantly.
Keywords: Probability; Dipping sonar; Front search; Calculation model

1. INTRODUCTION

With the rapid development of submarine construction technology, submarine mute performance has been greatly improved. Integrated with the use of position ambush and other tactics, it will be a fatal threat for surface warships formation in navigation. Shipboard anti-submarine helicopters can be deployed in the front the formation and implement front search by using dipping sonar in order to detect or eliminate the threat as soon as possible.

Researches on shipboard anti-submarine helicopters use with dipping sonar are a lot [1-3], from search implementation [4-6], search strategy [7] and method [8-10], search performance [11-13], dipping sonar performance prediction [14-15] and other aspects. However, these studies are mainly based on the use of anti-submarine helicopters using sonar search [16-17], and there are few studies of anti-submarine helicopters use in surface warship formation [18], and the corresponding probability of quantitative calculation models are few. Aiming at this problem, a multi-helicopter surface warship formation front search is used to as research background to establish probability quantitative calculation model to provide the basis for front search decision[19-21].

2. MULTI-HELICOPTER DIPPING SONAR FRONT SEARCH

Front search is a combat activity that the ship-based anti-submarine helicopter implements submarine search to the designated position or search area in front of the surface of the surface of the warships in a certain distance when there is a large submarine threat or found submarine signs, as shown in Figure 1.

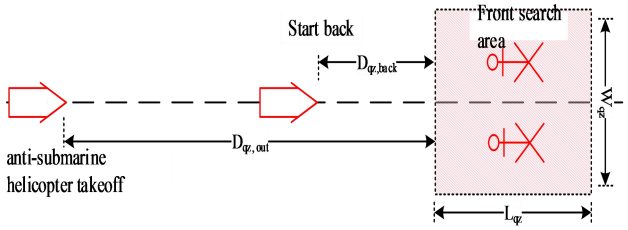


Figure 1 ship-based anti-submarine helicopter front search

The primary purpose of front search is to ascertain whether there is a submarine activity in the designated front search area to ensure that the surface warships can pass safely through the area. Therefore, the discovery probability is one of the most important measures in the submarine search helicopter dipping sonar front search.

multi-helicopter dipping sonar front search methods are: parallel search method and jagged search method. Anti-submarine helicopters can make flexible choice based on task requirements; the number of troops can get out, battlefield situation and many other actual battlefield situations.

3. MULTI-HELICOPTER DIPPING SONAR FRONT SEARCH DISCOVERY PROBABILITY CALCULATION MODEL

$$\text{zX}\quad P_{f,\text{d}} = P_d A_s / A_t \tag{1}$$

In it, P_d is the probability that dipping sonar is in contact with the submarine and correctly identified; A_s is the effective search area for multiple ship-based anti-submarine helicopters; A_t is the total area of the front search area required for the task.

If multiple ship-based anti-submarine helicopters make repeated search on the front search area for multiple voyages and search area overlap may occur, then discover probability of submarine is

$$P_{f,\text{d}} = 1 - \exp\left(P_d A_s / A_t\right) \tag{2}$$

If multi-helicopter uses dipping sonar and takes zigzag search method to search, as shown in Figure 2, front search task usually gives the length and width of the front search area; or only the width is given,

and the length depends on the blank time of the ship-based anti-submarine helicopter.

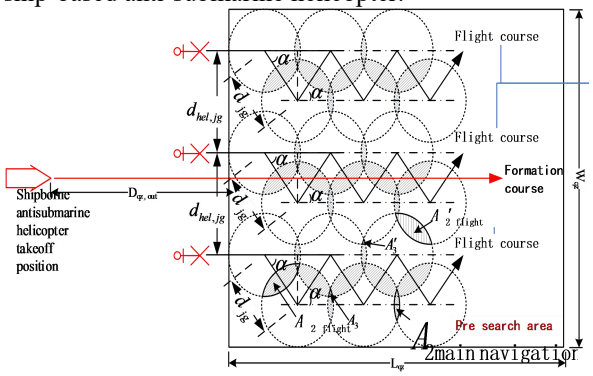


Figure 2 Front search jagged search method

If the front search task gives the length L_{qz} and width W_{qz} of the front search area, A_t is

$$A_t = L_{qz} \times W_{qz} \tag{3}$$

If the front search task only gives the width W_{qz} of the front search area, the ship-based anti-submarine helicopter is required to continue searching until the return time is not allowed, the actual search length L_{qz} is

$$L_{qz} = (N_{pt} - 1) d_{jg} \cos(\alpha) + 2R_{hs} \tag{4}$$

In it, N_{pt} means the number of hysteresis helicopter hovering detection; d_{jg} is distance between the adjacent hover detection points and meter is unit; R_{hs} is the effective range of dipping sonar and meter is unit; α is the angle between ship-based anti-submarine helicopter flight course and the main direction.

If the search total time of ship-based anti-submarine helicopter reaches the position is $T_{hel,s}$, then

$$N_{pt} = \left\lfloor \frac{T_{hel,s}}{T_{hs,cyc}} \right\rfloor \tag{5}$$

Then, $\lfloor \ \rfloor$ is the largest integer that is no greater than the number; $T_{hs,cyc}$ represents the average search period of the lifted sonar.

Ship-based anti-submarine helicopters are generally evenly arranged in the front search area, so according to the width W_{qz}, adjacent anti-submarine helicopter spacing $d_{hel,jg}$ can be determined as

$$d_{hel,jg} = \left(W_{qz} - d_{jg} \sin(\alpha) - 2R_{hs}\right) / \left(N_{hel} - 1\right) \tag{6}$$

In it N_{hel} indicates the number of ship-based anti-submarine helicopters called out.

(1)*Search period*

When ship-based anti-submarine helicopter uses dipping sonar for search, the average value of the time required to search for a hover probe is the search period $T_{hs,cyc}$, which is calculated as

$$T_{hs,cyc} = t_{lt} + t_{hp} + t_{hg} + t_c \tag{7}$$

In it, t_{lt} is the time required for dipping sonar transducers in the water; t_{hp} is the time required for the laying of dipping sonar transducers to the depth of submarine detection; and t_{hg} is the time required for the recovery of dipping sonar transducers into the cabin; t_c means the time required for ship-based anti-submarine helicopter climbs from the current hover, flies and descends to the next hover and the unit is second.

(2)*Search speed model for front search*

The search speed of front search is the searching distance of ship-based anti-submarine helicopters along the formation heading, that is, ship-based anti-submarine helicopters' speed projection along the formation direction.

From Figure 2, the actual search speed $V_{hel,c}$ of multi-helicopter dipping sonar front search can be got,

$$V_{hel,c} = \frac{d_{jg} \cos(\alpha)}{T_{hs,cyc}} \tag{8}$$

In it, $d_{jg} = \xi_{hs} \ R_{hs}$ means the distance between the adjacent hover detection points in meters; R_{hs} is the effective range of dipping sonar in meters; ξ_{hs} is distance coefficient between the detection points, referred to as spacing factor, usually take 1 ~ 2; α is the angle between ship-based anti-submarine helicopter search trajectory forward direction and the surface warships formation direction. Taking into account of the search efficiency of anti-submarine helicopters, usually this angle does not exceed 60 °.

According to trigonometric function knowledge, we have $\cos(\alpha) \leqslant 1$, then

$$\begin{aligned} d_{jg} &= \xi_{hs} \ R_{hs} \\ &= V_{hel,c} T_{hs,cyc} / \cos(\alpha) \\ &\geqslant V_{hel,c} T_{hs,cyc} \end{aligned} \tag{9}$$

After transformation, the following can be obtained

$$\xi_{hs} \geqslant V_{hel,c} T_{hs,cyc} / R_{hs} \tag{10}$$

It can be seen from the above equations that when ship-based anti-submarine helicopters use dipping sonar to carry forward front search, the spacing coefficient ξ_{hs} between hovering detection points

and the actual search speed $V_{hel,\mathrm{c}}$ should meet the constraints of the above inequality.

(3)*Dipping sonar effective search area*

A. When ship-based anti-submarine helicopter performs front search, if the spacing factor between dipping sonar detection points is $\xi_{\mathrm{hs}} \geq 2$, the effective search area A_{s} is the product of search area of each probe and the total number of hovering detection, that is

$$A_{\mathrm{s}} = N_{hel} \times N_{pt} \times \pi \times R^2{}_{hs} \tag{11}$$

B. If the spacing factor between dipping sonar detection points is $\xi_{\mathrm{hs}} < 2$, there is overlap between the detection areas. Thus, the effective search area A_{s} is got by the total search area minus the overlap area, that is

$$A_{\mathrm{s}} = N_{hel} A_{sa} - \left(N_{hel} - 1\right) A_{\mathrm{o2}} \tag{12}$$

In it, A_{sa} means the actual searching sea area of a ship-based anti-submarine helicopter in square meters; A_{o2} is the overlap area between two adjacent anti-submarine helicopters' detection area in square meters.

Single ship-based anti-submarine helicopter's effective search sea area A_{sa} is the sum of each hovering detection area and subtract the overlapped area A_{o1} where anti-submarine helicopters in dipping sonar detection area,

$$\begin{cases} A_{\mathrm{sa}} = N_{pt} \pi R_{hs}^2 - A_{\mathrm{o1}} \\ A_{o1} = \left(N_{pt} - 2\right) A_{2mn} \\ + \left(N_{pt} - 1\right) A_{2c} - \left(N_{pt} - 2\right) A_3 \end{cases} \tag{13}$$

In it, A_{2mn} indicates the overlapped area in a single adjacent detection area in the formation direction; A_{2c} indicates the overlapped area in a single adjacent detection area in ship-based anti-submarine helicopter's search trajectory direction; A_3 indicates the overlapped area in three dipping sonar search areas in square meters.

Two adjacent shipboard anti-submarine helicopters dipping sonar detection area's overlapped area is A_{o2}, then

$$A_{\mathrm{o2}} = \left(N_{pt} - 1\right) A'_{2c} - A'_3 \tag{14}$$

A'_{2c} is the overlapped area of two ship-based anti-submarine helicopters' adjacent dipping sonar detection areas; A'_3 is the overlapped area of two ship-based anti-submarine helicopters adjacent three dipping sonar detection areas in square meters.

4. Analysis of Simulation Results

Set the surface fleet formation's speed as 20 knots, requiring the delivery of two ship-based anti-submarine helicopters to the sea area 90 km ahead of the formation, and search in the front area in the route width of 40 km and return when gas is inefficient. The flight speed of ship-based anti-submarine helicopter cruises is 200 km / h and the clearance time is 4 hours. Dipping sonar's effective range is 7 km, the average search period is 12 minutes, and α is 45 degrees.

(1)The impact of search area width on discovery probability

Assuming that search area width is gradually increased from 25 km to 60 km, the width of the front search area has a greater impact on the probability of discovery. With the increase of the width of the search area, the probability of discovery increases first and then decreases. This is because the change in width makes spacing coefficient change, resulting in detection area overlap area changes, thus affecting the probability of discovery. Under the current simulation parameters, the maximum search probability is 33.5 km and the spacing factor is 1.354. When search in front search area whose width is 40 km, the spacing factor takes 1.616, which can achieve 0.82 double helicopters dipping sonar discovery probability.

(2)The influence of the number of forces and spacing coefficient on probability of discovery

When the ship-based anti-submarine helicopter is used to search in a front search area with a width of 40 km, the increase in spacing factor increases the probability of discovery rapidly. When the spacing factor is 2, the probability is found to remain at the maximum of 0.49. This is because when spacing factor is not less than 2, dipping sonar detection area has no overlap.

When two ship-based anti-submarine helicopters are deployed, the search performance is significantly improved compared to the dispatch of one ship-based anti-submarine helicopter. The probability of discovery of 2-helicopter cooperative front search increases rapidly and then decreases with the change of distance coefficient. With current front search parameters, take spacing factor as 1.63 and anti-submarine helicopter search potential steering angle as 49.5 degrees, the maximum performance of double helicopters front search can be achieved: the probability of discovery is up to 0.853.

5. Conclusion

During the voyage process of surface warships, we need to deal with the fugitive threat of enemy's submarines along the flight course. Ship-based anti-submarine helicopters use dipping sonar to implement front search potential, which is one of the important means to deal with such threats. Based on the characteristic analysis of dipping sonar front search, a probabilistic calculation model based on

effective search area is established by using analytic method based on the analysis of search methods. Simulation results show that the probability of discovery is affected by the influence of search area width, number of troops, spacing coefficient and search steering angle. The actual results are used to calculate actual parameters, and the results can provide decision-making reference and theoretical basis for effective implementation of ship-based anti-submarine helicopters front search.

REFERENCES

[1]Zhou Tianzai, Li Juwei.Optimization of dipping sonar search strategy based on genetic algorithm [J]. Fire and Command & Control, 2015,40 (2): 77-79.

[2]Qi Xuewen, Yan Jiangang, Xie Yu, Gao Dongfei. Study on helicopter dipping sonar callback [J]. Fire and Command & Control, 2014,39 (3): 47-50.

[3]MaXin, Sun Rongguang, Shu Xianglan, Li Houquan. Study on simulation of the distance of dipping sonar [J] . Acoustics Technique, 2013,32 (4): 420-422

[4]Sun Mingtai, Zhao Zhiyun, Ren Dongyan. Research on modeling and simulation of helicopter dipping sonar exploration. Journal of Qingdao University (Engineering & Technology Edition), 2014, 29 (1): 73-77.

[5]Zhao Zhiyun, Sun Mingtai, Ren Dongyan. Modeling and simulation of active mode of dipping sonar [J]. Journal of Command and Control, 2013, 35 (6): 49-63.

[6]Yang Rijie, Tian Shudong, Xiong Xiong. Anti-submarine helicopter crane hovering flight model [J]. Electro-Optic and Control, 2015,22 (4): 8-12.

[7]Ni Chunguang, Chen Yingchun, Wang Xianhua. Study on helicopter's strategy of using sonar to search [J]. Torpedo Technology, 2013,21 (4): 317-320.

[8]Wu Ming. Dipping sonar fan helix search diving modeling based on prior target heading [J]. Journal of System Simulation, 2015,27 (12): 2908-2912.

[9]Yan Jiangang, Yang Shifeng. A fast search method for helicopters search [J]. Operations Research and Management, 2016,25 (4): 44-48.

[10]Xie Zhenhua, Zhang Bing, Ouyang Huan, Cheng Jiang-tao. Study on simulation of hopping search performance of dipping sonar spiral[J]. Journal of Sichuan Ordance, 2014, 35 (1): 17-20.

[11]Wang Jing, Zhan Kai. Anti-submarine helicopter crane sonar search efficiency model research [J]. Ship Electronic Engineering, 2014,237 (3): 150-152.

[12]Cui Hanming. Anti-submarine helicopter search potential analysis [J]. Helicopter Technology, 2013, (3): 33-38.

[13]Chen Hui, Zheng Yang. Evaluation and simulation analysis on the efficiency of anti-submarine helicopter dropping[J]. Journal of China Academy of Electronics Science and Technology, 2013, 8 (6): 638-642.

[14]Zhi Shaolong. Application of ray tracing model in hoisting sonar performance prediction [J]. Acoustics Technique, 2013,32 (6): 123-124.

[15]Sun Mingtai, Zhou Lihui, Qin Feng. Study on the exposure distance of sonar active mode of aerial lifting[J]. Journal of Command and Control, 2013,25 (3): 56-59.

[16]Liu Jinrong, Lyu Zhengliang, Zhang Qilong. Modeling and simulation of lifting efficiency of dipping sonar[J]. Journal of Naval Aeronautical Engineering Institute, 2016, 31 (2): 163-167.

[17]Li Xiangke, Zhao Zhiyun, Du Yi. Anti-submarine helicopter dipping sonar passive search potential simulation and optimization [J]. Electro-optical and control, 2015,22 (11): 95-99.

[18]Cong Hongri, Zhao Yuanli, Li Tao. Helicopter flank escort tilt triangular search potential method and its simulation [J]. Electro-Optic and Control, 2014,21 (1): 23-27.

[19]Wu, B., & Shen, H. (2017). Exploiting Active Sub-areas for Multi-copy Routing in VDTNs. IEEE Transactions on Vehicular Technology.

[20]B. Wu, **H. Shen** and K. Chen, DIAL: A Distributed Adaptive-Learning Routing Method in VDTNs, *Proc. of the IEEE International Conference on Internet-of-Things Design and Implementation (IoTDI)*, April 4-8, 2016, Berlin, Germany

[21]B. Wu and **H. Shen**, A Time-Efficient Connected Densest Subgraph Discovery Algorithm for Big Data, *Proc. of the 10th IEEE International Conference on Networking, Architecture, and Storage (NAS)*, August 6-August 7, 2015, Boston, Massachusetts

Study on Chinese Pharmaceutical Industry Parks based on Correspondence Analysis

Li Yajie , Wu Yiwei*
School of Science, Beijing University of Posts and Telecommunications, Beijing, 100876, China

Abstract: The pharmaceutical industry has some characteristics of high technology, high investment, high risk and high added value , which determines the characteristics of its clusterization. This paper does research in the construction of China's pharmaceutical industrial parks from the perspectives of economics, Chinese characteristics and multivariate data analysis. To conclude, the Yangtze River Delta region, Bohai region and the northeast region have become the most concentrated area of China's bio pharmaceutical industry park. Taking Zhangjiang pharmaceutical industry park as an example, chemical medicine, biological medicine, Chinese traditional medicine and medical devices are four key areas of it.
Keywords: Industry cluster; correspondence analysis; pharmaceutical industry parks

1. INTRODUCTION

At present, the global bio pharmaceutical industry presents a clustering trend, incamong which USA, EU and Japan dominant. There are five biomedical technology clusters in America, including Boston, the Gulf of San Francisco, Washington, Santiago, North Carolina Research Triangle Park, among which the San Francisco Bay area gathers nearly 24% of the nation's bio pharmaceutical enterprises, becoming the pillar of the local economy and driving the innovation and industrial process of the bio pharmaceutical industry of America ,even of the world. Britain, a power in biomedical research and development which is second only to the United States, has been awarded more than 20 Nobel prizes in this field. Its bio pharmaceutical industries are mainly distributed in the higher institutes such as London , Oxford, Cambridge, Edinburgh and etc., and other areas where research institutions are intensively-located. The valley of the upper reaches of the Rhine in Europe has become the center of European Biotechnology[1]. Japanese pharmaceutical science has developed rapidly. The slogan that the nation should rely on the biotechnology industry was proposed in December 2002, which has formed 18 various high-tech theme parks, eleven of which focus on biotechnology or life sciences, such as the Osaka Biotechnology Industrial Park, Kobe Industrial Park and Hokkaido. Technology Industrial Park etc…

2. METHOD

This paper studies the construction of China's pharmaceutical industrial parks from the perspectives of economics, Chinese characteristics and multivariate data analysis. From the scale economy, the pharmaceutical industry park in the form of enterprises assembling contributes to the expansion in scale and influence of these original dispersed enterprises. Peer companies,which are geographically close to each other, can reduce their cost through reorganizing the value chain of enterprises and enhance the advantages of regional marketing integration through the agglomeration effects; from the point of view of transaction costs, the well-develpoed medicine industrial parks can have the overall brand effect which can reduce the cost of attracting talents. And it is also good for training talents[2] through mutual learning and exchanges between these enterprises. From the point of view of technology innovation, R & D departments in pharmaceutical enterprises are relatively concentrated, providing opportunities for employees to communicate with each other, which is more conducive to knowledge sharing. Also mutual competition among enterprises promotes innovation of technology [3,4,5]; from the industrial organization, industrial parks receive the support of the local governments. Their internal facilities are relatively perfect and they have many professional talents, which can reduce the entry barriers of new enterprises. The successful establishment of new enterprises encourages other enterprises to station, forming a virtuous cycle easily. The enterprises in the cluster can exit through mergers and transferring the possession, which can reduce the risk and barriers of exist[6].China's bio pharmaceutical industry cluster is divided into two types: one is establishing biomedical park in the existing national high-tech development zone or economic and Technological Development Zone. The number of state-level development zones (including state-level high-tech zones and nation-level economic development areas) increased from 219 in 2011 to 364 in 2015, with an average annual growth rate at 13.5%. The number of national development zones entered a steady growth stage after a rapid growthfrom 2012 to 2013. In 2014, the approval of the state-level development zones became more prudent, with a total of 9 newly approved state-level development zones, increasing by 2.8%. In 2015, the number of newly approved state-level development zones reached 31, with an increase of 9.3%. By the end of 2015, there were 145 state-level high-tech zones, and 219 nation-level

economic development areas. National high tech Zonesare mostly related to the biotechnology industry.By 2014, there are 103 national economic and Technological Development Zonesfocusing on bio pharmaceutical industry, 75high tech Zones and more than 400 provincial industrial parks. The other is establishing the Bio Medical Park alone. At present, there are no less than a hundred medicine valleysall over the country in various types, not fewer than 50 of which are approved by the department concerned or local governments. For example: Sichuan Chengdu medicine valley; Shanghai Zhangjiang Zhejiang medicine valley, Hangzhou medicine valley, Jiangsu Wuxi medicine valley, Zhejiang Lanxi medicine valley, Jiangsu Changzhou "san yao" production base; “modern high-tech bioengineering industrial park” in Xinjiang Tianshan medicine valley; Haikou medicine valley called “southland pharmacy”; Beijing pharmacy store" Yizhuang medicine valley, the Zhongguancun medicine valley; Tianjin international innovation; Jilin Tonghua medical city; Hunan Liuyang bio pharmaceutical industry park; Shenzhen pharmaceutical industry park; Guangzhou International Biological Island and so on[7,8].

According to statistics released by the investment adviser "2017-2021 China biomedical industrial park in depth analysis and development planning advice report", from the situation of bio pharmaceutical enterprises listed, a total of 33 listed companies in 2015, operating income reached 50 billion 587 million yuan. According to business income ranking: Fosun Pharmaceutical revenue reached 12 billion 609 million yuan in 2015, ranked first in the industry; Neptune biology and Changchun hi tech ranked two or three.

As for the distribution, the Yangtze River Delta region, Bohai rim and Northeast China become the most concentrated areas of China's bio pharmaceutical industry parks. Since 1997, the national development and Reform Commission and the Ministry of science and technology have established 56 bio pharmaceutical industry bases throughout the country. 70% of them locates in three areas with 18 of them in the Yangtze River Delta region,12 in Bohai rim, 8 in Northeast China; 11 of them locate in South China, and 7 locate in the western region, accounting for 18% and 12%. For example, Shanghai Zhangjiang hi tech park has become an important base of Shanghai high tech Industrial Development and technological innovation and growth pole of economic development in Shanghai; southeast of pharmaceutical raw materials and intermediate export base in zhejiang province has become the largest domestic production base of raw materials. In addition, the State Council approved the establishment of a national medical city in March 2009 and December 2013 in Jiangsu Taizhou and Jilin Tonghua separately, such as biotechnology is considered as a new economic growth point in taizhou jiangsu, to create a structure with "Taizhou Chinese medical city" as the center, and a number of parks around. Taizhou medicine high tech Zone has become the country's largest production base of Chinese medicine, narcotic and vitamin,forming nine areas, including new type of antibiotics, cardiovascular drugs, antineoplastic drugs and other, as the main body of the pharmaceutical industry group. In addition, Harbin and Xiamen were successfully selected to be the first ten pilot cities in October 2014 to develop strategic emerging industries by bio pharmaceutical strategic concentration program.

As for the output value, the structure takes on a pattern with the Yangtze River Delta region and the Bohai rim region as the leaders, and the northeast region, the Pearl River Delta region and the Sichuan and Chongqing regions developing hand-in-hand. In 2012, for example, the output values of bio pharmaceutical industries in Shanghai and Zhejiang, Jiangsu, Tianjin, Shandong are far higher than other regions of the country; that in Jilin, the Pearl River Delta, Sichuan and Chongqing areas are in the middle upper level; that in Hubei Jiangxi, Hunan and other places are about 40 billion yuan, showing that the bio pharmaceutical industry in the provinces in the middle and western region are relatively backward.

Since beginning to focusing on the layout of bio pharmaceutical industry, bio pharmaceutical industry in Zhangjiang demonstration area has become the pillar of Shanghai biological medicine, having formed an excellent situation with a good agglomeration of elements in technological innovation, an interactive development of IA collaberation, basically effective service platform and the strategic emerging industry to accelerate. The application of correspondence analysis and statistical graphics to study the data of Zhang Jiang demonstration area of biological medicine are from the "report of the development of Zhang Jiang high tech park of Shanghai biomedical industry (2009)" and "report of Zhang Jiang demonstration area of bio Pharmaceutical Industry (2015)".

Drug research means competitiveness. according to number of drugs in 2009 in Zhang Jiang biomedical enterprises in clinical and field, do multivariate data correspondence analysis. the corresponding analysis diagram is as follows, as shown in figure 1. X1-X6 represent pre-clinical, clinical, clinical first phase, clinical second phase, clinical third phase and the drug certificate approval separately. Y1-Y3 represent chemical medicine, biological products, Chinese Medicine & natural medicine. Therefore more medicine on study with biological products are used in the clinical third phase, relatively mature in research and development; more Chinese herbal medicine and natural drugs are used into the clinical second phase. Chemical drugs tend to be used in the first phase of clinical trials. 40% of them are being

reseached, which is 10% higher than that of biological products and traditional Chinese medicine. And Zhang Jiang new drug research and development varieties, whether chemical or biological products, are far more than the number of generic R & D and production, indicating its demonstration status and leading role of innovation.

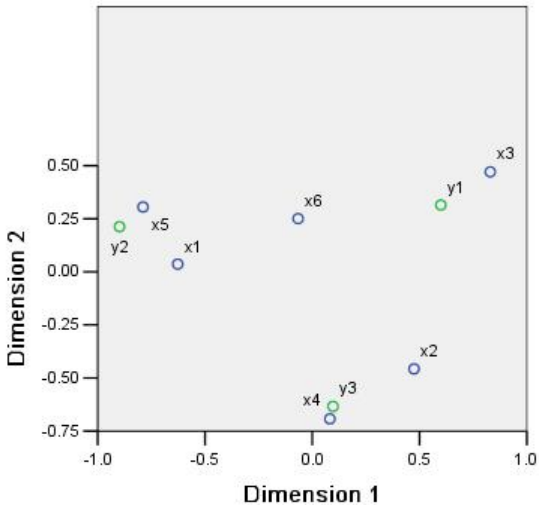


Figure 1 Correspondence analysis chart

Chemical medicine, biological medicine, Chinese medicine and medical devices are four key areas of Zhangjiang demonstration area of bio pharmaceutical industry in 2015. at that time, the total industrial output value reached 28 billion 52 million yuan, accounting for 44% in chemical medicine with 46 enterorises; 15% in biological medicine with 38 enterprises; 15% in medical equipment, with 36 enterprises; 14% in medicine with 15 enterprises. Scatter plot is as follow, as shown in figure 2.

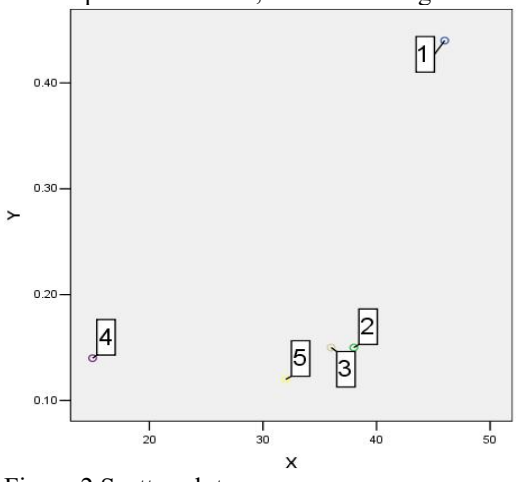


Figure 2 Scatter plot

Therefore the total industrail output values in three areas in the zhangjiang demonstration zone including Medical equipment, biological medicine and traditional Chinese medicine.have no big difference while the number of biological drugs and medical device companies are more than that of traditional Chinese medicine. thus, there are more small and medium enterprises in the field of medical and biological medicine.

In 2015, a total of 167 bio pharmaceutical enterprises were listed in the Zhangjiang demonstration area in Shanghai, accounting for 58.6% of the total bio pharmaceutical industry in the city. 98 of them have a income of over 100 million in their main business, and 12 of them receive more than 1 billion yuan in their main business and 63 of them earn over 200 billion in their main business. In July 2016, the "dialogue with Zhang Jiang" co sponsored by the Shanghai Zhang Jiang hi tech Zone Administrative Committee and the China economic information society, which lasted for half a year, received great attention from the whole society.

3. CONCLUSION

The Yangtze River Delta, the Bohai rim and northeast regions become the most concentrated area of China's bio pharmaceutical industry park distribution, which led to the development of local economy. also the local government plays an important role in the development of the pharmaceutical park. but it is vital to invigorate large enterprises while relaxing control over small ones and promote the survival of the fittest. Taking the bio pharmaceutical industry park in Zhangjiang demonstration area as an example, chemical medicine, biological medicine, traditional Chinese medicine and medical instruments are four key fields. The leading role of Zhangjiang park can be used as experience in other biological parks[9,10].

4. DISCUSSION

High and new technology industry cluster has become the most successful mode to develop high and new technology industry. in these areas where The bio pharmaceutical industry is relatively backward, we should take the advantages of localoties and learn from the experience of advanced areas, waiting to make further progress.

ACKNOWLEDGEMENTS

The authors acknowledge the National Natural Science Foundation of China (Grant: 61375066), the National Natural Science Foundation of China (Grant: 11471051).

REFERENCES

[1]Zhang Q. Development characteristics and inspiration of biomedical industrial parks in the US[J]. Science & Technology Industry Parks, 2011,11(4) : 111-113.

[2]Michael Hu. KallSchultz. Jack Sheu. Daniel Tschopp.The Innovation Gap in Pharmaceutical Drug Discovery & New Models for R&D Success. Kellogg School of Management.2007

[3]Wang F. Cooperation Mechanism of Biopharmaceutical Innovation Network[J]. Social Sciences in Nanjing, 2012, 1:40-46 .

[4]Adam B. Jaffe, Manuel Trajtenberg and Rebecca Henderson.Geographic Localization of Knowledge

Spillovers as Evidenced by Patent Citations[J].The Quarterly Journal of Economics, 1993, 108((3): 577-598.

[5]Knut Koschatzky, Rolf Sternberg. R&D Cooperation in Innovation Systems—Some Lessons from the European Regional Innovation Survey (ERIS)[J]. European Planning Studies,2000,8(4):487-501.

[6]PU Run ,LI Ping-ping ,SU Yue ,ZHU Min ,HUA Yu-tao.Development Statuses and Future Suggestions of Biomedical Parks in China[J].China Biotechnology,2015,35(3) : 104-106.

[7]Wang S, Chen Y. Current Development Situation of Biological Medicine Industrial Parks and Countermeasures in China[J]. Chinese Pharmaceutical Affairs,2012,26(10):1048-1051.

[8]Social Development Department of the Ministry of Scienceand Technology. Strategy Report of Biopharmaceutical Development Strategy-Industrial Parks . Beijing:Science Press,2009.

[9]Bresnahan T, Gambardella A, Saxenian A. 'Old Economy' Inputs for 'New Economy' Outcomes: Cluster Formation in the New Silicon Valleys[J]. Industrial & Corporate Change, 2001, volume 10(10):835-860.

[10]Xie Chenghong.Mechanism and Path of the Spillover Effects of Brand Cluster: Cases of Zhangjiang Biological & Pharmaceutical Industry Cluster in Shanghai[J]. Journal of Social Sciences,2015,12:50-54.

The Study of Coated Peek and Its Composites in Oral Implants

*Chenchen Liu, Xiaoqing Song, Tianjie Chen, Hong Liu**
College and Hospital of Stomatology, JilinUniversity,1500 QingHua Road, Changchun130021, PRChina

Abstract: Polyetheretherketone (PEEK) is a kind of synthetic thermoplastic polymer with good mechanical properties, high melting point, easy processing, high stiffness, good dimensional stability at high temperature and is chemically stable to nearly all organic and inorganic chemicals, all these characteristics make it highly attractive in the field of medicine. Compared with the titanium, the elastic modulus of PEEK is closer to human cortical bone, PEEK could be a viable alternative material for dental implants. Nevertheless the inherent bio-inert nature and lower osteogenic activity limit its wider clinical applications, thus a considerable effort has been made to improve its biological properties. This article makes a summary on the research progress of coated PEEK and its composites in oral implants.
Keywords*:* PEEK; surface coating; biological properties.

1. INTRODUCTION

Polyetheretherketone (PEEK) is one of the most widely used thermoplastic materials in various fields such as the aerospace, automotive, and chemical industries. Its superior mechanical properties and high thermal and chemical stability make PEEK attractive for various applications [1]. Following its approval as a medical grade material by the US FDA in the 1990s, PEEK has been increasingly used as a biomaterial for various implants [2]. In recent years, PEEK has been accepted as a potential material for dental orthopedic and spinal implants due its high strength and good wear resistance, and excellent chemical resistance. Especially, PEEK is considered as a substitute for metallic implant materials due to its extremely low elastic modulus (3–4 GPa), which reduces the extent of stress shielding observed in titanium-based metallic implants [3].Although PEEK has a wide range of advantages, the inherent bio-inert nature hinder its good combination with surrounding bone,resultly limits its wider clinical applications, so people used lots of methods to improve its biological properties. In this article, the research of coated PEEK and its composites in oral implants is reviewed.

There are two ways to modify PEEK surface: surface treatment and surface coating. Surface treatment includes sandblasting, laser irradiation and chemical etching etc. Surface coating includes electron beam deposition, plasma spraying, plasma immersion ion implantation, cold spray and spin coating etc. The surface coating method has been widely studied in recent years because of the difficulty of surface treatment, the bioactivity of PEEK was greatly enhanced after surface coating.

2. TYPES OF SURFACE COATING

A. Electron beam deposition

Titanium and its alloys are the most widely used implant materials in dentistry, because of its excellent mechanical and biological properties. Especially, in terms of biocompatibility, Ti is only surpassed by bioactive ceramics .Therefore, titanium is a strong candidate as the coating material for PEEK implants. A uniform nanoporous TiO2 surface was successfully created by anodizing a Ti film that had been deposited onto a PEEK implant using e-beam evaporation. Although PEEK has a certain degree of thermal resistance, heat treatments are very likely to adversely affect the PEEK substrate, the e-beam deposition method was a low-temperature coating process that formed a dense, uniform and well crystallized Ti layer without deteriorating the characteristics of the PEEK implant. The coating layer has good stability, and the scanning electron microscope revealed that the titanium layer coated onto PEEK was dense, smooth, uniform and crack-free without any trace of substrate damage [1]. The diameter of the nano hole formed on the coating layer is 70nm, which can provide the attachment position of osteoblasts, and can also promote the adhension of bone morphogenetic protein 2 (BMP-2) .BMP-2 has been well documented to play a key role in the differentiation of the stem cells and preosteoblast cells to osteoblastic cells in vitro and in vivo, BMP-2 can promote the formation of new bone, so it can significantly improve the biocompatibility of PEEK [4]. The in vitro test was evaluated in terms of cell attachment, proliferation, and differentiation. Compared with the uncoated group, the proliferation and differentiation of the titanium coating group increased by 2 times. The experiments in vivo showed that coated group showed much higher bone-implant contact (BIC) ratio (60%) than the bare PEEK (30%). It was also found that the wettability of the PEEK material was significantly improved after titanium coating, therefore the biocompatibility of PEEK was improved [1].

B. Plasma spraying

Plasma can be created by heating a gas or subjecting it to a strong electromagnetic field, applied with a laser or microwave generator at temperatures above

5000 °C, which can modify the surface of the material without affecting the main properties of the material itself. PEEK has been coated using bioactive materials such as HA by means of plasma-spraying. In this process, the plasma melts the particles to deposit on the implant surface and producing a rough surface layer. Although spraying of a bioactive layer may be suitable for larger implants, the coating produced is not suitable for the relatively smaller dental implants. This is because the highly rough and very thick apatite layer that may get delaminated leading to implant failures [5]. To evaluate the effect of the plasma induced PEEK modifications on stem cell adhesion and differentiation, adipose tissue-derived mesenchymal stem cells (adMSC) were seeded on PEEK specimens. We demonstrated an increased adhension, proliferation, and osteogenic differentiation of adMSC in contact to plasma treated PEEK. In dependency on the plasma power (between 10 and 200 W for 5 min), varying degrees of osteogenic differentiation were induced. When adMSC were grown on 10 and 50 W oxygen and ammonia plasma-treated PEEK substrates they exhibited a doubled mineralization degree relative to the original PEEK, indicating that plasma treatment of PEEK surface can promote the adhesion, proliferation and osteogenic differentiation of adMSC [6]. Argon plasma treatment of PEEK substrates can improve the proliferation activity of osteoblasts [7].

C. Plasma immersion ion implantation (PIII)

Plasma immersion ion implantation (PIII) is a surface modification technique of extracting the accelerated ions from the plasma by applying a high voltage pulsed DC or pure DC power supply and targeting them into a suitable substrate orelectrode with a semiconductor wafer placed over it, so as to implant it with suitable dopants. Coat TiO2 onto PEEK substrates by means of PIII can inhibit the activity of Staphylococcus aureus and Eschrechia bacilli to some extent, but its effect on periodontal pathogens is not so sure [8]. PIII was used to modify the surface of PEEK with water as the source, the results show that this method can significantly promote the adhesion, proliferation and differentiation of osteoblasts on the surface of materials [9]. PIII technology to modify the PEEK material using titanium plasma proved that this method not only improved the biological activity of the material, but also improved the antibacterial property of the material [8]. PIII modification using nitrogen can inhibit the adhesion of bacteria on the surface of the material, However, the specific antibacterial mechanism remains to be further studied[9,10]. Another study showed that PIII modification using nitrogen promoted the adhesion, proliferation and differentiation of MG-63cells, and modified materials showed anti-bacterial properties of Staphylococcus aureus[11].

D. Cold spraying

Cold spraying is a coating formed on the surface of a substrate at a relatively low temperature, which is accelerated by compressed air to accelerate the particles to the critical velocity. HA has good biocompatibility, bioactivity and bone conduction properties, so it can be used as a kind of surface coating agent for PEEK. Lee et al. [12] used a cold spray technique to fabricate HA-coated PEEK and evaluated its bioactivity in vitro and in vivo. In vitro tests indicated that the adhesion, viability and osteoblast differentiation of human bone marrow mesenchymal stem cells (hBMSCs) were improved on HA-coated PEEK compared with the uncoated one. For in vivo tests, these authors implanted HA-coated PEEK cylinders into a rabbit ilium model with uncoated PEEK as control and demonstrated that HA-coated PEEK promoted implant osteointegration with the surrounding bone using micro-computed tomography (micro-CT) and histomorphometric analysis.

E. Spin coating

Spin coating is using centrifugal force generated by high speed rotation, spreading the liquid filling material on the surface of the matrix and then forming a coating of the required thickness. Spin-coating is another method for coating a thin layer of nanoscale calcium hydroxyapatite on PEEK surface. In this process apatite dissolved in organic solvents is slowly dropped onto the surface of an implant rotating at high speeds. Upon heat-treatment a thin layer of HAp is formed on the implants. Animal studies have shown that spin-coated PEEK implants have higher BIC when compared with uncoated PEEK[13,14,15]. Barkarmo et al. [13] also found that the spin coated PEEK showed a higher BIC, suggesting that the nano hydroxyapatite coated PEEK could promote osteointegration.

3.OUTLOOK

The biological properties of PEEK were greatly enhanced after surface coating. With the progress of materials science, it is possible to improve its biological properties through a variety of ways to make it more widely used in oral clinic.

4. ACKNOWLEDGMENT

This research was supported by the Natural Science Foundation of Jilin (No. 201215051), Graduate Innovation Found of Jilin University (No.2016214) and Jilin Provincial Industrial Technology Research and Development Project (No. JF 2012C009-2; 2015Y038-3) of China.

REFERENCES

[1]Han C M, Lee E J, Kim H E, et al. The electron beam deposition of titanium on polyetheretherketone (PEEK) and the resulting enhanced biological properties.[J]. *Biomaterials*, 2010, 31(13):3465

[2]Kurtz S M, Devine J N. PEEK Biomaterials in Trauma, Orthopedic, and Spinal Implants.[J]. *Biomaterials*, 2007, 28(32):4845-4869.

[3]Toth J M, Wang M, Estes B T, et al. Polyetheretherketone as a biomaterial for spinal applications.[J]. *Biomaterials*, 2006, 27(3):324

[4]Han C M, Jang T S, Kim H E, et al. Creation of nanoporous TiO2, surface onto polyetheretherketone for effective immobilization and delivery of bone morphogenetic protein.[J]. *Journal of Biomedical Materials Research Part A*, 2014, 102(3):793–800.

[5]Wheeler S L. Eight-year clinical retrospective study of titanium plasma-sprayed and hydroxyapatite-coated cylinder implants.[J]. *International Journal of Oral & Maxillofacial Implants*, 1996, 11(3):340-50.

[6]Waser-Althaus J, Salamon A, Waser M, et al. Differentiation of human mesenchymal stem cells on plasma-treated polyetheretherketone.[J]. *Journal of Materials Science: Materials in Medicine*, 2014, 25(2):515-525.

[7]S.-W H A, Kirch M, Birchler F, et al. Surface activation of polyetheretherketone (PEEK) and formation of calcium phosphate coatings by precipitation.[J]. *Journal of Materials Science: Materials in Medicine*, 1997, 8(11):683-90.

[8]Lu T, Liu X, Qian S, et al. Multilevel surface engineering of nanostructured TiO2, on carbon-fiber-reinforced polyetheretherketone.[J]. *Biomaterials*, 2014, 35(22):5731-5740.

[9]Wang H, Lu T, Meng F, et al. Enhanced osteoblast responses to poly ether ether ketone surface modified by water plasma immersion ion implantation.[J]. *Colloids & Surfaces B Biointerfaces*, 2014, 117(9):89-97.

[10]Zhang W, Wang H, Oyane A, et al. Osteoblast differentiation and disinfection induced by nitrogen plasma-treated surfaces.[J]. Bio-medical materials and engineering, 2011, 21(2):75-82.

[11]Gan K, Liu H, Jiang L, et al. Bioactivity and antibacterial effect of nitrogen plasma immersion ion implantation on polyetheretherketone.[J]. *Dental Materials*, 2016, 32(11):e263-e274.

[12]Lee J H, Jang H L, Lee K M, et al. In vitro and in vivo evaluation of the bioactivity of hydroxyapatite - coated polyetheretherketone biocomposites created by cold spray technology.[J]. *Acta Biomaterialia* , 2013, 9(4): 6177-6187.

[13]Barkarmo S, Wennerberg A, Hoffman M, et al. Nano-hydroxyapatite-coated PEEK implants: A pilot study in rabbit bone.[J]. *Journal of Biomedical Materials Research Part A*, 2013, 101a(2):465–471.

[14]Barkarmo S, Andersson M, Currie F, et al. Enhanced bone healing around nanohydroxyapatite-coated polyetheretherketone implants: An experimental study in rabbit bone.[J]. *Journal of Biomaterials Applications*, 2014, 29(5):737-747.

[15]Pär Johansson, Ryo Jimbo, Per Kjellin, Fredrik Currie, Bruno Ramos Chrcanovic, Ann Wennerberg. Biomechanical evaluation and surface characterization of a nano-modified surface on PEEK implants: a study in the rabbit tibia.[J]. *International Journal of Nanomedicine*, 2014, 9(4):3903-3911.

A Multiscale Simulation Force Method for A Pseudo-Potential Lattice Boltzmann Model

He Zheng, Gu Xuan, Sun Xiaoyu, LiuJua , Wang Bin-Sheng
College of Aerospace and Civil Engineering,Harbin Engineering University, Harbin,150001 China

Abstract: Single component pseudo-potential lattice Boltzmann models have been widely studied due to their simplicity and stability in multiphase simulations. While numerous modelshave been proposed, comparative analysis and advantages and disadvantages of different force schemes areoften lacking. A pseudo-potential model to simulate large density ratios proposed by Kupershtokh et al. [1]is analyzed in detail in this work. Several common used force schemes are utilized and results compared. Based on the numerical results, the relatively most accurate force scheme proposed by Guo et al. [2]is selected and applied to improve the accuracy of Kupershtokh et al.'s model. Results obtained using the modified Kupershtokh et al.'s model [1]for different value of τare compared with those obtained using Li et al.'s model [3]. Effect of relaxation time τon the accuracy of the results is reported. Moreover, it is noted that the error in the density ratio predicted by the model is directly correlated with the magnitude of the spurious velocities on (curved) interfaces. Simulation results show that, the accuracy of Kupershtokh et al.'s model can be improved with Guo et al.'s force scheme [2]. However, the errors and τ's effects are still noticeable when density ratios are large. To improve the accuracy of the pseudo-potential model and to reduce the effects of τ, two possible methods were discussed in the present work. Both, a rescaling of the equation of state and multi-relaxation time, are applied and are shown to improve the prediction of the density ratios.
Keywords: Lattice Boltzmann method; Multiphase; Pseudo-potential model

1. INTRODUCTION

Lattice Boltzmann Equation(LBE) method [4], also known as Lattice Boltzmann Method(LBM), has attracted a significant attention due to its potential to solve problems at the mesoscopic scale. These models can be summarized into four categories: color models[5], pseudo-potential methods [6], free energy models [7,8]and kinetic models [9–11]. Gunstensen et al. [5]proposed the first color LBE model by labeling components and particles by colors in the LBE model. Several extensions were developed based on Gunstensen et al.'s model and have been successfully applied to complex interfacial flows [12,13]. However, these models suffer from several limitations, such as the anisotropy of surface tension and spurious currents [14]. Due to their simplicity and stability at a high density ratio, pseudo-potential models first proposed by Shan and Chen [6]are widely used, but they also have drawbacks such as spurious currents [14]. The first free energy type LBE model was proposed by Swift et al. [7]. However, it is restricted to low density ratios, and the early free energy LBE models often suffered from Galilean invariance [8]. Kinetic LBE models, as the name suggests, are based on kinetic methods. A typical kinetic LBE model is by He, Shan and Doolen[9], which is based on a modified Boltzmann equation. With a special discrete method, Lee and Lin [15]successfully extended the He–Shan–Doolen model for large density ratios. However, in addition to the sensitivity of the discrete approach, it has been shown that the mass conservation of these models is weak for large density ratios [16].

These LBE multiphase models have been widely used in simulations. However, most of the above models are limited to multiphase flows with small density ratios. To solve this problem, several additional LBE multiphase models for large density ratios were proposed [15,17–19]. Among these models, single component pseudo-potential models show promise to solve large density ratio flows since they are stable for large density ratios without fancy numerical methods. However, Yuan and Schaefer [19]found that the stabilities of these models vary with equations of state introduced in the pseudo-potential models. To address this issue, they developed the large density ratio pseudo-potential model by choosing an appropriate Equation Of State(EOS). However, it has been shown that the pseudo-potential models are consistent with thermodynamic theories only when the EOS takes a special exponent form. The stability of the pseudo-potential is related to the pressure tensor which varies with the inter-particle interaction force models and the LBE force schemes adopted in the model.

To address these problems, several approaches have been proposed to reduce the thermodynamic error and to increase the stability of the pseudo-potential method. The most common approach is the multi-range pseudo-potential model, devel-oped by Sbragaglia et al, which combines the nearest-neighbor interactions and the next-nearest-neighbor interactions. Though much improved, the introduction of the next-nearest-neighbor interactions leads to difficulties

in programming es-pecially for the boundary conditions. Li et al. recently put forward a method to reduce the thermodynamic error by introducing an additional term in the force scheme. It successfully improved the stability without adding much numerical cost. However, the special treatment of the inter-particle interaction force is developed specifically for the force scheme proposed by Guo et al. .

In a parallel effort to reduce the thermodynamic error, Kupershtokh et al. pointed out that the scale of the EOS is the main reason for the stability of the pseudo-potential model. They also developed an interparticle-force model by combining two nearest-neighbor interactions models and adjusting the scale of the reduced EOS. Later, Hu et al.extended this method to general EOS.

The development of Kupershtokh et al.'s model is however somewhat ad hoc. Thus the choice of the parameters in-troduced in the model lacks theoretical foundation. Moreover, some studies have shown that the Exact Difference Method(EDM) force scheme applied in Kupershtokh et al.'s work leads to error terms in the corresponding macroscopic equa-tion, and thus the numerical problem being solved is different from the original macroscopic problem. Huang et al. did attempt to integrate different LBE approaches, and provided some theoretical foundation for the Kupershtokh et al. model. However in Huang et al.'s work, the density distributions of the EDM force scheme vary with the relaxation time, which is not the case in Kupershtokh et al.'s work.

We here report a numerical error analysis of the Kupershtokh et al.'s model for EDM force scheme. We then extend and improve the model by applying the force scheme proposed by Guo et al., instead of using the EDM forcing scheme, thus eliminating the error in the corresponding macroscopic equation. Finally, numerical results obtained using the improved method developed here and those obtained using Li et al.'s method , which adopted a different approach to approximately satisfy the thermodynamic constraints, are compared.

Rest of the paper is organized as follows. The pseudo-potential LB model is briefly introduced in Section2. In Section3, interparticle interaction force calculation methods and the forcing schemes are theoretically analyzed. Numerical investiga-tions and comparisons are presented in Section4. Finally, conclusion are drawn in Section5.

2. THEORETICAL ANALYSIS

Kupershtokh et al.'s force model shows a great improvement compared with the original Shan and Chen's model. How-ever, the theoretic analysis have rarely been mentioned in early literatures, and it has been shown that the EDM force scheme applied in the model leads to extra terms when compared with Navies–Stokes equation. To fill the gap, the de-tailed analysis of the force model will be made in Section3.1, and the EDM will be theoretically compared with two other common used force schemes in Section3.2.

A. Mechanical Solution of Kupershtokh et al.'s Force Model

To obtain the macroscopic expression corresponding to each force model, Shan's method [29]is applied in the present work.

The corresponding pressure tensors can be obtained from the force expressions. However, the pressure obtained by integrating the Taylor expanded force form may be inconsistent with the pressure tensor obtained by the Chapman–Enskog expansion. To overcome this problem, Shan pointed out that the pressure tensor should be derived from the volume integral of the original force expression.

where $n$represents the normal direction of the interface between the phases. Parameters $a$and $b$are given in Table1for the three force models.

There are two ways to satisfy Eq.(19). One is by choosing a special effective density form which makes Eq.(18)identical to Eq.(19), as shown by Sbragaglia and Shan, which means only the specific EOS can be applied in the pseudo-potential model. In the second, more practical approach, in order to apply general EOS in the model, the parameter εin Eq.(18)is adjusted, as in Kupershtokh et al. [1]and Li et al. [3], to approximately satisfy the results of the Maxwell construction [3].

B. Force Schemes

There are three force schemes commonly used in the pseudo-potential model: the Shan–Chen (SC) type force scheme [6]which incorporates the force by shifting the velocity in the equilibrium distribution; the Exact-Difference-Method (EDM) proposed by Kupershtokhet al. ; and the Guo et al.'s force scheme [2]. Kupershtokh et al.noted that the density distribution for the pseudo-potential model obtained with Shan–Chen's force scheme varied with the relaxation time τ. To avoid this dependence, they proposed the so called Exact-Difference-Method (EDM) scheme .

However, it has been shown that both SC force scheme (Eq.(21)) and EDM force scheme (Eq.(22)) lead to error terms in the corresponding macroscopic equations, and lead to the coexistence curves that are different from the mechanical solutions. Reason behind this discrepancy is the low precision of these two force schemes (SC and EDM). Hence, higher precision force models have been suggested as the solution to the problem. As mentioned earlier, Guo et al.'s scheme is a higher precision force scheme. It is used here to develop improved schemes for the LBE method for high density ratio problems.

The macroscopic equations for the three schemes (SC, EDM and Guo's force scheme) can be obtained through the Chapman–Enskog analysis.

Both SC and EDM schemes are therefore will lead to numerical results that are not expected to match the solution of the Navier–Stokes equations. However, these error terms may make the model more stable in some cases .

Moreover, it is not clear what role, if any, τplays in these models. For example, model with EDM force scheme is claimed to be independent of τ, but Huang et al. found that the density distribution found using the EDM force scheme varied with τfor large density ratio problems.

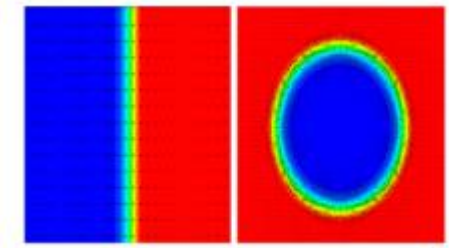


Figure 1 Spurious velocities of straight and curve interface

3. NUMERICAL SIMULATIONS

In this section, we numerically compare the performance of the three force schemes for their accuracy and to determine how strongly the results depend on τ. A different force scheme is suggested to improved Kupershtokh et al.'s model. Numerical results of the modified scheme are compared with Li et al.'s model. Finally, some suggestions are proposed to improve the accuracy of the modified Kupershtokh et al.'s model and to reduce the τ's effect and the spurious velocities.

A Incorporation of EOS

In order to numerically investigate the performance of the interparticle force methods and different force schemes, the C-S EOS is applied in the present work.

It has been shown that the scale of the EOS can influence the stability, and impact the interface width of the pseudo-potential model. Hence, a simple EOS scale adjustment is applied in the present work.

For 0 <K<1, the stability of this model can improve significantly , and the width of the interface is also increased. It should be pointed out that the Maxwell construction density solution (Eq.(19)) will not be changed for K_=1, however, the mechanical solution (Eq.(18)) will be different.

B. Comparison of Different Force Schemes

Here we test the three different force schemes with Kupershtokh et al.'s pseudo-potential model, and numerically com-pare the performance of these schemes for different τand temperature. Based on the simulation results, the best force scheme is then adopted for improvement of Kupershtokh et al.'s model.

(1)Influence of Relaxation Time

To assess the influence of relaxation time τon different force schemes, we simulated the phase coexistence with different value of τ. To avoid the influence of surface tension, a straight interface is simulated. Parameters used in this simulation of EDM and Shan and Chen's force schemes are given in Table2. To compare these methods on different aspects and to maintain the stability, the parameters of Guo et al.'s method may be different for other cases. Since the gas phase is more compressible, the influence of τwill be more pronounced in gas phase, hence we only show the simulation results of gas density.

The simulation results of gas density as a function of τare shown in Fig.2. For EDM and Guo's force schemes, the sim-ulation gas densities do not change with the relaxation times, but for Shan–Chen's force scheme, the gas density increases obviously with the relaxation time. Moreover, the simulation results are identical for the SC and the EDM force schemes when τ=δt=1. These results agree with the Chapman–Enskog expansion and Kupershtokh et al.'s work. It also should be mentioned that the stability of SC force scheme decreases significantly when the relaxation time is relatively small.

The EDM force is known to be influenced by τwhen the density ratio is large . To study the influence of τ, the density ratio for EDM and Guo et al.'s force model under different temperatures is numerically analyzed. The parameters are still given by Table2, except, to maintain the stability of the model, $A$is chosen as −0.5for Guo et al.'s force scheme. Figs.3and 4show the density ratios as a function of reduced temperature for two different relaxation times τfor EDM and Guo et al.'s schemes, respectively. It can be seen that the simulated density ratios are exactly the same for τ=0.7 and τ=1.5. It means that the simulated densities of both EDM and Guo et al.'s scheme are not influenced by τwhen the interface is straight. These results agree with the analyses in Section3.

It can be seen from Table3that the surface tensions and maximum spurious velocities of these two schemes are both influenced by τ. Consequently, the density distributions are influenced by τ. Meanwhile, the influence of τin Guo et al.'s scheme is in general smaller than in EDM force scheme. As discussed in Section3.1, the influence of τon Guo et al.'s scheme is caused by spurious velocities, while the influence of τon EDM is coursed by spurious velocities and the effect of τon the error terms (Rv,EDM). This might explain why the influence of τon Guo et al.'s scheme is smaller than on EDM force scheme.

(2)Comparison of Solutions for Different Force Schemes with Mechanical Solutions

In this section we compared the results obtained using the EDM and the Guo et al.'s force schemes with the mechanical solutions (Eq.(18)). The parameters were chosen as follows: ε=0.52, A =−ε/2 =−0.26, K=1. Since the mechanical analysis is based on a straight interface, only straight interface cases were considered here.

The simulation results of gas densities for different temperatures for these two force schemes are shown in Fig.1 It can be seen that the results of Guo et al.'s force scheme matches the mechanical solution much better than the EDM force scheme's results. These results are consistent with our analysis in Section3as well as with Li et al. [3].

Based on the above simulation results, we can see that although τhas no influence on both EDM and Guo et al.'s force schemes when the interface is straight, the simulation results vary with τwhen the interface is curved, and the influence is more pronounced on the EDM force scheme. In addition, solutions obtained using the Guo et al.'s force scheme agree with the mechanical solutions much better than those obtained using the EDM scheme. Based on these results, Guo et al.'s force scheme is selected for application in the following simulations.

C. Thermodynamic Consistency and Mechanical Solution

This form of ψ(ρ)makes Eq.(18)and Eq.(19)to be identical. However, this choice limits the choice of the EOS in the pseudo-potential model. To apply the model to different EOSs, Li et al.pointed out that by adjusting εin the mechanical solution, the thermodynamic consistency can be approximately satisfied.

To compare the accuracy of the modified Kupershtokh et al.'s model and Li et al.'s model, we first simulated the gas densities for the straight interface case with the same ε, and compared the results with the mechanical solution and Maxwell construction solution. In these simulations, ε=1.68[3], accordingly, A =0.84, σ=0.105, and K=1.

Fig.6shows the coexistence curves obtained using these two models for different temperatures. It can be seen that these results agree well with each other for the liquid branch (right side) and for the relatively high temperature values of the gas branch (left side). However, at low temperature values (T/Tc<0.7), the difference between the mechanical solution and the simulation results become noticeable for the gas branch, and the results of Li et al.'s model are closer to the mechanical results. The reason behind the discrepancy at low temperature values may be the higher order error terms of the pressure tensor in Li et al.'s model (Eq.(14)) are different from the corresponding terms in the modified Kupershtokh et al.' model (Eq.(16)), and these error terms become large when the temperature is too low since the density changes rapidly over the thin interface.

D. τ's Effects

The results above show a deviation in results obtained using between these two models when the temperatures are low. Hence, we further assess the performance of these two models for low temperature values (T<0.7Tc) and for curved interfaces. Specifically, we study the effects of τon the performance of these two models for τ=0.7, 0.8, 1.0and1.5. The parameters chosen are the same as those in the previous section except initially, a single bubble is placed at the center of simulation domain of 100 ×100lattices. The radius of the bubble is 23 l.u. and the temperature is equal to 0.6Tcin the simulation.

Simulation results are shown in Table4 and Table5(Li et al.'s model becomes unstable for τis equal to 0.7). It can be seen that the influence of τis more pronounced on gas densities for Li et al.'s model, and the τ's effect on density ratios is also larger. However, the largest spurious velocity obtained by these models vary for different τ: when τ<1, the maximum spurious velocity in Kupershtokh et al.'s model is larger than that in Li et al.'s model; when τ>1, the largest spurious velocity in Kupershtokh et al.'s model is smaller than in Li et al.'s model. Hence, conclusion can be made that although Kupershtokh et al.'s model shows lower accuracy compared to Li et al.'s model for straight interface case when the temperature is low, it is more stable for curved interfaces.

Over all, Li et al.'s model and the modified Kupershtokh et al.'s model have the same theoretical base, and their simula-tion results agree well with each other when the temperature is relatively high. However, the performances of these models are still different when the temperature is low.

E. Possible Approach to Improve the Accuracy and to Reduce the τ's Effect for Low Temperatures

Through the accuracy of Kupershtokh et al.'s model can be improved by applying Guo et al.'s force scheme, the simu-lation results still do not match the mechanical solution perfectly, and the τ's influence cannot be eliminated for the low temperatures. It is difficult to completely eliminate the drawbacks due to the mechanical nature of the pseudo-potential model, however, the shortcomings can be further reduced. Here we proposed two possible methods to improve the accu-racy and to reduce the τ's effect on the model.

1. Scale of the EOS

Since the difference between the simulation results and the construction solution becomes noticeable for the thin inter-face corresponding to low temperatures, the error can be reduced by enlarging the interface width by rescaling the EOS. This can be achieved by changing the value of the parameter Kin EOS. (It should be noted that the εshould also be changed to approximately match the Maxwell construction.) Hence here we compared the results for two values of K(1 and 0.1) with mechanical solution. The temperature is T/Tc=0.6, corresponding interface widths are about 3 and 6 lattice units, and the values of εare 1.68 and 2 for Kequal to 1 and 0.1, respectively. The simulation results are presented in Table6. It can be seen that when K=0.1, the difference between simulation results and the

mechanical solution are much reduced compared with the case for K=1.

4. SUMMARY AND CONCLUSIONS

In this paper, we studied Kupershtokh et al.'s single component pseudo-potential lattice Boltzmann models in detail. Three primary force schemes were theoretically analyzed and their numerical results compared. Based on the results, Guo et al.'s force scheme was adopted to improve the accuracy of the Kupershtokh et al.'s model. Numerical comparisons have also be carried out between the modified model and Li et al.'s model. The simulation results show that although the high precision force scheme can eliminate the error terms in the corresponding momentum equation, the numerical errors and effect of τare still noticeable when the temperatures are relatively low, especially when interfaces are curved. These errors are possibly because the viscosity terms in the momentum equation are dependent on spurious velocities. Besides, the high order error terms in the pressure tensor also make the simulation results different from the mechanical solutions. These error terms lead to different performances between the modified Kupershtokh et al.'s model and Li et al.'s model. To improve the accuracy of the modified model and to reduce the effects of τ, we proposed two approaches: increasing interface width, and applying the MRT model. Simulation results show that the performance of the model can be further improved by applying these two methods.

ACKNOWLEDGEMENTS

This work is supported by the National Natural Science Foundation of China(No. 11602066) and the National Science Foundation of Heilongjiang Province of China(QC2015058 and 42400621-1-15047), the Fundamental Research Funds for the Central Universities.

REFERENCES

[1]A.L. Kupershtokh, D.A. Medvedev, D.I. Karpov, On equations of state in a lattice Boltzmann method, Comput. Math. Appl. 58(5) (2009) 965–974.

[2]Z. Guo, C. Zheng, B. Shi, Discrete lattice effects on the forcing term in the lattice Boltzmann method, Phys. Rev. E 65(4) (2002) 46308.

[3]Q. Li, K.H. Luo, X.J. Li, Forcing scheme in pseudopotential lattice Boltzmann model for multiphase flows, Phys. Rev. E 86(1) (2012) 16709.

[4]R. Guy McNamara, G. Zanetti, Use of the Boltzmann equation to simulate lattice–gas automata, Phys. Rev. Lett. 61(20) (1988) 2332–2335.

[5]A.K. Gunstensen, D.H. Rothman, S. Zaleski, G. Zanetti, Lattice Boltzmann model of immiscible fluids, Phys. Rev. A 43(8) (1991) 4320–4327.

[6]X. Shan, H. Chen, Lattice Boltzmann model for simulating flows with multiple phases and components, Phys. Rev. E 47(3) (1993) 1815–1819.

[7]M.R. Swift, E. Orlandini, W.R. Osborn, J.M. Yeomans, Lattice Boltzmann simulations of liquid–gas and binary fluid systems, Phys. Rev. E 54(5) (1996) 5041–5052.

[8]M.R. Swift, W.R. Osborn, J.M. Yeomans, Lattice Boltzmann simulation of nonideal fluids, Phys. Rev. Lett. 75(5) (1995) 830–833.

[9]X. He, X. Shan, G.D. Doolen, Discrete Boltzmann equation model for nonideal gases, Phys. Rev. E 57(1) (1998) R13–R16.

[10]X. He, G.D. Doolen, Thermodynamic foundations of kinetic theory and lattice Boltzmann models for multiphase flows, J. Stat. Phys. 107(1) (2002) 309–328.

[11]L. Luo, Unified theory of lattice Boltzmann models for nonideal gases, Phys. Rev. Lett. 81(8) (1998) 1618–1621.

[12]J. Tölke, Lattice Boltzmann simulations of binary fluid flow through porous media, Philos. Trans. R. Soc. Lond. A, Math. Phys. Eng. Sci. 360(1792) (2002) 535–545.

[13]F.J. Alexander, S. Chen, D.W. Grunau, Hydrodynamic spinodal decomposition: growth kinetics and scaling functions, arXiv:comp-gas/9304005, 1993.

[14]Z. Guo, C. Shu, Lattice Boltzmann Method and Its Applications in Engineering, World Scientific, 2013.

[15]T. Lee, C. Lin, A stable discretization of the lattice Boltzmann equation for simulation of incompressible two-phase flows at high density ratio, J.Comput. Phys. 206(1) (2005) 16–47.

[16]J. Chao, R. Mei, R. Singh, W. Shyy, A filter-based, mass-conserving lattice Boltzmann method for immiscible multiphase flows, Int. J. Numer. Methods Fluids 66(5) (2011) 622–647.

[17]H.W. Zheng, C. Shu, Y.T. Chew, A lattice Boltzmann model for multiphase flows with large density ratio, J. Comput. Phys. 218(1) (2006) 353–371.

[18]T. Inamuro, T. Ogata, S. Tajima, N. Konishi, A lattice Boltzmann method for incompressible two-phase flows with large density differences, J. Comput. Phys. 198(2) (2004) 628–644.

[19]P. Yuan, L. Schaefer, Equations of state in a lattice Boltzmann model, Phys. Fluids 18(4) (2006) 42101.

New Transforming Algorithms among the Representations of Boolean Functions

Ning Wang, Hongxing Shi
College of Science ,Zhongyuan University of Technology, Zhengzhou, China

Abstract: Boolean function is a basic component of stream cipher, and has important applications in cryptography. There are three main representations of Boolean function: the algebraic normal form, the monomial form, and the truth table form. Such representations can be transformed from one to another. In this paper, according to the properties of binary sequences with period power of two, we deduce new transforming algorithms among the different representations of Boolean functions, and provide the new relations between Boolean functions and binary sequences with period power of two.
Keywords: Boolean function; binary sequence; linear complexity; Games-Chan algorithm.

1. INTRODUCTION

Boolean function is a very important function in cryptography. The core component of the block cipher, the s-box, is actually a special Boolean function. In stream cipher, the feedback function composed of the Boolean functions is the most important component to ensure the security. Detail properties and applications of Boolean functions can be found in literature [1].

Boolean functions have many different representations, such as Algebraic Normal Form (ANF), term representation, truth table representation, matrix representation, feature vector representation. Different representations have distinct advantages in distinct domains. In this paper, we study the transformation among several different representations of the Boolean function so that they can be better transformed in distinct domains.

The main objective of this paper is to connect Boolean function and binary 2^n-periodic sequences together. We can transform different representations of Boolean function fast by using the properties of the binary sequence and excellent algorithm. Compared to the present method, the new transformation method is more efficient and also shows the relationship between the Boolean function and the binary sequence with period of power of 2.

2. PRELIMINARIES

Let $F_2=\{0,1\}$ be binary field and n be a positive integer. An n-variable Boolean function $f(x_0,x_1,\ldots,x_{n-1})$ is a map from n-dimension vector space F_2^n over finite field F_2 to F_2. It can be expressed uniquely in the *Algebraic Normal Form*(ANF), i.e.,

$$f(x_0,x_1,...,x_{n-1})=\sum_{I\in\rho(N)} c_I \prod_{i\in I} x_i \quad , \tag{1}$$

where $c_I \in F_2$ and $\rho(N)$ is the power set of $N=\{0,1,\ldots,n-1\}$. A product of the form $\prod_{i\in I} x_i$ in (1) is called a *monomial*. The *degree* of f, denoted by $\deg(f)=\max\{|I| \; |c_I\neq 0\}$. If $\deg(f)=1$, f is called *affine*; furthermore, if , f is called *linear*.

When the input vector of Boolean function $f(x_0)$ is added in the lexicographic order, its output forms a binary vector of length as follows:

$s^f=(f(0,\ldots,0,0), f(0,\ldots,0,1), f(0,\ldots,1,1),\ldots, f(1,\ldots,1,1))$.(2) Such vector is called truth table of f. It corresponds to the Boolean function one by one and can be used to represent Boolean function, that is, the truth table representation of Boolean function. The number of 1s in the truth table is called the *Hamming weight* of f, denoted by $w(f)$.

According to the values of Boolean function f, the ANF of f can be written as

$$f(x_0,x_1,...,x_{n-1})=\sum_{(a_0,a_1,...,a_{n-1})\in F_2^n} f(a_0,a_1,...,a_{n-1}) x_0^{a_0} x_1^{a_1} \ldots x_{n-1}^{a_{n-1}} \tag{3}$$

where $x_i^1=x_i$ and $x_i^0=x_i+1$ for $i=0,1,\ldots,n-1$. Equation (3) is called the *term representation* of Boolean function f, Let $s=(s_0,s_1,s_2,\ldots)$ be a binary sequence, where $s_i \in F_2$. If there exists a positive integer N such that $s_{i+N}=s_i$ for all $i \geq 0$, then sequence s has period N, and sequence s can be written as $s=(s_0,s_1,s_2,\ldots,s_{N-1})$. The linear complexity of s, $c(s)$ is defined as the minimum positive integer L of following equation:

$s_j \oplus d_1 s_{j-1} \oplus \cdots \oplus d_L s_{j-L}=0$ for all $j \geq L$

where $d_i \in F_2$, $\oplus$ is addition module 2. If s is the zero sequence then $c(s)$ is 0, otherwise is the shortest length of linear feedback shift register (LFSR) generating s.

In this paper we view the binary vector s^f with length in (2) as a binary sequence s^f with period . Please notice that such sequence is different from the

sequence generated by the FSR with feedback function f.

The Games-Chan algorithm [3] can compute the linear complexity of binary -periodic sequences fast.

Algorithm 1. Games-Chan algorithm

input： $s^N=S_0=(s_0,s_1,s_2,\ldots,s_{N-1})$, $N=2^n$, $n>0$;

output：c, the linear complexity of.

$c=0$; $l=2^n$; $i=0$

while $l>1$ do

$l=l/2$; $S_i=(s_0,s_1,s_2,\ldots,s_{2l-1})$;

$L=(s_0,s_1,\ldots,s_{l-1})$, $R=(s_l,s_{l+1},\ldots,s_{2l-1})$; $B_i=L+R$;

if $B_i\neq\mathbf{0}$ /*Here $\mathbf{0}$ is the zero sequence

$c=c+l$; $S_{i+1}=B_i$;

else

$S_{i+1}=L$;

$i=i+1$;

end while

if $s_n\neq(0)$ then $c=c+1$.

The Games-Chan algorithm is very effective. Both its time and space complexities are $o(N)$.

The following lemma is an important basis for the main results in this paper.

Lemma1. For two binary -periodic sequences s_1 and s_2 ,

$$c(s_1+s_2)=\begin{cases}\max\{c(s_1),c(s_2)\}, & if\ c(s_1)\neq c(s_2)\\ <c(s_1), & if\ c(s_1)=c(s_2)\end{cases} \quad (4)$$

3. TRANSFORMATION BETWEEN ANF AND TRUTH TABLE

There are some transforming relationships between ANFs and truth table representations of Boolean functions. If the ANF of the Boolean function is known and the different input is taken separately, then the truth table can be directly evaluated by the output. Instead, if we know the truth table, we can get the term representation and expand the merge, then ANF is got. However, the transformation from truth table to ANF is more complex, and time and space complexities are high. In this section, we derive a new effective method of finding the ANF from the truth table. The idea is to use the property and algorithm of the linear complexity of binary -periodic sequences.

Firstly, we view an arbitrary term $\prod_{i\in I}x_i$ in ANF of Boolean function f as a Boolean function $g^I(x_0,x_1,\ldots,x_{n-1})$, where I is a subset of $\{0,1,\ldots,n-1\}$. Notice that if I is empty, g^I is a constant 1. The truth table list of Boolean function g^I is denoted as

$s^I=(g^I(0,\ldots,0,0),g^I(0,\ldots,0,1),\ldots,g^I(1,\ldots,1,1))$.

(5)

Obviously, the truth tables of Boolean function f and g^I satisfies $s^f=\sum c_I s^I$.

Because I is a subset of $\{0,1,\ldots,n-1\}$, we can define a binary n-vector $a_I=(a_0,a_1,\ldots,a_{n-1})$,where $a_i=1$ if and only if i in I. Note that vector a_I and the set I are one-to-one correspondence.

The binary 2^n-periodic sequence s^I has the following interesting properties.

Lemma2. For a binary 2^n-periodic sequence s^I, $a_I=(a_0,a_1,\ldots,a_{n-1})$,

1. Applying the Games-Chan algorithm on s^I, in the i-*th* step,$i=0,1,\ldots,n-1$, if $a_i=0$,then the left and right half parts of S_i are equal; and if $a_i=1$, then the 1s in S_i lie in the right half part of S_i;

2. $\log_2[wt(s^I)]=n-wt(a_I)$;

3. $c(s^I)=\sum a_i 2^{n-1-i}+1$,i.e., the binary representation of $c(s^I)-1$is equal to $a_I=(a_0,a_1,\ldots,a_{n-1})$.

Proof： Applying Games-Chan algorithm on s^I. if $a_0=0$,then $g^I(x_0,x_1,\ldots,x_{n-1})=\prod_{0\notin I,i\in I}x_i$ and x_0 does not appear in this term. At this time, the value of the x_0 does not affect the truth table of the g^I,i.e., s^I,so the left and right half parts of $S_0=s^I$ are equal. Similarly, if $a_0=1$, then only if $x_0=1$, the corresponding value in the truth table of g^I is possible to be 1. So the 1s of S_0 must be at the position satisfying $x_0=1$. That is, the right half part of S_0.

In the i-*th* step of Games-Chan algorithm, $i=0,1,\ldots,n-1$, according to the property of this algorithm, sequence S_i corresponds to the binary n-i vector $(a_i,a_{i+1},\ldots,a_{n-1})$. Using the same method recursively, we can prove that property 1 is right.

According to the properties of Games-Chan algorithm and property 1, if $a_i=1$, $wt(S_{i-1})=wt(S_i)$,and if $a_i=0$, $wt(S_{i-1})=2wt(S_i)$. Since the weight of $S_n=(1)$ is 1, we can derive the propertie 2.

Property 3 can be derived directly from Games-Chan algorithm and property 1.

□

According to the property 1 of lemma 2,given a term $g^I(x_0,x_1,\ldots,x_{n-1})$,we can easily find the corresponding sequence s^I.

Example1. Suppose that $g^I(x_0,x_1,x_2)=x_0x_2$, $I=\{0,2\}$, $a_I=(1,0,1)$. Applying the Games-Chan algorithm on s^I,we have $S_0=s^I$, S_1, S_2, $S_3=(1)$.

1. Because $a_2=1$,the 1 in S_2 lie in the right half part of S_2, so $S_2=(01)$,

2. Because $a_1=0$,the left and right half parts of S_1 are equal, so $S_1=(0101)$,

3. Because $a_0=1$,the 1s in $S_0=s^I$ lie in the right half part of $S_0=s^I$, so $s^I=(0000\ 0101)$.

It is easy to check that $wt(s^I)=2^{3-2}=2$, $c(s^I)=1\times2^2+0\times2^1+1\times2^0+1=6$.

According to Lemma2,we can provide an efficient algorithm to finding the corresponding ANF by the truth table of Boolean function.

Algorithm2. ANF Transformation Algorithm

Input：the truth table s^f of $f(x_0,x_1,\ldots,x_{n-1})$;

Output: the ANF of f.

STEP1: Compute $c(s^f)$ according to Games-Chan algorithm;

STEP2: Compute a_I, i.e., the binary representation of $c(s^f)-1$, compute the set I, and generate s^I,

STEP3: $s^f \leftarrow s^f+s^I$,
STEP4: If $s^f \neq \mathbf{0}$,go back to STEP1,
STEP5: Output all the sets of I,ANF=$\sum_I \prod_{i\in I} x_i$.

The following theorem guarantees the correctness and effectiveness of algorithm 2.

Theorem1. The algorithm 2 is correct.

Proof : In order to obtain the ANF of Boolean function f,it is sufficient to obtain all Is satisfying $c_I \neq 0$ in Eq. (1). We know that the 2^n-periodic sequence s^f in the truth table of f is the sum of all sequences s^I. For different I, according to Lemma 2, the linear complexity of sequence s^I is also different. According to Lemma 1, $c(s^f)$ is the one with the largest value of $c(s^I)$. Then according to $c(s^f)$ and Lemma 2, the largest linear complexity of the s^I and the corresponding I can be calculated. Subtracting s^I from s^f, then the linear complexity of the corresponding sequence will equal the value of the second largest linear complexityin $c(s^I)$. Continuing this process, we can successively determine all I, thus deriving the ANF of Boolean function f.

According to algorithm 2, the true table sequence of the corresponding term of linear complexity is different, we can successively determine each term, and finally calculate the sum of terms, i.e., ANF. Now, we illustrate how the algorithm works.

Example 2. Given a truth table s^f=(00101101), we use algorithm 2 to obtain ANF.

Applying the Games-Chan algorithm on s^f,we get $c(s^f)$=5, the binary representation of 4 is (1,0,0), I_1={0},the corresponding term is x_0, and can easily compute the corresponding sequence s_1=(00001111).

Applying the Games-Chan algorithm on $s^f+ s_1$,we get c(00100010)=4, the binary representation of 3 is (0,1,1), I_2={1,2},the corresponding term is x_1x_2,and can be easily compute the corresponding sequence s_2=(00010001).

Applying the Games-Chan algorithm on $s^f+ s_1+ s_2$,we get c(00110011)=3, the binary representation of 2 is (0,1,0), I_2={1},the corresponding term is x_1,and we can be easily computed the corresponding sequence s_3=(00110011).

$s^f+ s_1+ s_2+ s_3=\mathbf{0}$, end algorithm, output the ANF of f is $x_1x_2+x_0+x_1$.

Since the Games-Chan algorithm is very fast and efficient, so the algorithm 2 can be implemented efficiently. Compared with the existing transformation methods, our new method has less time and space complexities.

4. CONVERSION OF ANF AND THE MONOMIAL FORM

According to the similar idea, we can realize fast transformation from ANF to the monomial form. According to the coefficient of each term in ANF, we can define a binary 2^n-periodic sequence. For a set of $I\in\{0,1,\ldots,n\text{-}1\}$, we define an integer $t_I=\sum_{i\in I} 2^{n-1-i}$. if I is empty,t_I=0. According to the Eq. (1), we define the following sequence:

$u^f=(u_0,u_1,\ldots,u_{N-1})$, $N=2^n$, $u_t=c_I$ if and only if $t=t_I$. (6)

Actually, sequence u^f is made by the coefficients of each term in Eq. (1) are arranged in order, and it corresponds to the ANF of f.

For a binary n-vector $\mathbf{a}=(a_0,a_1,\ldots,a_{n-1})$,we define the monomial form

$$h^{\mathbf{a}}(x_0,x_1,\ldots,x_{n-1})= x_0^{a_0} x_1^{a_1} \ldots x_{n-1}^{a_{n-1}} . \quad (7)$$

This monomial form can be seen as a Boolean function, its output is 1 if and only if the input vector is $\mathbf{a}$. Similarly, we can also list $u^{\mathbf{a}}$ similarly to equation (6).

Example 3. Let Boolean function $f(x_0,x_1,x_2)=x_1x_2+x_0+x_1$, the set I of the corresponding three monomial are {0}, {1}, {1,2}, the corresponding t_I are 4, 2, 3, so u^f=(00111000).

Given a vector $\mathbf{a}$=(1,0,1),we know that the monomial form $h^{\mathbf{a}}= x_0(1+ x_1)\, x_2= x_0x_2+x_0x_1x_2$. By definition, we have $u^{\mathbf{a}}$=(00000101).

According to the relationship between Eq. (1) and Eq. (3), we know that the relationship between Eq. (6) and Eq. (7) is $u^f=\sum_{f(\mathbf{a})=1} u^{\mathbf{a}}$. In order to calculatethe monomial form of the Boolean function, we must find out all the vectors satisfying $f(\mathbf{a})$=1. Similar to the approach in the previous section, we can also translate the problem into the analysis of linear complexity of binary 2^n periodic sequences and sequence decomposition problems.

It is easy to prove sequence $u^{\mathbf{a}}$ satisfies the following properties similar to lemma 2, i.e.,

1. Applying the Games-Chan algorithm on $u^{\mathbf{a}}$, in the *i-th* step,i=0,1,…,n-1, if a_i=0,then the left and right half parts of $u^{\mathbf{a}}$ are equal; and if a_i=1, then the 1s in $u^{\mathbf{a}}$ lies in the right half part of $u^{\mathbf{a}}$,
2. $\log_2[wt(u^{\mathbf{a}})]=n\text{-}wt(\mathbf{a})$;
3. $c(u^{\mathbf{a}})=\sum a_i 2^{n-1-i}+1$, i.e., the binary representation of $c(u^{\mathbf{a}})$-1is $\mathbf{a}=(a_0,a_1,\ldots,a_{n-1})$.

According to these properties, we can also use the algorithm 2 to calculate the successive vector $\mathbf{a}$, which converts ANF into the monomial form. Because the methods are similar, we don't list specific steps here and just provide an example to show how to do that.

Example 4. Let Boolean function $f(x_0,x_1,x_2)=x_1x_2+x_0+x_1$, Using example 3, we can provides u^f=(00111000).

Applying the Games-Chan algorithm on u^f, we get $c(u^f)$=8, the binary representation of 8-1=7 is (1,1,1), We know that the corresponding monomial is $x_0x_1x_2$, and can easily compute the corresponding sequence s_1=(00000001).

Applying the Games-Chan algorithm on $u^f+ s_1$,we get c(00111001)=6, the binary representation of 5 is (1,0,1), the corresponding monomial is $x_0(1+x_1)x_2$,and can compute the corresponding sequence s_2=(00000101).

Applying the Games-Chan algorithm on $u^f+ s_1+ s_2$,we get c(00111100)=5, the binary representation of 4 is (1,0,0), the corresponding monomial is

$x_0(1+x_1)(1+x_2)$,and compute the corresponding sequence s_3=(00001111).

Applying the Games-Chan algorithm on $s^f+s_1+s_2+s_3$,we get c(00110011)=3, the binary representation of 2 is (0,1,0), the corresponding monomial is $(1+x_0)x_1(1+x_2)$, and compute the corresponding sequences_4=(00110011).

$s^f+s_1+s_2+s_3+s_4=\mathbf{0}$, end this algorithm, output the monomial form of f

$$f(x_0,x_1,x_2)=x_1x_2+x_0+x_1=x_0^1x_1^1x_2^1+x_0^1x_1^0x_2^1+x_0^1x_1^0x_2^0+x_0^0x_1^1x_2^($$

5. CONCLUSION

Boolean functions are very important in cryptography, and the study of Boolean functions is very useful for cryptography. The transformation among various representations of Boolean functions is a very basic problem, which is important in many domains. In this paper, we realize fast effective transformations among representations of Boolean function by linking the Boolean function with binary 2^n -periodic sequences and considering the different linear complexity of each sequence and decomposition of sequences. This approach is original. In the future work, we will continue to research the properties and applications of Boolean functions.

REFERENCES

[1]A. Menezes, P. Oorschot, S. Vanstone, Handbook of Applied Cryptography. Boca Raton: CRC Press, 1996.

[2]R. A. Ruppel, Analysis and Design of Stream Ciphers. New York: Springer-Verlag, 1986.

[3]R. A. Games, A. H. Chan, “A fast algorithm for determining the complexity of a pseudo-random sequence with period 2n,” IEEE Transactions on Information Theory, vol. 29, no. 1, 1983, pp. 144-146.

[4]K. Kurosawa, F. Sato, and W. Kishimoto, “A relation between linear complexity and k-error linear complexity,” IEEE Transactions on Information Theory, vol. 46, no. 2, 2000, pp. 694-698.

Research on Book Acquisitioning Crowdsourcing Mechanism of the College Libraries under the Thinking of "Internet +"

Haiqing Xiao
Guilin Normal College ,Guilin, 541001,China

Abstract: On the basis of elaborating the connotation and conceptual framework of crowdsourcing, the article introduces the thinking of "Internet +", mainly discuss the operation mechanism of the book interview crowdsourcing, puts forward the framework of the operation mechanism of the book interview crowdsourcing, and then, analyses its core advantages, such as the solution on the problem of shortage of human resources, reduction on book acquisitioning personnel's workload, better satisfaction of the demand of literature between teachers and students,optimization of library collection structure,and so on. Finally,it expounds the key problems of the book interview crowdsourcing.
Keywords: Internet+; Crowdsourcing; Book acquisitioning; the optimization of collecting books.

1. INTRODUCTION

Premier Keqiang Li formally put forward the "Internet +" action plan in the government work report of the "Two Sessions" in 2015, bringing it to the national strategic level." Internet +" is the product of modern information technology and the national strategic action, and are connected with all walks of life by the ways of interconnection, over-crossing and integration. The college libraries, as the literature information center and knowledge service center, should actively embrace "Internet +", take advantage of the thinking of "Internet +" to open up every link of service, management, technology, achieving the true integration of "Internet + library".

Limited budget and lack of human resources are common problems of the college libraries, which severely limit the advancement of the college libraries' literature resource construction, resulting in outstanding issues on insufficient collection structure reasonable and slow collection update. On the one hand, the shortage of money and manpower often lead to a difficult task for library buyers. On the other hand, in the age of new information, book publications have become "big data", with varying quality. At the same time, the acquisitioning personnel have to complete the collection with limited funds,which often leads to procurement staff into a dilemma. In order to complete the task, the phenomenon that is "more cheap books, buy less or not buy high-price books and buy more public readings , buy less or not buy professional books" often appears, which is also the unwritten potential rules of college libraries. Especially, when meeting being evaluated, the college libraries are often helpless because of the lack of reasonable collection development planning at ordinary times, instead ,they can only choose a lot of special offer books ,just go on "hold A Post Without Qualifications". Books are the foundation of traditional literature of libraries and an important organic component of the library collection structure, however, the pros and cons of books purchasing quality are directly related to the collection structure, quality of library, which is difficult to meet the demand of teachers and students of literature information and seriously affects the development of the school in the long term.

Therefore, in the full use of "Internet+" thinking, I try to introduce the crowdsourcing model in the college library book interview. Crowdsourcing is a kind of mass innovation that can gather the wisdom and strength of the masses and solve many problems which the college libraries face. Combining with the characteristics of the book acquisitioning of cellege library, using the conceptual framework, book acquisitioning crowdsourcing operation framework was proposed, and the operation mechanism of the key strategies are expounded.

2.CROWDSOURCING AND LIBRARY

2.1 the connotation of crowdsourcing

The concept of crowdsourcing was first officially proposed by Jeff Howe in WIRED magazine's "The Rise of Crowdsourcing" in June 2006. It refers to a type of work that a company or organization, in a free and voluntary form, gives to a non-designated mass network in a way that is previously performed by internal employee [1] . After the concept of crowdsourcing was brought forward, it was followed by many scholars and business people. Many scholars have studied the connotation of crowdsourcing from several different sides and defined it in combination with different application scenarios.,For example, Thrift (2006) believes that crowdsourcing is used to stimulate and coordinate the integration of irregular resources, making it possible to organize work [2].

Su-fen Lin and Ling Feng (2015) [3] reviewed and summarized the definition of crowdsourcing based on the domestic and foreign scholars' study on the basis of crowdsourcing literature, thinking that the definition of the crowdsourcing are related to computer (information) te chnology, business model and knowledge creation. According to the definition of crowdsourcing, its has the following characteristics:(1) open innovation, mass production and user creation;(2) a wide range of individuals or organizations, such as for-profit or non-profit, which are competent to be competent; the task of crowdsourcing ,not only include for-profit organizations such as the company, but also non-profit organizations or organizations, even individuals;the Internet users are involved in the public recruitment process;(5) the packages are mutually beneficial and mutually beneficial;(6)Crowdsourcing hides risks. Zhang Libin(2012)[4]concluded that freedom, openness, equality and collaboration are the main characteristics of crowdsourcing. The crowdsourcing is focused on the different aspects of the application scenario. The rich connotation and characteristics of crowdsourcing provide broad prospects for the application of crowdsourcing in different fields or scenarios. All in all, crowdsourcing as the product of modern information technology(especially the development of mobile Internet, big data) ,open collaboration, voluntary equality and mutual benefit and sharing are the essence of its connotation and survival rule. The college library is a non-profit organization that integrates modern information technology, knowledge creation and service and management, and has the benign soil of crowdsourcing.

2.2 conceptual framework of crowdsourcing

The operating mechanisms and processes of the crowdsourcing are critical to crowdsourcing, which is as a modern and popular working model. Many scholars both at home and abroad have carried on the related research to the crowdsourcing, put forward the basic framework of it, and provided a solid theoretical basis for its applications and operation in various fields and different scenarios .In summarizing the research achievements of MIT Sloan school of management related scholars, Chen Qiang etc. [5] (2013,2015) put forward a basic concept framework of crowdsourcing. According to the theoretical basis and practical needs, he made change on the concept of crowdsourcing framework, listed the providers and practitioners in the category of the world health organization (who) (as shown in Fig.1).

The basic concept framework of crowdsourcing, mainly illustrates the basic flow of the the whole operation mechanism of crowdsourcing, and mainly includes the task of crowdsourcing providers and practitioners (the contracting party and the receiving party), the package (cooperation, competition), the reason for the operation of crowdsourcing,and the results of the crowdsourcing (creative solutions or decision-making information). From the conceptual framework above, its whole operation mechanism and the process embody the characteristics that are open innovation, the whole people to participate , no boundary, freedom and equality, and cooperation and sharing, etc.,which can be found .

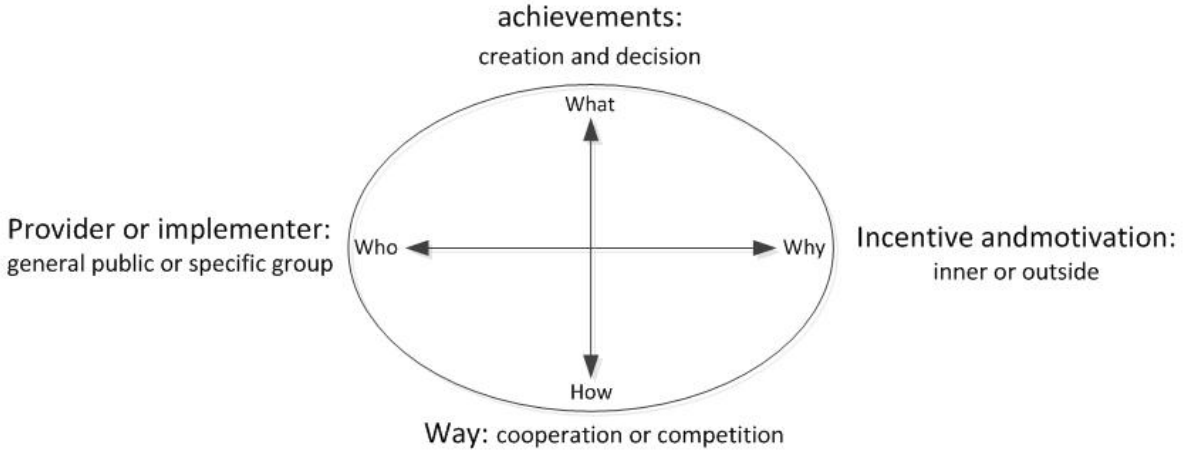


Figure 1 The conceptual framework of crowdsourcing

2.3 the application of crowdsourcing in library

Its characteristics of open innovation, full participation, no-boundary organization, freedom and equality, cooperation and sharing, etc, provided the infinite possibility for college libraries, a no-profit organization, to use crowdsourcing to improve library management and service , and its application in the library begins to enter our field of vision. The concept of library crowdsourcing, crowdsourcing, and the system of crowdsourcing, etc., has been put forward by relevant scholars. Zhang Ru and Ceng Yan thought that library crowdsourcing is an approach, which refers to the library outsourced its work,such as the construction improvementand the related services of information resources, to unspecific network mass users [7]. Seng Fang

(2012)proposed the concept of crowdsourcing librarians and called for the system of crowdsourcing. The document[8] thinks that crowdsourcing librarians refers to the librarians who make crowdsourcing library business as their main responsibilities,they will mainly be responsible for publishing the problems or tasks of libraries on the Internet under the participation of customers, suppliers and universities such people and institutions who are interested in, and at last, find out the best solution or complete a task under the joint efforts of the participants.

At present, the application of crowdsourcing in the domestic libraries is mainly in the following aspects; 1) the (virtual) reference, for example, Dong Fang (2012) [9] summarized the application of crowdsourcing on foreign libraries ,and then thought that domestic libraries could introduce the crowdsourcing model in virtual reference service ; 2) digital information resources construction, for example, Bai Sugong (2014) [10] discussed the application of crowdsourcing in digital resource construction from these four aspects:procurement, digital resource construction of digital resources, digital resources processing and post-consultation service; 3) disciplinary services, for example, document[7] has built a system of disciplinary service mechanism for crowdsourcing based on the concept of library crowdsourcing;4) the establishment of the characteristic database, for example, GuanFu Britain and Li Shuning (2015) [11]put forward the crowdsourcing in characteristic data resources construction strategies and measures on the basis of the feasibility of introducing the crowdsourcing. Liu Li (2015) [12] in the North Ethnic University introduced the crowdsourcing model in the construction of characteristic collection.

To sum up, that there are very few applied researches in the book acquisitioning, and only a few scholars involved can be found. For example, in this paper"crowdsourcing the impact on the library and its use" (2011) [13], Fanny proposed that the library can draw lessons from the concept of crowdsourcing, encourage the readers to involve in the choosing books work; Wang Lin and zhong yongwen (2015) [14], from the perspective of the PDA (Patron Driven Acquisitions), explored the basics and strategies of library book acquisitioning crowdsourcing. In the era of highly developed information technology and big data, book acquisition, as the traditional basis of college library literature resources construction project, should make full use of "Internet +" thinking, introduce the crowdsourcing model, improve the quality of books purchasing, optimize the structure of library collection, to reduce the "two eight phenomena" inherent to the library.

3.THE CROWDSOUCING MECHANISM OF LIBARARY BOOKS IN COLLEGE LIABRARIES

Crowdsourcing which has the characteristics of open innovation, full participation, the no-boundary organization , freedom, equality,cooperation and sharing , provides a new way of thinking, and new choices for the book acquisitioning work of university library facing the dilemma of "dilemma" . When facing the difficulties of acquisition funds inadequacy, lack of manpower ,publishing industry and big data, book acquisitioning personnel can introduce the crowdsourcing model, encourage the readers to actively participate in the public library of choose and buy. Book acquisitioning personnel can put the bibliographic data required for the number of subject setting, the composition of bibliographic data, school conditions and proportion, funds budget (can be converted into the average price of each book), and the desired outcome or solution to relevant platform, attract school discipline experts, professional teachers and students readers and even the public to participate in choosing books outside work through the corresponding mechanism. School discipline experts, professional teachers, student readers can draw on the subject of in-depth grasp and their own interests to select books, and submit to book acquisitioning personnel, to evaluate and audit in accordance with requirements. Giving the corresponding reward to the participants who select the required books , book acquisitioning personnel can make these book list posted on the Internet to share achievements finally.

3.1the book acquisitioning crowdsourcing operationg mechanism

Compared with for-profit organizations, such as companies or institutions of crowdsourcing, college library book acquisitioning crowdsourcing has bigger differences, which is non-profit, less money, university library document resources public free, for the teachers and students, so the mechanics of the crowdsourcing have their own characteristics.Based on the research results of documents [5] and [6], this paper puts forward the framework of the running mechanism of library book acquisitioning business which is suitable for college libraries, as shown in Fig.2.The party of the book acquisitioning crowdsourcing business is book acquisitioning personnel and outsourcee is covered by a disciplinary expert, a professional teacher and a student,using the library as a crowdsourcing platform rather than a third-party platform.

The contracting party: the book acquisitioning member, as the contractor of the crowdsourcing, needs to complete the following tasks:

(1)Collect and analyze book acquisitioning task. On the basis of the requirement of the development plan of the school and the requirement of the pavilion, the librarians should take full control of the library's collections and the structure of the collection, and then, do the book interview task list with the data drive.

(2)Subdivide book acquisitioning tasks/make acquisitioning rules. The book acquisitioning personnel will subdivide the tasks according to the categories, disciplines and specialties based on the book acquisitioning they collect. According to the structure of the collection and the volume of books, the total volume of book purchase is clearly defined. In addition, the rules for the implementation of the tasks shall be formulated for the price of books, the types of books, the source of books and the year of publication; At the same time, it is a good incentive plan, whether it is a material reward or a spiritual reward. The library is a non-profit organization that is free to the teachers and students, so it can be that the reward is spiritual, the material reward is secondary.

(3)Publish a book acquisitioning task. The college libraries publishes the mission on the third party crowdsourcing platform, although it is able to exert the intelligence of the group and get more quality solutions, the third platform has to face the problem of a wider audience,difficult management on third-party intervention, it is easy to appear the situation of hard control for book acquisitioning personnel. Instead ,this affects the process and even increase the cost of book acquisition. Therefore, the college libraries that are first involved in the bookacquisitioning crowdsourcing can choose Controllable platforms to publish tasks,such as school and library official website, mobile library .

(4)Evaluate and select the best option. In accordance with the requirements of the book acquisitioning in our library, book acquisitioning personnel select the best plan for the various proposals submitted by the crowdsourcing party. At the same time, participants were rewarded for the best solution, and share the best solution on the platform.

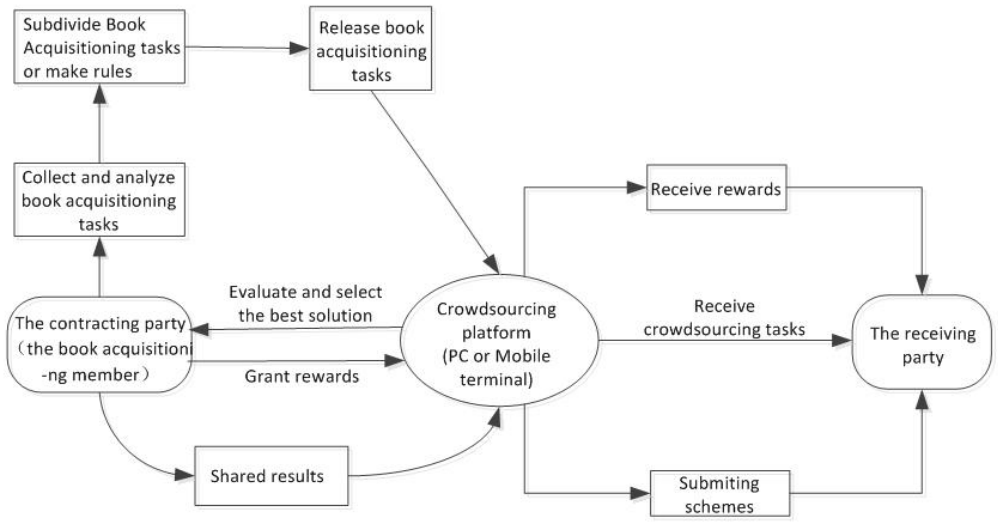


Figure 2 operation mechanism of business on book acquisitioning crowdsourcing

The receiving party: In this paper, the receiving party of book acquisitioning crowdsourcing mainly refers to the subject matter experts, the professional teachers and the general student readers and so on. The receiving party mainly decides whether to accept the task according to the requirement of the task, combined with their ability and interest in platform (the school website, our website, mobile library).

Once the task is accepted, the task will be implemented according to the requirements and rules of the issuer. Submit the task completion plan to the crowdsourcing platform after completing the task. If the issuer adopts his own plan, he will receive the award on the crowdsourcing platform after the awarding party.

3.2the core strengths of book acquisitioning crowdsourcing

The book acquisitioning carries out the crowdsourcing, can make full use of the power of the collective wisdom of the group, promote the efficiency and the quality of the book acquisitioning. Its core strengths are in the following aspects:

(1)Solve the problem of human resource shortage and cost in the library. The book acquisitioning business is one of the core business of the college library, which is related to the rationality of the overall library collection and the quality of the collection. And the shortage of human resources has always been a problem for the library. In the eyes of many people, the book acquisitioning is nothing just to choose books, to check the bibliographic data provided by the bookseller. By crowdsourcing, we can remove the task, solve the problem of human resource shortage, and reduce human cost. And, let more teachers and students join in the construction of the library and the course of the book acquisitioning , to understand the hard work of the book acquisitioning.

(2)Reduce the workload for the book acquisitioning personnel. Librarians are not only busy with the services, management but also research tasks of the library itself. Book acquisitioning crowdsourcing make the acquisitioning task transfer to the masses of teachers and students. After the tasks are broken down, the number of tasks each package will

complete is less, and the task of choosing a book in the big data of the publishing industry is greatly reduced by a small number of book acquisitioning, which is conducive to release from tedious choosing books for the book acquisitioning personnel, make them do a good job in optimizing, managing and understanding the research and development of the collection.

(3)Use the wisdom of the group to improve the quality of the collection and optimize the structure of the collection. College libraries are mainly for teachers and students readers . Therefore, let the teachers and students participate in the collection resources construction, the book acquisitioning work, which is good for the selection books to be more suitable for the needs of students and teachers and the needs of the development of the subject and profession. This will improve the quality of the collection and optimize the structure of the collection.

4. THE KEY PROBLEMS COLLEGE LIBRARY ACQUISITIONING CROWDSOURCING NEEDS TO PAY ATTENTION

There are differences in the structure of the book-acquisitioning crowdsourcing and other profitable organizations , such as enterprise.ChenQiang pionted out,the key issues of crowdsourcing are discussed from three dimensions of the organizer, the system and the participants.[6]Literature [7]displayed,the key strategies of developing the service oriented to multi subject services are discussed from four aspects, namely, the package platform construction mechanism, the user incentive mechanism, the crowdsourcing platform supervision mechanism and the content quality control.In this paper, the key issues of College Library Acquisitioning Crowdsourcing are discussed from the aspects of organization, platform and incentive mechanism design.

4.1 book acquisitioning crowdsourcing organizational problem

As the organizers of the book acquisitioning crowdsourcing, the book acquisitioning personnel need to pay attention to the three issues, decision-making, management and quality evaluation.

(1)Crowdsourcing decision problem

Crowdsourcing decision problem refers that the book acquisitioning personnel, on the basis of full investigation and collecting information and data, determine whether the book acquisitioning task can be implemented. When the book acquisitioning personnel go on book acquisitioning, they will consider the size of the acquisitioning workload, that whether it is confidential, feasibility, and the difficult level of the task. For example, a small amount of small and sporadic purchases are not suitable for the crowdsourcing,ect.

(2)Crowdsourcing management problem

Crowdsourcing management is that the book acquisitioning personnel track and monitor the published crowdsourcing project, guide the crowdsourcing participants in the implementation of the project to align with the project direction. According to the need, management, project management and other theoretical designs can be used for referrence to design the management mechanism that is suitable for the book acquisitioning crowdsourcing business, in order to provide the basis for future book acquisitioning the crowdsourcing management.

(3)Quality and content assessment problem

After outsourcee submits the crowdsourcing plan to crowdsourcing platform, g, book acquisitioning personnel, as organizers of crowdsourcing, need to evaluate its content strictly according to the structure of the collection, the plan of the subject development, the professional setting and the use of funds, strictly control the quality, realizing the optimization of the structure of the collection, the development of the discipline and the needs of the professional and the teachers and students for all college libraries.

4.2 the selection problem of books acquisitioning crowdsourcing platform

Book acquisitioning crowdsourcing is different from other non-profit organizations, therefore, its crowdsourcing platform selection problem is related to the problem of management, content quality in the whole process of crowdsourcing implementation.

Therefore, the book acquisitioning crowdsourcing platform selection should follow the following principles:1) keep the platform under control from inside and outside. New book acquisitioning personnel of crowdsourcing can choose internal controllable network platform, such as the school's website, library web site or mobile library terminals, and can also choose the external third-party platform like Weibo and WeChat to go on controlling it after the time is right . 2)Open a dedicated entrance to improve the user experience. On the distribution platform of the crowdsourcing task, such as the school's website, the website of the website, etc., the special entrance to the book acquisitioning business should be opened and the page design should follow the user experience principle. 3)Set up interactive channels. This is conducive to realize real-time interaction and communication between the contracting party and the receiving party, and facilitates management and project completion.

4.3 the problem of incentive mechanism design

Incentive mechanism is key to the book acquisitioning crowdsourcing, so acquisitioning personnel should combine the the nature of the college libraries and the characteristic of participants group to design a reasonable incentive mechanism.

First of all, the non-material incentives should be superior to the material incentives. The adopted

scheme can be published to school and library website to let the the whole school teachers and students get to know and share achievement of the participants. The participants can be offered a tilt in the time limit for book lending and quantity of borrowed books.The library can be granted "Excellent Contributors to Library Literature Resources". Sendly, subdivide the task and content and make content more interesting, challenging, and learnable. Ru and Ceng Yan (2014) [7] summarized foreign scholars' motivations for crowdsourcing are mainly based on the experiential and cognitive characteristics of the platform, the higher autonomy of content, and the ability to add new skills. Therefore, the book acquisitioning personnel should focus on the above contents in the design of the incentive mechanism of crowdsourcing.

5. CONCLUSION

Based on the elaboration of the connotation and conceptual framework of crowdsourcing, this paper mainly discusses the key issues to be paid attention to. The implementation of the college library book acquisitioning crowdsourcing is a practice of "Internet +" plan of action, facing the problems of the big data in publishing industry, insufficient funds for library books in colleges and universities, the shortage of human resources and acquisitioning personnel’s heavy workload, the introduction of crowdsourcing model in the book acquisitioning can effectively solve the above problems. Of course, there are still shortcomings in this article, such as the limitation of the selection of the platform, inadequate feedback mechanism design, which will require further research in the future.

ACKNOWLEDGMENT

The authors wish to thank CALIS of Guangxi Information Service Center and Guilin Normal College. This work was supported by a grant for Research on the development of professional ability of Young Librarians in University Libraries in big data Era(Gant No.CALISGC201610) and Research on the construction of vocational ability system of Young Librarians Based on big data environment(Gant No.KYB201612) from CALIS of Guangxi Information Service Center and Guilin Normal College.

REFERENCES

[1]Howe J.The Rise of Crowdsourcing,Wired, 2006,14(6):176-183.

[2]Thriftn.Re-inventing Invention: new Tendencies in Capitalist Commodification,Economy And Society , 2006,35(2):279-306.

[3]Sufen Lin,and Feng Lin,A Research on the Definitions and Models of Crowdsourcing and Their Future Development,Science and Technology Management Research,2015(4):212-217.

[4]Libin ZHang,Fuping Zhong,and Hui Tu, A Research Review on Crowdsourcing,Science & Technology Progress and Policy,2012,29(6):154-160.

[5]Qiang Chen, Jinhong Wu,and Yufeng Zhang,On Competitive Intelligence Mechanism Based on Crowdsourcing in the Era of Big Data,Journal of Intelligence,2013,(3)2815-18.

[6]Qiang Chen,Research on Crowdsourcing Model of Enterprise Competitive Intelligence in the Environment of Big Data,wuhan Textile university,2015.

[7]Ru Zhang, and Yan Zeng,The Research of Subject Services in Academic Libraries based on Crowdsourcing,Library Journal,2014,33(8):53-58.

[8]Fang Sheng ,and Zhenglong Li,etc.Crow dsourcing and Crow dsourcing Librarian System:Prom oting Library Service in Transition,Document,Information & Knowledge,2012(4):95-102.

[9]Fang Dong,Applicationand and beneficial implications of crowdsourcing in foreign libraries,New Century Library,2012(12):38-40.

[10]Suhong Bai,The Study on Co nstruction Model of Digitized Collection of Library Based onCrowdsourcing,Library and Information,2014(3):134-136.

[11]Fuying Guan, and Shuning Li,Crowdsourcing:New Choice for Library Special Collection Development ,Library Journal,2015,34(2):58-62.

[12]Li Liu,Study on the Characteristic Database of University Libraries Based on Crowdsourcing Mode in the Era ofBig Data-Taking the Library of Beifang University of Nationalities as an Example,Journal of Library and Information Sciences in Agriculture,2015,27(8):83-86.

[13]Lijuan Fan,Influence and Utilization of Crowdsourcing in Libraries,Library Development,2011(1): 89-91.

[14]Lin Wang,Yongwen Zhong,Research on the crowdsourcing foundation and Countermeasures of Library Literature Resources Construction,Library Work and Study,2015,2(36):48-50.

Application of Ecological Design in Post - industrial Landscape

Gan Lu[1], Wang Jiangping [2]
[1]School of Art, Yangtze University, Hubei, China，Hubei, Jingzhou，434000
[2]School of Urban Design, Wuhan University, Hubei, China，Hubei, Wuhan，430000

Abstract: In order to solve the problem of industrialization and urbanization, the abandoned industrial facilities and abandoned land, this paper expounds the ecological concept and principle of landscape design from the perspective of the application of landscape ecology in the concrete design, the park ecological design examples for analysis to provide a certain theoretical basis for the future transformation of the factory.
Keywords: ecological design, post - industrial landscape, application

1. INTRODUCTION

Since the 1960s and 1970s, people have woken up from the rich dreams of the industrial age and began to realize the environmental and energy crises. Landscape design has shown concern about the relationship between man and nature, which is a kind of natural and cultural new understanding. In 1969 Ian McHeag "design combined with nature" come out, the ecological thinking applied to the landscape design, resulting in "design respect for nature", the landscape design and ecology perfect fusion, opened up the ecological landscape Design of the scientific era, also produced a more extensive sense of the ecological design.

The global wave of ecology has prompted people to look at the landscape industry from a scientific perspective. Landscape architects have also begun to link their mission to the whole earth ecosystem. Now, in some countries developed in the landscape industry, eco-design has long been not empty talk on papers and drawings, and no longer a few designers of experiments, ecologicalism has become a landscape designer intrinsic and essential thinking. Respect for the natural development process, advocate the recycling of energy and material and the self-maintenance of the site, the development of sustainable processing technology and other ideas throughout the landscape design, construction and management of the always. In the design of the pursuit of ecology has been with the pursuit of functional and form of the same important, and sometimes even beyond the latter two, occupy the primary position.

The introduction of ecological thought, landscape design ideas and methods have undergone a major change, but also greatly affected or even changed the image of the landscape. Landscape design no longer stay in the garden design of the small world, it began to intervene in a wider range of environmental design areas, embodies a strong ecological philosophy.

2.THE CONCEPT OF POST-INDUSTRIAL LANDSCAPE

The development of human social economy has been thousands of years of history, the international community for a country or regional economic development stage is usually through the industrialization of the measure to assess the overall degree of economic development, according to the stage of industrial growth, the socio-economic development stage Divided into agricultural, industrial, post-industrial three periods. Among them, the industrialization period, the economic development of the secondary industry; post-industrial period, the economic development of the tertiary industry.

The 18th century industrial revolution completely changed people's life and mental state, mankind ended thousands of years of farming time, into the machine production of the industrial era, a variety of industrial plants, buildings also came into being, the city's industry Areas, mining areas in the country have appeared. In the 1950s and 1960s, when the western developed countries took the lead in the post-industrialization period, the industry gradually declined, and with the rise of the anti-urbanization movement, a large number of abandoned land appeared. For the future abandoned land landscape transformation to create a material basis.

Professor Wang Xiangrong in the "Western modern landscape design theory and practice," a book describes the "post-industrial landscape" from the English literal translation, the basic meaning is used as industrial production, abandoned after the landscape reconstruction. In this paper, the post-industrial landscape is defined as: in the industrial waste land, make full use of industrial elements and other industrial era markers, through the art of design techniques to show, protect or beautify the purpose of landscape art design.

3.THE ECOLOGICAL PLANNING AND DESIGN OF POST - INDUSTRIAL LANDSCAPE

In the mid-20th century, with the acceleration of urbanization and industrialization, the original habitat was destroyed. Broken habitats lead to changes in landscape structure, landscape ecological dysfunction. With the application of new technologies such as

remote sensing and computer in landscape research and planning, landscape ecological planning has developed rapidly. Landscape ecological planning plays an important role in biodiversity and environmental improvement, through which it can coordinate the relationship between man and nature and resource benefits, and is an important way to achieve sustainable development (Mark Ming, 2004). Landscape ecological planning is the establishment of a reasonable landscape structure of the base sleeve, it is in the nature reserve design, land sustainable use and improve the ecological environment is of great significance.

Industrial activities have seriously damaged the natural landscape, but it is also the product of human civilization, so the use of ecological planning and design methods, the rational planning of the post-industrial landscape is respect for history, but also a new economic growth the way. After the industrial landscape planning and design at the same time with economic, social and cultural benefits.

4.THE DESIGN PRINCIPLES OF POST - INDUSTRIAL ECOLOGICAL LANDSCAPE

(1)The holistic principle

A landscape is a terrestrial region consisting of interacting ecosystems that are recurring in a similar manner in a given area and have a high degree of heterogeneity. The landscape is a whole, so the landscape ecological planning should be managed as a whole unit, to achieve the overall optimal, without having to reverse and limit its partial optimization. Through the comprehensive analysis of the whole landscape, the regional landscape structure and the regional natural characteristics and economic development to adapt to the landscape structure and function to achieve the overall optimization.

(2)The endivity principles

Landscape ecological planning is for a particular region of agriculture, urban or natural landscape, different areas of the landscape have different structures, patterns and ecological processes, planning purposes are not the same, such as the protection of biological diversity of the design of nature, agricultural adjustment for agricultural services, and urban planning to maintain a good environment. For different planning objectives of the landscape planning, should be selected for different analysis of indicators and different evaluation and planning methods, making planning better integration into the local and reflect the local characteristics.

(3) Principles of sustainability.

The needs of specific areas or groups should not harm and weaken the interests of other regions or groups, while the needs of contemporary people should not pose a hazard and influence on the survival and development of future generations, which is emphasized by sustainable development as a natural of the benefits of the ecosystem and the succession of demand, such demand for the natural environment and the survival of which organisms have the same important significance and value: it is in such conditions, sustainable development is fair, synergy, efficiency And other practical attributes.

Sustainable landscape design and planning seeks to reduce the impact on the environment by minimizing the consumption of energy and other natural resources. In design and planning, regional factors are important factors in the concept of sustainability, such as climate, geology, hydrology, history, economics, and a large number of cultural processes. At the same time, the potential impact should also be taken into account, for example, the city from the environment to absorb a variety of resources at the same time, but also emissions of a large number of waste, heat, dust and other pollutants, to the local and global accumulation The more pressure, such as rainforest cuts and deteriorating landscapes, is due to the construction of inappropriate, irresponsible buildings, the abolition of mining and unreasonable agricultural activities. Harvard University Landscape Architecture Professor Richard Follman believes that sustainable development is looking for an optimal ecosystem and land use spatial configuration to support ecological integrity and human desire to achieve environmental sustainability to reach the maximum.

(4)The Artistic principles

Landscape is a combination of time art and space art, and post - industrial landscape should have the expression of aesthetic art on the basis of satisfying its basic function. After the industrial landscape with the internal landscape elements in the form, structure, scale and other forms of language combination, to be able to bring the user a comfortable and coordinated feelings and beauty to enjoy, this is the artistic principle in the landscape shaping requirements. The use of scientific and artistic means, starting from the site itself, to find the best balance between nature and artificial landscape, so that the space into the art of organic symbiosis.

5. THE APPLICATION OF ECOLOGICAL DESIGN IN POST - INDUSTRIAL LANDSCAPE

(1)The protective design

Combined with local bio-climate, topography and landscape design, make full use of local building materials and plant materials, coordinate site ecosystems, ensure site environmental characteristics and biodiversity, minimize human disturbance, and design a landscape suitable for local and regional culture The In the post-industrial landscape design, it emphasizes respect for the spirit of the place, protects the characteristics of the site, protects the native tree species and makes reasonable use of the natural vegetation of the abandoned land. This method is an effective way to restore the ecology of the damaged site.

(2)The ecological restoration and promotion

The ecosystem has strong self-recovery and reverse succession mechanisms, but today's environment is interfered with by violent human factors in addition to being disturbed by natural factors. The internationally recognized principles of landscape restoration are the 4R principles, namely Rehabilitation, Reclamation, Recreation and Recovery, which are aimed at sites that are severely damaged by man-made lands, thus promoting the benignness of the various systems developed into the responsibility of contemporary landscape designers.

In the narrow sense, the compensatory compensation given by the ecological externality of the ecological environment caused by the ecological compensation of human behavior emphasizes that ecological compensation is a voluntary and negotiated framework that affects the land use of ecological benefit providers. Broadly speaking, ecological compensation is a combination of payment, transaction, reward or compensation for ecological services and that as long as the resources can increase the stock, environmental quality improvement, can be regarded as compensation. After the transformation of industrial landscape, is to ecological compensation to restore the landscape, and the use of ecological compensation evaluation and effect analysis to ensure the sustainable development of post-industrial landscape.

(3)Ecological restoration technology

The so-called landscape ecological restoration technology, refers to the use of ecological principles and systems of scientific methods, the modern technology and traditional methods through a reasonable design and space and time clever combination of the landscape system to maintain a healthy material, energy cycle, so as to achieve Natural coordinated development of the restoration of governance technology. At present, the application of a wide range of technologies is: vegetation restoration technology, soil transformation technology and waters comprehensive management technology.

(4)Vegetation restoration and reconstruction technologies

In the initial stage of vegetation restoration in industrial waste land, the selection of plant species is essential. The general principle of plant species follows the following principles: 1) selection of plants with fast growth, strong adaptability, good resistance and high survival rate; 2) preference for nitrogen fixation plants with improved soil capacity; 3) selection of local excellent 4) The choice of plant species should not only consider the high economic value, but also the main benefits of the plant, mainly including drought, moisture, pollution, resistance to sand, and refractory. , Thin, resistant to pests and diseases and have high economic value. Those plants that are naturally settled on industrial waste land can adapt to extreme conditions on abandoned land and should be a priority plant. According to the physical and chemical properties of abandoned land, there are three basic plant cultivation techniques: direct planting of common plants, improved substrate after planting resistant plants and surface treatment plant after planting. If the substrate is improved properly and the appropriate plant material is selected, ordinary planting methods can be used, such as direct seeding, water sowing, transplanting seedlings and mixed sowing.

(5)Soil modification technology.

Bioremediation of contaminated soils is the process of using modern biotechnology, physical remediation and chemical improvement techniques to remove harmful pollutants from the soil, improve or improve soil quality.

Bioremediation has the advantages of low cost, no secondary pollution, good treatment effect, but the microbial degradation of organic pollutants in the process will produce some more harmful intermediates, it should be noted. In the Seattle gas plant park, the designer did not dig all the contaminated soil, but added humus to the soil to increase soil effort and promote soil restoration by cultivating microorganisms and plants. This will not only improve the fragile ecosystem, but also for the natural regeneration of the ecosystem provides favorable conditions.

Physical repair technology is best suited for disposal of contaminated sites in a small area, mainly for the remediation of inorganic contaminated soils, to restore normal soil function by separating heavy metals from contaminated soils (Ren Gang, 2010). Most physical separation and repair technology equipment is simple, low cost and sustainable high output, but in the specific separation process, requires pollutants with high concentrations and exist in different physical characteristics of the phase medium; simple dry pollutants the dust in the solid matrix and the contaminants in the waste liquid need to be reprocessed. These limitations make this technique only for small applications.

Chemical modification technology is mainly for some abandoned ground matrix structure is poor, quick chemical fertilizer is easily leaching in the case, only a small amount of multiple application of quick chemical fertilizer or the use of some slow decomposition of long-term fertilizer. But if there are toxic factors, the lack of major nutrients is a secondary factor. When the pH value is too high, FeS04, sulfur continuation, stone green and eutrophic can be added to the soil when the pH value is too high. For example, laying on the abandoned land with a thickness of about 20 cm and 20 kg / lime can improve the tailings pH and reduce its conductivity, and effectively prevent the acidification of the lower tailings, plant growth is also better.

REFERENCES

[1]Chen Peilin, Ren Yufeng. Post-industrial landscape "Silk change" - Reconstruction of old factory of Yongfeng Silkworm in Xifeng County[J]. Jilin Agricultural. 2013 (04): 12-18.
[2]Zhang Ming. Post-industrial landscape place to create the spirit of [J]. China Packaging Industry. 2015 (06):22-27.
[3]Sun Wan, Shan Pengyu. Post-industrial landscape aesthetic characteristics of the New York high-line park as an example[J]. Modern horticulture. 2013 (08):32-38.
[4]Zhou Lu. Ruins on the paradise[J]. Shanxi Architecture. 2012 (11):887-889
[5]Zhang Tianting. Analysis of post-industrial landscape protection and regeneration[J]. Art Education Research. 2012 (07):45-49.
[6]Zhang Wei. Rational design of post-industrial landscape[J]. Art and Design (Theory) 2012 (05):52-57.
[7]Hu Xihong, Zhang Wenyong. Generation and type of visual elements in industrial landscape [J]. Modern Decoration (Theory). 2012 (09):2019-2012.
[8]Shi Junqiao, Sun Nianxiang. On the necessity of industrial landscape regeneration design in Panxi area[J]. Shanxi Architecture. 2010 (34)112-119.

casting defects. For example: Casting prone to "pouring incomplete" and "gas" and "cold spot" and

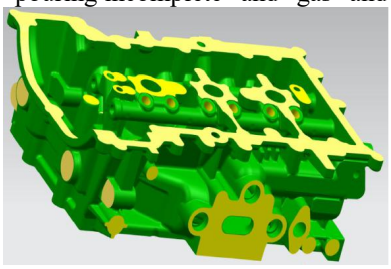


Fig.1 Three-dimensional model of engine cylinder head

other defects, it also affects the solidification process, may lead to "shrinkage", "shrinkage" phenomenon.

Is that from the advantages of bottom pouring scheme: the from the bottom to the top slowly injected, relative to the level before a plan it will be more gentle, not a "splash" and "smooth" defects, but also to avoid the liquid metal for direct impact type, reduce the oxidation of metal splash generation "; the drawback of this scheme is that it does not meet the characteristics of sequential solidification, so the bottom is likely to have a certain" shrinkage "," shrinkage "casting defects, as shown in Figure 2.

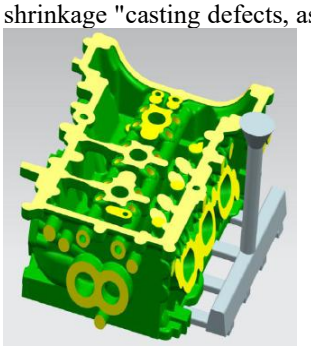


Fig.2 Bottom pouring system

3.PRE-PROCESSING OF NUMERICAL SIMULATION

3.1 Finite Element Mesh Generation

ProCAST software division unit tetrahedron unit, the division of total casting of cylinder head for node 7504757, related to the accuracy of the quality of the grid, the grid casting simulation in more details the simulation time is longer, the relatively accurate. The mesh is shown in Figure 3 below.

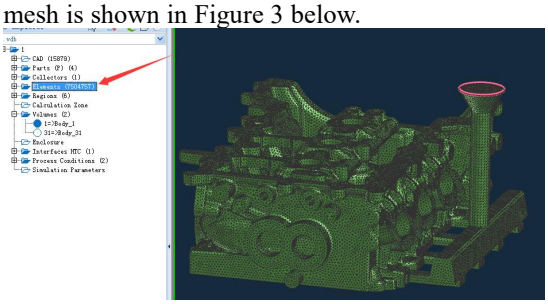


Fig.3 Volume mesh of engine cylinder head

3.2 Set Pouring Process Parameters

The material used in this engine casting is ZL105 aluminum alloy. It belongs to the Al-Si-Mg system.This material has good casting properties, high strength and good plasticity.The liquidus temperature of ZL105 alloy is 622℃, and the solidus is 536℃.The original sand is quartz sand (silica sand), and the boundary conditions have a lot to do with the material, so the material is different and the boundary conditions are different.In this paper, the heat transfer coefficient, pouring temperature, pouring rate, gravity direction and size, initial temperature of mould and casting are mainly included in sand casting.The reference values are shown in table 1.

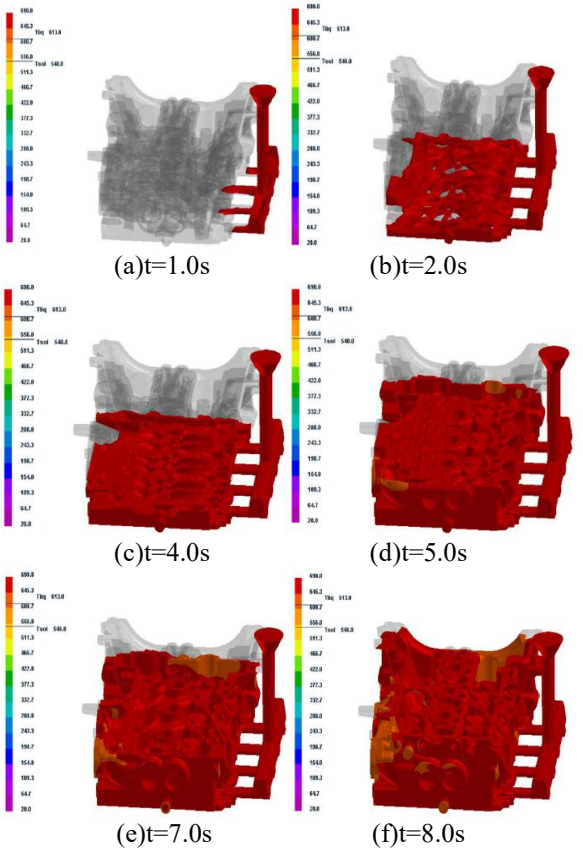
Tab.1 Initial conditions and reference values of boundary conditions

Parameter names	pouring temperature(℃)	pouring speed(kg/s)	Initial casting temperature(℃)	Preheating temperature of sand box(℃)	Interface HTCW/(m^2·K)	Gravitational acceleration(m^2/s)
Values	690	0.6056	690	200	500	9.8

4 NUMERICAL SIMULATION AND RESULTS ANALYSIS OF OPTIMIZATION SCHEME

The unilateral bottom gating scheme, unchanged in other boundary conditions and initial parameters, (adjusted some parameters and boundary conditions in the simulation, values, such as initial temperature, filling time, end temperature simulation of interfacial heat transfer coefficient, and ultimately selected values, these parameters are more suitable for the in this study, only listed in the other conditions remain unchanged, the size of the sand box preheating temperature for what can achieve the best simulation results) by changing the adjustment of sand box preheating temperature, get the simulation results to analyze the casting during filling and solidification process in the presence of molten metal in the filling process of oxidation and, rolling, inclusion, misrun defects.

The total mold filling time of casting simulation is 8.05s, the casting speed is 0.6056kg/s, and the preheating temperature of sand box is 200℃. The flow and temperature distribution at different stages of metal liquid filling are shown in figure 4. From the analysis of the figure contrasts, smooth filling unilateral end of injection can be achieved when the liquid metal, t=1.0s, sand box for preheating temperature of liquid metal under 200℃ has begun filling a casting, Aluminum Alloy liquid bottom-up filling smoothly eased, the filling time distribution is reasonable, in front of avoid sand and gas phase. The liquid surface can rise at a uniform speed and finally complete the filling of all the castings.



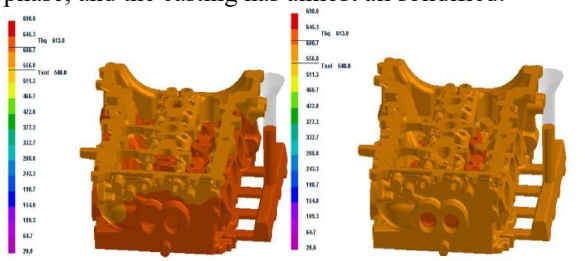
(a)t=1.0s (b)t=2.0s

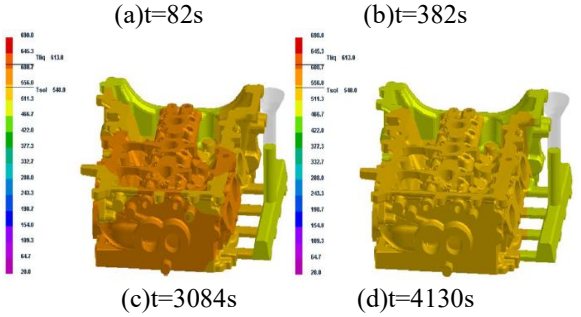
(c)t=4.0s (d)t=5.0s

(e)t=7.0s (f)t=8.0s

Fig.4 Filling state of engine cylinder head

Consistent with setting conditions of solidification process of the filling process, the solidification process with a total of 4130s, as shown in Figure 5 is in the sand box preheat temperature for the solidification process of liquid metal temperature change process of cylinder head under 200℃.To 110s in the casting solidification time, the filling percentage found casting into a 98.6%, this is because the cooling method used for air cooling, the room temperature is 20℃ in the simulation environment, changes in the solidification process, because the outside and pouring out the outside atmospheric pressure is inconsistent, the pressure difference the riser will eventually occur shrinkage. As can be seen from Fig. 5 (a), the solidification sequence of the molten metal in the mold is in line with the principle of sequential solidification in the time when the casting is filled.It can be seen from Figure 5 (b) that there is obvious shrinkage at the riser and riser, and that it has a good tonic effect.At 4130s, the solidification of the casting remains below the liquid phase, and the casting has almost all solidified.





(a)t=82s (b)t=382s

(c)t=3084s (d)t=4130s

Fig.5 Solidification state of engine cylinder head

Figure 6 is the filling time distribution of each part of the casting mold. Can be seen from Figure 6, due to the pouring scheme for unilateral bottom pouring, so the filling time at the bottom of the different distance gate opened near the side of the liquid metal fill time, filling molten metal mold on the side of a long time. But because of the bottom pouring slow way, when the liquid metal filling time reached 15%, the same level is basically the same, filling water is relatively stable, it can effectively avoid the occurrence of slag, turbulence, casting defects such as metal oxide.

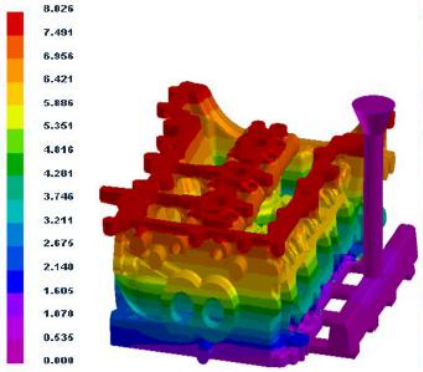


Fig.6 Filling time distribution of different parts of casting

One end of injection in the sand box preheating temperature were 150℃ and 200℃ under the conditions of casting shrinkage and position as shown in Figure 7, the left side of the map for the casting sand box preheating temperature at 150℃ of the shrinkage and position, the right side of the map for the sand box preheating temperature at 200℃ under the condition of casting shrinkage and position display.

Shrinkage cavity and shrinkage porosity are common casting defects in casting. The shrinkage hole is a hole produced by the casting in the condensation process, which can not get the supplement of the metal solution. It is irregular in shape and rough in the hole wall. It is usually located at the hot spot of the casting. The pores and pores are often very similar in appearance. Usually, the inner walls of the pores are smooth, while the inner walls of the shrinkage holes show a dendrite like end. Shrinkage is the zone where the final solidification of the casting has not been obtained by the addition of metal solution, resulting in scattered and small holes, often in the thicker part of the casting, as well as at the

junction of the thickness section or the heat node. The distribution area of shrinkage porosity is much larger than that of shrinkage cavity. It is often hidden in the interior of casting, which can not be observed by naked eye. Shrinkage and shrinkage in the casting waste occupies a large proportion, it is very important to improve this defect, so as to improve the qualified rate of castings. From figure 7 on the left side of the figure we can see that the shrinkage and dispersed position is relatively concentrated in the center of the internal casting into a ball, so the casting quality is not ideal, the right side of the figure we can see the shrinkage and position of less and more evenly dispersed, casting quality than ideal.

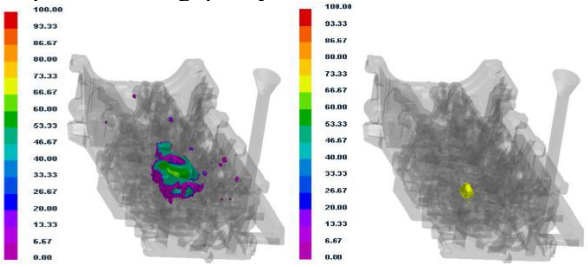


Fig.7 Distribution of shrinkage porosity with the preheating temperature of the sand box is 150℃ and 200℃

5 CONCLUSION

This paper is mainly about the analysis of simulation results, through the software ProCAST on the cast grid, material and boundary conditions, the software running parameters and different parameters under the conditions of the mold filling and solidification process were analyzed and the casting shrinkage in Kong Que analysis, comparative analysis of simulation results obtained. Under the same boundary conditions and operating parameters under the condition of sand filling and solidification process is better than the preheating temperature is 200℃ under the condition of casting temperature in the sand box for the filling and solidification process under 150℃, so the choice of second parameter scheme.

REFERENCES

[1]2009.Bassoli, Elena, et al. "3D printing technique applied to rapid casting."Rapid Prototyping Journal 13.3(2007):148-155.

[2]Bassoli, Elena, et al. "3D printing technique applied to rapid casting."Rapid Prototyping Journal 13.3(2007):148-155.

[3]Popan, Alina, et al. "Using Simulation to Improve the Quality of the Metallic Industrial Components Made by Rapid Casting." Applied Mechanics & Materials 808(2015):187-192.

[4]Sun, Junju, and L. Lin. "Application of Computer Technology in Rapid Casting Forming Process." Foundry Technology (2016).