A AHP-based method to solve contradiction matrix with multiple engineering parameters

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Abstract

Currently, in the use of TRIZ contradiction matrix table, users need to manually find optimization parameters and deterioration parameters of the invention for the corresponding inventive principles. When many parameters are queried, the user is hard to get the statistics, which are most likely to correspond to the invention and have to rely on tedious accumulative calculation to predict the most likely corresponding inventive principle. In this paper, we aimed to apply the analytic hierarchy process (AHP) to predict the inventive principle; on the basis of the successful cases data, we can take advantage of AHP for the statistics and projections of 40 invention principle through the optimization parameters and deterioration parameters chosen. In this way, we ranked 40 invention principles by the use of probability to give users inventive principles of efficient prediction results and provide the user with a practical guide at the same time.

Keywords: TRIZ, analytic hierarchy process, contradiction matrix table, multiple engineering parameters

1 Introduction

TRIZ is the meaning of the theory of inventive problem solving, it is spelled by the Russian first letter of the words meaning that the theory of inventive problem solving (*Teoriya Resheniya Izobretatelskikh Zadatch*) composed. In the United States and Europe, it can also be abbreviated as TIPS.

The Russian Theory of TRIZ was originally proposed by *Altshuller* from 1946. This method solves technical problems and offers innovative product structures by employing a knowledge base built from the analyses of approximately 2.5 million patents, primarily on mechanical design [1]. TRIZ theory reveals the inherent laws of the invention, it focuses on clarifying and emphasizing contradictions existed in the system, and ultimately achieves the ideal solution completely. It is based on the laws of technology evolution to research the whole process of design and development, rather than random. Through years of verification, the improved use of TRIZ theory can greatly speed up the progress of invention and help people to invent high-quality innovative products. TRIZ consisted of many innovation tools. The basic constituents of TRIZ are the contradiction matrix, effect database, laws of evolution, ideal final result, substance field resources and ARIZ algorithm [2-4].

Contradiction matrix, which consists of 39 engineering parameters and 40 inventive principles, can effectively resolve the conflicts between customer requirements. Effect database is a knowledge database system consisting of physical, chemical, and geometrical effects and rules for solving problems. Among these TRIZ tools, contradiction matrix is the most commonly used in TRIZ innovation. During the process, firstly, we should find the improved engineering parameter to optimize the system, but with this direction, a worsening engineering direction is created, so a worsening engineering parameter needs to be chosen. In the next step, with the two parameters, two or three inventive principles are matched in the contradiction matrix. The design engineer can solve the engineering innovative design problem with one of these inventive principles. But in the actual complicated system, improving engineering parameter is easily found toward the direction of the system improvement. On the other hand, a worsening engineering parameter is quite difficult to be chosen. The user may choose several worsening engineering parameters for innovative design problem. A proper principle selection is a very important issue for this process, but a multiplied likelihood of inventive principles is generated with this method. Due to the difficulty for users to decide which principle is the fittest. The decision-maker with TRIZ experience may need a large amount of data for analysis and many factors should be considered for selection of the proper principle. Or they can only rely on cumbersome cumulative calculation to predict the most likely principles of the invention.

AHP (Analytic Hierarchy Process AHP for short), proposed by T.L. Saaty, a professor of USA strategist in early 1970s, is a simple, flexible and practical multi-criteria decision making approach for the quantitative analysis of qualitative problem. The characteristics of the analytic hierarchy process are the basis for the analysis of complex decision problems in nature, its inherent relationship between factors and so on. It just makes use

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of quantitative information to make decision during the process of mathematical thinking, and then provides solutions for complex decision problem of multi-objective, multi-criteria or no structural characteristics. It is particularly suitable for the measurement occasions where decision result is far more difficult to direct accurate.

This paper was organized as follows: The second part of the system, the article expounded the theory of TRIZ contradiction matrix and its solving process. The third part described in detail the principle of analytic hierarchy process (AHP) and basic steps. In the fourth part introduced the case analysis, and through the corresponding contradiction matrix to solve application software based on AHP analytic hierarchy process (AHP) to solve practical problems. The last part summarized the relevant results and development prospects.

2 Contradiction matrix

Through the study of a large number of invention patents, Altshuller summed up 39 common parameters, which are generally physical, geometrical and technical performance parameters, and usually used in the engineering field representation of system performance, where he extracted the most important TRIZ, with widespread use of 40 inventive principles. Altshuller linked the 39 general engineering parameters and 40 inventive principles organically to establish correspondence of the organized contradiction matrix of 39X39. The first column indicates the matrix optimization parameters for improvement, while the first line indicates deterioration parameters which will bring in determining the optimal parameters .After confirm optimization parameters and deterioration parameters, users can find a serial number corresponding innovation yards in the matrix table, the principle constitutes a collection of contradictions possible solutions.

When using the contradiction matrix and 40 inventive principles to solve practical problems, users should first determine the function of technology systems and raise the problem to be solved, and then convert into the universal significance of specific issues and deterioration and optimization parameters .After that, users should determine the corresponding matrix table to resolve conflicting principles of the invention to identify the solution of the problem with practice analysis. As shown in Figure 1:

Determine the system function

↓ *Classify system*

Specific issues to be addressed

↓ *Application of 39 parameters*

Deterioration and optimization parameters

↓ *Application of 40 inventive principles*

Extract the inventive principles

FIGURE 1 Application steps of contradiction matrix

In order to make the method to be more normative and manoeuvrability, several steps are given as follows:

- Determine the main function of the technical system.
- Decompose technical system in detail, divided into system levels, lists the super system, system, subsystem parts at all levels and all kinds of auxiliary functions.
- Describe the actual concrete problems existing in the technical system.
- Abstract the actual problem, apply the 39 contradictions matrix and determine the technical characteristics of the system, which should be improved.
- Screen designed systems to identify and deteriorate properties. Improvements in enhancing characteristics, while the other is bound to bring deterioration of one or more characteristics .Because of deteriorated parameters are not yet occurred and often, so when screening and determining the characteristics of deterioration requires "bold vision, careful verification".
- Query contradiction matrix table through the determined parameters.
- Find contradiction matrix table to get the recommended principles of the invention Sort Code.
- Find 40 Sort Code in accordance with the principles of the invention directory, and get the serial number and name of the principles of the invention.
- According to the invention of the principle of the serial number and name, corresponding to find article 40 invention principles and examples for invention principle of explanation.
- Apply the recommended principles of the invention one by one to specific issues, and explore how to apply each principle and implementation on specific issues.
- If the principles of the invention do not apply to specific problems, users need to redefine the project parameters and contradictions, then apply and search a contradiction matrix table again.
- Filter out the best solutions into the product design stage.

3 Analytic hierarchy process (AHP)

3.1 INTRODUCTION TO AHP

AHP (Analytic Hierarchy Process AHP for short) is an American Operations Research Professor TL Saaty proposed in the early 1970s, the AHP is a problem of qualitative quantitative analysis of a simple, flexible and practical method of multi-criteria decision-making. It addresses how to determine the relative importance of a set of activities in a multi-criteria decision problem [8].It is characterized by dividing the complex problems in a variety of factors into interconnected orderly levels and streamlines, then making it principled. According to a subjective judgment of a certain objective reality structure (mainly pairwise comparisons), AHP quantitatively describes the importance of a hierarchy of elements of pairwise comparisons by analysing the expert opinions, the objective judgment results together directly and efficiently. Then, by using mathematical method to calculate, the weights reflect the relative importance of the order of elements in each level .However, users should calculate the relative weights of all the elements right and sort based on all levels of the total order; and then establish the judgment matrix, by calculating the eigenvalues and eigenvectors of the judgment matrix, finally obtain the weight of the different options and provide evidence for the fittest. The AHP method is based on three principles: structure of the model; comparative judgment of the alternatives and the criteria; synthesis of the priorities. The method was introduced to China in 1982, with its combination of qualitative and quantitative characteristics of the decision-making to deal with a variety of factors, as well as the advantages of their system which is simple and flexible .So far AHP has been widely appreciated and applied in many study areas for complicated decision-making, especially in various fields of social economy, such as energy systems analysis, urban planning, economic management, research and evaluation.

3.2 THE BASIC STEPS OF THE AHP

3.2.1 Hierarchy model

Firstly a complex decision problem is structured as a hierarchy, analysed the problem profoundly. On the basis of in-depth analysis of the practical problem, the various factors related to different properties are divided into a number of levels from top to bottom, with a layer of the factors belonging to the upper layer of the element or elements affected, while the next control factors underlying layer or by action of factors. The objectives, criteria and alternatives are arranged in a hierarchical structure similar to a family tree. The uppermost layer of the target, usually only one factor, the program or object is generally lower layer, the intermediate may be one or several levels, typically as a criterion or indicator layer. Criteria (for example, more than nine) should be further decomposed sub-standard level when the number is large. The factors identified include stratification: Top (aim to solve the problem); the lowest level (for a variety of measures to address the problem, programs, etc.). The various factors in the same layer are basically relatively independent when compared with each other and should be considered in the appropriate level. Express clearly the relationship of these factors with the hierarchical structure. Usually, the hierarchy can be divided into the goal-guidelines or indicators-program [4]

3.2.2 Multiple pairwise comparison matrix

After the problem has been decomposed, and the hierarchy is constructed, prioritization procedure starts in order to determine the relative importance of the criteria within each level. The criteria is based on related factors between two layers of the pairwise comparison, and n criteria can be summarized in an $(n \times n)$ evaluation matrix A in which every element a_{ij} $(i,j = 1,2,3,\dots,n)$ is the quotient of weights of the criteria.

Based on pairwise comparison method and 1~9 scales, construct the comparison array. As the disposable element of the second layer is 40, far more than 9, so this article took the elements itself weight to construct paired comparison array.

While compare the importance of i and j with upper layer of some factor relative, a_{ij} is used to describe the quantified relative weights. A total of n elements in comparison, it is called a paired comparison matrix. Pairwise comparison matrix values of a_{ij} refer to Satty's proposal, which is according to the following scale assignment. The value of a_{ij} is among $1 \sim 9$ and its inverse.

- $a_{ij} = 1$, i is as important as j;
- $a_{ij} = 3$, i is more important than j slightly;
- $a_{ij} = 5$, i is more important than j;
- $a_{ij} = 7$, i is much more important than j;
- $a_{ij} = 9$, i is extremely important than j;
- $a_{ij} = 2n$, $n= 1,2,3,4$, the importance of i and j is between $a_{ij} =2n - 1$ and a_{ij} $2n+ 1$;
- $a_{ij} = \frac{1}{n}$, $n = 1,2,3,\dots 9$, if and only if $a_{ij} =n$. Features: paired comparison matrix. $a_{ij} > 0, a_{ij} = 1, a_{ij} = \frac{1}{a_{ji}}$, when $i = j$, $a_{ij} = 1$.

3.2.3 Calculate the weight vector

In order to extract useful information from the judgment matrix and understand the regularity of things, we need to calculate the weight vector of judgment matrix to provide scientific basis for decision-making. Calculate the relative weight of factors in each judgment matrix according to its principles. It means calculating the largest eigenvalue and eigenvectors for each pairwise comparison matrix; and then test the consistency .If passed, the eigenvectors are equal to the weight vector. Accurate calculation of the largest eigenvalue and eigenvectors are too complex. Therefore, in this paper, we apply the simplified calculation method that any column vector of the consistent array is eigenvectors. The column vector of a reciprocal matrix of good consistency approximates to its eigenvectors. Therefore, the arithmetic average of the column vectors is available.

3.2.4 Consistency test

When determining an order of the matrix, it is often difficult to construct a matrix of conformance. However, the consistency of judgment matrix deviation condition should have a degree, therefore, we must determine whether it is an acceptable matrix for identification, which is the connotation of the consistency check. We use consistency index, random consistency index and consistency ratio to test for consistency of each pairwise comparison matrix calculated maximum eigenvalue and the corresponding eigenvector. Calculate the lowest level of the target portfolio weight vector, and do a combination of consistency test according to the formula, if the test is passed, according to a combination of the weight vector ,the results can be expressed in decision-making, or we need to rethink or re-construct a larger model that consistency ratio pairwise comparison matrix.

Only through consistency test, we can think the judgment matrix is reasonable logically. The consistency test is calculated as follows:

$$CR = CI/RI \, . \tag{1}$$

CI - consistency index, which is used to measure a paired comparison matrix inconsistent degree of indicators, can be calculated as:

$$CI = (\lambda_{\max} - n)/(n-1), \tag{2}$$

where $\lambda_{\max}$ is the largest eigenvalue of judgment matrix, n is the number of pairwise comparison factor. The smaller the value of the *CI* is, the greater the consistency indicates.

RI is the random consistency index and related to the order number judgment matrix. Generally, the order of the matrix increases, the greater possibility of deviation from the greater consistency of the random will be. It can be referred to the look-up table as follows in Table 1:

TABLE 1 Value of *RI*

Matrix order	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
RI	0	0	0.58	0.90	1.12	1.24	1.32	1.41	1.45	1.49

CR is the consistency proportion. The consistency of judgment matrix can be acceptable when *CR<0.10*, otherwise will be required to make modifications.

4 Analytic hierarchy process specific application

4.1 CONSTRUCTION OF HIERARCHY MODEL

For predicting the possibility of the inventive principles in the mechanical field, we first predicted the possibility of the principles of the invention as the first layer--the target layer; then stratified factors involved, the first layer consists of two factors, the principle of occurrences and principle applied probability, they are the second layer, i.e. the criterion level, $O = \{c_1, c_2\}$; the second layer comprises of 40 factors, respectively, acts as TRIZ 40 principles of the invention, they are the third layer - Option layer, $C_1 = \{P_1, P_2, \cdots P_{40}\}$, $C_2 = \{P_1, P_2, \cdots P_{40}\}$. As shown in Figure 2:

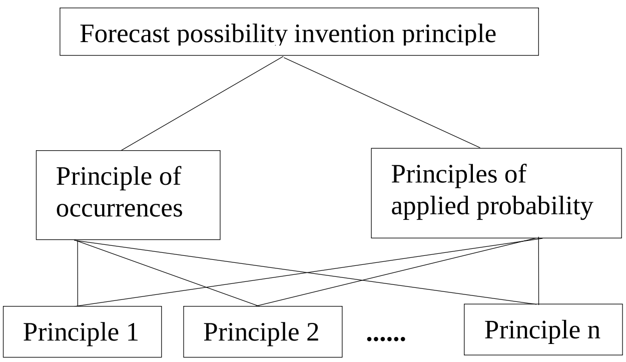

FIGURE 2 Hierarchy model of AHP

4.2 CONSTRUCT PAIRWISE COMPARISON MATRIX

According to the questionnaire with a number of success cases and the collation of data, we have the initial data, $P_i = \{x, y\}$, x represents the principle of occurrences, y represents the principle applied probability.

$$P_1 = \{29, 0.75\}, P_2 = \{22, 0.50\}, P_3 = \{23, 0.75\}, P_4 = \{21, 0.75\}, P_5 = \{20, 0.75\},$$
$$P_6 = \{16, 0.75\}, P_7 = \{21, 0.75\}, P_8 = \{14, 0.50\}, P_9 = \{14, 0.50\}, P_{10} = \{25, 0.75\},$$
$$P_{11} = \{18, 0.50\}, P_{12} = \{14, 0.50\}, P_{13} = \{13, 0.50\}, P_{14} = \{20, 0.75\}, P_{15} = \{20, 0.25\},$$
$$P_{16} = \{13, 0.25\}, P_{17} = \{21, 0.50\}, P_{18} = \{20, 0.75\}, P_{19} = \{22, 0.25\}, P_{20} = \{10, 0.25\},$$
$$P_{21} = \{15, 0.25\}, P_{22} = \{22, 0.50\}, P_{23} = \{14, 0.50\}, P_{24} = \{26, 0.75\}, P_{25} = \{16, 0.50\},$$
$$P_{26} = \{16, 0.75\}, P_{27} = \{19, 0.50\}, P_{28} = \{31, 0.50\}, P_{29} = \{16, 0.50\}, P_{30} = \{16, 0.50\},$$
$$P_{31} = \{14, 0.25\}, P_{32} = \{13, 0.50\}, P_{33} = \{9, 0.25\}, P_{34} = \{9, 0.25\}, P_{35} = \{13, 0.25\},$$
$$P_{36} = \{14, 0.25\}, P_{37} = \{17, 0.50\}, P_{38} = \{5, 0.25\}, P_{39} = \{10, 0.25\}, P_{40} = \{16, 0.50\}.$$

$$C_1 = \begin{pmatrix} 1 & P_1.x/P_2.x & P_1.x/P_3.x & \cdots & P_1.x/P_{40}.x \\ P_2.x/P_1.x & 1 & P_2.x/P_3.x & \cdots & P_2.x/P_{40}.x \\ \vdots & \vdots & \vdots & \vdots & \vdots \\ P_{40}.x/P_1.x & P_{40}.x/P_2.x & P_{40}.x/P_3.x & \cdots & 1 \end{pmatrix},$$

$$C_2 = \begin{pmatrix} 1 & P_1.y/P_2.y & P_1.y/P_3.y & \cdots & P_1.y/P_{40}.y \\ P_2.y/P_1.y & 1 & P_2.y/P_3.x & \cdots & P_2.y/P_{40}.y \\ \vdots & \vdots & \vdots & \vdots & \vdots \\ P_{40}.y/P_1.y & P_{40}.y/P_2.y & P_{40}.y/P_3.y & \cdots & 1 \end{pmatrix}.$$

The data into C_1 and *C2*, we have:

$$C_1 = \begin{pmatrix} 1 & 29/22 & 29/23 & 29/16 \\ 22/29 & 1 & 22/23 & 22/16 \\ \vdots & \vdots & \vdots & \vdots \\ 16/29 & 16/22 & 16/23 & 1 \end{pmatrix},$$

$$C_2 = \begin{pmatrix} 1 & 0.75/0.50 & 0.75/0.75 & 0.75/0.50 \\ 0.50/0.75 & 1 & 0.50/0.75 & 0.50/0.50 \\ \vdots & \vdots & \vdots & \vdots \\ 0.50/0.75 & 0.50/0.75 & 0.50/0.75 & 1 \end{pmatrix}.$$

4.3 CALCULATE THE WEIGHT VECTOR AND TEST CONSISTENCY

Because C_1 satisfy $C_{ij} \times C_{jk} = C_{ik}$, where i, j, k=1,2,3, 40, C_{ij}, C_{jk}, C_{ik} , are respectively the i row j column element, and the j row, column k element, the i row element of the column k of C_1, so C_1 is consistent array.

Normalize the column vector of C_1, we have A_1:

$$A_1 = \begin{pmatrix} P_1.x/PX & P_1.x/PX & \cdots & P_1.x/PX \\ P_2.x/PX & P_2.x/PX & \cdots & P_2.x/PX \\ \vdots & \vdots & \vdots & \vdots \\ P_{40}.x/PX & P_{40}.x/PX & \cdots & P_{40}.x/PX \end{pmatrix}.$$

The arithmetic average of A_1, obtain the weight vectors W_1:

$$W_1 = \begin{pmatrix} P_1.x/PX \\ P_2.x/PX \\ \vdots \\ P_{40}.x/PX \end{pmatrix},$$

wherein $PX = \sum P_i.x \quad i = 1, 2, 3 \cdots 40$.

Values into W_1, we have:

W_1^T = [0.0422, 0.0320, 0.0334, 0.0305, 0.0291, 0.0233, 0.0305, 0.0203, 0.0218, 0.0363, 0.0262, 0.0203, 0.0189, 0.0291, 0.0291, 0.0189, 0.0305, 0.0291, 0.0320, 0.0145, 0.0218, 0.0320, 0.0203, 0.0378, 0.0233, 0.0233, 0.0276, 0.0451, 0.0233, 0.0233, 0.0203, 0.0189, 0.0131, 0.0131, 0.0189, 0.0203, 0.0247, 0.0073, 0.0145, 0.0233].

Since C_2 satisfy $C_{ij} \times C_{jk} = C_{ik}$, wherein i, j, k=1,2,3,…,40, C_{ij}, C_{jk}, C_{ik}, are respectively the i row j column element, the j row, column k element, the i row element of the column k of C_2, so C_2 is consistent array

Normalize column vector of C_2, we have A_2:

$$A_2 = \begin{pmatrix} P_1.y/PY & P_1.y/PY & \cdots & P_1.y/PY \\ P_2.y/PY & P_2.y/PY & \cdots & P_2.y/PY \\ \vdots & \vdots & \vdots & \vdots \\ P_{40}.y/PY & P_{40}.y/PY & \cdots & P_{40}.y/PY \end{pmatrix},$$

The arithmetic average of A_2, obtain the weight vectors W_2:

$$W_2 = \begin{pmatrix} P_1.y/PY \\ P_2.y/PY \\ \vdots \\ P_{40}.y/PY \end{pmatrix},$$

where in $PY = \sum P_j.y \quad j = 1, 2, 3 \cdots 40$.

Values into W_2, we have:

W_2^T = [0.0395, 0.0263, 0.0395, 0.0395, 0.0395, 0.0263, 0.0395, 0.0263, 0.0263, 0.0395, 0.0263, 0.0263, 0.0263, 0.0395, 0.0132, 0.0132, 0.0263, 0.0132, 0.0132, 0.0132, 0.0132, 0.0263, 0.0263, 0.0395, 0.0263, 0.0395, 0.0263, 0.0263, 0.0263, 0.0263, 0.0132, 0.0263, 0.0132, 0.0132, 0.0132, 0.0132, 0.0263, 0.0132, 0.0132, 0.0132].

4.4 CALCULATE THE WEIGHT OF COMBINATION VECTOR AND TEST THE CONSISTENCY

We believe that the principle of occurrences and principles applied probability are equally important to predict the possibility of the invention principles, effect rate of O_1, O_2 are 0,5.

Values into O, we have:

$$O = \begin{pmatrix} 1 & 0.5/0.5 \\ 0.5/0.5 & 1 \end{pmatrix},$$

O to satisfy $O_{ij} \times O_{jk} = O_{ik}$, wherein i, j, k=1,2, O_{ij} , O_{jk}, O_{ik} are respectively the i row of the j column element, the j row of the k column element of i row of k column element of O, so O is consistent array.

Normalize column vector of O, we have A_3:

$$A_3 = \begin{pmatrix} O_1/(O_1+O_2) & O_1/(O_1+O_2) \\ O_2/(O_1+O_2) & O_2/(O_1+O_2) \end{pmatrix}.$$

The arithmetic average of A_3, obtain the weight vectors W_3:

$$W_3 = \begin{pmatrix} O_1/(O_1+O_2) \\ O_2/(O_1+O_2) \end{pmatrix},$$

values into the W_3, we have:

$W_3^T = [0.5, 0.5]$.

Finally, the combination of the weight vector W:

$W = W_3^T \cdot [W_1, W_2]$,

$$W = \begin{pmatrix} [O_1/(O_1+O_2)] \cdot P_1 \cdot x/PX + [O_2/(O_1+O_2)] \cdot P_1 \cdot y/PY \\ [O_1/(O_1+O_2)] \cdot P_2 \cdot x/PX + [O_2/(O_1+O_2)] \cdot P_2 \cdot /PY \\ \vdots \\ [O_1/(O_1+O_2)] \cdot P_{40} \cdot x/PX + [O_2/(O_1+O_2)] \cdot P_{40} \cdot y/PY \end{pmatrix},$$

where $PX = \sum P_i \cdot x; PY = \sum P_j \cdot y; i = 1, 2, 3 \cdots 40$.

Values into the W, we have:

$$W^T = [0.0409, 0.0292, 0.0365, 0.0350, 0.0343, 0.0248, 0.0350, 0.0233, 0.0241, 0.0379, 0.0263, 0.0233, 0.0226, 0.0343, 0.0212, 0.0161, 0.0284, 0.0212, 0.0226, 0.0139, 0.0175, 0.0292, 0.0233, 0.0387, 0.0248, 0.0314, 0.0270, 0.0357, 0.0248, 0.0248, 0.0168, 0.0226, 0.0132, 0.0132, 0.0161, 0.0168, 0.0255, 0.0103, 0.0139, 0.0248].$$

5 Features of the system

Based on the above technical contradiction matrix computer knowledge representation, this paper proposed a search algorithm based on the principle of AHP, and studied the software application of computer aided innovations and researches in China and oversea. By analyzing the advantages and limitations of existing soft wares, we finally established multiple parameters based on AHP technology invention principle contradiction auxiliary innovation software.

The use steps of the software are as follows:

Firstly, enter a problem description and industry, and then select the optimized parameters. For example, the problem description: cell phones, industry: electronic, optimized parameters: the weight of the stationary object, the length of a stationary object, as shown in Figure 3.

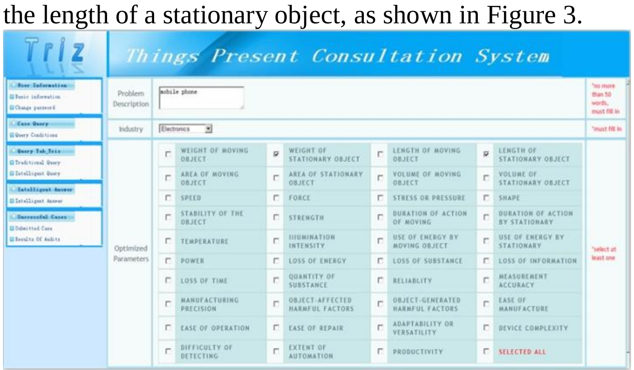

FIGURE 3 Optimization parameter selection interface

Secondly, click [Submit] to get into the degradation parameter selection interface, choose degradation parameters, for example: Control complexity, design complexity, the degree of automation and productivity, as shown in Figure 4.

FIGURE 4 Degradation parameter selection interface

Then, click the [Submit] to get into the principles of the present invention interface, as shown in Figure 5.

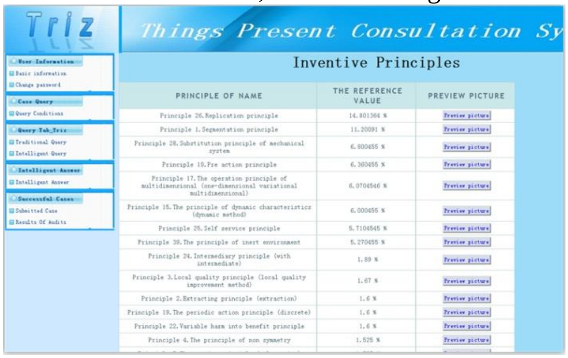

FIGURE 5 Invention principles interface

At last, click the [Preview] to get into the corresponding principle picture according to the principle of 1 as an example, as shown in Figure 6.

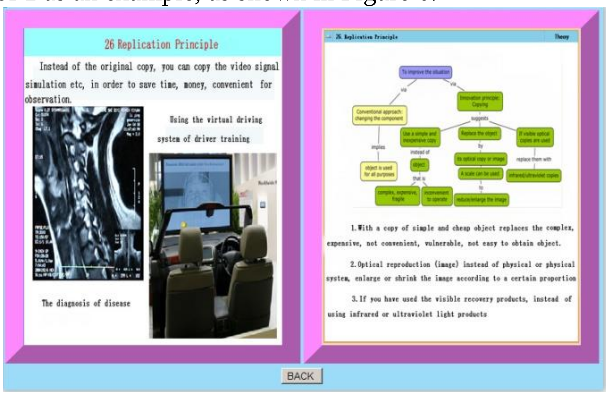

FIGURE 6 Corresponding principle picture

6 Conclusions

The TRIZ innovation system is a complex one. In different industries, the prediction of the principles of the invention to solve the problem is difficult to achieve. The reason may be that various factors affect each other and affecting factors are so many .Therefore, based on the scientific and practical principles, it should be combined with the characteristics of the TRIZ innovation system, using the Uncertain AHP to analyse the predictions of the inventive principles and determine the weight of impact factors, then obtain the predictive value of the 40 inventive principles. The purpose of this paper was to apply the analytic hierarchy process(AHP) for predicting the inventive principle ,namely that, on the basis of the successful cases data, we can take advantage of the analytic hierarchy process(AHP) for the statistics and projections of 40 invention principle through the optimization parameters and deterioration parameters chosen .In this way, we can rank 40 invention principles by the use of probability to give users inventive principles of efficient prediction results and provide the user with a practical guide at the same time. With the rapid development of TRIZ innovative system, the predictive value of the 40 inventive principles in different industries will be more and more accurate, the significance is increasing.

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