CHEMICAL ENGINEERING TRANSACTIONS
VOL. 66, 2018
A publication of AIDIC
The Italian Association of Chemical Engineering
Online at www.aidic.it/cet
Guest Editors: Songying Zhao, Yougang Sun, Ye Zhou

ISBN 978-88-95608-63-1; **ISSN** 2283-9216
DOI: 10.3303/CET1866245

Application of Extension Strategy Generation System Algorithm in Chemical Enterprise Management

Wei Wu

Anhui Finance & Trade Vocational College, Anhui 230601,China
weiwu28319120@126.com

This paper aims to study the feasibility and effectiveness of extension strategy generation system algorithm in the chemical enterprise management. To this end, the problems that often occur in the management process of domestic chemical enterprises were analysed, and then by introducing the extension strategy generation system algorithm, a data model conforming to the characteristics of enterprise management was established. The results indicate that in the chemical enterprise management, the applied extension strategy generation system algorithm is highly feasible. It provides an important reference for solving the problems in the enterprise management process. Therefore, in the related management work of chemical enterprises, the application of extension strategy generation system algorithm can not only quickly improve the efficiency and level of management, but also provide effective guarantees for promoting the long-term sound development of enterprises. This is of great value of promotion and application.

1. Introduction

With the rapid development of the social economy, the information technological level has been continuously improved. At the same time, the systems that are related to decision-making have become more and more complex, so, more parameters should be considered in the actual application process. In this context, the optional strategies continue to emerge. If only relying on the human brain to generate strategies, the effectiveness of their decisions cannot be guaranteed. In the increasingly fiercely competitive market environment, in order to maintain their core competitive advantages and stand firm, the enterprises have expected to promote strategic generation and problem development or early warning through the use of computer and network technologies during the massive information processing and reprocessing, so as to provide the reliable reference for subsequent decisions. But this isn't supported by the auxiliary decision support system and the management software in the current market. The fundamental reason is that firstly, the related research results for the basic theory of strategy generation are still in the embryonic stage; secondly, in terms of the strategy generation method and model, the feasibility and effect of computer application need to be further discussed and studied. The extension strategy generation system is mainly based on Extenics. Its application provides the key information for the joint development of artificial intelligence and decision science.

Since the operational extension transformation research is realized on the basis of the computer, it is necessary to comprehensively analyse and measure the relevant computer technologies, such as the database, data mining, object-orientation and artificial intelligence etc. The domestic research on the extension transformation has been conducted officially, but there have been very few research reports on its implementation on computers and the strategy generation on the basis of extenics. Therefore, in the research process of strategy generation algorithms, the Extenics method and its principles must be introduced, which should be all presented on the computer. This shall offer a new direction for the research and development of extenics, and also provide the important reference for the realization of intelligent management in chemical enterprises.

Please cite this article as: Wu W., 2018, Application of extension strategy generation system algorithm in chemical enterprise management, Chemical Engineering Transactions, 66, 1465-1470 DOI:10.3303/CET1866245

2. Literature review

With the changes of the times, the development of the world economy is complicated. China's economic development has entered a downward path. With the trend of economic globalization is more and more obvious, trade protectionism is in vogue. The company is in a very special period. At this stage, there is insufficient demand in the domestic market and the situation in foreign markets is complex. The operation and management of an enterprise is affected by various factors. When it comes to decision-making, it is more difficult than ever before. Corporate management strategies are increasingly difficult. Some strategies have flaws and cannot take into account the overall situation. In the aspect of corporate management, chemical companies are even more strenuous. Enterprise management, employee management, production management, equipment management, and safety management are all considerations for business managers. In recent years, the government has paid more and more attention to the safe production and environmental protection of enterprises. In 2017, many companies were ordered by the environmental protection department to stop work for rectification due to environmental problems. These factors make chemical companies more and more pressure on management. In particular, in the face of a complex and ever-changing environment, it is very difficult for management personnel to change management decisions. Chemical company managers began to use the extension strategy generation system algorithm to manage the enterprise. Extension strategy management is based on the theory of extenics. Combining computers, and based on the different data presented, strategies are intelligently generated (Borland et al., 2016).

Cai Wen's land mark article "Extended Sets and Non-Compatibility Issues" was published in 1983. Therefore, it declares the birth of Extenics. The goal of Extenics is to study the uncompromising and incompatible issues in the real world (Ertek et al., 2017). The theoretical basis of Extenics is matter-element theory and extended set theory. Extended control, extended information, extended systems, extended logic, etc. are all part of this theoretical system. Its practical methods include the expansion of engineering methods, further including the concept of extended feature analysis, bridge conversion, extended cognition, extended decision making, and extended forecasting. The three pillar theories of extension theory are elementary theory, extension set theory and extension logic. Extenics mainly studies the dynamic set theory based on transformation to express the quantized tool that transforms the contradiction problem into the non-contradictory and the nature transformation process by transformation. A formal model that combines quality and quantity is studied to overcome the limitation of the mathematical model, the transformation of the contradiction and the basis of the transformation of the object. The basic theory and method of extenics and the combination of knowledge in various fields are studied.

The process of management is to solve contradictions by developing new ideas (Kumar et al., 2017). Extenics is a discipline that solves this problem. It uses formal positive models to study the possibility of expanding things and develop new rules and methods of innovation, and to solve contradictions (Lieder and Rashid, 2016). Based on the current state of application of extenics in the field of management, the prospects of applying extenics in conflict management, system thinking, and complex system management are proposed (Lin et al., 2017). In the era of knowledge economy, information and knowledge have become an important resource. At the same time, it also caused information explosion and knowledge overload. The intelligence of information management and knowledge management has put forward new requirements (McDonald-Buller, et al., 2016). In exploring the problems encountered in the process of information management and knowledge management, based on the concept of extenics, it proposes a complementary development model between information management, knowledge management and extenics. The existing research results have enriched the foundation and expanded the basis for transformation methods. In the process of information management and knowledge management, the introduction of extenics methods and concepts can make the development of information management and knowledge management more intelligent (Rangaiah et al., 2015).

Chinese scholars have continued to conduct in-depth studies of extensions and integrate ideas with business management. It provides a good idea and foundation for chemical enterprise extension strategy management. The bottlenecks encountered in the management of domestic chemical companies can be solved based on the research of these outstanding scholars. At present, domestic data mining, data analysis, machine learning, artificial intelligence, big data analysis and other technologies have developed rapidly. All these provide an excellent technical basis for the development of the extension strategy generation system. In the current era, enterprise management technology has also been continuously updated to better solve the complex problems encountered by enterprises in the real world. The extension strategy generation system is an artificial intelligence strategy generation system that uses computers to assist people in generating contradictory problems (Simon et al., 2014).

In summary, the theory of extenics is of great significance in business management. Chemical companies face complex situations at home and abroad, and risk factors have greatly increased. Enterprises must rely on

enough information to make decisions in business management. Obviously, the traditional way of human decision-making is not entirely competent in enterprise management. Research, development, and application of extension strategy generation systems are of great significance to chemical companies. The extension strategy generation system can greatly improve the accuracy of chemical companies' decision-making. According to the environment in which the company is located, this system can consider the factors affecting the company in multiple ways. It provides the chemical industry with a variety of decision-making programs that are fast, comprehensive, and scientific, so that managers of chemical companies can select and make decisions. The operating efficiency of the company is improved, human resources are saved, and the management efficiency and capability of chemical companies are improved. This provides comprehensive support for the development of the company.

3. Methods

Through the study of extenics, database technology, and object-oriented technology, the main contents of this study are as follows: Based on the basic extension theories and methods, the theoretical requirements and system design requirements related to this topic are discussed; the study is based on the theory and method of extenics which can be used in the formalized description of computer-generated strategy; the combination and application of extension method and database, data warehouse and object-oriented technologies were explored; the related definitions and implementation methods were discussed by the extension data mining method; based on the theoretical results of the above discussion and research, a strategy generation system for clothing sales based on extension transformation was designed and implemented; By adopting a more reasonable human-computer interaction interface and using the data mining method, the strategy generation and evaluation process based on the extension transformation technology are achieved more completely. Figure 1 shows the effect of the intelligent extension algorithm applied in the chemical enterprise management under the strategy of extension strategies, where, a is the initial state and b is the end state.

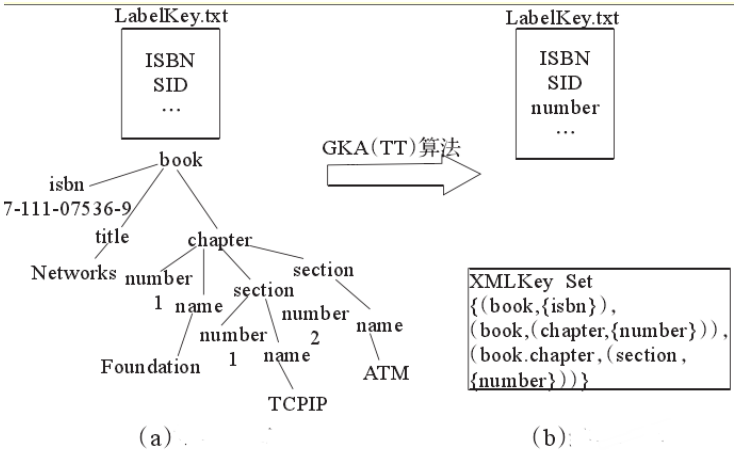

Figure 1 : Effect diagram of the algorithm can be extended

3. Results and analysis

3.1 Knowledge about extension strategy generation

The Extenics is to adopt the method of extension transformation on the conditions or purpose of the problem through analysis of the inconsistency problem, produce the extension strategy set, and apply effective strategies to solve the problem. Extension strategy is the specific measure to solve contradictory problems. It is the ultimate goal of applying Extenics and also the way that Extenics can be applied to actual production and life. The extension strategy is to use the extension transform equation to change the compatibility degree of incompatible problems from ≤0 to > 0. The solution transformation of incompatible problems is an extension strategy. The process to generate an extension strategy is called extension strategy generation. Extension strategy generally means to apply extension transformation to one certain problem or target based on the problem related tree, and then generate the strategy set for solving the contradictory problem. According to the nature of related networks and correlations, this extension transformation will also cause conduction transformation on the primitives of problem-related tree. Through the transformation of one certain leaf

primitive in the initial correlation tree, the generated implication tree of extension transformation is called the extension strategy generation tree. In the specific application system of extension strategy generation, according to the extension model of the contradiction problem, the conditions or targets of this problem are conducted with extension analysis and extension transformation so as to generate the strategy set over 0; then through the evaluation of goodness, the high-evaluated strategy is recommended to decision makers for selection. Table 1 lists the relevant conditions of the generated objects.

Table 1: Calculation table

work	ACTIM	
1-2-3-4	3+2+4	9
1-3	5	5
2-3	2	2
2-3-4	2+4	6
3-4	4	4

The experiments were made for the two algorithms with more applications, by taking the SKA algorithm in literature [6] for comparison. The experimental platform and main parameters include: (1) The computer with CPU intelP43.06 and the memory 1G; (2) The operating system of Windows XP; (3) The simulation software Matlab 7.01. The experimental results are shown in Figure 2.

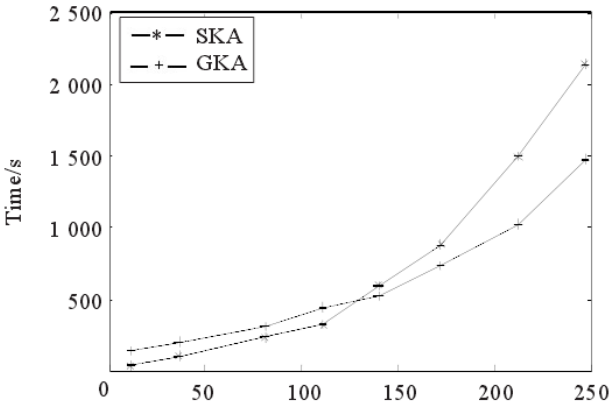

Figure 2: Calculation time comparison between GKA and SKA

Experiments show that for both GKA and SKA algorithms, the computing time have exponentially increased, but that of GKA growth is relatively slow. It's because that in the beginning phase of test, the key identification file in GKA needs to be continuously updated, which spends extra more time.

3.2 Generation algorithm method and simulation experiment

3.2.1 Fractal recursive algorithm

The recursive algorithm can be simply understood as a "self-replicating" process. Essentially, it uses the computer's "push-and-pop the stack" to store the breakpoints of the function call, and repeatedly applies some specific rules to generate nested structures. Fractals have self-similar features, so recursive algorithms can be used to generate fine fractals. For the generation of those classic fractal graphs, most of them can use the fractal recursive algorithm. It is the simplest algorithm for generating fractal graphs. The Cantor-ternary set is a special point set constructed by the German mathematician Cantor when studying the trigonometric series problems.it is a classic self-similar fractal graph. Later, the meteorologist, Richardson (1881-1953) applied it to the practical measurement for the length of the west coast of the United Kingdom. The Cantor-ternary set has a great influence, so, the fractal recursive algorithm is used to achieve its mapping. Figure 3 shows the principle of using the recursive algorithm to realize the Cantor-ternary set.

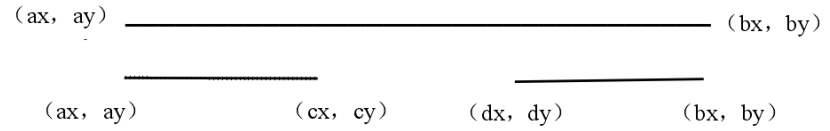

Figure 3: Cantor form principle figure

The basic idea of IFS is to use the fractal self-affinity feature to realize the generation of two-dimensional fractal graphs. Many objects of two-dimensional fractal graph have a certain degree of similarity in their locality and entirety. The IFS algorithm is through the continuous use of fractal self-similarity features and repeated iterative computing, to find the fractal affine transformation parameters, make some formula derivations, and achieve the final two-dimensional fractal graph. The resulting two-dimensional fractal map is dependent on the iteration rules and the affine transform coefficients, with no relation to the selected initial point. In general, to generate a very complex graph, many different affine transformations must be made. But affine transformations require artificial modifications because affine transformations may not be needed in a certain direction. Therefore, the probability P that the affine transformation is invoked was introduced as one variable. When the probability P is larger, it means that the number of affine transformations in this direction is greater; if P is smaller, the number of affine transformations is smaller. If this phenomenon is reflected on the generated two-dimensional map, it can be understood that if the portion with a large probability P occupies a large proportion of the entire graph, the plotted points are more intensive. If the portion with the small probability P occupies a small proportion of the entire graph, the dots are sparse and the colors naturally look relatively dark. By introducing the probability P, the affine transformation has the distinction between primary and secondary, and also makes the generated two-dimensional fractal image more harmonious and more realistic. Table 2 lists the IFS code of the Sierpinski gasket.

Table 2: The IFS code of Sierpinski gasket

i	ai	bi	ci	di	ei	fi	pi
1	0.5	0	0	0.5	0	0	0.34
2	0.5	0	0	0.5	0.5	0	0.33
3	0.5	0	0	0.5	0.25	0.5	0.34

In Table 3 below, for example, based on the characteristics of chemical enterprises, the corresponding management chart was created, in which (a) and (b) are the materials required for management process, and the material generated by (c) can not only be taken as the reference for the management of chemical enterprises, but can also be applied in other fields

Table 3: Generating system algorithm generating rules

Corresponding illustrations	The number of	W	P
a	90	F-F-F	P：F-F[F]+F+F[F]-F
b	90	F-F-F	P:F-F[F]+F-F[++F]-F+F
c	90	F-F-F	P:F-FF[-F+F+F]F

According to the principle of L-system algorithm to generate two-dimensional fractal maps, the L system algorithm program flow was designed. By code writing, the fractal graph corresponding to the rules shown in Table 3 above was implemented.

4. Conclusions

After a series of studies in this paper, the following conclusions have been drawn:
Based on the basic extension theories and methods, the related theoretical requirements and system design requirements were discussed;
It uses the extension theory and method to solve contradictory problems, adopts the extension model to describe things and laws in the objective world, applies extension reasoning and extension transformation to establish inference rules for generating strategies, and sets extension and association as a quantitative tool for strategy generation and strategy evaluation so as to provide new methods for computer intelligence.

Due to the limitations in research time and our academic level, there remain still many aspects of this system for further improvement and optimization, and also much work to be completed and improved in future. Through the combination of extension theory and computer technology, the development of the extension strategy generation system implemented on the computer are still in the preliminary stage, and further research should be conducted later.

Acknowledgement

Supported by the Program for Excellent Young Talents of Universities in Anhui Province in 2017. (gxyqZD2017092);
Supported by the Research Project of Major Educational Reform of Anhui Province in 2017. (2017jyxm0803).

Reference

Borland H., Ambrosini V., Lindgreen A., Vanhamme J., 2016, Building theory at the intersection of ecological sustainability and strategic management, Journal of Business Ethics, 135(2), 293-307, DOI: 10.1007/s10551-014-2471-6

Ertek G., Tokdemir G., Sevinç M., Tunç M.M., 2017, New knowledge in strategic management through visually mining semantic networks, Information Systems Frontiers, 19(1), 165-185, DOI: 10.1007/s10796-015-9591-0

Kumar A., Sah B., Singh A.R., Deng Y., He X., Kumar P., Bansal R.C., 2017, A review of multi criteria decision making (MCDM) towards sustainable renewable energy development, Renewable and Sustainable Energy Reviews, 69, 596-609, DOI: 10.1016/j.rser.2016.11.191

Lieder M., Rashid A., 2016, Towards circular economy implementation: a comprehensive review in context of manufacturing industry, Journal of Cleaner Production, 115, 36-51, DOI: 10.1016/j.jclepro.2015.12.042

Lin J., Naim M.M., Purvis L., Gosling J., 2017, The extension and exploitation of the inventory and order based production control system archetype from 1982 to 2015, International Journal of Production Economics, 194, 135-152, DOI: 10.1016/j.ijpe.2016.12.003

McDonald-Buller E., Kimura Y., Craig M., McGaughey G., Allen D., Webster M., 2016, Dynamic Management of NO x and SO2 Emissions in the Texas and Mid-Atlantic Electric Power Systems and Implications for Air Quality, Environmental science & technology, 50(3), 1611-1619, DOI: 10.1021/acs.est.5b04175

Rangaiah G.P., Sharma S., Sreepathi B.K., 2015, Multi-objective optimization for the design and operation of energy efficient chemical processes and power generation, Current Opinion in Chemical Engineering, 10, 49-62, DOI: 10.1016/j.coche.2015.08.006

Simon D., Fischbach K., Schoder D., 2014, Enterprise architecture management and its role in corporate strategic management, Information Systems and e-Business Management, 12(1), 5-42, DOI: 10.1007/s10257-013-0213-4