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A New Interdisciplinary–Extenics

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Abstract- In this paper, we make a brief introduction to a new interdisciplinary--Extenics from three main parts -- extension theory, extension engineering and extension innovation methods, which can let more scholars from all over world to know what is Extenics, what achievements Extenics scholars have obtained.

Keywords: *extenics, extension theory, extension engineering, extension innovation methods.*

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A New Interdisciplinary—Extenics

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I. INTRODUCTION

In 1983, No. 1 of China's Journal of Scientific Exploration published the paper of "Extension Set and Incompatible Problems", which marked the birth of Extenics. Extenics is an original and traverse discipline, which discusses the possibility of matters' extension and rules and methods of innovation with formalized models, which are used to solve contradictory problems that people's goals cannot be reached in current conditions [1-3]. Over the past 30 years, Extenics scholars have initially established the theoretical system--extension theory, conducted the application of extension theory and extension methods in different fields--extension engineering, and studied unique method system--extension innovation method [4]. This paper briefly introduces the main three parts of Extenics--extension theory, extension engineering and extension innovation methods.

II. EXTENSION THEORY

Extension theory includes basic-element theory, extension set theory and extension logic [5]:

a) *Basic-element theory*

Basic-element theory puts forward the basic elements which describe the affair, matter and relation—"matter-element", "affair-element" and "relation-element". It discusses the extensibility of basic-elements and rules of extension transformation, and studies the extension models which combine qualitative and quantitative property. It provides formalized languages that describe changes of matters and conversion of contradictions. The basic-element theory provides a new formalized tool for expression of knowledge while extension models provide models that combine qualitative and quantitative property for expression of artificial intelligence problems, which is of great importance for the development of artificial intelligence.

b) *Extension set theory*

Extension set theory is a kind of development and breakthrough compared with traditional set theory. It is a quantitative tool which depicts the mutual transformation of matters between the positive and the negative, and the process of quantitative change and qualitative changes. Extension fields of extension set and dependent function bring hierarchy and alterability to extension set and further lay a foundation for researching contradictions and developing quantitative mathematics methods—extension mathematics and extension logic.

c) *Extension logic*

Extension logic is a science that studies the transformation alteration between contradictions and consistency, and rules of reasoning. It is the logic foundation of Extenics.

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For the framework of extension theory, you can see Figure 1.

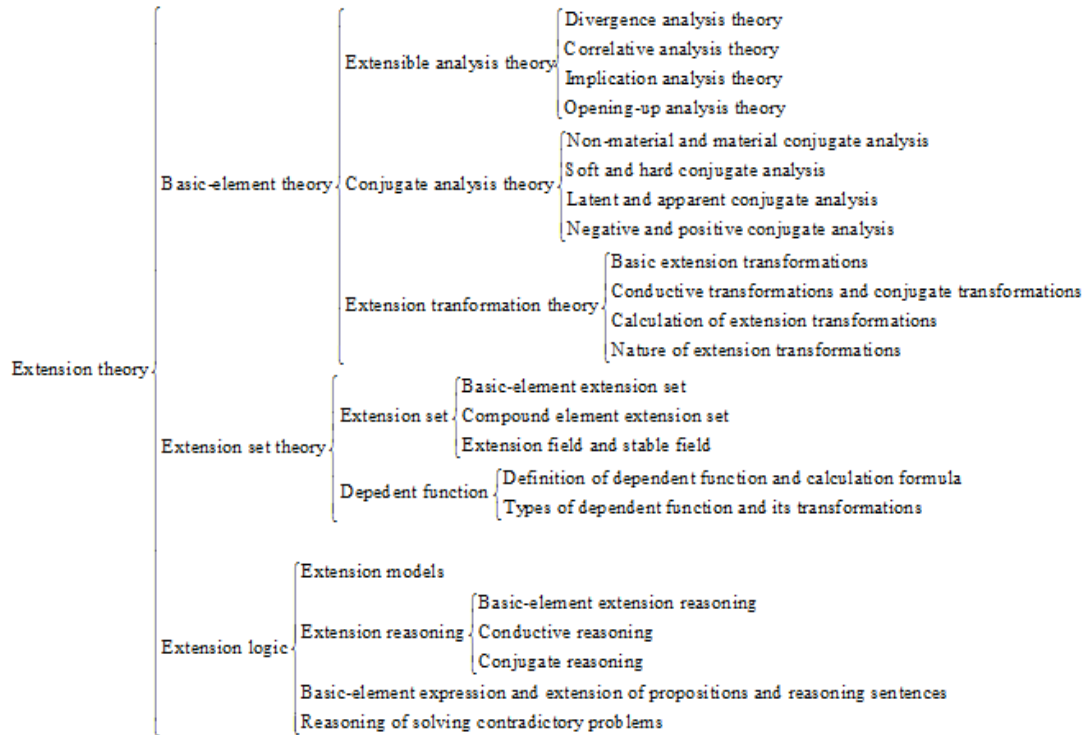


Figure 1 : Framework of extension theory

III. EXTENSION ENGINEERING

Based on extension theory, many Exenics scholars proposed lots of extension methods, such as divergent tree, decomposition and combination chains, correlative net, implication system and conjugate pair; superiority evaluation, true or false information judgment methods; basic transformations, compound transformations and transmission methods; rhombus thinking methods and transforming bridge methods. Extension engineering applies extension methods to solve contradictory problems in such fields as engineering technique, social economy, management science, computer science, biomedicine, and traffic environment protection. Application techniques in various fields are developed while methods and techniques of various subjects and majors are combined. All this is called “extension engineering” [5].

IV. EXTENSION INNOVATION METHODS

Extension innovation methods are a kind of methods with the combination of formalization, quantification and logicalization. They not only can be effectively applied to put forward creative ideas of new products and new projects, but can be applied to extend, convert, reason and identify contradictory problems. They formalize the process of solving contradictory problems by mankind, provide methods

for people to complete the process of “discover problems→establish models of problems→analyze problems→generate strategies for solving contradictory problems” with formalized models, and realize them through computer in the way of man-machine combination. It can be seen from existing application achievements that they can be used in product innovation and technological innovation as well as other innovative activities such as organizational innovation and management innovation [6]. For the framework of extension innovation methods, you can see Figure 2.

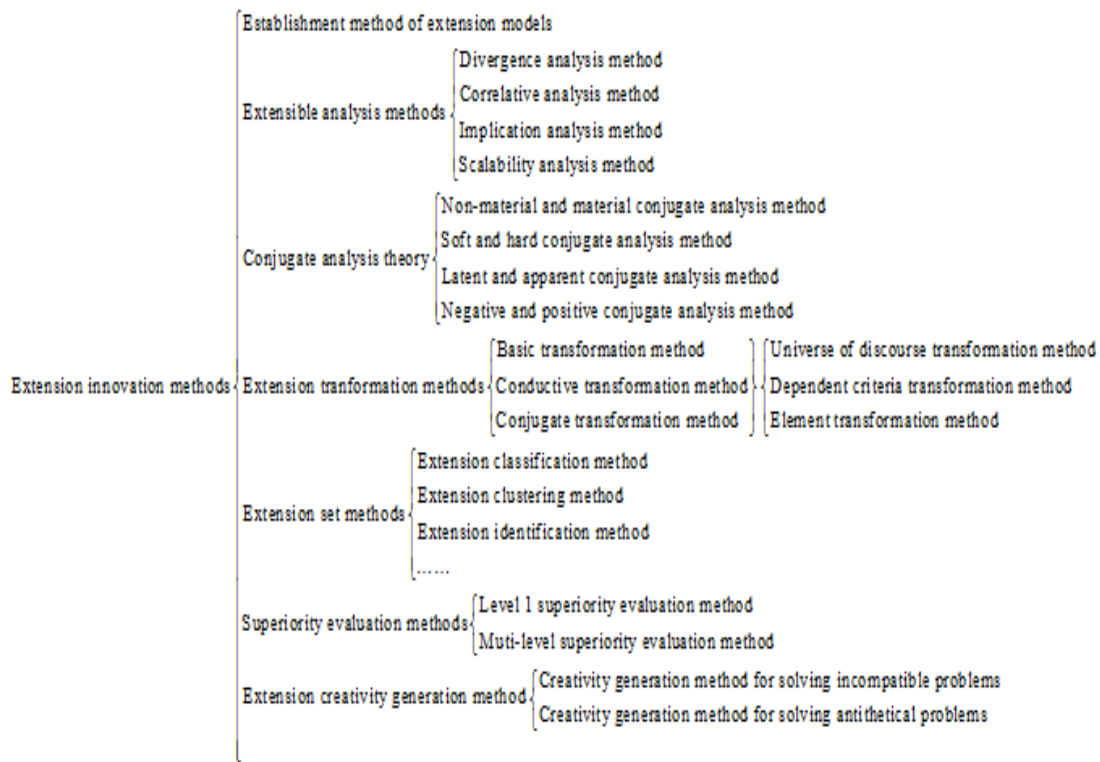


Figure 2 : Framework of extension innovation methods

V. APPLICATION STATUS OF EXTENICS

Through more than 30 years' study, Extenics have been gradually mature and are now widely applied to many fields such as engineering technique, economic and management science, computer science, information and intelligent science and biomedicine, and traffic environment protection. According to incomplete statistics, 375 journals in China have published papers on Extenics. Science Press and others have published over 30 relevant monographs such as Extension Engineering (Yang & Cai), Extension design (Zhao & Su 2010). Until 2012, the number of Extenics study projects sponsored by National Natural Science Foundation of China was 59 covering different fields. There are 17 acquired software copyrights and 8 acquired (or applied for) patents [6].

VI. CONCLUSIONS

Though Extenics scholars have obtained tremendous achievements in many fields such as engineering technique, economic and management science, computer science, information and intelligent science, concepts and theories of Extenics are still being improved.

This paper just makes a brief introduction to the main three parts of Extenics-- extension theory, extension engineering and extension innovation methods. More information about Extension theory and its applications, you can refer to *Extenics: Theory, Method and Application* (Yang & Cai 2013).

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