# “Tian, Di, Ren, Ji” Information Integrative Network System

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**Abstract:** *“Space, earth, man, and computer” in Chinese words that is “Tian, Di, Ren, Ji”. This paper discusses how has integrated remote sensing system (RSS), global positioning system (GPS), data collected system (DCS), geographical information system (GIS), expert information system (EIS), management information system (MIS), decision-making information system (DIS), and virtual reality system (VRS) into one network system for information society. It is an open, complex, and great system.*

**Keyword**: *Remote Sensing; GPS; DCS; GIS; EIS; MIS; DIS; VRS; Open Complex Great System.*

## 1. Introduction

The modern science and technology, development rather fast, those are information science and technology, especially, computer science and technology with outer space science and technology. In the world, what is the greatest information system? As people know that is the “Internet”, in the earth surface for everyone. Is the “Internet” could expand to the outer space? And will complete a whole network? The Internet becomes to space and earth network. This is authoring to put forward the question could be solved [1]. Author gives an open, complex, and great network system to solve this problem. To expect academic circle will be interesting in the world.

## 2. Views of the history for the research

1975 author beginning has studied remote sensing information, and processing remote sensing data, 1980 has researched the remote sensing information model, 1982 has studied geographical information system, 1986 has studied geographical information coding model with data collected system, 1988 has studied knowledge base, and logical base with global positioning system, 1993 has researched management information system, and planning model with communication system, 1995 has researched decision-making information system, and game model. In the 1998, has published a paper in the Peking University academic journal [2]. See the Fig. 1.

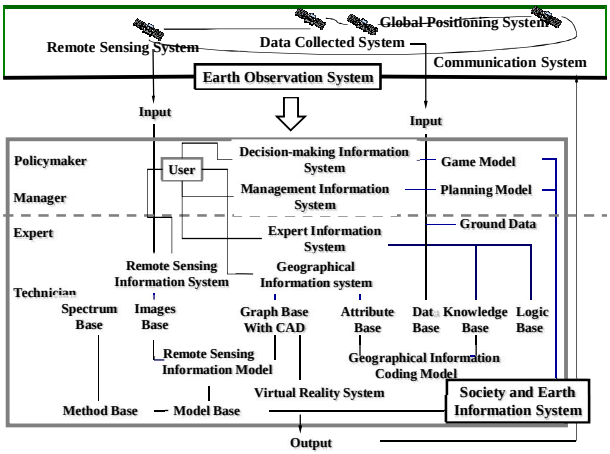



**Fig. 1 “Tian, Di, Ren, Ji” Information Integrative Network System**

There is a line of dashes in the Fig. 1, that meaning is above the line of dashes belong to society science, and below the line of dashes belong to nature science.

## 3. Open, Complex, and Great System

### 3.1 Open System

From 1975 to 1998, the “Tian, Di, Ren, Ji” information integrative network system, step by step grow up, the one hand is with the outer space science and technology, such as remote sensing information system, data collected system, global positioning system, communication satellites system, and so on; the other hand is with the computer science and technology, such

as remote sensing information model, geographical information system, geographical information coding model, expert information system, management information system, decision-making information system, virtual reality system and so on. Thus, the network system still will grow up with new science and technology. So, it is open.

### 3.2 Complex System

In the Fig. 1, you could find many lines linked each other. There are so many relationships. Now, only explain the remote sensing Information model, it is a formula, as follows:

$$\pi_y = a_0 \pi_{x_1}^{a_1} \pi_{x_2}^{a_2} ... \pi_{x_n}^{a_n} \qquad (1)$$

The $\pi$ is a similar standard, which is non unit, but it is factors mass. Here is data to say everything. The $a_i (i = 1,2...n)$ expresses linear or non-linear, fuzzy or gray, chaos or fractal, and so on. $a_0$ Would be express certain or uncertain, which is including random. So the formula (1) is more complex than any before mathematics formula. See Fig. 2.

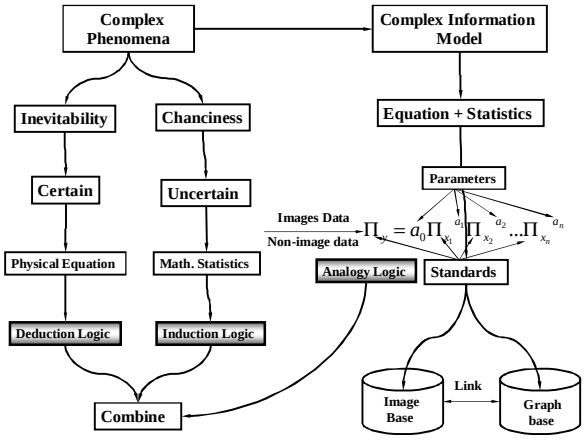



**Fig. 2 Complex Information Model**

And the formula (1) also is a coupling with Image and equation. On account of, remote sensing image, which is compare by digital with picture. It is meaning each pixel (= picture element) has a number (such as form 0~255). The picture is composed by pixel number. See Fig. 3.

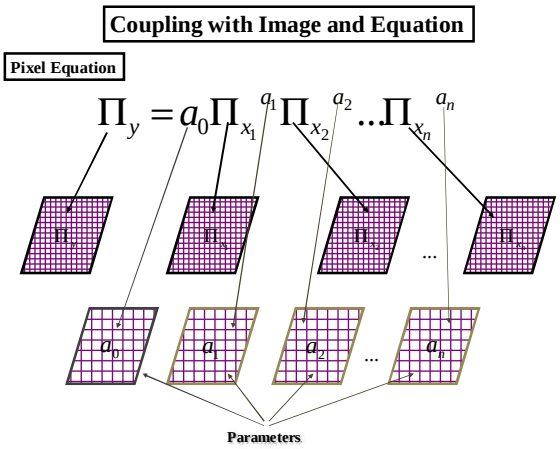
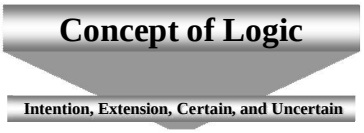



**Fig.3 Coupling with Image and Digital (Equation)**

The complex system is in logic, as follows Fig. 4




| Logic | Intention Extension Certain | Intention is Certain Extension is Uncertain | Intention is Uncertain Extension is Certain | Intention Extension Uncertain |
|---|---|---|---|---|
| System | White System | Fuzzy System | Gary System | Black System |
| Mathematics Equation | Physical Eq. | Fuzzy Eq. | Gary Eq. | Stochastic Eq. |

*** In the physical Equations, there are part of "Fractal" , it is uncertain.**

**Fig. 4 the Complex System in Logic**

The formula (1) is a very complex equation, including linear, non-linear, fuzzy, gray, random, and fractal at all.

### 3.3 Great System

The Fig.1 is great network system, especially, when using this network system to applications, such as national economy, the subsystems maybe thousands upon thousands. And the network has more complexity. If use the system formula, as follows:

$$S_{II} = f(\sum_{i=1}^{n}\sum_{j=1}^{m} E_{ij}, [R]_{ij}, s, t) \Leftrightarrow C \qquad (2)$$

In the formula, $S_{II}$ is showed “Tian, Di, Ren, Ji”

information integrative network system; $E_{ij}$ the elements of network system spans and levels $(i, j)$; $[R]_{ij}$ the relationship of subsystem, that is more complex with matrix; $s,t$ are space and time; $C$ is circumstances of "Tian, Di, Ren, Ji" information integrative network system. Formula (2) is open system, and has behavior with functions.

## *4. Conclusion*

This paper is a summarize report. Many research's works already had published, about open complex great system, but mostly in Chinese[3−6]. There is major for the information science in short thesis.

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