International Journal of Information, Control and Computer Sciences
ISSN: 2517-9942
Vol:4, No:3, 2010

Basic Tendency Model in Complete Factor Synergetics of Complex Systems

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***Abstract*—**The deviation between the target state variable and the practical state variable should be used to form the state tending factor of complex systems, which can reflect the process for the complex system to tend rationalization. Relating to the system of basic equations of complete factor synergetics consisting of twenty nonlinear stochastic differential equations, the two new models are considered to set, which should be called respectively the rationalizing tendency model and the non- rationalizing tendency model. Therefore we can extend the theory of programming with the objective function & constraint condition suitable only for the realm of man's activities into the new analysis with the tendency function & constraint condition suitable for all the field of complex system.

***Keywords*—**complex system, complete factor synergetics, basic equation, rationalizing tendency model, non-rationalizing tendency model.

I. Introduction

As the preparation for the further exploration on complexity[1–6] , the essential dynamical factor and essential effect factor influencing and determining respectively the sufficient condition and necessary condition of the change process of complex systems are approached in the papers [7]–[12]. The new system of equations to be set in the paper [12] is above all the combination and unity of the nonlinear stochastic differential equation and the determinant constraint condition, and then the combination and unity of the practical state function and reasonable state function (or non-reasonable state function) of the system on the basis of the basic system of equations of complete factor synergetics.

On this basis, the basic factors influencing and determining the sate condition of the existence and motion as well as development processes of complex systems will be approached further in this paper.

The states of complex systems are many and varied. The state as the object of the essential dynamical analysis of a complex system should be that exerting essential action on the various behaviors of the complex system, while the state variable and response variable of the complex system should form the basic content of the mathematical analytical object of the complex system.

For complex systems, we should have generalized understanding and processing between the advantages and disadvantages. Taking it as the standard judging the interest whether to be favorable to the emergence, existence and motion as well as development of a complex system, we can see that the interest exists not only in the life world and the society of mankind, but also in the complex field of non-life world. No all the behaviors of a complex system are with relation to the interest, while only the behavior with relation to the interest can be taken by us as the basic behavior of the complex system.

For the state of complex system, we should distinguish out a pair of relation factors: the gain tendency and the reasonable pattern, i.e. the state tendency in favor of the complex system and the selective pattern of rationalization. This gain tendency is decided by the sufficient and necessary conditions on the basis of the essential dynamical effect relations. In other word, the requirement of the finite maximization of the disposing action of the complex system under the set condition of the resources load of the complex system, the requirement of the finite maximization of the resources load of the complex system under the set condition of the disposing action of the complex system, and the requirement of the finite maximization of the whole attrition of the complex system under the set condition of the whole efficacy of the complex system, as well as the requirement of the finite maximization of the whole efficacy of the complex system under the set condition of the whole attrition of the complex system, all will drive the behavior of a complex system to be prone to the most favorable state. We should call this process being always prone to the most favorable the rationalization.

Thus the state variables of complex systems should be divided into these two kinds : the targeting state variable and the practical state variable. The former is the variable that the complex system fits the rationalizing requirement of some large system (or its environment), the latter is the variable that the system is adjusting in practice. The deviation between the targeting state variable and the practical state variable forms the state tending factor of a complex system, while this factor reflects the process that the state of the system is prone to rationalization. The reasonable state equation and practical state equation as well as state tending factor equation of complex systems are set in this paper.

For the basic behavior of a complex system, we should set the quantitative relation among the state variable and control quantity as well as response quantity of the complex system. If it is certain to determine the state variable of the complex system, we should obtain the response at any moment to the given control quantity.

Thus the response variables of complex systems should be divided into these two kinds : the targeting response variable and the practical response variable. The former is the variable that the complex system fits the rationalizing requirement of

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some large system (or its environment), the latter is the variable that the system is adjusting in practice. The deviation between the targeting response variable and the practical response variable forms the response tending factor of a complex system, while this factor reflects the process that the response of the system is prone to rationalization. The reasonable response equation, practical response equation and response tending factor equation of complex systems are set in this paper.

Therefore we can extend the theory of programming with the objective function & constraint condition suitable only for the field of man's activities into the new analysis with the tendency function & constraint condition suitable for all the field of complex system.

II. DRIVE AND RESTRICTION OF ESSENTIAL DYNAMICAL EFFECT AND TENDENCY PATTERN OF RATIONALIZATION

It is necessary that the state-space techniques of complex systems is expanded and substantiated. First, the state variable of complex systems is with relation both to the various resources nodes and to the various disposal nodes, thus being with relation to the disposal organizing node; second, the essential dynamical and effect relations of complex systems constitute the targeting requirement and constraint condition for the state variable.

The analyses of the papers [7]–[12] show that the emergence, existence and motion as well as development of complex systems in its varied complex environment are always driven and restricted by the essential dynamical effect relation. A complex system is always prone on one hand to the maximization of the whole disposal action under the finite condition as full as possible to maintain load, on the other to the maximization of the whole disposal efficacy under the finite condition as little as possible to reduce attrition. Moreover, the drive forces and constraint conditions formed of the two aspects cross again together, to constitute the sufficient-necessary drive and restriction for the state of the complex system.

This cross relation should be expressed by the following formalization.

The drive and constraint unilaterally from the essential dynamical relation:

The tendency function

$$Max: \ F_d = C_p Q_d \frac{d^2u}{dt^2} = M_d \frac{d^2u}{dt^2} \tag{1}$$

The restriction condition

$$M_{d,F} = M_d(F_d) \geq M_{d,C}(t)$$
$$\frac{d}{dt}(M_{d,F} - M_{d,C}(t)) \leq 0 \tag{2}$$

where F_d is the disposal force, $M_{d,F}$ is the resource disposing amount fitting the requirement of disposal force F_d, $M_{d,C}(t)$ is the disposal load.

The drive and constraint unilaterally from the essential effect relation:

The tendency function

$$Max: \ S_F = a_F \int_A^B F_d du \tag{3}$$

The restriction condition

$$M_{d,S} = M_d(S_F) > M_{d,L}(t)$$
$$\frac{d}{dt}(M_{d,S} - M_{d,L}(t)) > 0 \tag{4}$$

where S_F is the efficacy of system, $M_{d,S}$ is the resource disposing amount fitting the requirement of the efficacy S_F of system, $M_{d,L}(t)$ is the attrition of system.

Combining the above drive and constraint unilaterally from the essential dynamical relation with the above drive and constraint unilaterally from the essential effect relation to cross together, we should obtain the following cross drive and constraint:

The tendency function

$$Max: \ F_d = C_p Q_d \frac{d^2u}{dt^2} = M_d \frac{d^2u}{dt^2}$$
$$S_F = a_F \int_A^B F_d du \tag{5}$$

The restriction condition

$$M_{d,F} = M_d(F_d) \geq M_{d,C}(t)$$
$$\frac{d}{dt}(M_{d,F} - M_{d,C}(t)) \leq 0$$
$$M_{d,S} = M_d(S_F) > M_{d,L}(t)$$
$$\frac{d}{dt}(M_{d,S} - M_{d,L}(t)) > 0 \tag{6}$$

The above cross drive and constraint from the essential dynamical effect relation show that the requirement of the finite maximization of the disposing action of the complex system under the set condition of the resources load of the complex system, the requirement of the finite maximization of the resources load of the complex system under the set condition of the disposing action of the complex system, and the requirement of the finite maximization of the whole attrition of the complex system under the set condition of the whole efficacy of the complex system, as well as the requirement of the finite maximization of the whole efficacy of the complex system under the set condition of the whole attrition of the complex system, all will drive the behavior of a complex system to be prone to the most favorable state.

This process being always prone to the most favorable should be called the rationalization.

III. TARGETOMG STATE VARIABLE AND PRACTICAL STATE VARIABLE OF COMPLEX SYSTEMS

To set the concepts of the integrating state of the complex system and its state variable, we should put the complex system into the integrated distributive system of resources based on resources nodes, and then into the integrating disposal system of resources based on disposal nodes, and further into the disposal organizing system of resources based on organizing nodes. In this analysis, the integrating state and its variable of the complex system should be put into the state and its variable of the integrated distributive system of resources, and then into the state and its variable of the integrating disposal system of resources, and further into the state and its variable of the disposal organizing system of resources.

For the complex system, and then for the disposal organizing system based on resources nodes and disposal nodes as well as organizing nodes, we should take the integrating configuration $r = x - x_0$ and its time rate v of motion-like and the integrating entropy varying $\zeta = s - s_0$ and its time rate Ξ of development-like as well as the integrating variable $u = \gamma - \gamma_0$ and its time rate Σ of complete-like as the integrating state variable of the complex system, where the time rate of configuration and the time rate of total entropy as well as the time rate of completion are respectively

$$v(t) = v(t_0) + \frac{1}{M_d}\int_0^t F_{mov,d}(\tau)d\tau \qquad (7a)$$

$$\Xi(t) = \Xi(t_0) + \frac{1}{M_d}\int_0^t F_{dev,d}(\tau)d\tau \qquad (7b)$$

$$\Sigma(t) = \Sigma(t_0) + \frac{1}{M_d}\int_0^t F_{com,d}(\tau)d\tau \qquad (7c)$$

where $F_{mov,d}$ and $F_{dev,d}$ as ell $F_{com,d}$ should be respectively taken as the disposal action of motion-like and the disposal action of development-like as well as the disposal action of complete-like. Generally, there should be

$$v(t) = \psi[v(t_0), F_{mov,d}(t)], \quad t \ge t_0 \qquad (8a)$$

$$\Xi(t) = \psi[\Xi(t_0), F_{dev,d}(t)], \quad t \ge t_0 \qquad (8b)$$

$$\Sigma(t) = \psi[\Sigma(t_0), F_{com,d}(t)], \quad t \ge t_0 \qquad (8c)$$

The integrating configuration of motion-like and the integrating entropy varying of development-like as well as the integrating variable of complete-like are respectively

$$r(t) = r(t_0) + \int_0^t [v(t_0) + \frac{1}{M_d}\int_0^\xi F_{mov,d}(\tau)d\tau]d\xi \qquad (9a)$$

$$\zeta(t) = \zeta(t_0) + \int_0^t [\Xi(t_0) + \frac{1}{M_d}\int_0^\xi F_{dev,d}(\tau)d\tau]d\xi \qquad (9b)$$

$$u(t) = u(t_0) + \int_0^t [\Sigma(t_0) + \frac{1}{M_d}\int_0^\xi F_{com,d}(\tau)d\tau]d\xi \qquad (9c)$$

or

$$r(t) = \psi[r(t_0), v(t_0), \dot{F}_{mov,d}(t)], \quad t \ge t_0 \qquad (10a)$$

$$\zeta(t) = \psi[\zeta(t_0), \Xi(t_0), \dot{F}_{dev,d}(t)], \quad t \ge t_0 \qquad (10b)$$

$$u(t) = \psi[u(t_0), \Sigma(t_0), \dot{F}_{com,d}(t)], \quad t \ge t_0 \qquad (10c)$$

We should call the initial disposal condition at moment $t = t_0$

$$r(t_0),\ \zeta(t_0),\ u(t_0),\ v(t_0),\ \Xi(t_0),\ \Sigma(t_0)$$

The basic complete integrating state of the complex system at the moment $t = t_0$.

If the basic complete integrating state of the complex system should be expressed by the following a group of variables

$$r(t),\ \zeta(t),\ u(t),\ v(t),\ \Xi(t),\ \Sigma(t),$$

such a group of variables should be called the variable of basic complete integrating state.

Generally, if the complex system should be expressed by the following a group of integrating variables

$$x_1 = \dot{u}_1(t) = \psi[\dot{u}_1(t_0), F_{d,1}(t)], \quad t \ge t_0$$

$$x_2 = \dot{u}_2(t) = \psi[\dot{u}_2(t_0), F_{d,2}(t)], \quad t \ge t_0$$

....

$$x_n = \dot{u}_n(t) = \psi[\dot{u}_n(t_0), F_{d,n}(t)], \quad t \ge t_0$$

$$x_{n+1} = u_1(t) = \psi[u_1(t_0), \dot{u}_1(t_0), \dot{F}_{d,1}(t)], \quad t \ge t_0$$

$$x_{n+2} = u_2(t) = \psi[u_2(t_0), \dot{u}_2(t_0), \dot{F}_{d,2}(t)], \quad t \ge t_0$$

....

$$x_{2n} = u_n(t) = \psi[u_n(t_0), \dot{u}_n(t_0), \dot{F}_{d,n}(t)], \quad t \ge t_0 \qquad (11)$$

such a group of variables should be called the integrating state variable of complex system.

The integrating state variable fitting the drive target and constraint condition of the essential dynamical effect of complex system should be called the targeting integrative state variable of complex system, i.e. :

The targeting state variable

$$\dot{u}(t) = \psi[\dot{u}(t_0), F_d(t)], \quad t \ge t_0$$

$$u(t) = \psi[u(t_0), \dot{u}(t_0), \dot{F}_d(t)], \quad t \ge t_0 \qquad (12)$$

which must fit

The tendency function expression (5)

The restrictive condition expression (6)

The basic state variable of complete integrating fitting the drive target and constraint condition of the essential dynamical effect of complex system should be called the basic targeting state variable of complete integrating of complex system, i.e. :

The targeting state variable

$$v(t) = \psi[v(t_0), F_{mov,d}(t)], \quad t \ge t_0$$

$$\Xi(t) = \psi[\Xi(t_0), F_{dev,d}(t)], \quad t \ge t_0$$

$$\Sigma(t) = \psi[\Sigma(t_0), F_{com,d}(t)], \quad t \ge t_0$$

$$r(t) = \psi[r(t_0), v(t_0), \dot{F}_{mov,d}(t)], \quad t \ge t_0$$

$$\zeta(t) = \psi[\zeta(t_0), \Xi(t_0), \dot{F}_{dev,d}(t)], \quad t \ge t_0$$

$$u(t) = \psi[u(t_0), \Sigma(t_0), \dot{F}_{com,d}(t)], \quad t \ge t_0 \qquad (13)$$

which must fit

The tendency function

expressions (1) and (3) as well as(5)

The restrictive condition

expressions (2) and (4) as well as(6)

To distinguish the targeting integrative state variable and the practical integrative state variable, we should mark the targeting integrative state variable as $\underline{x}_1(t)$, $\underline{x}_2(t)$, $\cdots$, $\underline{x}_n(t)$.

All the complex systems are non-linear. The integrating state equation of the complex system should be written into the following form of non-linear differentiation equation:

$$\dot{x}_1 = f_1(x_1, x_2, \cdots, x_n; F_{d,1}, F_{d,2}, \cdots, F_{d,m})$$
$$\dot{x}_2 = f_2(x_1, x_2, \cdots, x_n; F_{d,1}, F_{d,2}, \cdots, F_{d,m})$$
....
$$\dot{x}_n = f_n(x_1, x_2, \cdots, x_n; F_{d,1}, F_{d,2}, \cdots, F_{d,m}) \quad (14)$$

or into the form of vector matrix:

$$\dot{x}(t) = f(x(t),\ F_d(t)) \quad (15)$$

where the integrating state variable is

$$x(t) = [x_1(t), x_2(t), \cdots, x_n(t)]^T,$$

and the input vector is

$$F(t) = [F_{d,1}(t), F_{d,2}(t), \cdots, F_{d,n}(t)]^T$$

IV. BASIC RATIONALIZING TENDENCY MODEL OF COMPLETE FACTOR SYNERGETICS

On the analytical base for the basic system of the equations of complete factor synergetics to be set preliminarily, we should consider now setting forth the rationalizing tendency model of the basic system of the equations of complete factor synergetics for complex systems.

Let $x_1 = \underline{X}^+$ be the reasonable state variable of the system fitting the requirement of the environment for its existence, $x_2 = X$ be the practical state variable of the system, $x_3 = \underline{Y}^+$ be the reasonable response variable of the system fitting the requirement of the environment for its existence, $x_4 = Y$ be the practical response variable of the system, $x_5 = M_{d,F}$ be the practical resources amount for the requirement of disposal force F_d, $\underline{x}^+_5 = \underline{M}^+_{d,F}$ be the reasonable resources amount fitting the requirement of the system for its existence to disposal force, $x_6 = M_{d,C}$ be the practical resources load, $\underline{x}^+_6 = \underline{M}^+_{d,C}$ be the reasonable resources load fitting the requirement of the system for its existence, $x_7 = M_{d,S}$ be the practical resource amount for the requirement of the system efficacy S_F, $\underline{x}^+_7 = \underline{M}^+_{d,S}$ be the reasonable resources amount fitting the requirement of the system for its existence to the system efficacy, $x_8 = M_{d,L}$ be the practical attrition of the system, $\underline{x}^+_8 = \underline{M}^+_{d,L}$ be the reasonable attrition fitting the requirement of the system for its existence, $x_9 = M_{d,EF}$ be the practical resources amount for the requirement of the environmental load E_F, $\underline{x}^+_9 = \underline{M}^+_{d,EF}$ be the reasonable resources amount for the requirement of the environmental load E_F, $x_{10} = M_{d,EC}$ be the practical load formed of the system for its environment, $\underline{x}^+_{10} = \underline{M}^+_{d,EC}$ be the reasonable load for the requirement of the environment for its existence, $x_{11} = M_{d,ES}$ be resources amount for the requirement of the ecosystem efficacy S_{EF}, $\underline{x}^+_{11} = \underline{M}^+_{d,ES}$ be the reasonable resources amount fitting the requirement of the environment for its existence to the ecosystem efficacy S_{EF}, $x_{12} = M_{d,EL}$ be the practical attrition of the ecosystem, $\underline{x}^+_{12} = \underline{M}^+_{d,EL}$ be the reasonable attrition of the ecosystem fitting the requirement of the environment for its existence, $x_{13} = W_{SE,\Gamma}$ be the external cooperative resources amount, $\underline{x}^+_{13} = \underline{W}^+_{SE,\Gamma}$ be the reasonable amount of x_{13}, $x_{14} = W_{SE,\Gamma}$ be the external competitive resources amount, $\underline{x}^+_{14} = \underline{W}^+_{SE,L}$ be the reasonable amount of x_{14}, $x_{15} = M_{SE,\Lambda}$ be the external concentrative interflow amount, $\underline{x}^+_{15} = \underline{M}^+_{SE,\Lambda}$ be the reasonable amount of x_{15}, $x_{16} = M_{SE,V}$ be the external dispersive interflow amount, $\underline{x}^+_{16} = \underline{M}^+_{SE,V}$ be the reasonable amount of x_{16}, $x_{17} = W_{S,\Gamma}$ be the internal cooperative resources amount, $\underline{x}^+_{17} = \underline{W}^+_{S,\Gamma}$ be the reasonable amount of x_{17}, $x_{18} = W_{S,L}$ be the internal competitive resources amount, $\underline{x}^+_{18} = \underline{W}^+_{S,L}$ be the reasonable amount of x_{18}, $x_{19} = W_{S,\Lambda}$ be the internal concentrative interflow amount, $\underline{x}^+_{19} = \underline{M}^+_{S,\Lambda}$ be the reasonable amount of x_{19}, $x_{20} = M_{S,V}$ be the internal dispersive interflow amount, $\underline{x}^+_{20} = \underline{M}^+_{S,V}$ be the reasonable amount of x_{20}, hence we should set forth the following rationalizing tendency model for the basic system of the equations (3 *a*) - (3 *m*) of complete factor synergetics :

The basic system of dynamical equations

$$\frac{dx_i(t)}{dt} = F_i(x_1, x_2, \cdots, x_{20}) + f_i \qquad i = 1, 2, \cdots, 20 \quad (16)$$

The basic rationalizing tendency function

$$x_1(t) - x_2(t) = 0 \quad \text{i.e.} \quad \underline{X}^+(t) - X(t) = 0 \qquad (16a)$$

The reasonable restrictive condition of essential dynamics

$$x_5(t) \geq x_6(t), \quad |\underline{x}^+{}_5(t) - x_5(t)| < \delta$$
$$|\underline{x}^+{}_6(t) - x_6(t) < \delta \qquad (16b1)$$

The reasonable restrictive condition of essential effect

$$x_7(t) \geq x_8(t), \quad |\underline{x}^+{}_7(t) - x_7(t)| < \delta$$
$$|\underline{x}^+{}_8(t) - x_8(t)| < \delta \qquad (16c1)$$

The reasonable restrictive condition of environmental dynamics

$$x_9(t) \geq x_{10}(t), \quad |\underline{x}^+{}_9(t) - x_9(t)| < \delta$$
$$|\underline{x}^+{}_{10}(t) - x_{10}(t)| < \delta \qquad (16b2)$$

The reasonable restrictive condition of environmental effect

$$x_{11}(t) \geq x_{12}(t), \quad |\underline{x}^+{}_{11}(t) - x_{11}(t)| < \delta$$
$$|\underline{x}^+{}_{12}(t) - x_{12}(t)| < \delta \qquad (16c2)$$

The reasonable equilibrium condition of external dynamics

$$x_{13}(t) = x_{14}(t), \quad |\underline{x}^+{}_{13}(t) - x_{13}(t)| < \delta$$
$$|\underline{x}^+{}_{14}(t) - x_{14}(t)| < \delta \qquad (16d1)$$

The reasonable restrictive condition of external cooperation

$$x_{13}(t) > x_{14}(t), \quad |\underline{x}^+{}_{13}(t) - x_{13}(t)| < \delta$$
$$|\underline{x}^+{}_{14}(t) - x_{14}(t)| < \delta \qquad (16d2)$$

The reasonable restrictive condition of external competition

$$x_{13}(t) < x_{14}(t), \quad |\underline{x}^+{}_{13}(t) - x_{13}(t)| < \delta$$
$$|\underline{x}^+{}_{14}(t) - x_{14}(t)| < \delta \qquad (16d3)$$

International Journal of Information, Control and Computer Sciences
ISSN: 2517-9942
Vol:4, No:3, 2010

The reasonable equilibrium condition of external synergy

$$x_{15}(t) = x_{16}(t), \quad |\underline{x}^{+}{}_{15}(t) - x_{15}(t)| < \delta$$
$$|\underline{x}^{+}{}_{16}(t) - x_{16}(t)| < \delta \qquad (16\,e1)$$

The reasonable restrictive condition of external concentration

$$x_{15}(t) > x_{16}(t), \quad |\underline{x}^{+}{}_{15}(t) - x_{15}(t)| < \delta$$
$$|\underline{x}^{+}{}_{16}(t) - x_{16}(t)| < \delta \qquad (16\,e2)$$

The reasonable restrictive condition of external dispersion

$$x_{15}(t) < x_{16}(t), \quad |\underline{x}^{+}{}_{15}(t) - x_{15}(t)| < \delta$$
$$|\underline{x}^{+}{}_{16}(t) - x_{16}(t)| < \delta \qquad (16\,e3)$$

The reasonable equilibrium condition of internal dynamics

$$x_{17}(t) = x_{18}(t), \quad |\underline{x}^{+}{}_{17}(t) - x_{17}(t)| < \delta$$
$$|\underline{x}^{+}{}_{18}(t) - x_{18}(t)| < \delta \qquad (16\,f1)$$

The reasonable restrictive condition of internal cooperation

$$x_{17}(t) > x_{18}(t), \quad |\underline{x}^{+}{}_{17}(t) - x_{17}(t)| < \delta$$
$$|\underline{x}^{+}{}_{18}(t) - x_{18}(t)| < \delta \qquad (16\,f2)$$

The reasonable restrictive condition of internal competition

$$x_{17}(t) < x_{18}(t), \quad |\underline{x}^{+}{}_{17}(t) - x_{17}(t)| < \delta$$
$$|\underline{x}^{+}{}_{18}(t) - x_{18}(t)| < \delta \qquad (16\,f3)$$

The reasonable equilibrium condition of internal synergy

$$x_{19}(t) = x_{20}(t), \quad |\underline{x}^{+}{}_{19}(t) - x_{19}(t)| < \delta$$
$$|\underline{x}^{+}{}_{20}(t) - x_{20}(t)| < \delta \qquad (16\,g1)$$

The reasonable restrictive condition of internal concentration

$$x_{19}(t) > x_{20}(t), \quad |\underline{x}^{+}{}_{19}(t) - x_{19}(t)| < \delta$$
$$|\underline{x}^{+}{}_{20}(t) - x_{20}(t)| < \delta \qquad (16\,g2)$$

The reasonable restrictive condition of internal dispersion

$$x_{19}(t) < x_{20}(t), \quad |\underline{x}^{+}{}_{19}(t) - x_{19}(t)| < \delta$$
$$|\underline{x}^{+}{}_{20}(t) - x_{20}(t)| < \delta \qquad (16\,g3)$$

The reasonable constraint relation of essential dynamical factors

$$\frac{d}{dt}(x_5(t) - x_6(t)) \le 0 \quad |\underline{x}^{+}{}_{5}(t) - x_5(t)| < \delta$$
$$|\underline{x}^{+}{}_{6}(t) - x_6(t) < \delta \qquad (16\,h1)$$

The reasonable constraint relation of essential effect factors

$$\frac{d}{dt}(x_7(t) - x_8(t)) > 0 \quad |\underline{x}^{+}{}_{7}(t) - x_7(t)| < \delta$$
$$|\underline{x}^{+}{}_{8}(t) - x_8(t)| < \delta \qquad (16\,i1)$$

The reasonable constraint relation of environmental dynamical factors

$$\frac{d}{dt}(x_9(t) - x_{10}(t)) \le 0 \quad |\underline{x}^{+}{}_{9}(t) - x_9(t)| < \delta$$
$$|\underline{x}^{+}{}_{10}(t) - x_{10}(t)| < \delta \qquad (16\,h2)$$

The reasonable constraint relation of environmental effect factors

$$\frac{d}{dt}(x_{11}(t) - x_{12}(t)) > 0 \quad |\underline{x}^{+}{}_{11}(t) - x_{11}(t)| < \delta$$
$$|\underline{x}^{+}{}_{12}(t) - x_{12}(t)| < \delta \qquad (16\,i2)$$

The reasonable equilibrium constraint relation of external dynamical factors

$$\frac{d}{dt}(x_{13}(t) - x_{14}(t)) = 0 \quad |\underline{x}^{+}{}_{13}(t) - x_{13}(t)| < \delta$$
$$|\underline{x}^{+}{}_{14}(t) - x_{14}(t)| < \delta \qquad (16\,j1)$$

The reasonable cooperative constraint relation of external dynamical factors

$$\frac{d}{dt}(x_{13}(t) - x_{14}(t)) > 0 \quad |\underline{x}^{+}{}_{13}(t) - x_{13}(t)| < \delta$$
$$|\underline{x}^{+}{}_{14}(t) - x_{14}(t)| < \delta \qquad (16\,j2)$$

The reasonable competitive constraint relation of external dynamical factors

$$\frac{d}{dt}(x_{13}(t) - x_{14}(t)) < 0 \quad |\underline{x}^{+}{}_{13}(t) - x_{13}(t)| < \delta$$
$$|\underline{x}^{+}{}_{14}(t) - x_{14}(t)| < \delta \qquad (16\,j3)$$

The reasonable equilibrium constraint relation of external synergetic factors

$$\frac{d}{dt}(x_{15}(t) - x_{16}(t)) = 0 \quad |\underline{x}^{+}{}_{15}(t) - x_{15}(t)| < \delta$$
$$|\underline{x}^{+}{}_{16}(t) - x_{16}(t)| < \delta \qquad (16\,k1)$$

The reasonable concentrative constraint relation of external synergetic factors

$$\frac{d}{dt}(x_{15}(t) - x_{16}(t)) > 0 \quad |\underline{x}^{+}{}_{15}(t) - x_{15}(t)| < \delta$$
$$|\underline{x}^{+}{}_{16}(t) - x_{16}(t)| < \delta \qquad (16\,k2)$$

The reasonable dispersive constraint relation of external synergetic factors

$$\frac{d}{dt}(x_{15}(t) - x_{16}(t)) < 0 \quad |\underline{x}^{+}{}_{15}(t) - x_{15}(t)| < \delta$$
$$|\underline{x}^{+}{}_{16}(t) - x_{16}(t)| < \delta \qquad (16\,k3)$$

The reasonable equilibrium constraint relation of internal dynamical factors

$$\frac{d}{dt}(x_{17}(t) - x_{18}(t)) = 0 \quad |\underline{x}^{+}{}_{17}(t) - x_{17}(t)| < \delta$$
$$|\underline{x}^{+}{}_{18}(t) - x_{18}(t)| < \delta \qquad (16\,l1)$$

The reasonable cooperative constraint relation of internal dynamical factors

$$\frac{d}{dt}(x_{17}(t) - x_{18}(t)) > 0 \quad |\underline{x}^{+}{}_{17}(t) - x_{17}(t)| < \delta$$
$$|\underline{x}^{+}{}_{18}(t) - x_{18}(t)| < \delta \qquad (16\,l2)$$

The reasonable competitive constraint relation of internal dynamical factors

$$\frac{d}{dt}(x_{17}(t)-x_{18}(t))<0 \quad |\underline{x}^{+}{}_{17}(t)-x_{17}(t)|<\delta$$
$$|\underline{x}^{+}{}_{18}(t)-x_{18}(t)|<\delta \qquad (16\,l3)$$

The reasonable equilibrium constraint relation of internal synergetic factors

$$\frac{d}{dt}(x_{19}(t)-x_{20}(t))=0 \quad |\underline{x}^{+}{}_{19}(t)-x_{19}(t)|<\delta$$
$$|\underline{x}^{+}{}_{20}(t)-x_{20}(t)|<\delta \qquad (16\,m1)$$

The reasonable concentrative constraint relation of internal synergetic factors

$$\frac{d}{dt}(x_{19}(t)-x_{20}(t))>0 \quad |\underline{x}^{+}{}_{19}(t)-x_{19}(t)|<\delta$$
$$|\underline{x}^{+}{}_{20}(t)-x_{20}(t)|<\delta \qquad (16\,m2)$$

The reasonable dispersive constraint relation of internal synergetic factors

$$\frac{d}{dt}(x_{19}(t)-x_{20}(t))<0 \quad |\underline{x}^{+}{}_{19}(t)-x_{19}(t)|<\delta$$
$$|\underline{x}^{+}{}_{20}(t)-x_{20}(t)|<\delta \qquad (16\,m3)$$

The above model (16 a) - (16 m) should be called the basic rationalizing tendency model of complete factor synergetics.

V. BASIC NON-RATIONALIZING TENDENCY MODEL OF COMPLETE FACTOR SYNERGETICS

On the analytical base for the basic system of the equations of complete factor synergetics to be set preliminarily, we should consider now setting forth the non- rationalizing tendency model of the basic system of the equations of complete factor synergetics for complex systems.

Let $x_1 = \underline{X}^-$ be the non-reasonable state variable of the system not fitting the requirement of the environment for its existence, $x_2 = X$ be the practical state variable of the system, $x_3 = \underline{Y}^-$ be the non-reasonable response variable of the system not fitting the requirement of the environment for its existence, $x_4 = Y$ be the practical response variable of the system, $x_5 = M_{d,F}$ be the practical resources amount for the requirement of disposal force F_d, $\underline{x}^-{}_5 = \underline{M}^-{}_{d,F}$ be the non-reasonable resources amount not fitting the requirement of the system for its existence to disposal force, $x_6 = M_{d,C}$ be the practical resources load, $\underline{x}^-{}_6 = \underline{M}^-{}_{d,C}$ be the non-reasonable resources load not fitting the requirement of the system for its existence, $x_7 = M_{d,S}$ be the practical resource amount for the requirement of the system efficacy S_F, $\underline{x}^-{}_7 = \underline{M}^-{}_{d,S}$ be the non-reasonable resources amount not fitting the requirement of the system for its existence to the system efficacy, $x_8 = M_{d,L}$ be the practical attrition of the system, $\underline{x}^-{}_8 = \underline{M}^-{}_{d,L}$ be the non-reasonable attrition not fitting the requirement of the system for its existence, $x_9 = M_{d,EF}$ be the practical resources amount for the requirement of the environmental load E_F, $\underline{x}^-{}_9 = \underline{M}^-{}_{d,EF}$ be the non-reasonable resources amount not fitting the requirement of the environmental load E_F, $x_{10} = M_{d,EC}$ be the practical load formed of the system for its environment, $\underline{x}^-{}_{10} = \underline{M}^-{}_{d,EC}$ be the non-reasonable load not fitting the requirement of the environment for its existence, $x_{11} = M_{d,ES}$ be resources amount for the requirement of the ecosystem efficacy S_{EF},

$\underline{x}^-{}_{11} = \underline{M}^-{}_{d,ES}$ be the non-reasonable resources amount not fitting the requirement of the environment for its existence to the ecosystem efficacy S_{EF}, $x_{12} = M_{d,EL}$ be the practical attrition of the ecosystem, $\underline{x}^-{}_{12} = \underline{M}^-{}_{d,EL}$ be the non-reasonable attrition of the ecosystem not fitting the requirement of the environment for its existence, $x_{13} = M_{SE,\Gamma}$ be the external cooperative resources amount, $\underline{x}^-{}_{13} = \underline{M}^-{}_{SE,\Gamma}$ be the non-reasonable amount of x_{13}, $x_{14} = M_{SE,L}$ be the external competitive resources amount, $\underline{x}^-{}_{14} = \underline{M}^-{}_{SE,L}$ be the non-reasonable amount of x_{14}, $x_{15} = M_{SE,\Lambda}$ be the external concentrative interflow amount, $\underline{x}^-{}_{15} = \underline{M}^-{}_{SE,\Lambda}$ be the non-reasonable amount of x_{15}, $x_{16} = M_{SE,V}$ be the external dispersive interflow amount, $\underline{x}^-{}_{16} = \underline{M}^-{}_{SE,V}$ be the non-reasonable amount of x_{16}, $x_{17} = W_{S,\Gamma}$ be the internal cooperative resources amount, $\underline{x}^-{}_{17} = \underline{M}^-{}_{S,\Gamma}$ be the non-reasonable amount of x_{17}, $x_{18} = W_{S,L}$ be the internal competitive resources amount, $\underline{x}^-{}_{18} = \underline{M}^-{}_{S,L}$ be the non-reasonable amount of x_{18}, $x_{19} = M_{S,\Lambda}$ be the internal concentrative interflow amount, $\underline{x}^-{}_{19} = \underline{M}^-{}_{S,\Lambda}$ be the non-reasonable amount of x_{19}, $x_{20} = M_{S,V}$ be the internal dispersive interflow amount, $\underline{x}^-{}_{20} = \underline{M}^-{}_{S,V}$ be the non-reasonable amount of x_{20}, hence we should set forth the following non-rationalizing tendency model for the basic system of the equations (3 a) - (3 m) of complete factor synergetics :

The basic system of dynamical equations

$$\frac{dx_i(t)}{dt}=F_i(x_1,x_2,\cdots,x_{20})+f_i \qquad i=1,2,\cdots,20 \quad (17)$$

The basic non-rationalizing tendency function

$$x_1(t)-x_2(t)=0 \quad \text{i.e.} \quad \underline{X}^-(t)-X(t)=0 \qquad (17\,a)$$

The non-reasonable restrictive condition of essential dynamics

$$x_5(t)\le x_6(t), \quad |\underline{x}^{-}{}_5(t)-x_5(t)|<\delta$$
$$|\underline{x}^{-}{}_6(t)-x_6(t)|<\delta \qquad (17\,b1)$$

The non-reasonable restrictive condition of essential effect

$$x_7(t)\le x_8(t), \quad |\underline{x}^{-}{}_7(t)-x_7(t)|<\delta$$
$$|\underline{x}^{+}{}_8(t)-x_8(t)|<\delta \qquad (17\,c1)$$

The non-reasonable restrictive condition of environmental dynamics

$$x_9(t)\le x_{10}(t), \quad |\underline{x}^{-}{}_9(t)-x_9(t)|<\delta$$
$$|\underline{x}^{-}{}_{10}(t)-x_{10}(t)|<\delta \qquad (17\,b2)$$

The non-reasonable restrictive condition of environmental effect

$$x_{11}(t)\le x_{12}(t), \quad |\underline{x}^{-}{}_{11}(t)-x_{11}(t)|<\delta$$
$$|\underline{x}^{+}{}_{12}(t)-x_{12}(t)|<\delta \qquad (17\,c2)$$

The non-reasonable equilibrium condition of external dynamics

$$x_{13}(t) = x_{14}(t),\quad |\underline{x}^{-}_{13}(t) - x_{13}(t)| < \delta$$
$$|\underline{x}^{-}_{14}(t) - x_{14}(t)| < \delta \qquad (17\,d1)$$

The non-reasonable restrictive condition of external cooperation

$$x_{13}(t) > x_{14}(t),\quad |\underline{x}^{-}_{13}(t) - x_{13}(t)| < \delta$$
$$|\underline{x}^{-}_{14}(t) - x_{14}(t)| < \delta \qquad (17\,d2)$$

The non-reasonable restrictive condition of external competition

$$x_{13}(t) < x_{14}(t),\quad |\underline{x}^{-}_{13}(t) - x_{13}(t)| < \delta$$
$$|\underline{x}^{-}_{14}(t) - x_{14}(t)| < \delta \qquad (17\,d3)$$

The non-reasonable equilibrium condition of external synergy

$$x_{15}(t) = x_{16}(t),\quad |\underline{x}^{-}_{15}(t) - x_{15}(t)| < \delta$$
$$|\underline{x}^{-}_{16}(t) - x_{16}(t)| < \delta \qquad (17\,e1)$$

The non-reasonable restrictive condition of external concentration

$$x_{15}(t) > x_{16}(t),\quad |\underline{x}^{-}_{15}(t) - x_{15}(t)| < \delta$$
$$|\underline{x}^{-}_{16}(t) - x_{16}(t)| < \delta \qquad (17\,e2)$$

The non-reasonable restrictive condition of external dispersion

$$x_{15}(t) < x_{16}(t),\quad |\underline{x}^{-}_{15}(t) - x_{15}(t)| < \delta$$
$$|\underline{x}^{-}_{16}(t) - x_{16}(t)| < \delta \qquad (17\,e3)$$

The non-reasonable equilibrium condition of internal dynamics

$$x_{17}(t) = x_{18}(t),\quad |\underline{x}^{-}_{17}(t) - x_{17}(t)| < \delta$$
$$|\underline{x}^{-}_{18}(t) - x_{18}(t)| < \delta \qquad (17\,f1)$$

The non-reasonable restrictive condition of internal cooperation

$$x_{17}(t) > x_{18}(t),\quad |\underline{x}^{-}_{17}(t) - x_{17}(t)| < \delta$$
$$|\underline{x}^{-}_{18}(t) - x_{18}(t)| < \delta \qquad (17\,f2)$$

The non-reasonable restrictive condition of internal competition

$$x_{17}(t) < x_{18}(t),\quad |\underline{x}^{-}_{17}(t) - x_{17}(t)| < \delta$$
$$|\underline{x}^{-}_{18}(t) - x_{18}(t)| < \delta \qquad (17\,f3)$$

The non-reasonable equilibrium condition of internal synergy

$$x_{19}(t) = x_{20}(t),\quad |\underline{x}^{-}_{19}(t) - x_{19}(t)| < \delta$$
$$|\underline{x}^{-}_{20}(t) - x_{20}(t)| < \delta \qquad (17\,g1)$$

The non-reasonable restrictive condition of internal concentration

$$x_{19}(t) > x_{20}(t),\quad |\underline{x}^{-}_{19}(t) - x_{19}(t)| < \delta$$
$$|\underline{x}^{-}_{20}(t) - x_{20}(t)| < \delta \qquad (17\,g2)$$

The non-reasonable restrictive condition of internal dispersion

$$x_{19}(t) < x_{20}(t),\quad |\underline{x}^{-}_{19}(t) - x_{19}(t)| < \delta$$
$$|\underline{x}^{-}_{20}(t) - x_{20}(t)| < \delta \qquad (17\,g3)$$

The non-reasonable constraint relation of essential dynamical factors

$$\frac{d}{dt}(x_5(t) - x_6(t)) < 0 \quad |\underline{x}^{-}_{5}(t) - x_5(t)| < \delta$$
$$|\underline{x}^{-}_{6}(t) - x_6(t)| < \delta \qquad (17\,h1)$$

The non-reasonable constraint relation of essential effect factors

$$\frac{d}{dt}(x_7(t) - x_8(t)) < 0 \quad |\underline{x}^{-}_{7}(t) - x_7(t)| < \delta$$
$$|\underline{x}^{+}_{8}(t) - x_8(t)| < \delta \qquad (17\,i1)$$

The non-reasonable constraint relation of environ- mental dynamical factors

$$\frac{d}{dt}(x_9(t) - x_{10}(t)) < 0 \quad |\underline{x}^{-}_{9}(t) - x_9(t)| < \delta$$
$$|\underline{x}^{-}_{10}(t) - x_{10}(t)| < \delta \qquad (17\,h2)$$

The non-reasonable constraint relation of environ- mental effect factors

$$\frac{d}{dt}(x_{11}(t) - x_{12}(t)) < 0 \quad |\underline{x}^{-}_{11}(t) - x_{11}(t)| < \delta$$
$$|\underline{x}^{+}_{12}(t) - x_{12}(t)| < \delta \qquad (17\,i2)$$

The non-reasonable equilibrium constraint relation of external dynamical factors

$$\frac{d}{dt}(x_{13}(t) - x_{14}(t)) = 0 \quad |\underline{x}^{-}_{13}(t) - x_{13}(t)| < \delta$$
$$|\underline{x}^{-}_{14}(t) - x_{14}(t)| < \delta \qquad (17\,j1)$$

The non-reasonable cooperative constraint relation of external dynamical factors

$$\frac{d}{dt}(x_{13}(t) - x_{14}(t)) > 0 \quad |\underline{x}^{-}_{13}(t) - x_{13}(t)| < \delta$$
$$|\underline{x}^{-}_{14}(t) - x_{14}(t)| < \delta \qquad (17\,j2)$$

The non-reasonable competitive constraint relation of external dynamical factors

$$\frac{d}{dt}(x_{13}(t) - x_{14}(t)) < 0 \quad |\underline{x}^{-}_{13}(t) - x_{13}(t)| < \delta$$
$$|\underline{x}^{-}_{14}(t) - x_{14}(t)| < \delta \qquad (17\,j3)$$

The non-reasonable equilibrium constraint relation of external synergetic factors

$$\frac{d}{dt}(x_{15}(t) - x_{16}(t)) = 0 \quad |\underline{x}^{-}_{15}(t) - x_{15}(t)| < \delta$$
$$|\underline{x}^{-}_{16}(t) - x_{16}(t)| < \delta \qquad (17\,k1)$$

The non-reasonable concentrative constraint relation of external synergetic factors

$$\frac{d}{dt}(x_{15}(t) - x_{16}(t)) > 0 \quad |\underline{x}^{-}_{15}(t) - x_{15}(t)| < \delta$$

$$|\underline{x}^{-}_{16}(t)-x_{16}(t)|<\delta \qquad (17\,k2)$$

The non-reasonable dispersive constraint relation of external synergetic factors

$$\frac{d}{dt}(x_{15}(t)-x_{16}(t))<0 \quad |\underline{x}^{-}_{15}(t)-x_{15}(t)|<\delta$$

$$|\underline{x}^{-}_{16}(t)-x_{16}(t)|<\delta \qquad (17\,k3)$$

The non-reasonable equilibrium constraint relation of internal dynamical factors

$$\frac{d}{dt}(x_{17}(t)-x_{18}(t))=0 \quad |\underline{x}^{-}_{17}(t)-x_{17}(t)|<\delta$$

$$|\underline{x}^{-}_{18}(t)-x_{18}(t)|<\delta \qquad (17\,l1)$$

The non-reasonable cooperative constraint relation of internal dynamical factors

$$\frac{d}{dt}(x_{17}(t)-x_{18}(t))>0 \quad |\underline{x}^{-}_{17}(t)-x_{17}(t)|<\delta$$

$$|\underline{x}^{-}_{18}(t)-x_{18}(t)|<\delta \qquad (17\,l2)$$

The non-reasonable competitive constraint relation of internal dynamical factors

$$\frac{d}{dt}(x_{17}(t)-x_{18}(t))<0 \quad |\underline{x}^{-}_{17}(t)-x_{17}(t)|<\delta$$

$$|\underline{x}^{-}_{18}(t)-x_{18}(t)|<\delta \qquad (17\,l3)$$

The non-reasonable equilibrium constraint relation of internal synergetic factors

$$\frac{d}{dt}(x_{19}(t)-x_{20}(t))=0 \quad |\underline{x}^{-}_{19}(t)-x_{19}(t)|<\delta$$

$$|\underline{x}^{-}_{20}(t)-x_{20}(t)|<\delta \qquad (17\,m1)$$

The non-reasonable concentrative constraint relation of internal synergetic factors

$$\frac{d}{dt}(x_{19}(t)-x_{20}(t))>0 \quad |\underline{x}^{-}_{19}(t)-x_{19}(t)|<\delta$$

$$|\underline{x}^{-}_{20}(t)-x_{20}(t)|<\delta \qquad (17\,m2)$$

The non-reasonable dispersive constraint relation of internal synergetic factors

$$\frac{d}{dt}(x_{19}(t)-x_{20}(t))<0 \quad |\underline{x}^{-}_{19}(t)-x_{19}(t)|<\delta$$

$$|\underline{x}^{-}_{20}(t)-x_{20}(t)|<\delta \qquad (17\,m3)$$

The above model (17 a) - (17 m) should be called the basic non-rationalizing tendency model of complete factor synergetics.

VI. Conclusion

Relating to the system of basic equations of complete factor synergetics consisting of twenty nonlinear stochastic differential equations, the two new models are considered to set, which should be called respectively the rationalizing tendency model and the non-rationalizing tendency model.

The basic system of equations of complete factor synergetics and its rationalizing tendency model as well as non-rationalizing tendency model set in this paper are the 1st kind of system of equations of the new dynamics, which should be taken as the expansion for Langevin equation.

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