Semantics and Selforganization in Nanoscale Physics

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Abstract
Each complex system interacts with environment, which is changing, and the live of complex system depends on the adaptational possibility of our system. The problem of simulation of condition of guarantee to the adaptational maximum is investigating. It is suggested that the behavior of system with n variables is given to an approximation of m intersecting manifolds, n > m. If the system is considered as a multidimentional generator whereat least a part of variable interact with environment's variables, and if the objective of system is to decrease the functional of discoordination between them, the system control unit has two instruments of influence of the system. First, this is the tuning – the change of underdeterminated coefficients in the structure of the differential equations of system taking account that more is these coefficients the more accurate are the responses of the system to the change of environment. Second, this is the learning – the imposition of new restriction on the systems behavior. The amount of arbitrary coefficients in the structure,of equivalent equations is changing in the process of learning, of consecutive imposition of new and new restrictions on the system behavior. In the systems with the number of variables more than six the amount of arbitrary coefficients increase first and then going through the maximum begin to decrease. This phenomenon permits to explain the processes of growth, complication and death of a system. The existence of adaptational maximum phenomenon is proved by numerous biological, economical and physical-technical systems. We use the linguo-combinatorial method of investigation of the poorly formalized complex system, then we use the key words for creation of equivalent equations. The study of adaptational phenomenon in complex systems permits to increase the adaptational possibility in different systems. This Paper discusses utilization of linguo-combinatorial simulation approach for complex systems modeling. When dealing with complex systems one has to consider that conditions and environment are not fully determined. In the course of this paper it is discussed how a poorly formalized system can be efficiently represented and modeled by combinatorial simulation.
Keywords: Combinatorial simulation, Uncertainty, Appearance, Essence, General system theory, Physics, Biology, Semantics, Psychology.

1. Introduction

Natural language is the main intellectual product of mankind, the structure of natural intellect is reflected in natural language. Natural language is accessible for investigation.

International Journal of Computing Anticipatory Systems, Volume 22, 2008
Edited by D. M. Dubois, CHAOS, Liège, Belgium, ISSN 1373-5411 ISBN 2-930396-09-1

Scientific experience can be expensive and dangerous. Simulation permits to decrease the cost of investigating of the system. The simulation must accurately reflect the characteristics of the real world. Combinatorial simulation allows studying the full set of system variant including uncertainty. Any system contains some types of uncertainty, which are determined by their existence in real world. Humans interact with both physical objects and their descriptions by natural language, mathematics or tables. Descriptions often only partially represent the essence of real processes. The inaccuracy description introduces uncertainty. More often the uncertainty of systems is, however, inherent from the real world. This study is aimed toward such types of uncertainty in mental processes. Physical laws, the balance of energy and matter, and information limit the system behavior. In boundaries of these limits, systems interact and adapt to their systems and environment, and undergo the destructive actions.

2. Linguo-Combinatorial Simulation and Polarization Operation

Frequently we have system description in natural language. We propose to transfer from natural language description to mathematical equations. For example, we have sentence

WORD1 + WORD2 + WORD3 (1)

In this sentence we assign words and only imply meaning of words, the meaning (sense) is ordinary implied but not designated. We propose to assign meaning in the following form

(WORD1)*(SENSE!) + (WORD2)*(SENSE2)+(WORD3)*(SENSE3) = 0 (2)

In this equation Ai will denote words from English Appearance and Ei will denote senses from English Essence. Then equation (2) we can represent in following form

A1*E1 + A2*E2 + A3*E3 = 0 (3)

The equations (2) and (3) are the model of sentence (1). The equations (2) and (3) are the result of the polarization operation application. When we have the mathematical equation in the form F(x1, x2, x3)=0, we can turn to such form by means of differentiation where the partial derivatives are the appearances and the derivatives with respect to time are the essences. This model is algebraic ring and we can resolve this equation relatively the appearances Ai or the essences Ei [1,2,3]:

A1 = U1*E2 + U2*E3
A2 = – U1*E1 + U3*E3 (4)
A3 = – U2*E1 – U3*E2

or

E1 = U1*A2 + U2*A3
E2 = – U1*A1 + U3*A3 (5)
E3 = – U2*A1 – U3*A2

where U1, U2, U3 – the arbitrary coefficients, can be use the for decisions of different task on the initial manifold (2) or (3). For example, if we would like to reach the maximum of x3, we can assign the arbitrary coefficients U2 = –b*A1, U3 = – b*A2 and we get

$$\begin{aligned} dx1/dt &= U1*A2 - b*A1*A3 \\ dx2/dt &= - U1*A1 - b*A2*A3 \\ dx3/dt &= b*(A1*A1 + A2*A2) \end{aligned} \qquad (6)$$

and if b > 0 then variables x3 strive to maximum stable, for manipulation we left with one arbitrary coefficient U1.

In general if we have n variables and m manifolds, restrictions, then the number of arbitrary coefficients will be defined as the number of combinations from n to m+1 [1].

The number of arbitrary coefficients is the measure of uncertainty. Usually when solving mathematical systems the number of variables equals to number of equations. On practice frequently we do not know many constrains on our variables. Combinatorial simulation permits to simulate and study the systems with uncertainty on the base of incomplete information. It is important that we describe a system with a full sum of combinations and have the all variants of decisions. The linguo-combinatorial simulation is the useful heuristic approach for investigation of complex, poor formalized systems. Natural language is the main intellectual product of mankind, the structure of natural language reflects the structure of natural intellect of mankind and his separate representatives on the level of consciousness and unconscious. Linguo-combinatorial simulation is the calculation, which permit to extract the senses from texts. Wittgenstein wants to have the calculation of senses. In our calculation we have the three groups of variables : the first group – the words of natural language Ai, the second group – the essences Ei, which can be the internal language of brain ; we can have the different natural languages, but we have only one internal language of brain; this hypothesis open the new way for experimental investigation; the third group of variables –the arbitrary coefficients, uncertainty in our model, which we can use for adaptation in translation processes and etc

3. Combinatorial Model of Atoms

For example we consider the problem of atom simulation. For Hydrogen we have the key words

Atom + Proton + Electron (7)

Then the equivalent equation will be (3), where A1- characteristic of Hydrogen atom, in particular his specrtral characteristic, E1 – variation of this characteristic, A2 – characteristic of proton, E2 – variation of this characteristic, A3 – characteristic of electron, E3 – variation of this characteristic.

For simulation of Deuterium we will have the key words

Atom + proton + electron + neutron (8)

Then equivalent equations will be

$$E1 = U1*A2 + U2*A3 + U3*A4$$
$$E2 = -U1*A1 + U4*A3 + U5*A4$$
$$E3 = -U2*A1 - U4*A2 + U6*A4 \quad (9)$$
$$E4 = -U3*A1 - U5*A2 - U6*A3$$

where U1, U2, U3, U4, U5, U6 – the arbitrary coefficients, A1- characteristic of Deuterium atom, E1- variation of this characteristic, A2-characteristic of proton, E2 – variation of this characteristic, A3- characteristic of electron, E3- variation of this characteristic, A4- characteristic of neutron, E4 – variation of this characteristic. In case of nuclear reaction it is possible to conversion of Deuterium in Hydrogen by means of transformation of equations (9) to (4).

The same way it is possible to create the combinatorial models of all atoms from Mendeleev table and molecules. It is way for computer simulation&modeling of chemical reactions. This approach is the basement of cybernetical physics.

Today we have the problem of creation of nanorobots, which can build the different microsystems from separate atoms and molecules and which can destroy the different systems. We have the big experience about creation the man-dimension robot [2, 12], but the creation of nanorobot is the difficult problem. The linguo-combinatorial simulation can help to decide this problem. From one side we have the models of the atoms and molecules, from another side we have the models of robots and we can compare these models. For example, if we have the three-link manipulator, which describe by means of equations

$$(x1 - x4)^2 + (x2 - x5)^2 + (x3 - x6)^2 = L1^2$$
$$(x4 - x7)^2 + (x5 - x8)^2 + (x6 - x9)^2 = L2^2$$
$$(x7 - x10)^2 + (x8 - x11)^2 + (x9 - x12)^2 = L3^2$$

where x1, x2, x3 and x4, x5, x6 – the endpoints coordinates of the first link of manipulator, L1 – the length of the first link, x4, x5, x6 and x7, x8, x9 – the endpoints coordinates of the second link of manipulators, L2 - the length of the second link, x7, x8, x9 and x10, x11, x12 – the endpoints coordinates of the third link of manipulators, L3 – the length of the third link, then in the equivalent equations we will have

$$S = C^{m+1}_N = C^4_{12} = 792$$

arbitrary coefficients. Consequently, the molecules, which we can use for nanorobot synthesis, must have the bigger number of arbitrary coefficients in there equivalent equations.

Necessary condition of nanorobot synthesis is " The complexity of substance, which we use for the nanorobot synthesis, must be bigger than the complexity of control nanorobot algorithms".

Sufficient condition of nanorobot synthesis is " The nanorobot must be in adaptational maximum zone".
The structure of atoms and molecules gets over the structure of brain and determines the uncertainty of mental processes.

4. Structure of General Model of Mental Processes

If we have the key words – Perception, Attention, Memory, Thinking, Language, Emotion, Motion for simulation of mental processes, then the equivalent equation of our model will be

$$
\begin{aligned}
E1 &= U1*A2 + U2*A3 + U3*A4 + U4*A5 + U5*A6 + U6*A7 \\
E2 &= -U1*A1 + U7*A3 + U8*A4 + U9*A5 + U10*A6 + U11*A7 \\
E3 &= -U2*A1 - U7*A2 + U12*A4 + U13*A5 + U14*A6 + U15*A7 \\
E4 &= -U3*A1 - U8*A2 - U12*A3 + U16*A5 + U17*A6 + U18*A7 \\
E5 &= -U4*A1 - U9*A2 - U13*A3 - U16*A4 + U19*A6 + U20*A7 \\
E6 &= -U5*A1 - U10*A2 - U14*A3 - U17*A4 - U19*A5 + U21*A7 \\
E7 &= -U6*A1 - U11*A2 - U15*A3 - U18*A4 - U20*A5 - U21*A6
\end{aligned}
\qquad (10)
$$

where A1 – characteristic of perception, E1- variation of this characteristic, A2 – characteristic of attention, E2 – variation of this characteristic, A3 – characteristic of memory, E3 – variation of this characteristic, A4 – characteristic of thinking, E4 – variation of this characteristic, A5 – characteristic of language, E5 -variation of this characteristic, A6 – characteristic of emotion, E6 variation of this characteristic, A7 – characteristic of motion, E7 – variation of this characteristic, U1, U2, . . . U21 – arbitrary coefficients, which compose the block of control our mental structure.

The equations (10) determinate the interactions between different parts of our mental structure in the boundaries our model. From this model we have the necessity in control block, which can manipulate the arbitrary coefficients. The same equations must describe the city model [11]. This control block is the analog of the high psychology structure – Personality. The mental processes are the part of whole organism [9].

5. The Ways of Transition from One World Point to Another

The three-dimensional space and time are the four–dimensional world. The world point is the point in concrete time. The coordinates of the world point are X1, X2, X3, X4. The event is the physical phenomenon, appearance in concrete worlds point. The four-dimensional distance between two worlds points X1, X2, X3, X4 and X5, X6, X7, X8 is

$$c^2 - (X4 - X8)^2 - (X1 - X5)^2 - (X2 - X6)^2 - (X3 - X7)^2 = (X9)^2 \qquad (11)$$

where c – velocity of light, (X4 – X8) – interval of time. It is possible the different ways for transition from one point to another and it is very interesting to investigate of this question.

After differentiation the equation (10) we will have

$$A1*E1 + A2*E2 + \ldots + A9*E9 = 0 \qquad (12)$$

where:

A1 = –(X1 – X5), E1 = dX1/dt, A2 = –(X2—X6), E2 = dX2/dt,
A3 = –(X3—X7), E3 = dX3/dt, A4 = c (X4 – X8) , E4 = dX4/dt,
A5 = (X1—X5), E5 = dX5/dt, A6 = (X2 – X6), E6= dX6/dt,
A7 = (X3 – X7), E7 = dX7/dt, A8 = –c (X4 – X8), E8 = dX8/dt,
A9 = – X9, E9 = dX9/dt.

The structure of equivalent equations of this model will be

E1 = U1*A2 + U2*A3 + U3*A4 + U4*A5 + U5*A6 + U6*A7 + U7*A8 + U8*A9
E2 = –U1*A1+U9*A3+U10*A4+U11*A5+ +U12*A6+U13*A7+U14*A8+U15*A9
E3 = – U2*A1–U9*A2+U16*A4+U17*A5+ +U18*A6 +U19*A7+U20*A8+U21*A9
E4 = – U3*A1–U10*A2–U16*A3+ +U22*A5+U23*A6+U24*A7+U25*A8+U26*A9
E5 = – U4*A1–U11*A2–U17*A3–U22*A4 +U27*A6+U28*A7+U29*A8+U30*A9
E6 = – U5*A1–U12*A2–U18*A3–U23*A4–U27*A5+U31*A7+U32*A8+U33*A9
E7 = – U6*A1–U13*A2–U19*A3–U24*A4–U28*A5–U31*A6+U34*A8+U35*A9
E8 = – U7*A1–U14*A2–U20*A3–U25*A4–U29*A5–U32*A6–U34*A7+U36*A9
E9 = – U8*A1–U15*A2–U21*A3–U26*A4–U30*A5–U33*A6–U35*A7–U36*A8

where U1, U2, . . . ,U36 - the arbitrary coefficients, which can be used for tuning of the model. This system of equations is full this system covers all combination of ways between two world points.

6. Conclusion

Combinatorial simulation is the universal method for simulation & modeling and permit to create the new model in different areas – in physics, chemistry, biology, psychology etc. The universality of this method is determined the linguistic basement of simulation – natural language is the universal sign system and linguo-combinatorial simulation is everything simulation method. This approach permits to have the general method for description of mind, psychology and physical systems. We try the show the different level of models. For reliability each system must be in adaptational maximum zone. We can have the superconductivity in adaptational maximum zone. It is necessary to do the verification of these models, but its structure is interesting for understanding of complex systems in different areas of science.

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