American Journal of Modern Physics
2012; 1(1) : 7-11
Published online December 30, 2012 (http://www.sciencepublishinggroup.com/j/ajmp)
doi: 10.11648/j.ajmp.20120101.12

The linguo –combinatorial simulation in modern physics

Mikhail Ignatyev

St-Petersburg State University of Aerospace Instrumentation, St-Petersburg, Russia

Email address:
ignatmb@mail.ru (M. Ignatyev)

To cite this article:
Mikhail Ignatyev. The Linguo –Combinatorial Simulation in Modern Physics. *American Journal of Modern Physics*. Vol. 1, No. 1, 2012, pp. 7-11. doi: 10.11648/j.ajmp.20120101.12

Abstract: It is considered the systems with structured uncertainty which is determined by mean of number of the arbitrary coefficients. The arbitrary coefficients defines the chaotic behavior. Any complex system interacts with its changing environment and its viability depends on its adaptability. The number of arbitrary coefficients in the structure of equivalent equations of complex system changes in the process of learning. In systems with more than six variables, the number of arbitrary coefficients increases first, and then, passing through the maximum, begins to decrease. This phenomenon makes it possible to explain the processes of system growth, complication and death in biological, economical and physical-engineering systems. We use the linguo-combinatorial method for investigation of complex systems, in taking key words for building equivalent equations. This phenomenon is able to investigate the adaptability of different atoms and astrophysical systems. The contemporary physics must use the concept of control and information.

Keywords: Adaptability, Combinatorial Simulation, Uncertainty, Appearance, Essence, General Systems Theory, Physics, Atoms, Astrophysics

1. Introduction

The natural language is the main intellectual product of mankind. The structure of the natural intellect is reflected in natural language that is accessible for investigation. Some scientific experiments can be expensive and dangerous. The simulation techniques permit to decrease the cost for investigating these systems. The simulation must accurately reflect the characteristics of the real world. Combinatorial simulation allows studying the full set of system variants 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 in terms of natural language, mathematics or tables. Descriptions often only partially represent the essence of real processes. The inaccuracy of description introduces uncertainty. More often the uncertainty of systems is, however, inherent to 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 systems behavior. Within these limits, systems interact and adapt to other systems and environment, and undergo destructive actions.

2. Linguo-combinatorial Simulation

Frequently we use the natural language to describe systems. We propose to transfer this natural language description to mathematical equations.

For example, we have a sentence

$$\text{WORD1} + \text{WORD2} + \text{WORD3} \qquad (1)$$

where 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

$$(\text{WORD1}).(\text{SENSE1}) \, (\text{WORD2}). \\ (\text{SENSE2}) \, (\text{WORD3}).(\text{SENSE3}) \, 0 \qquad (2)$$

This equation (2) can be represented in the following form

$$\text{A1.E1} + \text{A2.E2} + \text{A3.E3} = 0 \qquad (3)$$

where Ai, i = 1, 2, 3, will denote words from English Appearance and Ei will denote senses from English Essence. The equations (2) and (3) are the model of the sentence (1). This model is an algebraic ring and we can resolve this equation with respect to the appearances Ai or the essences Ei [4,5,6]:

$$\text{A1} = \text{U1.E2} + \text{U2.E3}$$

$$A2 = -U1.E1 + U3.E3 \quad (4)$$

$$A3 = -U2.E1 - U3.E2$$

or

$$E1 = U1.A2 + U2.A3$$

$$E2 = -U1.A1 + U3.A3 \quad (5)$$

$$E3 = -U2.A1 - U3.A2$$

where U1, U2, U3 are arbitrary coefficients, can be used for solution of different tasks on the initial manifold (2) or (3) and can to define the chaotic behavior. In general if we have n variables in our system and m manifolds, restrictions, then the number of arbitrary coefficients S will be defined as the number of combinations from n to m+1 [2], as shown in Table 1

$$S = C_n^{m+1},\ n > m \quad (6)$$

Table 1. *The number of arbitrary coefficients depending on the number of variables n and the number of restriction m.*

n /m	1	2	3	4	5	6	7	8
2	1							
3	3	1						
4	6	4	1					
5	10	10	5	1				
6	15	20	15	6	1			
7	21	35	35	21	7	1		
8	28	56	70	56	28	8	1	
9	36	84	126	126	84	36	9	1

The formula (6) is the basic law of cybernetics, informatics and synergetics for complex systems. The number of arbitrary coefficients is the measure of uncertainty. Usually, when solving mathematical systems, the number of variables is equal to the number of equations. In practice we frequently do not know how many constraints there are on our variables. Combinatorial simulation makes it possible to simulate and study the systems with uncertainty on the base of incomplete information. The problem of simulation of condition, guaranteeing the existence of maximum adaptability is investigated.

It is supposed that the behavior of a system with n variables is given with an accuracy of m intersecting manifolds, n > m. If the system is considered as a multidimensional generator (Fig.1) where at least a part of the variables interact with environment variables, and if the objective of the system is to decrease the functional of discoordination between them ($\Delta 1 \ldots \Delta k$), the system control unit has two instruments of impact, a and b, upon the system. First, this is the tuning – the changing of uncertain coefficients in the structure of the differential equations of the system, taking account that the greater number of these coefficients implies more accurate system response to changing environment. Second, this is the learning – the imposing new restrictions on the system behavior. The number of arbitrary coefficients, in the structure of equivalent equations, changes in the process of learning, of consecutive imposing new and new restrictions on the system behavior. In the systems with more than six variables the number of arbitrary coefficients increases first, and then, passing through the maximum begins to decrease. This phenomenon makes it possible to explain the processes of system growth, complication and death. The existence of maximum adaptability phenomenon is observed in and proved by numerous biological, economical and physical-engineering systems.

Fig. 1 shows the interaction between system and environment. It is important that we describe a system with a full sum of combinations and have all the variants of decisions. The linguo-combinatorial simulation is a useful heuristic approach for investigation of complex, poorly formalized systems.

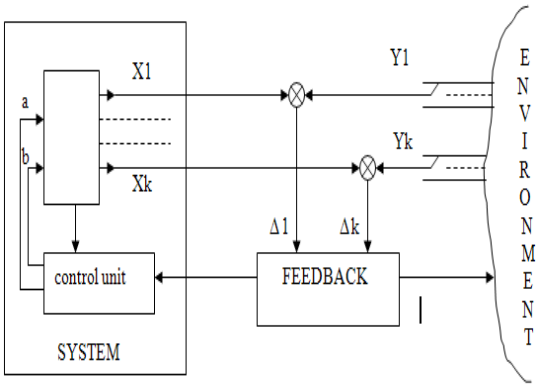

Fig. 1. *Model of "System - Environment".*

Natural language is the main intellectual product of mankind; the structure of natural language reflects the structure of natural intellect of mankind and its separate representatives on the level of consciousness and unconscious. Linguo-combinatorial simulation is the calculation, which permits to extract the senses from texts. Wittgenstein wanted to have the calculation of senses [1]. 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 [1]; we can have the different natural languages, but we have only one internal language of brain; this hypothesis opens a 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.

Each complex system interacts with environment, which are changing, and the life of complex system depends on the adaptational possibility of our system. The problem of simulation of condition of guarantee to the adaptational maximum are 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 where at 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 permit to increase the adaptational possibility in different systems and to resolve a lot of paradoxes.

3. Combinatorial Model of Atoms

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

$$\text{Atom} + \text{Proton} + \text{Electron} \qquad (7)$$

Then the equivalent equation will be (4, 5), where A1-characteristic of Hydrogen atom in particular his spectral 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

$$\text{Atom} + \text{proton} + \text{electron} + \text{neutron} \qquad (8)$$

After polarization operation

$$A^1{}_1*E1 + A^1{}_2*E2 + A^1{}_3*E3 + A^1{}_4*E4 = 0 \qquad (9)$$

And equivalent equations will be

$$\begin{aligned} E1 &= U1*A^1{}_2 + U2*A^1{}_3 + U3*A^1{}_4 \\ E2 &= -U1*A^1{}_1 + U4*A^1{}_3 + U5*A^1{}_4 \\ E3 &= -U2*A^1{}_1 - U4*A^1{}_2 + U6*A^1{}_4 \\ E4 &= -U3*A^1{}_1 - U5*A^1{}_2 - U6*A^1{}_3 \end{aligned} \qquad (10)$$

where U1, U2, U3, U4, U5, U6 – the arbitrary coefficients, $A^1{}_1$- characteristic of Deuterium atom, E1- variation of this characteristic, $A^1{}_2$-characteristic of proton, E2 – variation of this characteristic, $A^1{}_3$- characteristic of electron, E3- variation of this characteristic, $A^1{}_4$- 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 (10) to (5).

After covering the additional restriction on the system variables

$$A^2{}_1*E1 + A^2{}_2*E2 + A^2{}_3*E3 + A^2{}_4*E4 = 0 \qquad (11)$$

the equivalent equations will be (12)

$$\begin{aligned} E1 &= U1*D^1{}_{23} + U2*D^1{}_{24} + U3*D^1{}_{34} \\ E2 &= -U1*D^2{}_{13} - U2*D^2{}_{14} + U4*D^2{}_{34} \\ E3 &= U1*D^3{}_{12} - U3*D^3{}_{14} - U4*D^3{}_{24} \\ E4 &= U2*D^4{}_{12} + U3*D^4{}_{13} + U4*D^4{}_{23} \end{aligned} \qquad (12)$$

where U1, U2, U3, U4 – arbitrary coefficients,

$$D^1{}_{23} = A^1{}_2*A^2{}_3 - A^1{}_3*A^2{}_2$$

and etc.

The same way it is possible to create the combinatorial models of all atoms from Mendeleev table and molecules. The superconductivity zone is the zone of adaptational maximum. It is way for computer simulation&modeling of chemical reactions and anticipation of the new property of substance. By means of these models it is possible to resolve the Paradox in Cyber-Physical Systems and nanotechnology.

In Mendeleev table it is necessary to include the additional characteristic – the adaptational possibility of atoms and its isotopes. The elements, which are in 1, 2, 3, 4 periods, are found in adaptational maximum zone, but the elements of the next periods are found far off the adaptational maximum zone and among them we have the radioactive elements. Linguo-combinatorial simulation permits to explain the different properties of atoms and molecules.

4. Space-Time problem

The linguo-combinatorial approach is a universal method for simulation and modeling. For simulation of space-time relation we must designate the key words –

$$\text{Space} + \text{Time} + \text{Matter} + \text{Energy} \qquad (11)$$

The space-time equation will consist four variables (9, 10).

Today in astronomy and astrophysics we have a lot of facts, which need the new explanation. On another side we have the new scientific directions – cybernetics, system analysis, synergetics and informatics, which used for study of complex systems in biology, economics and techniques, and naturally to try to consider Universe how complex system and to use the accumulated arsenal of instruments of investigation of self-organizational system. This report is the attempt in this direction. We have a lot of the astrono-

my objects, but the big problem is astronomy objects interdependency. For example we examine the linguo-combinatorial simulation of solar system, where used how key words the names of planets, and detect the structural uncertainty in equivalent equations systems, which can used for adaptation in flow of changes. The constructed self-organized system is the basic building block, which can create collective on different levels – planetary, galactics etc. Star clasters are the basic blocks for creation of equivalent equations with structural uncertainty, which can use for stabilization of systems.

Today the understanding of asteroid hazard for mankind is confirmed by means of big amount of experimental facts and theoretical simulation results. The size of asteroids increase the degree of danger, it is obviously impossibility of catastrophe for big asteroids if we will be stay on old scientific paradigm[12, 13].

5. Cybernetical Astronomy and Astrophysics

If we shall take the key words – Sun, Mercury, Venus, Earth, Mars, Jupiter, Saturn, Uranus, Neptune, Pluto – 10 variables, we shall have the equivalent equations with 45 arbitrary coefficients-

$$E1=U1*A2 +U2*A3 +U3*A4 +U4*A5 +U5*A6 +U6*A7 +U7*A8 +U8*A9 +U9*A10$$

$$E2=U1*A1+U10*A3+U11*A4+U12*A5+U13*A6+U14*A7+U15*A8+U16*A9+U17*A10$$

$$E3=-U2*A1-U10*A2+U18*A4+U19*A5+U20*A6+U21*A7+U22*A8+U23*A9+U24*A10$$

$$E4=-U3*A1-U11*A2-U18*A3+U25*A5+U26*A6+U27*A7*+U28*A8+U29*A9+U30*A10$$

$$E5=-U4*A1-U12*A2-U19*A3-U25*A4+U31*A6+U32*A7+U33*A8+U34*A9+U35*A10 \quad (12)$$

$$E6=-U5*A1-U13*A2-U20*A3-U26*A4-U31*A5+U36*A7+U37*A8+U38*A9+U39*A10$$

$$E7=-U6*A1-U14*A2-U21*A3-U27*A4-U32*A5-U36*A6+U40*A8+U41*A9+U42*A10$$

$$E8=-U7*A1-U15*A2-U22*A3-U28*A4-U33*A5-U37*A6-U40*A7+U43*A9+U44*A10$$

$$E9=-U8*A1-U16*A2-U23*A3-U29*A4-U34*A5-U38*A6-U41*A7-U43*A8+U45*A10$$

$$E10=-U9*A1-U17*A2-U24*A3-U30*A4-U35*A5-U39*A6-U42*A7-U44*A8-U45*A9$$

In this equations system A1 – characteristics of Sun, E1 – variation of this characteristics, A2 – characteristics of Mercury, E2 – variation of this characteristics,…, U1, U2,…,U45 – arbitrary coefficients, which are the structural uncertainty. For stability the sun system must be in the adaptation maximum zone.

For retaining the system within maximum adaptability zone, we have the different instruments – increasing the variables number, imposing new restrictions or removing the old ones etc. For example, we can joint different systems in an integral system to increase or decrease the adaptability of systems. So, from the two following systems

$$\text{S1} \quad C_{n1}^{m1+1} \text{ And S2} \quad C_{n2}^{m2+1} \quad (13)$$

we can joint them in imposing new restrictions, mcol, in view of obtaining the new collective system

$$\text{Scol} = C_{n1+n2}^{m1+m2+mcol} \quad (14)$$

where the adaptability of this new system can be either Scol > S1 + S2 or Scol < S1+ S2 depending upon concrete parameters. We can only see the collective, total effect. By means of these models it is possible to create the adaptive chemistry and the adaptive nuclear physics and to resolve the paradoxes of approaching complexity and global collaboration.

For example, the dark energy and dark matter can be considered how result of the external control that can be the indirect proof of the existence of another smart worlds [11,12,13].

6. Conclusion

The combinatorial simulation is a universal method for simulation and modeling. With it, it is possible to create a new model in different areas – in physics, chemistry, biology, psychology, etc. The linguistic basement of the simulation determines the universality of this method: the natural language is the universal sign system and the linguo-combinatorial simulation is thus the simulation method, perhaps, of everything. We have tried to show different levels of models. For reliability, each system must be then within maximum adaptability zone. It is necessary to carry out the verification of these models, but their structure is interesting for understanding complex systems. In contrast to biology and economics, physics do not use the concept of control and information. In this article we try to introduce these concepts in physics and hope, that cybernetical physics help us to overcome the great ecological crisis [5,11,13].

References

[1] Morick, H. (Ed): Wittgenstein and the problem of other mind. N.Y.(1967).

[2] Ignatiev, M.B.: Golonomical automatic systems.(in Russian) Publ..AN USSR, Moscow-Leningrad , 204 p.(1963).

[3] Ignatiev, M.B., Kulakov, F.M., Pokrovskij, A.M.:Robots-manipulators control algorithms.(in Russian) Leningrad, 248 p.(1972).

[4] Ignatiev, M.:Simulation of Adaptational Maximim Phenomenon in Developing Systems. Proceedings of The SIMTEC'93 - 1993 International Simulation Technology Conference, San Francisco, USA.(1993).

[5] Ignatyev, M., Makina, D., Petrischev, N., Poliakov, I., Ulrich, E., Gubin, A.: Global model of organism for decision making support. Proceedings of the High Performance Computing Symposium – HPC 2000, Ed. A. Tentner, 2000 Advanced Simulation Technologies Conference, Washington D.C. USA p.66-71(2000).

[6] Ignatyev, M.B.: Linguo-combinatorial method for complex systems simulation. Proceedings of the 6th World Multiconference on Systemics, Cybernetics and Informatics, vol.XI, Computer science II, Orlando, USA p.224-227.(2002).

[7] Ignatyev, M.B.: Seven-blocks model of city for decisions making support .(in Russian) Proceedings of the seminar "Computer models of urban development" St-Petersburg, Russia, p.40-45.(2003).

[8] Ignatyev, M.B.: The study of Adaptation Phenomenon in Complex Systems. AIP Conference Proceedings, Melville, New York, vol.839, p.322-330.(2006).

[9] Ignatyev, M.B.: Information technology in micro-,nano- and optoelectronics.(in Russian) Monograph, St-Petersburg, 200 p.(2008).

[10] Ignatyev, M.B.: Linguo-combinatorial simulation of complex systems. Journal of Mathematics and System Science, vol.2, Number 1, January 2012, p.58-66.(2012).

[11] Ignatyev, M.: Asteroid Hazard Prevention Problem Analysis.(in Russian) Proceedings of the International Conference of Asteroids Hazard – 2009, St-Petersburg.(2009).

[12] Ignatyev, M., Pinigin, G.: Linguo-combinatorial simulation of Universe. XXV General Assembly of International Astronomical Union, July 2003, Sydney, Australia, Simposium 216, Maps of the Cosmos, IAU 01105 , (2003).

[13] Ignatyev M. "Cybernetical picture of world. Complex systems theory" (In Russian) St-Petersburg, 448 p., (2011).

[14] Masters K. "A Zoo of Galaxies", IAU 28th General Assembly, Beijing, China, (2012).