CONSCIOUSNESS, SUB-CONSCIOUSNESS AND EMOTIONS, SOUL AND KDS

Zinoviy Rabinovich, Yuriy Belov

Annotation: *The report discusses some neurophysiologicai and other phenomena, interpretation of which persuasively supports, although indirectly, coceptual views developed by the authors, concerning memory organization in human brain and the processes that occur in it.*

Keywords: *memory, soul, consciousness, subconsciousness, emotions, problem solving.*

Introduction

 First of all, it should be mentioned, that the terms used in the report title are meant by the authors as encyclopaedic (borrowed from the "Encyclopaedic dictionary" of 1981 edition), i. e. usual, colloquial

not subject to any modern interpretation.

This is especially important, for, as it often happens, all arguments concerning nature as natural mechanisms of subconsciousness, consciousness and soul (which is often idealistically separated from its natural essence), arise because of different understanding and interpretation of the terms. In this meaning the brain itself is the concentration of the notions expressed with the above mentioned terms. Scientific literature qualifies brain research as one of three main scientific problems of today (the other two being the State and the Universe). This research is subject to two main objectives: many-sided cognition and, accordingly, applied use (including its use in artificial intellect). Our point of view is that such bionic use is of most interest within the problems of KDS (Knowledge, Dialog, Solution) -because it consists of rational adoption of certain qualities, peculiarities and mechanisms of thinking, viewed as information processing in the brain memory (hereafter – Memory), for information mechanisms and technology. Besides, the problem of KDS in itself is of great interest for the cognition of the mechanisms of human thinking. Indeed, human thinking is defined as both processing of sensory information and as work at knowledge, represented in the language, which is the main attribute of conscious thinking. This issue will be discussed later, now we will only mention that the processes taking place in human soul, which according to the encyclopedic definition is the inner world of a person, consist exactly of a combination of processes of unconscious and conscious thinking, i. e. work at knowledge, which is represented by the first symbol K in abbreviation KDS. Furthermore, thinking as such takes place in double-sided communication of the thinking substance with the outside environment, in other words, in a dialogue with it, which is represented by the second symbol D in KDS. And, finally, the third symbol S, which implies problem solving, is the essence of human thinking (including the main component for the artificial intellect directed at solving particular problems). Thus, studying the mechanisms of thinking as one of the main problems of cybernetics (in its classical, traditional sense) in relation with the problems of KDS, turns out to be rather useful, taking into account that extraordinary circumstance,that the problems of KDS are already equipped with effective mathematical formal descriptions – the theory of representation and knowledge processing, the theory of semantic networks, the theory of probability and its application for solving the problems of model–creation and making defective decisions, defective optimal evaluation, theoretical analysis of possibilities, processing and interpretation of experiment, etc.

The authors' reports at the previous KDS conference contain the conceptual views which deal with the images recognition and problem solving in human memory [1], which are hypothetical, but at the same time supported by the mathematical analogue-computation research of cognitive processes in brain memory[2].This research was based upon the experimental data which was kindly provided by the neurophysiologist, Doctor of Biology, assistant–professor of Moscow State University, named after M. V. Lomonosov, G. S. Voronkov with whom the authors have a long–standing scientific cooperation.

In the report the authors list in addition some neurophysiological phenomena (among which are those discovered quite recently), the interpretation of which, though indirectly, but persuasively supports our conceptual views on memory organization in human brain and the processes that occur in it. This makes it possible, in our opinion, to transfer them from the category of probable and hypothetical to the category of authentic.

Consciousness, unconsciousness, emotions and soul

Without reiterating the aforementioned conceptual ideas we will recapitulate just its main essence to an extent which is necessary for further understanding and expounding the subject of this report. So, what is the brain memory (Memory) as the receptacle of stored knowledge, subconscious, conscious and soul as a whole? As it is known, Memory is only a part of the brain neuron network, the part in which the traces of incoming information, reproduced when stimulated, are formed. The rest of the neuron network of the whole organism serves for the transmission of the information to Memory, transforming accordingly the incoming signals from the environment without memorizing them. Since the information transmitted to Memory is of the enormous discretion it should be generalized, or in other words, structured, to make its representation possible. The information generalization is achieved with the hierarchical pyramidal structures   which arise in the basis of the neurons and links between them, The foundations of these pyramidal structures are composed of all incoming sensory data and their apices are symbols themselves. Hence, the pyramid of the image consists of the hierarchy of the subimages which can be part of other images, which are connected with it by association. The orientation of the links determines the diffusion of stimulation, i. e. the above mentioned generalization is achieved through directing the stimulation upwards. But the presence of only such links in the pyramids of image is not sufficient and its formation in the form of the remembered structure demands the presence in the pyramids of image of the inverse, i. e. descending links from its top to the tops of the subimages to the foundation of the pyramid.

This claim arose out of the fundamental hypothesis, which states that the reproduction of the memorized image is achieved through the stimulation of the same Memory components, which have provided the image perception, i.e. the components that are in the foundation of the pyramid.

This completely particular statement, which originates, first of all, from the common sense, in its less concrete, i. e. more general aspect which is not connected to pyramidl structures, of images, can already be observed in modern literature as explanatory presence and the role of the inverse links connecting the "upper " sections of the cerebral cortex with its "lower" sections, responsible for the perception of external information.

In general the above mentioned hypothesis (viewed by the authors as the main hypothesis) indicates the border in the neuron network of the brain between "non-memory" and Memory itself, which in this way begins where inverse descending links end. In this sense brain memory resembles computer system memory, which is the result of outlet to input shorting (through the ansas inside the memory). Stimulation of the outlets in Memory, i. e. the tops of the pyramids, spreads via inverse links and leads to the stimulation of their components including the very foundations. This process, according to our hypothesis, is the phenomenon of recollection as action, the so-called mental look. Thus, the mental look snatches out of the multitude of the limiting memory components their definite combination marked by the top of the pyramid of an image. This recollection determines recognition of the presented image as well - because if Memory contains its whole pyramid (with all upward and downward links), then stimulation, when the image is initially presented, is transmitted through upward links, but as it moves towards the top of the pyramid, it begins to be transmitted through downward links towards the foundation. Thus, the process of image recognition is characterized by dynamic composition and decomposition, which somewhat falls behind the phase. Consequently, as this process unfolds, all the components of the image, except its very top, get stimulated twice and it is the splash of the second stimulation that means the recognition of the image. If the image is not remembered in Memory, then its presentation causes only the process of composition as its formation in Memory through direct (upward) links (the brain can see, not only the eye), but the process of decomposition will not take place because of the absence of the inverse (downward) links – consequently the component of the recurring stimulation will not receive the image, i. e. the image in the whole will be perceived as new, unknown (but exactly – in the whole).

Transition of such image into a remembered one will demand its recurring presentation, in order to create inverse links through advancement of genetically inherited links (which, as it is known, was discovered in neurophysiology). Memory is formed as a result of such training. The view which was presented above by the authors of the work is in essence the interpretation of the facts already known in neurophysiology and psychology. Nevertheless, this view includes some speculative, i. e. hypothetical conclusions, connecting these facts through the cause and effect relations, that makes them convincing. At the same time, we can name some indirect arguments which prove that the views we have mentioned above are true, but cannot be verified experimentally.

Thus, for example, the active sleep stage during which dreams occur, is caused by the rapid eye movements, which appear and are directed by the special center (quadrigeminal bodies), situated on the thalamus, which receives the primary visual information as well as inverse links from the cortex, where it is processed. That is, thalamus contains the lowest layer of memory, stimulation of components of which takes place during the active sleep stage and is accompanied by REM, just like when one is awake. Dreams are appearing images; consequently their appearance proves existence of primary components of the remembered images in the lower level of memory, as well as their reproduction in the form of constituent parts in diverse combinations which represent dreams. The indicated "existence" and "reproduction" are the key aspects of the initial hypothesis.

But the process of reproduction itself (the exact way the stimulation takes place) is not subject to the given hypothesis and, as a matter of fact, is related to the production of the splash of stimulation of the image components, which leads to its reproduction.

The hypothetical assumption that the splash takes place as a result of image decomposition was proved during the analogue–computation of the process of perception of the remembered image, which was conducted using real neurophysiological data. The analogue-computation discovered the oscillatory process, which occurs only when inverse decomposition links are present [2]. But we have direct, factual confirmation of the hypothesis about the image recognition, as a result of the splash.

This confirmation is revealed when studying the phenomena which occur in polygraph (the so-called lie-detector). The tested person is asked questions about the events supposingly known to him and his physiological state is controlled with precise instruments. If the event is known to the tested it means that it is structurally stamped on his Memory. The question about this event, i. e. the introduction of the image of the event into his Memory, will provoke automatic reaction of its recognition. This reaction will manifest itself in decompositional splash. If the event is unknown, i. e. its image is absent from Memory, the splash will not occur. The event which has happened can be stamped only in subconsciousness. The presence of the splash is registered by the instruments (in particular, it becomes apparent in the changes of the encephalogram). Thus, independently from admition or denial by the tested that the supposed event took place, the truth will reveal itself in certain physiological reaction. This reaction indirectly indicates the presence of the splash during the recognition of the once again presented image which is already stamped on Memory. This serves as a proof of the true nature of the hypothesis concerning this process.

Recognition of images as the most elementary function of Memory is inseparable from this concept, and is peculiar to any organism that possesses it. But Memory is that enclosed space which contains different structured knowledge and where all thinking takes place. Thinking is understood in broad sense as the work at knowledge including its perception, analysis, accumulation, synthesis etc. It should be particularly emphasized, that the defying factor of the nature of thinking is knowledge presentation in two forms – the form of structured images and the language form. The language form is developed considerably better in Humans than in lower organisms that possess memory. It is quite possible that it is this difference of transition from quantity to quality that makes humans Human. We should emphasize that these two forms of knowledge presentation are localized in different divisions of Memory space, which are named accordingly "Sensorium" and "Language system" [3], and also in the common highest associative system which unites them. From this point we will turn directly to the subject of the report (as it is indicated in the title). First of all, it should be mentioned that the processes of thinking are divided into conscious and unconscious. Let us consider the following: what is conscious thinking, as the process of work with knowledge in Memory which occurs on the conscious level? According to the subject of the report the answer to this question should proceed, first of all, from the use of that side of the versatile notion of consciousness which refers to its structural embodiment in the brain memory, exactly of the human brain (this notion without specifications refers exactly to Humans).This structural embodiment must ensure the possibility of social communication of a Human, as his being in the world of people. The means of such information communication is Language. All the knowledge with which conscious thinking deals is expressed in Language. The Language system of Human brain contains this knowledge (and only such knowledge is covered by the encyclopaedic notion of "Knowledge"). But, as it was mentioned above all the object images remembered in the sensory memory (Sensorium) also belong to Knowledge (although not obvious knowledge). In the thinking processes the interchange of information between the sensory and language systems of the brain takes place through the transition of stimulation. Thus, we come to the following conclusion (which is an exhaustive answer to the raised question), that the process of conscious thinking takes place due to the stimulation of dynamic structures which consist of the components of both Sensorium and Language system. This process is exactly

consistent because the stimulation in the Language system leads to the pronunciation of the words. And though, this pronunciation is mental it is caused by all the necessary commands of the nervous system (which has been experimentally ascertained in neurophysiology).

This process on the conscious level, in fact, corresponds to the encyclopaedic notion of "thinking". But thinking in the broad sense of this term, as information process of work with knowledge in Memory (no matter what form they are presented in) is characterized by the processes in Sensorium which are independent of the processes of conscious thinking which necessarily involves Language system. The thinking process in sensorium is not connected with consistent pronunciation of words and can be in general deeply disparallelized or, to be more precise, distributed. In unconscious thinking (i. e.   thinking without participation of the language system) this process can be of a spontaneous character and be initiated by unconscious desires.

In conscious thinking the process in sensorium gains certain purposefulness because of the functional correlation between logical and figurative thinking which prevail accordingly in Language system and Sensorium. In this case the preservation of the possibility of the disparallelized processing of knowledge is not accidental. As psychological research demonstrated, unconscious component in human thinking is approximately ten to fifteen times more prevalent than conscious. Consequently, subconsciousness on the level of work with knowledge and without exceeding the boundaries of consciousness, though it is in essense its basis, is of considerably more significance for Human thinking process. The above mentioned is especially clearly demonstrated by the phenomenon of targetl thinking as the process of solving the problem, which is set by the initial and target situations which are reflected in Human Memory as models on the conscious level. The essence of thinking according to its classical interpretation lies exactly in the solving of Problems, which are not necessarily defined specifically, as in the case above, but the problems that just mean the achievement of something desirable starting from the point of real. The considered case is the most interesting both for the cognition of human thinking and for the technical application of this knowledge, i. e. bionic approach towards the development of artificial intellect. That is why the hypothetical conceptional model of solving a Problem in the brain memory, which was first stated in 1979 [4] and then developed in further publications of Z.L. Rabinovich, including those written in cooperation with G. S. Voronkov [5] and Y. A. Belov [6], was of great interest among neurophysiologists, psychologists and cyberneticists. Let us briefly review its main theses necessary for further presentation of the report.

The initial and target situations of the Problem which is being solved (the term "model" is only implied) are expressed in Memory as stimulated structures that, as it is known from neurophysiology, due to the so-called emotion of interest (and in general satisfaction of a need) causes the process of aim (target situations) achievement. What kind of process is that? To make the answer to this question clear the notion of "Problem Generator"(PG) was introduced in the above mentioned article. PG was meant as model which unites initial and target situations which are, accordingly, its poles. Thus, PG acts as support for the Problems, which is being solved, of the potential difference on its poles (which symbolizes the above mentioned interest. The solving of the problem is achieved through the formation of the circuit, which closes initial and target situations in cause-and-effect connections. In other words the initial situation is transformed into target – in general through the creation of a line of intermediate situations.

How does this circuit appear? Initial and target situations as it was mentioned are conscious. And though they are reflected in Sensorium, they are also set in the language. This leads to logical reasoning as consecutive creation of links of circuit shorting. The shorting of the circuit possibly takes place from its both poles. Each step of such construction contains an element of conjecture as the search of the necessary information in Memory, or even as a creation of new knowledge in it That is each step like this contains a conscious question and the answer which is received as a result of conjecture. Conjecture is the manifestation of intuition.

If as a result of the whole process of solving the Problem New Knowledge is acquired and registered in the Language, this process is in fact conscious and creative.

The main role in intuitive conjecture is, apparently, played by the processes in sensorium, i. e. on the subconscious level. But after this conjecture appears it penetrates into the conscious level, making up a deficiency in PG circuit, which is perceived as striking when the conjecture has great importance. This striking will be sudden (as a remarkable psychological phenomenon, if at the moment when it occurs, PG is not stimulated, i. e. the process of solving the Problem is absent from the language system, which means lack of current conscious work at knowledge. But for this realization to occur again (i. e. for the stimulation of the PG to take place) – the stimulation of the structures in Sensorium (i. e. on subconscious level), during striking should be

so strong, so that due to the connection of Sensorium with language system it should resume stimulation of PG, inserting in it its missing link. Thus, thinking while solving the Problem involves work at knowledge the form of interaction of Sensorium and language system, i. e. on conscious and unconscious levels. This work is realized through basic operations with vertical bilateral transformation of stimulations in pyramid structures of Memory, which includes through operations connections between the structures of Memory, both vertical and horizontal the result of which is the formation of the circuit of structures which close the PG poles and which means the solving of the Problem.

This circuit – external in relation to PG, creates in this process cyclic rout of stimulation in Memory (simultaneously with stimulation of PG structures for its "support"). These cyclic routs were apparently observed in neurophysiological research as the ones that accompany thinking. Besides such indirect, in fact, experimental confirmation of the described hypothetical conceptual-modeling view on structural implementation in Memory of the process of purposeful thinking, authenticity (or let us say with caution, verisimilitude) of this view is conclusively supported with various neurophysiological phenomena. For instance, the bigger is the difference between initial and a target situation of the Problem, the more mental effort is necessary (applied to its decision through the above mentioned operations). Other examples are the phenomenon of receiving the probable solution of the Problem as sudden striking, the influence of emotional factor on the process of Problem solving (which will be mentioned later) etc.

In general, all thinking can be represented with similar models, only in more broadly defined forms, which express "desirable and real". According to the very notion of "thinking", which manifests itself as interaction of conscious and unconscious thinking the first of which is implemented in consciousness and involves the information processing in the whole Memory, and the second – in subconsciousness and is the prerogative of Sensorium and is not expressed in Language system.

Thus, consciousness is inseparable from subconsciousness, where all the sensory images are represented and subconsciousness can be interpreted as an independent subject of thinking, but working independently of it (under the influence of environment or spontaneously).

Consequently, the inner world of a Human contains both consciousness (which stands to reason) and subconsciousness, which can be also called Human soul according to the colloquial and encyclopaedic meaning of this term and also according to its materialistic interpretation (i. e. the structural organization in the brain), which is the basis of the described conception.

But the inner world of a Human, i. e. his soul contains not only consciousness and subconsciousness, as the semantic categories, but also manifestations of emotions, which appear as the result of the influence of emotiogenious organs which affect directly the physiological characteristics of Memory components with chemical mediators (the excitation thresholds of basic elements, the "conductivity" of links between them). Besides, the chemical mediators are secreted, mainly, in the lower layers of Memory (in its so-called "organic field", which is characteristic of animals, possessing the central nervous system, but in the form of its upper layers). And such state of Memory, which is localized, i. e. connected with the stimulation of its certain structures (already with the help of electric mediators) generates correspondent mood as a feeling. For example – interest, inspiration, astonishment, alarm, etc. Thus, Memory seems to have two classes of outputs – the principal semantic and emotional in which the subconscious plays the main role. On the inputs of Memory the receptor signals have the so-called "emotional colouring" which depends on the type of the influence under which they were formed and the mediator complex by which they were expressed.

Thus, thinking on the conscious and subconscious levels is not only implemented in the sphere of Memory, but undergoes the influence of the changeability of this sphere, in its turn influencing the changeability. That is the dialectics of the process.

In this meaning, the already mentioned process of purposeful thinking is the characteristic example. The emotion of interest as a moving force of the human thinking, in general has a great influence on this process this emotion leads to the increase of the "difference of potentials" of PG and "conductivity" of links between the stimulated PG structures. In such way it promotes the appearance of inspiration, as the highest emotional wholesome influence on this process.

Thus, the Human soul is the concentration of three interconnected components – consciousness, subconcsiousness and the system of emotions, each of which is highly individualized in every human, which, however, determines the importance of determining common conceptual paradigms of the inner world of a Human, both for the purpose of their cognition and for the applied use in the various fields of human activities.

According to the subject of the report, we consider the cognition of Soul from the perspective of the KDS problems. Thus, let us concentrate on the first problem of Soul which correlates with knowledge, at which both Human consciousness and subconsciousness work. In this regard, somewhat digressing from the literal expounding of the subject of the report, let us produce a sensational and interesting piece of information, which additionally proves correctness of assuming as the basis the correlation between the notions of knowledge, language, their representations and emotions.

Among all the natural organisms, only Humans possess such wealth of language and knowledge which is expressed with its help. And by definition, i. e. by agreement, this refers to the notion of Human soul. Maybe it is not right? Maybe it is a defective agreement and the human soul is something else – something independent from knowledge and language notion, which is characteristic to some extent of other organisms, which do not posses human qualities, dealing with Knowledge and the Language of their representation. So, the experiments, which were recently carried on, in Lviv revealed ("Facts" newspaper ("Fukty"), the 17th of March, year 2006), that the luminescence around the human head (aura) lasts for seventy-two hours after his death. This fact proved the results of research conducted by Professor K. Korotkov, of Saint Petersburg State Technical University of information technology, precise mechanics and optics. But this research confirmed the discovery made by K. Korotkov (which has not yet obtained general recognition of the official science), moreover they revealed that such luminescence is completely absent around the dead animals, i. e it disappears immediately after the animal's death. What does it indicate? It indicates the fact that the developed conscious thinking (as a processing of knowledge represented in language) characteristic only to Humans is supplemented with the second, characteristic only to Humans feature – aura inertia. The question naturally arises: can this aura be the material field form of the information representation of a Human soul (that, generally speaking, complies with the theory of noosphere by V. I. Vernadskiy, the phenomena of telepathy and telekineticism etc.)? But if it is so, the conducted interpretation of the notion of soul which refers only to humans, receives additional confirmation (which at a time is not really necessary for the applied technical aspects covered by KDS, but which is interesting for purposes of knowledge

Now, let us move on to the possibility of the bionical approach towards the representation and processing of knowledge in artificial intellect.

As it was mentioned above, the knowledge in Memory is represented by the complex of networks of pyramid structures which consist of two forms of neuron networks – sensory images (Sensorium) and verbal notions (Language system) which have common spheres on their higher levels. These networks are created by the basic link operations between the stimulated elements of these structures, through which the stimulation spreads. Besides, these links are vertical bilateral within each pyramid and horizontal, connecting the other pyramids. That is the neuron networks begin from the entry of information into Memory, but they do not end as separate protruding complex heads of pyramids, instead they form "web" of their interlacements. And it is in this "web" that the images light up dynamically. These images are either recognized, if the "web" contains them, or realized as new, not known yet. The declarative knowledge is concentrated mainly in Sensorium, Language system contains both declarative and operative knowledge.

The bionical approach towards knowledge representation and work on it in artificial intellect mean, first of all, the conceptual analogue-computation of Memory contents, or to be more precise – of our ideas about it. This can be achieved in two ways – through structural and programme realization. The first on because of insuperable technical and information-technological difficulties is practically possible only for limited specialized application. The second one, which can prove not to be so effective in work as the first one, is, in fact universal, restricted only by quantitative parameters. It is already determined by the capacity of application of calculating devices (computer engineering techniques).

Thus, it is the second universal realization which can be practically and effectively applied for solving different tasks that deal with artificial intellect (the most important of which probably are the tasks of problem solving). But it is implemented as analogue-computation of structures and processes only in the Language system of Memory – because all the information processed in the programme must have verbal representation.

Certainly, in this case the mathematical apparatus is indispensable for the representation of the mentioned network of pyramid structures and operations in it. The above mentioned growing pyramidal networks (GPN) can effectively serve as a basis for such apparatus. Indeed, in these networks, the images, as the combination of signs are presented by correspondent pyramids, the connections between which are implemented by common associative elements and through the transmission of stimulation. The mathematical apparatus of GPN has

already been successfully applied for solving a number of practical tasks – the synthesis of chemical compounds, classification, recognition by analogy and a number of others, which was stated in the known publications by V. P.Gladun and the members of his scientific school. This apparatus was approved both for the analogue-computation of some brain processes (namely, the model of aforementioned process of image recognition), and (with appropriate development) in the creation of the methods of designing highly productive computers on the basis of bionical approach [7, 8].

Lately, not without the influence of the demands that arise because of the conditions of the development of this approach, the GPN apparatus was broadened due to the introduction in it of the procedures of decomposition (also known as deductive and divergent), and of the procedures of composition (also known as deductive and divergent),anc of the procedures of composition(also known as inductive and convergent).. The creation or disparallelized variants of solving the problems of artificial intellect is also desirable. These variants should include the procedures based on bionic approach, which are oriented at the realization of these variants based on the super-highly productive multimicroprocessing computers (with cluster architecture), in which, as we can surmise with a certain degree of assurance [9], the sphere of thinking should be effectively reflected. Such machines, like the first models of the Ukrainian line of cluster supercomputers have already been created[10] the development of this line continues [8,9].

Let further development in the direction be perceived as the epitaph to the main designer of these machines, an outstanding scientist, the participant of previous KDS conferences, Professor Valeriy N. Koval who passed away so suddenly.

Literature

[1]   Rabinovich Z.L.: Conceptual representation about pattern recognition and problem solving in human memory and possibility of its using in artificial intelligence.// KDS-2005 Proceedings. - Volume I. - XI Conf. - June 20-30, (2005) Varna, Bulgaria. - p. 1-8(in Russian).

[2]   Yuriy A. Belov, Sergiy V. Tkachuk, Roman V. Iamborak. Mathematical and Computer Modelling and Research of Cognitive Processes in Human Brain. Part II. Applying of Computer Toolbox to Modelling of Perception and Recognition of Mental Pattern by the Example of Odor Information Processing, XI-th International Conference KDS-2005 Proceedings V.1, FOI-Commerce, Sophia, 2005, pp. 32-36.

[3]   Voronkov G.S., Rabinovich Z.L.: Sensor and lingual systems - two form of knowledge representation. // News of artificial intelligence. (1993) p. 116-124 (in Russian).

[4]   Rabinovich Z.L.: A particular bionic approach to structural modelling of purposeful thinking. // Cybernetics (1979) No 2. - p. 114-118 (in Russian).

[5]   Rabinovich Z.L., Voronkov G.S.: // Knowledge representation and processing in interaction of sensor and language human neuro-system. // Cybernetics and system analysis (1998) No 2. - p. 3-11 (in Russian).

[6]   Zinoviy L. Rabinovich, Yuriy A. Belov. Conceptual Idea of Natural Mechanism of Recognition, Purposeful Thinking and Potential of Its Technical Application. Mechanisms, Symbols and Models. First Intern Work-Conference on the Interplay , Spain, June, 2005, Proceedings, Part I.

[7]   Zinoviy L. Rabinovich, V. A. Yaschenko. One approach to process of thinking modelling based on growing neuronal networks // Cybernetics and system analysis (1996), No 5, p. 3-20 (in Russian).

[8]   A. A. Morozov, V. A. Yaschenko. PC intellectualisation based on new class of growing neuronal networks // NAN Ukraine 1997, 125 (in Russian).

[9]   Zinoviy L. Rabinovich.: On concept of machine Intelligence and its development. // Cybernetics and system analysis (1995) No 2. - p. 163-173 (in Russian).

[10] Valeriy Koval, Sergey Ryabchenko, Volodimyr Savjak, Ivan Sergienko, Anatoliy Yakuba, XI-th International Conference KDS-2005 Proceedings V.1, FOI-Commerce, Sophia, 2005, pp. 98-103.

[11] Yuriy A. Belov, V. P. Didenko, O. E. Citritskiy and others. Mathematical support of complicated experiment, Kyiv: «Naukova dumka», 1982-1990, vol.1-5 (in Russian).

Authors' Information

Zinoviy Rabynovych – professor, doctor of technical sciences, Academician Glushkov Institute of Cybernetics, Academician Glushkov avenue 40, Kyiv-187, 03680 Ukraine, e-mail: : eco@public.icyb.kiev.ua

Yuriy Belov – professor, doctor of physical-mathematical sciences, Taras Shevchenko National University in Kyiv, Ukraine, 03680, Kyiv - 680, Academician Glushkov Avenue 2, building 6, e-mail: belov@ukrnet.net