Main Problems the Creation of Universal Theory the Computer Science

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Abstract: The main problems of the creation of the universal theory of computer science are discussed. Short historical analysis of this question is represented. Issues related to what such a theory should be and what problems it should solve are discussed. The issue of the need to introduce a system approach in information theory is analyzed. It showed that this theory must be variant theory of everything in a global sense and must be theory of open type. We analyzed six criteria, which such theories must satisfy. An example of such a theory is polymetric analysis, a theory of variable measure and hierarchy. This concept includes the procedure for choosing the operating base (mathematical transformations) and the corresponding computational construct (connectedness parameter). Two components of this method theory of informative calculation and the hybrid theory of systems allow for resolving the main problems of modern computer science. Thus, the theory of information calculations was used for the some problems of computer arithmetic). The hybrid theory of systems was used for resolution the S. Beer centurial problem in cybernetics (the problem of information complexity) and the classification of information according to its computational complexity. Other questions of application this concept in computer science are discussed too.

Keywords: open systems, computer science, S. Beer centurial problem, universal theory, Euclid, L. Hall, Descartes, Newton, de Broglie, polymetric analysis

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1. Introduction

The problem of the creation universal theory of computer science is one of the central problems of modern science, [1], [2], [3], [4], [5], [6], [7], [8], [9], [10], [11], [12], [13], [14], [15], [16], [17], [18], [19], [20], [21], [22], [23], [24]. This problem is connected with the development of this science. If at the beginning of the formation of this science, it developed according to technological and economic needs, now it is used for all fields of knowledge and types of human activity without exception. Therefore, such a science should include the main features of the problem of formalizing knowledge, reducing it to a "computer" form, and convenience and comfort in processing it, [5]. A significant role in this is played by the computer-human dialogue, [2], [9], [10]. The less time we spend on this, the more modern computer technology and science, [9], [10].

The main element of a modern computer is a processor that deals with matrix calculations, [15]. In other words, one or another way we have to reduce the relevant problem to calculations, [5]. From this point of view, we can consider modern computer science as an extension of computational mathematics, as well as a deeper formalization of information theory, [5].

The problem of creating the foundations of computer science is closely related to the foundations of mathematics. As well as the foundations of mathematics in computer sciences, the problem of the completeness of the system of axioms is closely related. It was the problem of completeness (incompleteness) that led to a crisis in the foundations of mathematics. Thanks to tsomts, the main concepts of the foundations of mathematics can be attributed: to logical [20], formal [20], and intuitionistic [4], [5], [16], [20] to the structural concepts of the foundations of mathematics, since they use one or more sections of mathematics to solve this problem, which, as a rule, have a closed structure. Gödel's theorem on incompleteness is considered a fundamental theorem for computer science as well. This raises the question of creating a theory of open systems and developing criteria for creating such theories.

Roughly speaking the universal theory of computer science must be a theory of everything, [6]. Such theories must satisfy to six criteria, [5].

A typical representative of this theory is polymetric analysis – theory of variable measure and systems with variable hierarchy, [5], [15]. The main elements of this theory are functional numbers (generalized quadratic forms); generalized mathematical transformations (15 minimum types); information lattices; theory of information calculations; polymetric theory of measures and measurements and theory of hybrid systems, [5].

The theory of informational calculations made it possible to combine analog and numerical calculations into a single system. Its main principle of optimal (minimum) computation is the generalization of the principle of least action and the entropy laws of physics and information theory into a single "dimensionless" principle, owing to the de Broglie ratio from the thermodynamics of a point, [5], [22].

The hybrid theory of systems made it possible to combine all fields of knowledge, including verbal and non-verbal, and to classify them by complexity. The basis of complexity is the concept of completeness and the parameter of connectivity of the elements of the information construct, [5]. It was shown that only 10 minimal types of hybrid systems (systems of formalization of the knowledge) exist, but the number of these systems may be however large, [15]. Thus, Polymetric Analysis may be represented as natural concept of foundations of mathematics (mathematics is précised knowledge, [24]), [5]; variant of resolution centurial problem in Cybernetics (problem of information complexity), [2], [15] and a variant of foundations of Computer Science (realization of idea, [15], of main concept the computer science). According to this, the main problem of computer science according to [15], is the formalization of the thesis “Everything that comes from the head is reasonable”, [15].

In order to create a universal theory of computer science, we must rely this thesis, [15], on the results of the development of the foundations of mathematics, information theory, and computer science.

2. Main Peculiarities of Computer Science in its Historical Retrospective

The first computing devices are known since ancient Greece (abacus) and in other civilizations (nodular Kipu system in Peru, carvings on bones and wooden boards). Modern computer technology was starting and develoing in XVI + XIX centuries, [5], [13].

This is how mechanical arithmetic meters appeared, which could perform four arithmetic operations of addition, subtraction, multiplication, and division.First programming language was creating in XIX century, [13].

The further development of computer technology is due to the need to solve more complex problems of technical physics (for the needs of creating nuclear weapons and energy and managing complex systems, including industry and business), [9], [10].

The first computers were built on tube electronics (they are also called second generation of computers). The next third generation used semiconductor electronic generation, the fourth – integrated circuits, and modern computers use optoelectronic methods. In the process of development of the technological base of computer technology, its elements were minimized, which led to an increase in the speed of its computation, [5], [13], [14].

Accordingly, to solve these problems, programming evolved from machine programming languages to algorithmic, later to six, and at the modern stage, to synthetic ones, [9], [10].

To solve this problem, cybernetics was created (the science of control in the living and non-living world), [8]. According to, [5], [14] cybernetics is synthetical science, which is included mathematics, physics, biology, psychology, etc.

However, this synthesis may be changed. This changing is connected with development of corresponding branch of computer science. Therefore, we have biological cybernetics, economical cybernetics, physical cybernetics, theory of algorithms, computer arithmetics, etc, [5].

In general, this synthesis changes with the development of computing and is determined by the following factors [5]:

1.The complexity and specificity of tasks for which the use of computer technology is necessary.
2.The level of development of computer technology.
3.The level of software development.
4.Convenience and complexity of presenting information for the consumer.

However, cybernetics today includes, [5]: control theory; mathematical theory of communication and information; general systems theory, systems engineering and systems analysis; theory of optimization (including linear and nonlinear programming; dynamic programming; optimal control; fuzzy optimization; discrete optimization, genetic algorithms, and so on); operations research (graph theory, game theory and statistical decisions, etc.); artificial intelligence; data analysis and decision-making; robotics and other sciences, including systems engineering, recognition, artificial neural networks and neural computers, ergatic systems, fuzzy systems (rough sets, grey systems, etc), mathematical logic, identification theory, algorithm theory, scheduling theory and queuing theory, mathematical linguistics, programming theory, synergetics and all similar sciences, [5].

Wiener's definition of cybernetics, [10] indicates that we should develop computing systems based on existing biological systems. It is thanks to this that such models as Ashby's homeostat, [7], perceptrons and neural networks, [12], the theory of cellular and self-reproducing automata, [19], self-organization systems, [6], [7], etc. arose.

According to Wikipedia, computer science is the science of how to handle information, that is, to receive, recycle, store, and exchange it, [9], [10]. Computing includes the design, development, and construction of hardware and software systems; creation, structuring, and management of various types of information; carrying out scientific research on and through computers; creation of more "smart" computers; creation and use of communication and entertainment environments, etc. Sub-disciplines of computer science are computer engineering, hardware, software, computer science, information systems, and information technologies, [9], [10].

Computer engineering is a discipline that synthesizes several branches of modern electronics, including optoelectronics, and computer science in the development of hardware and software for computers, [9], [10]. Computer engineers typically use electronic circuits, software, and hardware-software synthesis, and not just software or hardware (electronic) software. They introduce hardware and software to various computer components from the design of individual microprocessors, personal computers, and supercomputers to networking. This branch of engineering solves not only the problems of computer systems but also their complexes.

Software engineering is the application of systematic, partly scientific, quantitative approaches to the design, development, management, and conservation of programs and the study of these approaches. From an amateur's point of view, this is the penetration into understanding, modeling, and getting a qualitative solution to the problem. This term was first proposed in 1968 at the NATO Software Engineering Conference. The development of programming has expanded this concept not only to engineering problems. The concept of software engineering has been extended for all knowledge and has been called the Software Engineering Knowledge Directory (SWEBOK). An international standard ISO / IEX TR 19759: 2005 was creating for SWEBOK, [9], [10].

Computer science is a synthesis of scientific and practical problems for calculations and their applications. Computer scientist specializes in the theory of computing and designing computer systems, [9], [10], [15].

Since the structure of computer science is changing, these changes must also be taken into account in the general theory. And this leads to the construction of a theory with a variable hierarchy.

It should be noted that the systems theory arose only in the XVIIIth century, [5], [19]. System aspects of science of XVI – XVIII centuries was generalized in XVIII century, [24] and summarized the trends that were in existed in science at that time, [5]. In this time was created system concept and action principles gave a clear definition of the system concept and its main problem – to create a doctrine with a minimum of principles, [5], [24].

Information systems are engaged in the study of additional networks of hardware and software that individual individuals and organizations use to collect, filter, work, create, and distribute data, [9], [10]. Computer information systems is a computing section that studies computational and algorithmic processes, including their principles, the creation of software and hardware, [5], [9], [10], their applications, and their impact on society.

Information technology is engaged in the use of computers and telecommunication equipment for the storage, correction, transmission, and manipulation of data, [5], [9], [10]. This term is generally used as a synonym for computers and their networks, but it also involves other information-sharing technologies such as television and telephone. Several technologies are associated with information technology. This is hardware and software for computers, electronics, semiconductor physics, the Internet, TV equipment, and commercial and computer services, [5], [9].

Information theory was created in 1948, [9]. Main law of this theory is Shannon theorem, [9]

$$dS_{ie} \geq 0,$$

where S_{ie} – information entropy [9].

However according to, [25], we have three types of information,: combinatorial; probabilistic; algorithmic. This classification, strictly speaking, does not fully correspond to the problem of information description.

From our point of view, a fourth approach should be included – systemic, because it more fully includes the main aspects of preparation, organization, and processing of information. The need to introduce a systematic approach to information description is due to the expansion and versatility of methods and methods of obtaining, describing, and presenting it. That is why general theories should be of an open type while the concept, [25] operates with closed-type theories. This follows both from Gödel's theorems of incompleteness and Newton's four rules of reasoning in physics, [26]: 1) No more causes of natural things should be admitted than are both true and sufficient to explain their phenomena. 2) Therefore, the causes assigned to natural effects of the same kind must be, so far as possible, the same. 3) Those qualities of bodies that cannot be intended and remitted and that belong to all bodies on which experiments can be made, should be taken as qualities of all bodies universally. 4) In experimental philosophy, propositions gathered from phenomena by induction should be considered either exactly or very nearly true notwithstanding any contrary hypotheses, until yet other phenomena make such propositions either more exact or liable to exception.

Gödel's incompleteness theorems and Newtonian method are epistemologically not equivalent. Gödel's theorems indicate the need to develop a theory of open systems. Such theories can claim universality. Newtonian method is the first systematic method that showed how it is possible to formalize any field of knowledge. He gives these rules in the last third edition of his "Principle". That is, he only at the end describes the method by which he created theoretical mechanics and practically indicates that it can be used for other similar problems. Practically, this is the first systematic approach to the construction of information theory. There, in the fourth rule of his deductions, there are practical pointers to the expansion of the meaning of the axioms, that is, the foundations of Gödel's incompleteness theorems are laid.

Therefore, Newtonian and Gödel's results may be expanded on all knowledge and science and roughly speaking show the necessity of creation theories of open type if we can have universal theories or metatheories, [5].

An important role in the computer system belongs to system administrators, individuals who serve and manage computer systems and networks, [5], [9], [10].

As well as cybernetics, computer science is a synthesis of many sciences and branches of knowledge.

There were attempts to make a intuitionistic universal theory of computer science, [4], [16]. First intutionistic theory or metamathematics [19], was published almost 20 years later after the publication of Gödel's paper on the incompleteness of arithmetic, which marked, if not the beginning of modern logic, at least a turning point after which nothing was ever the same. If we look at it from another point of view, this is perhaps the most successful implementation of Leibniz's program to create a universal calculus based on logic, [5]. Therefore, this system was called metamathematics, [16]. If we use Russell's inductive logical types, [17], then we will practically get a logical concept of intuitionism, which was emphasized in, [16].

A more powerful system, the intuitionistic system of computer science, was represented in, [4]. This system is practically a generalization of computer systems Mathematics [5]. Unlike logic, elements of graph theory and computer linguistics, etc., are also included there, [4]. From the point of view of calculations, Wolfram's system is more productive than Kleene's system, [16], as it includes various sciences with equal rights, [4].

As shown in, [5], unresolved problems of modern computer science are either to the theory of numbers, or to the theory of information, either to mathematical logic, or linguistics, or to their joints.

According to thesis about nature of computer science, [15], the universal theory of computer science must be open system or system with variable hierarchy and according must be satisfy next six criteria, [5], [15]:

1. It must be theory with variable hierarchy.
2. This theory must be having one or two principles.
3. It must include the nature of mathematics (analysis, synthesis and formalization all possible knowledge).
4. Sign structure of this system must unite verbal and nonverbal knowledge (mathematical and other) in one system.
5. These metasciences may be selected as expert system of existing systems of knowledge and may be use for the creation of new systems of knowledge and science.
6. The principle of continuity must be true for all possible chapters of knowledge.

It is easy to see that these criteria include both the Newtonian four rules of reasoning in physics and Gödel's theorem. In this case, if Newton's rules were made the mathematical foundations of natural philosophy and thanks to this he needed to develop the basic rules of the Euclidean system so that it could be applied to the mathematization of sciences, then these six criteria are a systematic extension of this method to all fields of knowledge and culture without exception.

3. Main Concepts of Polymetric Analysis

Main concept of Polymetric Analysis (PA) as a theory satisfies our six criteria, [5]. The basic task of PA is a formalization of triple minimum in the process of formalization of the knowledge: philosophical (methodological), mathematical, and concrete scientifically, [5].

The concept of polymetric analysis is based on the idea of a triple minimum: methodological, mathematical and specifically scientific, [5]. It should be noted that this idea was expressed by in 1590 in Bruno's work "The Triple Minimum in Measurement", [5]. In this work three indivisible quantities: the number in mathematics, the atom in physics, and the monad in philosophy, from which measurements should begin, were analyzed, [5]. Late rthese three elements were united into one monad in Leibniz's monadology, [8]. However, it was an "atomic" concept. In this sense, polymetric analysis is the result of a systematic synthesis of three main fields of knowledge. In this sense, polymetric analysis is the result of a systematic synthesis of three main fields of knowledge and is a systemic concept.

The main elements of this synthesis are functional numbers, generalized mathematical transformations, and theory of hybrid systems.

Roughly speaking, we have to go back to Newton (his four rules of reasoning in physics). It was these rules, although they were written as a supplement to Newton's axiomatic method that played a significant role in the formalization of knowledge and the creation of theoretical sciences. The logical direction itself was initiated by W. Leibniz, who tried to use logic to build a universal calculus, although from a computational point of view, integro-differential calculus is more powerful than mathematical logic, [5].

The main mathematical elements of PA are functional elements of quadratic forms (roughly speaking generalizing polyfunctional matrixes), [5], [15]. This grope is represented by functional parameters and functional numbers.

The second group elements of PA is mathematical and other transformations, which allow connecting the mathematics (roughly speaking the ordering and formalization) with proper science, [5]. Quantitative and qualitative transformations are introduced here, which correspond, roughly speaking, to primary and secondary measurements. Based on functional numbers and these transformations, the main elements of calculations – generalized constructive mathematical elements were constructed.

The third group elements of PA are system aspects: creation of proper theories and systems of analysis, synthesis, and formalization of the knowledge, [5]. Among them:

1. Polymetrical theory of measure and measurements. This theory is based on two principles: the principle of asymmetry the measurement for primary measurement and the principle of dimensional homogeneity for secondary measurements. For this case generalized mathematical elements is the elements of polymetrical measure, which is including procedure off measurements
2. Information lattice – manifold of generalized mathematical elements. In this case, generalized constructive mathematical elements is a generalized knot of infiormative lattice.
3. Theory of information calculation, which is constructed on the informative lattice.
4. Hybrid theory of systems – universal theory, which allows to classified of all possible concepts and theories by degrees of their complexity. This theory is based on two criteria: the criterion of reciprocity and the criterion of simplicity and the parameter of connectedness. The criterion of reciprocity is the principle of the creation of the corresponding mathematical constructive system (informative lattice). The criterion of simplicity is the principle of the optimization of this creation, [5].

This concept allows formalizing the Pythagorean phrase "Numbers are ruling the World", [7].

Detailed main axiomatic of PA is represented in, [5], [15]. Now we represent only the necessary elements of this axiomatic, [5].

Definition 1. **Mathematical construction (constructive)** is the set of all possible elements, operations, and transformations for the resolution corresponding problem. The basic functional elements of this construction are called constructive elements, [5].

To further describe the theory of information calculations (computing), we need to introduce the notion of information lattice, [5].

Definition 2. A generalized knot or generalizing constructive mathematical element is a ratio:

$$ {}^{stqo}_{nmab}B^{\alpha\beta\gamma\ldots}_{ijl\varphi} = A_{i_1}\ldots A_{i_\alpha}\bar{A}_{i_1}\ldots\bar{A}_{i_\alpha}O_{k_1}\ldots O_{k_\gamma}\bar{O}_{p_1}\ldots N_{\varphi_{ij}}. \quad (1) $$

Where $N_{\varphi_{ij}}$ – functional numbers, A_{i_1} – straight qualitative mathematical transformations, $\bar{A}_{i_1}$ – opposite qualitative mathematical transformations, O_{k_1} – straight quantitative mathematical transformations, $\bar{O}_{p_1}$ – opposite quantitative mathematical transformations.

Manifold of generalized knots was called informative lattice, [5].

In addition, right and left transformations are introduced, which act only on the right or, respectively, the left part of the functional number, [5]. Also, such a concept as the rank of transformations plays an important role, [5]. Supermodular arithmetic was creating to work with these elements, [5].

These transformations may be have various nature. It may be all possible transformations, [5].

Only 15 minimal main types of generalizing mathematical transformations are existed, [5]. Strictly speaking, only 9 types of transformations are mathematical in classical sense. The other six types of transformations are not mathematical in the classical sense of the word. Thus, the classification allows a single point of view to classify transformations (generalized mathematical ones) that can relate to different fields of knowledge and culture.

The manifold of generalized knots was called an informative lattice, [5].

Now we represented the general problem of calculation in modern science according to, [5]. This problem is one of central in modern computing science. Systematization and representation of large volumes of information is connected with various technical and mathematical difficulties. In some chapters of information calculation as self-numeric algorithms the general approaches and criteria of estimation the efficiency are absent.

For the resolution of this problem, the theory of informative calculation was created. Later this theory was introduced in the structure of PA.

Three types of informative calculation (computability) were selected, [5]:

1. Informative calculation (computability) C – the number of possible mathematical operations, which are required for the resolution of a proper problem.
2. Technical informative calculation (computability)

$$C_t = C\sum_{i=1}^{n} t_i, \tag{2}$$

where t_i – realization time of proper computation.

3. Generalizing technical informative calculation (computability)

$$C_g = k_{AC}C_t, \tag{3}$$

where k_{AC} – a coefficient of algorithmic complexity, [1], [5].

The main principle of this theory is the **principle of optimal (minimal) informative calculations,** [5]: any algebraic, including constructive, informative problem has an optimal resolution for minimum informative computability C, technical informative computability C_t, or generalizing technical informative computability C_g.

The idea of this principle may be more detail explaining on the basis de Broglie formula from the thermodynamics of point, [5], [22]

$$\frac{S_a}{\hbar} = \frac{S_e}{k_B} = S_g \tag{4}$$

(equivalence of quantity of ordered and disorder information [5]). Where S_a– action, ħ – Planck (Dirac) constant, S_e– entropy, , k_B – Boltzman constant ,and S_g may be represented as a dimensionless measure of information. Therefore, we can go from dimensional quantities (action and entropy) to dimensionless quantities – a number of proper mathematical operations. This formula allows uniting an information theory and physics in one system.

The theory of informative calculations was constructed analogously to the theoretical classical mechanics. The role of the action principle is introduced here to the principle of optimal information calculation. This is clearly visible from the ratio:

$$\delta S_g \geq 0. \tag{5}$$

With sign equality (=) in (5), we have the generalized second law of equilibrium thermodynamics and the action principle, with the sign greater ($>$) we have Shannon's theorem, the principle of non-equilibrium thermodynamics and the criterion for the existence of open systems [5]. It should be noted that in this case, this criterion can be extended to deterministic systems (the theory of Yu. Klimontovich includes the entropy functional), [5].

Formula (4) indicates a synthesis of theoretical physics and information theory. An attempt to bring physics and mathematics closer was made in, [4].

A hybrid theory of systems was built to systematize of the procedure of formalization and calculations on informative lattice and may be expanded on other systems, [5]. At the same time, we used Condillac's principle that the system should have a minimum of principles, preferably one, [24]. We came up with two of them: the principle of combining elements into a system − the **criterion of reciprocity**, and the principle of optimality of this arrangememinus the**criterion of simplicity**.

Strictly speaking, the second criterion of the hybrid theory of systems can be the principle of optimal information calculations. This makes it possible to use this theory both for the analysis of calculations in a more narrow sense, such as computed algorithms, and in a broader sense for the creation of a universal theory of computer science.

For more formalization, the all-famous regions of knowledge and science the **parameter of connectedness** σ_t was introduced. This parameter means the number of different bonds the one element of mathematical construction with other elements of this construction. For example, in classic mathematics σ_t = 1, in linguistics and semiotics σ_t > 1. The need to take connectivity into account when analyzing complex systems was pointed in, [1]. Taking this fact into account, we introduced σ_t. It should be noted that connectivity to one degree or another is specified in generalized transformations as well. In general, it should be separated into a separate category of values, which is what we did.

For systematization of the computational processes and procedures on information lattices the hybrid theory of systems was created. This theory is based on two principles:

The criterion of the reciprocity for corresponding systems is signing the conservation in these systems the next categories, [5]: the completeness; the equilibrium; and the equality of the number of epistemological equivalent known and unknown notions.

The criterion of the simplicity for corresponding systems is signing the conservation in these systems the next categories, [5]: the completeness; the equilibrium; and the principle of the optimal calculative transformations.

In general, there are only10 minimal types of knowledge formalization systems, [5], [15]:

1. *Simple system* is characterized by the conservation all positions of the criteria of reciprocity and simplicity for all elements of mathematical construction (functional numbers $N_{\varphi_{ij}}$ and transformations).

2. *Parametric simple system* is characterized by the conservation the criterion of simplicity only for functional numbers $N_{\varphi_{ij}}$.

3. *Functional simple system* is characterized by the conservation of the criterion of simplicity only for general mathematical transformations.

4. The S*emisimple system* is characterized by the no conservation of the principle of optimal informative calculation and with $\sigma_t = 1$.

5. *Parametric semisimple system* is characterized by the nonconservation of the principle of optimal informative calculation only for $N_{\varphi_{ij}}$ and with $\sigma_t = 1$.

6. *A functional semisimple system* is characterized by the no conservation of the principle of optimal informative calculation only for general mathematical transformations and with $\sigma_t = 1$.

7. *A complicated system* is characterized by the no conservation of the principle of optimal informative calculation and with $\sigma_t \neq 1$.

8. *A parametric complicated system* is characterized of the no conservation of the principle of optimal informative calculation only for $N_{\varphi_{ij}}$.

9. *A functional complicated system* is characterized by the no conservation the principle of optimal informative calculation only for general mathematical transformations and with $\sigma_t \neq 1$ is calling.

10. *An absolutely complicated system* is characterized of no conservation the criteria of reciprocity and simplicity and with $\sigma_t \neq 1$ is calling.

Thus, there is a finite number of types of knowledge formalization systems, and the number of implementations of specific systems can be arbitrarily large. So, from the representing 10 types of systems, only 6 are mathematical. This classification is based on the concept of completeness, which is also related to the problem of information complexity.

In modern computer technology, inductive logical types are used, [17]. There can be any number of them; just one system differs from another in the type and number of predicates. The role of predicates in PA is played by generalized mathematical transformations, which are classified using a polymetric measure, [5], [15].

Russell's types are obtained by inductive expansion from simpler ones to more complex ones, [17]. There can be any number of them. In this respect it is somewhat similar to intuitionism, there can also be an almost infinite number of mathematical systems. This fact allows us to attribute the logical, formal, and intuitionistic approach to structural approaches in the foundations of mathematics and shows that there is no significant difference between them, [5], [23]. Therefore, we have no other choice but to go to the natural concept of the foundations of mathematics. The subject of mathematics is the analysis, synthesis, and formalization of any system of knowledge, [20]. This brings us closer to defining mathematics as exact knowledge, [24], while science is ordered knowledge, [5].

This can automatically be transferred to the foundations of computer science. In the polymetric analysis, the number of types of formalization systems is finite, with only 10 types, and taking into account the types of transformations – 150. However, the number of implementations can be arbitrarily large.

4. Polymetric Analysis and Computer Science

In this section, we want to emphasize how the polymetric method with computer sciences.

Many of these issues have already been highlighted in previous chapters. This is the theory of dynamic information-physical structures, functional logic, the theory of multimedia games, the problem of image recognition in polymetric analysis, the theory of information lattices and calculations, the theory of hybrid systems, the theory of functional numbers, the theory of generalized mathematical transformations, etc., [5].

According to modern representations, [9], [10], computer science is a theoretical and applied (technical, technological) discipline that studies the structure and general properties of information, as well as methods and means of its creation (including technical), transformation, storage, transfer, and use in various fields of human activity, [5], [9], [10].

In general, polymetric analysis is a mathematical basis of knowledge and one of its main applications is the convergence of the exact and humanitarian branches of knowledge and bringing them into one system, [5], [15].

With the development of modern computer science, one should not wait for some kind of system optimization of the methods being created. An important role in the development of computer science played and still plays mathematical logic, matrix analysis, and number theory, [1], [5], [12], [15]. When the first one is used mainly for theoretical substantiation of certain computer theories or approaches and in programming, the last two sections are used in the processors, which is today the basis of real computers.

However, it should be noted that in the computer sciences arose several unresolved problems that should be solved for faster progress of both computer science and computer technology, [5], [15].

Since polymetric analysis is a universal system of analysis, synthesis, and formalization of knowledge, and based on its variable polymetric measure, it can claim the role of both theoretical foundations of informatics and generalized computer theory, [5], [15].

In contrast to the logical approach, which has a finite number of formalization types in the polymetric method, there is a finite number of types of systems (hybrid system theory) for obtaining and formalizing knowledge. Each computer science can be classified through these types of systems. In addition, in this way, one can revise computer science as a whole, as well as anticipate its development and the emergence of new components, [5], [15].

Many unsolvable problems in the theory of algorithms (multiplication of numbers and matrices) can be successfully solved in the theory of information calculation, [5]. In particular, the task of sorting arrays is successfully solved here, [5].

System approaches of the polymetric approach led to the emergence of functional logic, where each logical element is an element of a polymetric measure. It should be noted that the synthesis of logic and probability theory has led to the creation of the theory of fuzzy sets. The comprehensive logic, [26], also allows us to extend the limits of the application of mathematical logic, but not to the whole science. In any science, the main thing is to measure, evaluate and forecast the obtaining of relevant results and the question of the truth of these or other judgments is usually resolved by history.

That is why the polymetric analysis is a metatheory for the next theories: information theory, physics, and computer science, [15].

Other branches of computer science (including cybernetics, artificial intelligence, and computer arithmetic) can be extended, representing, and explained using polymetric analysis, [15].

So, the theory of informative calculations and the principle of optimal informative calculations allow for resolving many computer problems of modern cybernetics in the area of the obtained algorithms, matrix algebra, and the problem of forming arrays. This theory may be used for the resolution of computational fifth and sixth Smale's problems of modern mathematics, [5]. From a fundamental point of view, the principle of optimal informational calculations makes it possible to bring physical processes and information theory closer together. This is shown in the theory of information-physical structures, [5] and in formulas (4) and (5). PA may be used for the determination of the step of computing complexity of systems and in the choice of both an expert system and a new promising system for the corresponding synthesis (theory of hybrid systems), [5], [15].

Roughly speaking, a generalized constructive mathematical element is an element of a multifunctional matrix. A computer processor is a device that performs matrix operations. This functional "processor" can select and carry out operations of almost any calculations, including the procedure of their organization, establishment of hierarchy, and assessment of complexity at various stages of calculations. Therefore, from this point of view, it can be said that polymetric analysis is a functional extension of the processor, which includes the procedure and pre-processing of information. That is why the PA can be a candidate for the theoretical foundations of computer sciences, [15].

The problem of the complexity of information (the problem of the centurial problem in cybernetics [2]) can be presented in polymetric analysis as the problem of simplicity-complexity, [15]. The arrangement of types of systems according to their level of complexity can be a solution to centurial problem in cybertnetics, [15].

Therefore, the problem of the resolution of the problem of complexity in computer sciences must be connected with the problem of calculations, [2], [15]. This confirms Casti's hypothesis about the resolution the problem of the complexity of information with the help the calculation, [1], and maybe representing as its realization in the general sense, [15].

The main difference is that in the Casti case, we have hierarchical systems tied to a specific mathematical apparatus, while for polymetric analysis we are dealing with systems with a variable hierarchy, [15].

The Casti work is devoted to a thorough discussion of stability theory in all of its mathematical manifestations, [1]. After a rapid treatment of classical notions involving input-output and stability, and a more detailed discussion of qualitative ideas centering upon structural stability. In particular, it was presented an extended account of catastrophe theory and its relations to bifurcation analysis. In addition, several sections are devoted to the topic of the "resilience" of a dynamic process, [6]. This notion, originally motivated by ecological considerations, involves the ability of a system to persist in the face of unknown (and possibly unknowable) external disturbances. All these problems in the polymetric analysis are described using the choice of mathematical transformations and the connectedness parameter, [15].

Unlike other theoretical approaches that claim the role of a universal theory of computer science, PA is not based on existing theoretical approaches and sections of mathematics or their combination, but on the basis of a general system mathematical apparatus and procedure of creation mathematical and other theories, which is based on a generalized theory of calculations with a minimum of philosophical paradoxes. In other words, this is a further development of the methods of Pythagoras and Plato about the three types of numbers (arithmetic, sensible, and ideal), Euclid (axiomatics based on the structure of his principles), and Newton (four principles of reasoning in physics), [5]. The system properties of Godel's numbers were also pointed in [12]. Functional numbers are generalizing all types of numbers. Whole numbers may be represented as numbers of four types: first type – arithmetic numbers; second type – algebraic, stochastic, and other numbers; third type – coding numbers and fourth type – system numbers, [5]. System type numbers include the number of signs in the Egyptian mythology), [5], Cabbalas tree of sephirots, [6], Plato's ideal numbers, [5], and Dee's monadology, which is based on the number 22 (the number of letters in the ancient Egyptian alphabet), [5]. In Polymetric Analysis, all these types of numbers are combined into one system that can change the hierarchy, [5].

Formula (4) allows you to combine stochastic and deterministic calculations and systems into a single system and thus bring physical and informational processes closer together and show their interrelationship. In addition, it allows us to conclude that all theories have an information basis and can be included in a generalized theory of information. If this theory is related to calculations, like polymetric analysis, then this theory claims to be a universal theory of computer science.

It should be noted that the basis of the criterion of reciprocity is the concept of completeness in a broader sense than in Gödel's theorems, [5]. In this case, the concept of incompleteness is related to calculations and the construction of the corresponding theory. The incompleteness itself is defined through the fulfillment of the relevant provisions of the reciprocity and simplicity criteria and the value of parameter the of connectedness, [5].

Thus, we arecv expanding Gödel's incompleteness theorems on a system level. Newton's fourth rules of reasoning in physics have analogous role and may be using for the creation of other concrete theoretical sciences, [6]. However, the Newtonian method (four rules of reasoning in physics) was created for the mathamatization of natural philosophy. Therefore, these rules are also called four rules of reasoning in philosophy, [27].

Generally speaking, a universal theory of computer science should include computational processes at all stages of information preparation and processing and satisfy the six criteria listed above, [5]. This is because both the technological base of modern computer technology and the field of applications are changing. That is why the general principles of its construction, which would consider these factors, should be included in the structure of the universal theory. Polymetrical analysis has more wide application. Roughly speaking PA is a deductive addition to Newtonian method, [6]. It is resolving back problem of Newtonian rules – the creation of a universal system of knowledge and culture and the evolution of their formalizaton, [5].

In other words, if Newtonian method is the extension of Euclid's method to the mathematization of various fields of knowledge, then polymetric analysis is an extended synthesis of the methods of Aristotle and Euclid, or the extension of the Pythagorean method to modern science, [5].

The problem of any science or area of knowledge can also be considered from the point of view of a polymetric measure (formula (6)). The polymetric theory of measurements and measurements itself is based on two principles (the principle of asymmetry of measurements – the criterion of primary measurements) and the principle of dimensional homogeneity – the criterion of secondary measurements). the primary measurements include the measurement itself (the Bache-Mendeleev problem, etc.), and the secondary measurements include the selection of measured values (dimensional analysis, etc.), [5].

In general, polymetric analysis can be used not only as a universal system of analysis, synthesis, and formalization of knowledge but also as an expert system for existing knowledge systems, and the need for the feasibility of creating new effective knowledge systems that arise during the development of science, [5]. It was shown that the existing theories of measure and measurements are included in this theory as partial cases, [5].

Therefore, polymetric analysis is a universal theory of analysis, synthesis, and formalization of knowledge, which is based on measurements, including the procedure of measurements and calculations. This is the basis of this science. Computer science is based on the creation of various systems and calculation methods for the resolution of various problems of science, knowledge, and culture. Thus, Polymetric Analysis may be represented as variant of universal theory of computer science.

5. Conclusions

1. A short system historical analysis of the development of computer science is represented.
2. Necessity of creating the universal theory of computer science as a variant theory of everything in a global sense is formulating.
3. Six criteria that must be satisfied by the theories of the general deductive type (theories of everything) are given and analyzed.
4. The main concepts of polymetric analysis as a theory of everything is analyzed.
5. The relationship between polymetric analysis and computer science is showing.
6. It is concluded that polymetric analysis can be presented as a universal theoretical approach for computer sciences.

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