Polymetric Analysis: Retrospective and Perspective

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Abstract **-** The concept of polymetric analysis is analyzed. The necessity of creation, basic peculiarities of development and some application of this science are discussed. Bonds of polymetric analysis and other sciences, including mathematics, computer science and theory of information, are shown. Problem of century in cybernetics by S. Beer and way of their resolution with help of polymetric analysis is analyzed too.

Keywords *- polymetric analysis; theory of information; informtive calculations; problem of century in cybernetics; hybrid theory of systems; synthesis; unification.*

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I. Introduction

Problem of creation optimal theory knowledge or is caused of the development of modern science, including physics, cybernetics and computer science [1-6]. Complexity of calculations is one of central problems of modern cybernetics and computer science [1,7-9]. This problem is included in famous important unresolved problems of modern mathematics (Smale problems) [8].

This problem may be resolved with help polymetric analysis (PA) – system theory with variable hierarchy or variable measure.

One of basic element of variant of PA is the theory of informative calculations [1,10]. This theory may be represented as variant of the creation of universal system of calculations. The ways of resolution of this problem were searched by Pythagor and Leubniz [1]. Pythagorean way was founded on the synthesis of esoteric Egyptian mythological system and “open” Sumerian mythological system. Leubnician way was caused to creation of modern differential and integral calculations and mathematical logics [1].

PA is based on the principle of triple optimal synthesis (mathematical, methodological and concrete scientifically). It is practically optimal formalization Descartian – Newtonian method.

PA may be used as expert system of analysis of modern science and knowledge, including prognostication of generation of new sciences.

This method allow to realize the A. N. Whitehead “organismic” concept of modern mathemaics [1,11] and may be represented as system variant of resolution S. Beer problem of century in cybernetics (problem of complexity).

II. Basic Concept of Polymetric Analysis

Polymetric analysis was created as alternative optimal concept to logical, formal and constructive conceptions of modern mathematics and theory of information [1]. This concept is based on the idea of triple minimum.

Basic elements of this theory and their bonds with other science are represented in Figure 1 [1].

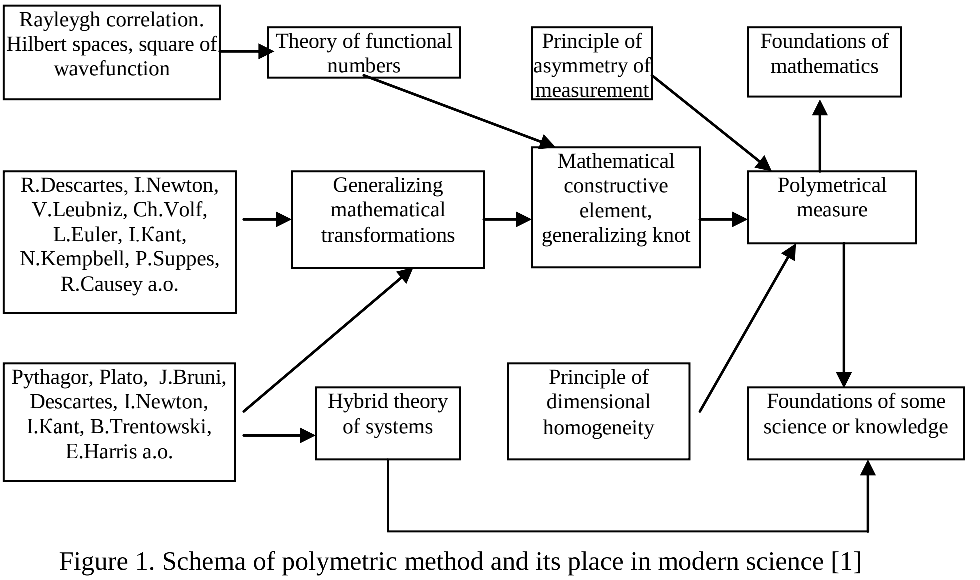

Figure 1. Schema of polymetric method and its place in modern science [1]

Basic mathematical element of polymetric analysis is functional number (generalizing elements of square forms) [1]. As in Greece mathematics number is basic elements of its system. For these numbers generalizing mathematical transformations were constructed. 15 minimal types of its transformations are existed. Informative lattice is constructed on the basis if functional numbers and generalizing mathematical transformations. Theory of informative calculations is created for this lattice. Basic principle of this theory is the principle of optimal calculations.

For classification of systems of calculation hybrid theory of systems was created. This theory is based on two criterions: criterion of reciprocity – principle of creation of proper formal system, and criterion of simplicity – principle of optimality of this creation. For "inner" bond of two elements of informative lattice a parameter of connectedness was introduced. Principle of optimal informative calculation is included in criterion of simplicity. Only 10 minimal types of hybrid systems are existed [1]. But four types of these systems aren't mathematical in classical sense [1]. Hybrid theory of systems is open theory. Parameters of openness are number of generalizing mathematical transformations and parameter of connectedness. Thereby we have finite number of types of systems, but number of systems may be infinite. Hybrid theory of systems allows considering verbal and nonverbal knowledge with one point of view [1, 12, 13]. Roughly speaking this theory may be represented as variant of resolution S. Beer centurial problem in cybernetics [1].

Mathematical constructive element may be represented as generalizing knot of informative lattice. Generalizing mathematical transformations are classified as quantitative and qualitative, left and right. Calculative (quantitative) transformations are corresponded to primary measurement and qualitative transformations – to derived (secondary) measurements. It allows formalizing N.R.Campbell concept [14, 15] about primary and derived measurements. Result of this formalization was named polymetric theory of measure and measurement. Basic principles of this theory are principle of asymmetry of measurement for calculative transformations and principle of dimensional homogeneity. This theory is optimal synthesis of all famous theories of measure and measurements and dimensional analysis [1]. N.R. Campbell concept is more general as "measuring" part of quantum mechanics. Therefore L.I. Mandelstam called Quantum Mechanics as science of derivative measurements [16].

Polymetric analysis is the system of optimal formalization, synthesis and analysis of knowledge. But it is the nature of mathematics [17]. For creation of theory of foundations of mathematics we must include three aspects: synthesis, analysis and formalization. This theory must be open system. Therefore Russel – Whitehead "logic" concept, Hilbert – Bernayce "formal" concept and Brauer – Heiting "constructive" concept can't be full theories of foundations of mathematics [1]. It was cause of crisis in theory of foundations of mathematics. Therefore A.N. Whitehead made conclusion that logical concept can't be the theory of foundations of mathematics [12]. But it must be "organismic" theory. Practically this concept was realized in cybernetics: theory of neuronets, systolic computers, theory of cellular automata a.o. [1, 2, 4]. Therefore polymetric analysis may be represented as variant of realization of Whitehead concept of "organism" mathematics and formalizing unification of proper cybernetic theories.

Polymetric analysis may be represented as optimal "dynamical' formalization of Errol E. Harris polyphasic concept of modern science [1, 18].

Thus basic concepts of awakening, creation and development of synthesis with including of historical analysis of this problem are represented in [1]. Was shown, that polymetric analysis is the necessary development of problem of formalized synthesis in modern science.

III. STRUCTURE OF POLYMETRIC ANALYSIS

Roughly speaking PA is the operational expansion of quadratic forms. Quadratic forms are the basis for the measure: from Pythagor theorem to square of wave functions in quantum mechanics. Therefore these forms were selected as basic elements of PA [1]. But it must include the procedure of the measurement and estimation of proper data. These generali8zing forms without taransformations were called functional numbers and with transformations – generalizing mathematical elements. Set of these elements (polyfunctional matrix) was called mathematical construction or informative lattice [1].

The basic axiomatic of the polymetric analysis is the next [1].

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

Definition 2 . The mathematical constructive elements $N_{x_{ij}}$ are called **the functional parameters**

$$N_{x_{ij}} = x_i \cdot \overline{x}_j , \qquad (10)$$

where x_i , $\overline{x_j}$ - the straight and opposite parameters, respectively; · - respective mathematical operation.

Definition 3 . The mathematical constructive elements $N_{\varphi_{ij}}$ are called the **functional numbers**

$$N_{\varphi_{ij}} = \varphi_i \circ \overline{\varphi}_j . \qquad (11)$$

Where $\varphi_i\left(x_1,...x_n, \overline{x_1}...\overline{x_m},...N_{x_{ij}},...\right)$, $\overline{\varphi_j}\left(x_1,...x_n, \overline{x_1}...\overline{x_m},...N_{x_{ij}},...\right)$ are the straight and opposite functions, respectively; ∘ – respective mathematical operation.

Remark 1. Functions φ_I , $\overline{\varphi}_j$ may be have different nature: mathematical, linguistic and other.

Definition 4. The mathematical constructive elements $N^d_{x_{ij}}$ are called the **diagonal functional parameters**

$$N^d_{x_{ij}} = \delta_{ij} N_{x_{ij}} . \qquad (12)$$

Where δ_{ij} is Cronecker symbol.

Definition 5. The mathematical constructive elements $N^d_{\varphi_{ij}}$ are called the **diagonal functional numbers**

$$N^d_{\varphi_{ij}} = \delta_{ij} N_{\varphi_{ij}} . \qquad (13)$$

Example 1. If $x_i = x^i$, $\overline{x}_j = x^{-j}$ and $\max\{i\} = \max\{j\} = m$, then $\{N^d_{\varphi_{ij}}\}$ is diagonal single matrix.

The another examples may be the orthogonal eigenfunctions of the Hermitian operator.

Remark 2. These two examples illustrate why quantities (1) – (4) are called the parameters and numbers. Practically it is the simple formalization the measurable procedure in Fig.1 The straight functions correspond the "straight" observation and measurement and opposite functions correspond the "opposite" observation and measurement. This procedure is included in quantum mechanics the Hilbert's spaces and Hermitian operators.

The theory of generalizing mathematical transformations is created for works on functional numbers [1].

Definition 6. **Qualitative transformations** on functional numbers $N_{\varphi_{ij}}$ (straight A_i and opposite $\overline{A}_j$) are called the next transformations. The straight qualitative transformations are reduced the dimension $N_{\varphi_{ij}}$ on *i* units for straight parameters, and the opposite qualitative transformations are reduced the dimension $N_{\varphi_{ij}}$ on *j* units for opposite parameters.

Definition 7. **Quantitative (calculative) transformations** on functional numbers $N_{\varphi_{ij}}$ (straight O_k and opposite $\overline{O}_p$) are called the next transformations. The straight calculative trasformations are reduced $N_{\varphi_{ij}}$ or corresponding mathematical constructive element on *k* units its measure. The opposite quantitative transformations are increased $N_{\varphi_{ij}}$ or corresponding mathematical constructive element on *l* units its measure, i.e.

$$O_k \overline{O}_l N_{\varphi_{ij}} = N_{\varphi_{ij}} - k \oplus l . \qquad (14)$$

Definition 8. **Left and right transformations** are called transformations which act on left or right part of functional number respectively.

Definition 9. The maximal possible number corresponding transformations is called **the rang of this transformation**

$$rang(A_i \overline{A}_j N_{\varphi_{ij}}) = \max(i, j) ; \qquad (15)$$

$$rang(O_k \overline{O}_p N_{\varphi_{ij}}) = \max(k, p) . \qquad (16)$$

Remark 3. The indexes *i,j, k,p* are called **the steps of the corresponding transformations.**

The basic types of generalizing mathematical transformations are represented in Table 1 [1].

Table 1. *The basic types of generalizing mathematical transformations.*

№	Tronsfor-mation	1	2	3	4	5	6	7	8	9	10	11	12	Representation		
														S	O	M
1	full straight	+	+	+	+	+	+	+	+	+	+	+	+	+	–	–
2	full opposite	+	+	+	+	+	+	+	+	+	+	+	+	-	+	–
3	full mixed	+	+	+	+	+	+	+	+	+	+	+	+	-	–	+
4	left full straight	+	-	+	–	+	-	+	–	+	–	+	–	–	+	–
5	right full opposite	–	+	–	+	–	+	–	+	–	+	–	+	+	–	–
6	left straight	+	–	+	–	+	–	+	–	+	–	+	–	+	–	–
7	right opposite	–	+	–	+	–	+	–	+	–	+	–	+	–	+	–
8	mixed full straight	+	-	+	–	+	–	+	–	+	–	+	–	–	–	+
9	mixed full opposite	–	+	–	+	–	+	–	+	–	+	–	+	–	–	+
10	left half-straight	+	–	–	+	–	+	+	–	–	+	–	+	–	+	–
11	mixed half-straight	+	–	–	+	–	+	+	–	–	–	–	–	–	–	+
12	right semi-opposite	–	+	+	–	+	–	–	+	+	–	+	–	+	–	–
13	mixed semi-opposite	–	+	+	-	+	–	–	+	+	–	+	–	–	–	+
14	mixed straight	+	–	+	–	+	–	+	+	+	+	+	+	–	–	+
15	mixed opposite	–	+	–	+	–	+	+	+	+	+	+	+	–	–	+

Remarks to Table 1. S – straight; O – opposite; M – мixed; 1 – A_i ; 2 – $\overline{A}_j$; 3 – A^r ; 4 – $\overline{A}^r$; 5 – A^l ; 6 – $\overline{A}^l$; 7 – O_k ; 8 – $\overline{O}_p$; 9 – O^r ; 10 – $\overline{O}^r$; 11 – O^l ; 12 – $\overline{O}^l$. In Table 1 sigh + (plus) is defined that action of corresponding transformation on $N_{\varphi_{ij}}$ is fully or particularly; sign (minus) – is absented.

Basic elements of PA is the generalizing mathematical elements or its various presentations – informative knots [1, 19]. Generalizing mathematical element is the composition of functional numbers (generalizing quadratic forms, including complex numbers and functions) and generalizing mathematical transformations, which are acted on these functional numbers in whole or its elements [1]. Roughly speaking these elements are elements of functional matrixes.

This element ${}^{stqo}_{nmab}M_{ijkp}$ may be represented in next form

$$ {}^{stqo}_{nmab}M_{ijkp} = A_i\bar{A}_j O_k \bar{O}_p A_s^r \bar{A}_t^r O_q^r \bar{O}_o^r A_n^l \bar{A}_m^l O_a^l \bar{O}_b^l N_{\varphi_{ij}} \,. \quad (17) $$

Where $N_{\varphi_{ij}}$ – functional number; $O_k, O_q^r, O_a^l, \bar{O}_p, \bar{O}_o^r, \bar{O}_b^l$; $A_i, A_s^r, A_n^l, \bar{A}_j, \bar{A}_t^r, \bar{A}_m^l$ are quantitative and qualitative transformations, straight and inverse (with tilde), (r) – right and (l) – left.

Polyfunctional matrix, which is constructed on elements (17) is called informative lattice. For this case generalizing mathematical element was called knot of informative lattice []. Informative lattice is basic set of theory of informative calculations. This theory was constructed analogously to the analytical mechanics [1].

Basic elements of this theory are [1, 12, 13]:

1. Informative computability C is number of possible mathematical operations, which are required for the resolution of proper problem.

2. Technical informative computability $C_t = C\sum t_i$, where t_i – realization time of proper computation.

3. Generalizing technical informative computability $C_{t0} = k_{ac}C_t$, where k_{ac} – a coefficient of algorithmic complexity [1].

Basic principle of this theory is **the principle of optimal informative calculations** [1]: any algebraic, including constructive, informative problem has optimal resolution for minimum informative computability C, technical informative computability C_t or generalizing technical informative computability C_{to}.

The principle of optimal informative calculations is analogous to action and entropy (second law of thermodynamics) principles in physics.

The principle of optimal informative calculation is more general than **negentropic principle the theory of the information** and **Shennon theorem** [1, 20, 21]. This principle is law of the open systems or systems with variable hierarchy. The negenthropic principle and Shennon theorem are the principles of systems with constant hierarchy.

Idea of this principle of optimal informative calculation may be explained on the basis de Broglie formula [1, 22]

$$ S_a/\hbar = S_e/k_B \quad (18) $$

(equivalence of quantity of ordered and disorder information) [1,5]. Where S_a – action, $\hbar$ – Planck constant, S_e – entropy and k_B – Boltzman constant. Therefore we can go from dimensional quantities (action and entropy) to undimensional quantity – number of proper quanta or after generalization to number of mathematical operations. Thus, theory of informative calculations may be represented as numerical generalization of classical theory of information.

For classification the computations on informative lattices hybrid theory of systems was created [1]. This theory allow to analyze proper system with point of view of its complexity.

The basic principles of hybrid theory of systems are next:

1) **the criterion of reciprocity;** 2) **the criterion of simplicity**.

The criterion of reciprocity is the principle of the creation the corresponding mathematical constructive system (informative lattice). The criterion of simplicity is the principle the optimization of this creation.

The basic axiomatic of hybrid theory of systems is represented below.

Definition 10. The set of functional numbers and generalizing transformations together with principles reciprocity and simplicity (informative lattice) is called **the hybrid theory of systems** (in more narrow sense the criterion of the reciprocity and principle of optimal informative calculations).

Criterion of the reciprocity for corresponding systems is signed the conservation in these systems the next categories:

1) the completeness;
2) the equilibrium;
3) the equality of the number epistemological equivalent known and unknown knotions.

Criterion of the simplicity for corresponding systems is signed the conservation in these systems the next categories:

1) the completeness;
2) the equilibrium;
3) the principle of the optimal calculative transformations.

Criterion of reciprocity is the principle of creation of proper informative lattice. Basic elements of principle reciprocity are various nuances of completeness. Criterion of the simplicity is the principle of the optimality of this creation.

For more full formalization the all famous regions of knowledge and science the **parameter of connectedness** $\square_t$ was introduced. This parameter is meant the number of different bounds the one element of mathematical construction with other elements of this construction. For example, in classic mathematics $\square_t$ = 1, in linguistics and semiotics $\sigma_t > 1$. The parameter of connectedness is the basic element for synthesis in one system of formalization the all famous regions of knowledge and science. It is one of the basic elements for creation the theory of functional logical automata too.

At help the criteria of reciprocity and simplicity and parameter of connectednesss the basic famous parts of knowledge and science may be represent as next 10 types of hybrid systems [1, 12, 13]:

1. The system with conservation all positions the criteria of reciprocity and simplicity for all elements of mathematical construction ($N_{\varphi_{ij}}$ and transformations) is called the **simple system**.

2. The system with conservation the criterion of simplicity only for $N_{\varphi_{ij}}$ is called the **parametric simple system**.

Remark 4. Further in this classification reminder of criteria of reciprocity and simplicity is absented. It mean that these criteria for next types of hybrid systems are true.

3. The system with conservation the criterion of simplicity only for general mathematical transformations is called **functional simple system**.

4. The system with nonconservation the principle of optimal informative calculation and with $\Box_t$ = 1 is called the **semisimple system**.

5. The system with nonconservation the principle of optimal informative calculation only for $N_{\varphi_{ij}}$ and with $\Box_t$ = 1 is called the **parametric semisimple system**.

6. The system with nonconservation the principle of optimal informative calculation only for general mathematical transformations and with $\Box_t$ = 1 is called the **functional semisimple system**.

7. The system with nonconservation the principle of optimal informative calculation and with $\Box_t \neq 1$ is called **complicated system**.

8. The system with nonconservation the principle of optimal informative calculation only for $N_{\varphi_{ij}}$ is called **parametric complicated system.**

9. The system with nonconservation the principle of optimal informative calculation only for general mathematical transformations and with $\Box_t \neq 1$ is called **functional complicated system**.

10. The system with nonconservation the criteriums of reciprocity and simplicity and with $\Box_t \neq 1$ is called **absolute complicated system**.

With taking into account 15 basic types of generalized mathematical transformations we have 150 types of hybrid systems; practically 150 types the formalization and modeling.

In comparison with other theories of systems the hybrid theory of system has finite number of types of systems. But number of systems may be infinite. This theory is the theory of open system or theory system with variable hierarchy.

Generalizing mathematical elements (17) may be represented as the elements of variable polymetric measure, which are included the procedure of measurements [1], which are corresponded N. R. Campbell concept of measurement [14, 15]. Quantitative transformations are corresponded to primary measurement; qualitative transformations – to secondary (derivative) measurement.

Theory, which are based on generalizing mathematical elements (17), was called polymetric theory of measure and measurements [1].

The basic principles of the polymetric theory of measure and measurements are the principle of the asymmetry the measurement and the principle of dimensional homogeneously. In operational representation it has the next kind [1].

Principle of the asymmetry the measurement. When process of measurement may be represent in form (17) then

$$
\begin{aligned}
&|k-p| \geq 1;\\
&|q-0| \geq 1; \qquad (19)\\
&|a-b| \geq 1.
\end{aligned}
$$

Strictly speaking sufficiently that one of formulas (20) was true.

Principle of the dimensional homogeneously. When process of measurement may be represent in form (19) then the next correlation for definition of dimensions the measurement must be true

$$
\begin{aligned}
M_{ijkp} &= \delta_{ij}\left(A_i, \overline{A_j}\right)\delta_{st}\left(A_s^r, \overline{A_t^r}\right)\delta_{mn}\left(A_m^l, \overline{A_n^l}\right)\circ \\
&\circ O_k \overline{O_p} O_q^r \overline{O_\theta^r} O_a^l \overline{O_b^l} N_{\varphi_{ij}}
\end{aligned} \qquad (20)
$$

where $\delta_{ij}\left(A_i, \overline{A_j}\right), \delta_{st}\left(A_s^r, \overline{A_t^r}\right), \delta_{mn}\left(A_m^l, \overline{A_n^l}\right)$ are the corresponding Cronecker's symbols.

The correlation (21) may be represent in more simple form

$$
\begin{aligned}
M_{ijkp} &= \delta_{i+s+n,\, j+t+m}\left(A_i, \overline{A_j}, A_s^r, \overline{A_t^r}, A_m^l, \overline{A_n^l}\right)\circ \\
&\circ O_k \overline{O_p} O_q^r \overline{O_\theta^r} O_a^l \overline{O_b^l} N_{\varphi_{ij}}\,.
\end{aligned} \qquad (21)
$$

where $\delta_{i+s+n,\, j+t+m}\left(A_i, \overline{A_j}, A_s^r, \overline{A_t^r}, A_m^l, \overline{A_n^l}\right)$ is the generalized Cronecker's symbol.

Practically the principle of asymmetry the measurement is the principle of primary measurements while the principle of dimensional homogeneously is the principle of derivative measurements.

The basic processes of measurement in more general sense (measurement and mathematical modeling and prognostication) are included in constructive mathematical element (17).

Methods of polymetric analysis were used for the decoding of Pythagorean civilization, of VI – V B.C., which was open by German archeologists in Mediterranean in 1980 – 1984; and for decoding of mathematical and linguistically part of Table of God Thot (Egyptian mythology). Multiplicative (operative) mathematical system was used for these cases. Zero and infinity weren't important elements of these systems [1].

IV. Some applications of PA

A. Introductory

Polymetric analyses may be used for the resolution of system problems of modern science and theories, which are complicated of PA, may be used for the resolutions problems of concrete science [1]..

Functional numbers may be represented as number of fourth generation (number is system element or generalizing mathematical element). This number and its generalization (knot of informative lattice) may be used as basic element of functional logic, functional logical automata, polymetric theory of measure and measurement.

Theory of informative calculations is added the modern theory of information [1]..

PA allows resolving the problem century in cybernetics by S. Beer [1, 7] in system sense and creating the natural concept of foundations of mathematics [1, 23].

B. Mechanics and problem of measurement

The place of the classical and quantum mechanics in the polymetric methodology may be represented in the form of next theorems. Further we′ll use classification of hybrid theory of systems for mechanics [1].

Theorem 1. The classical mechanics is the simple system.

Proof. The classical mechanics is closed system therefore criteria of the reciprocity and simplicity are true. The action principle is the analogous the principle of optimal informative calculations. Parameter of connectedness is equal 1. But its definition of simple system and theorem is proved.

Theorem 2. The quantum mechanics is the semisimple system : 1) in Heisenberg's representation – parametric simple; 2) in Shrödinger's representation – functional simple; 3) in the representation of interaction – semisimple system.

Proof. The quantum mechanics is closed system as classical mechanics. But the criterion of the simplicity isn't true for operators (in Heisenberg's representation), for wave functions (in Shrödinger's representation) and for operators and wave functions (in representation of the interaction). Parameter of connectedness is equal 1 for all three representations. But it is the definitions of proper systems and theorem is proved.

This theorems practically are represented the system character of the theoretical (classic) and quantum mechanics in modern science.

Optical interpretation of quantum mechanics is based on polymetric method [1].

The optical interpretation of the quantum mechanics is based on the optical physical (wave) analogous and one application to the quantum mechanics. The elementary schema of the measurement is represented in Figure 2.

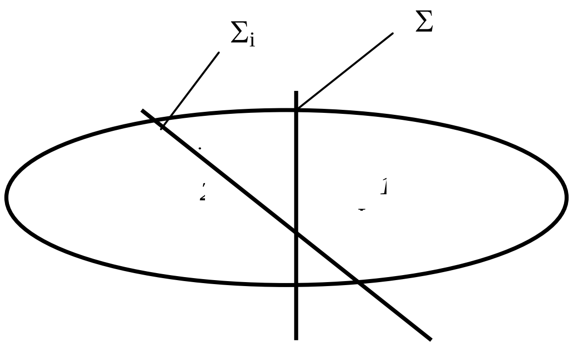

Figure 2. The elementary schema of the measurement [1].

The part 1 (logic region) in Figure 2 is represented the region of all phenomena and processes which can be measured with help primary measurements. In this case the unit of the measurable quantity is less or equal than minimal possible value of one. Respectively the part 2 (chaotic region) in Figure 2 is represented the region of all phenomena and processes which can be measured with help derivative measurements. The section Σ is a border between logic and chaotic regions of the measurement. The pure basic and derivative measurements in modern science are absented practically. The real measurement (section Σ_i in Figure 2) include the both measurements (primary and derivative).

The Rayleygh's correlation and the square of wave functions may be represented as particularly case of the schema the measurement of Figure 2 in epistemological sense. The first is the basis for the definition the threshold of the sensitivity of the measurement in spectral analysis. The second is the basis for the definition the density corresponding state in the quantum mechanics. The optical interpretations of the quantum mechanics are based on these two conceptions of the modern physics.

The Rayleygh's correlation is the basic for the receiving the mathematical form of the principles of the uncertainty and the supplementary. The mathematical proof of this is following. The **Rayleigh's correlation** for general case has following form []

$$\Delta k_x \cdot \Delta x = \Delta k_y \cdot \Delta y = \Delta k_z \cdot \Delta z = \Delta\omega \cdot \Delta t = 1\,, \quad (22)$$

where Δk_x , Δk_y , Δk_z , Δx , Δy , Δz , $\Delta\omega$ and Δt are change wave numbers, Descartian coordinates, frequency and time respectively.

The problem of the hidden parameters in the optical interpretation of the quantum mechanics is absented because in the nature of the wave-particular dualism the grouping wave parcel is localized in uncertainty preciously space-time region. This uncertainty is defined the nature of the quantum measurable process (derivative "mathematical" measurement). Differential operator of linear momentum and energy in hamiltonian formalism of quantum mechanics are corresponded to qualitative transformations. The problem of the hidden parameters is the problem of the creation the optimal mathematical procedure of the prognostication and receiving the results of the measurement . Therefore the problem of the hidden parameters in quantum mechanics (in the optical interpretation) is more mathematical and information than physical. It is of problem of secondary measurement according L. I. Mandelstam [16].

Near approach to optical interpretation of the quantum mechanics was represented by Y. Schwinger[25]. In this case the quantum mechanical measuring process is discussed with the point of many body problem in quantum theory. Our starting point is to consider this process as a special scattering phenomenon where within one of the partners, i.e. the many body measuring device, a collective coherent motion is induced by the interaction with the microobject. In this case our system has large but finite numbers N of degrees of the freedom. Then we study in detail what will be happen in the limit N→ ∞, however emphasizing that this transition is actually only performed in the mind of the observer. This implies that certain tail events together with their phase to be truncated. Was shown that the dichotomy "pure state' versus "mixture" as outgoing scattering states will vanish in this limit in so far as it has no observable consequences provided one is only interested in the state of the microobject. The role of the observer the notion of "event", the relation between single preparation and ensemble picture, and the so-called "reduction of the wave function" in the light of our approach, i.e. explaining the phenomena accompanying the measuring process in terms of many body quantum theory are discussed too.

In the Lagrangian interpretation of the quantum mechanics [26] procedure of the measurement is opposite to the Hamilton's case and one represent the measurement with the help of the integral operators . Procedure of the measurement is practically derivative and as in first case one is connected with symmetry of the measurement with the help the function of the action. The sections of the possible results of the measurement may be interpreted as sections Σ_i in Figure 2. These sections are introduced with the help Green's functions. In quantum theory of the measurement it are well known as Aleksandrov's-Blokhintsev's sections [1]. The statistical character of the measurement is included in the functional integrals. For the more precise definition of the procedure the measurement any psychophysical parallelism and other philosophical insertions aren't necessary. Therefore the statistical interpretations of the quantum mechanics is more complex and informative surplus than optical interpretation. As variant of the Lagrangian interpretation of quantum mechanics may be represented the Cramer's interactional interpretation.

The variant of the optimal synthesis the classical and quantum mechanics in the Heisenberg's style is represented by Anderson [27]. This synthesis is realized with help algebra $U^{(q-c)}$. For this algebra the classical commutative variables x and k must satisfy Poisson's brackets $\{x,k\}$ and noncommutative elements q, p must satisfy the canonical commutative correlation $[q, p] = i$.

Two elements $A, B \in U^{(q-c)}$ is satisfied the next correlation

$$[A, B]_{(q-c)} = [A, B] + i\{A, B\} = i . \qquad (23)$$

Remark 4. For quantum canonical commutative correlation and corresponding part of the correlation (23) the Planck's constant h is equal 1 (one).

The order of the quantum variables has meaning for Poisson's brackets. If u, v are functions of the quantum variables and f, g - functions of the quasiclassic variables than we have **quasiclassic bracket.**

$$[fu, gv]_{(q-c)} = fg[u, v] + iuv\{f, g\} . \qquad (24)$$

This quasiclassic bracket isn't antisymmetrical. Thus we have mixed representation which is based on quantum and classical variables. The region of the possible application of this approach is the quantum field theory.

In our case the bond of the classical and quantum physics is represented with the help formulas (1)-(4).

With point of the polymetric method the synthesis classical and quantum mechanics is the union the simple and semisimple systems in one system. The modern physics in general case is the science of the system synthesis and the unification many approaches, models and theories including mathematical, philosophical, physical (classical and quantum too) and other. This way of the development of modern physics is one of the more productive.

The polymetric method may be represented as functional expansion of the optical interpretation of the quantum mechanics on all knowledge. But this expansion is more widely than quantum mechanics. The polymetric method shows the development and evolution the any simple system and creation new systems. With this point of view polymetric method may be represented as constructive formalization of many world interpretations of the quantum mechanics.

C. Polymetric analysis and foundations of mathematics and science

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We'll consider now from the general scientific point of view the place of polymetric method in modern science.

Firstly it is the foundations of mathematics, and secondly – foundations of each science. We analyzed this problem on the basis Descartian thesis "Science is science so far as it is mathematics". This phrase is basis of Descartian method of mathematical synthesis. This method is beginning of modern theoretical science.

Search of universal formalized system is one of basic problem of modern science. Mathematics is more optimal system as other sciences, including linguistics, philosophy and other.

Number and measure was basic in mathematics from Euclides to Euler.

Short representation of this concept may be represented with help Newtonian four rules of conclusions in physics:

Rule 1. Do not require the nature of other causes than those who are true and sufficient to explain the phenomena.

This is nothing but a criterion of optmal informative calculations of simplicity.

Rule 2. Therefore, as far as possible, the same reason we should attribute displays the same kind of nature.

Roughly speaking this rule is a criterion of similarity in the most general terms. It is easy to see that he is more general theorem of similarity, because not tied to mathematical formalism. In our case it enters the criteria of reciprocity and simplicitly in another form.

Rule 3. Such properties of bodies that can not be either amplified or unfasten and which are all bodies over which you can do the test shall be considered by the general properties of all bodies.

There is practically solved the problem of establishing invariants or laws that set the inductive method. It also implicitly included the criteria of reciprocity and simplicity.

Rule 4. In experimental philosophy, propositions derived from phenomena through a common induction should be considered for exact or approximate correct, despite the possibility of conflicting hypotheses them until there are phenomena that they are even more précised or are found to be unreal.

It is inductive principle, which included as a particular case to the criterion of simplicity.

Nature of mathematics is the analysis, synthesis and formalization of all possible knowledge. This concept was formulated by Ch. Volf (1916): "Mathematics - science to measure everything that can be measured. Of course it described as the science of numbers, the science of value, ie the things that might increase or decrease. Since all finite things can be measured in all that they have a finite, that is what they are, then nothing is, what can not be applied math, and because you can not have any more precise knowledge than when properties of things can be measured, the math leads us to the most perfect knowledge of all possible things in the world".

The concept of mathematical (measured) value was formulated student by Euler:

1. First of all the known value that can increase or decrease…

2. There are many different kinds of values that are not exposed to calculate, and they come from different branches of mathematics, each of which has to do with their native values. Mathematics in general case is nothing but the science of values, dealing with finding ways of how to measure past.

3. However, it is impossible to determine whether a measured value except as known to take as another value of the same type and value set, which it is for her.

4. In determining whether any kind of measurement values so we come to what is known primarily established certain quantity of the same kind, called the measure or unit and depends solely on our choice. Then determined, in what respect is the appropriate value to the extent that it is always expressed in numbers. Thus measurement is no more than an attitude, which is one size to another, taken as a unit.

But in XIX – XX centuries, foundations of mathematics were called problems, which is based one aspect of nature mathematics.

One of founder of logical concept A. N. Whitehead gave up his views in favor of the "organism" concept.

Thus theory of foundations of mathematics must be open theory because science is the developing system. Basis of each science is measure, therefore this theory must be include the procedure of receiving of this measure (see Figure 1).

Polymetric method may be represented as more general "dynamical" formalization of polyphasic Errol E. Harris concept too [18].

Polymetric analysis is the system addition to the creation of theory of everything [6]. J. Barrow analyzed this question from point of view of structure of theoretical physics [5]. Polymetric analysis is based on the search the way of optimal creation this theory. Roughly speaking J. Barrow way is begun from Newtonian gravitation law, polymetric analysis from four Newtonian rules of conclusions in physics [6].

D. Polymetric analysis and computer science

Since polymetric analysis is a universal system analysis, synthesis and formalization of knowledge, and it laid the foundation polymetric variable measure, he can claim the role of theoretical computer science and generalized computer theory.

According to A Ershov basic problem of modern computer scince is formalization of phrase of Canadian philosopher L.

Hall: “Everything comes from the head – intelligent” [1]. Polymetrical variable measure and hybrid theory of systems as theory of variable hierarchy.

Unlike logical approach in which there is a finite number of types of formalization in polymetric method is a finite number of types of systems (hybrid systems theory) of receive and formalize knowledge. Each computer sciences can be classified because of these types of systems. And so you can make an audit of computer science in general, and its expected development and the emergence of new chapters.

A number of unsolved problems in the theory of algorithms (multiplication of matrixes) can be successfully resolved in theory of information calculations.

This theory was used for the estimation of effectiveness of matrix calculations and problem of formation of arrays [1].

For the practical application theory of informative calculations normalized measure of calculations was created $\text{mes}\, N\left\{ {}^{stqo}_{nmab}M_{ijkp} \right\}$

$$\text{mes}\, N\left\{ {}^{stqo}_{nmab}M_{ijkp} \right\} = \frac{\text{mes}\left(N\, {}^{stqo}_{nmab}M_{ijkp}\right)}{\max\left\{\text{mes}\left(N\, {}^{stqo}_{nmab}M_{ijkp}\right)\right\}}. \quad (25)$$

Norm of functional matrix and normalized measure of calculation are comfortable characteristics for practical estimations of proper calculations (transformations).

Now we are representing the example of application this theory to matrix calculation. Matrix calculations(computations) are basic for computer processors. For this case we are using the principle of optimal informative calculations.

For squarte matrix

$$C = \overline{C};\;\; C_t = \overline{C}_t;\;\; C_{to} = \overline{C}_{to}, \quad (26)$$

where $C, C_t, C_{to}, \overline{C}, \overline{C}_t, \overline{C}_{to}$ – proper informative calculations for straight and opposite (with tilde) matrix multiplication.

For multiplication of rectangular matrixes

$$C \neq \overline{C};\;\; C_t \neq \overline{C}_t;\;\; C_{to} \neq \overline{C}_{to}. \quad (27)$$

Computing procedures with conditions (26) were called symmetrical, with conditions (27) – asymmetrical,

Now we represent the examples C for the multiplication of various types of matrixes. Further we marked C as Π – number of algebraic operations only.

1. Multiplication of two matrixes with dimensions $m \times n$.

In one case (”straight” multiplication) we have squarte matrix with dimension $m \times m$, and in second case (inverse multiplication) – $n \times n$. Number of operations for proper multiplication is equaled:

for $m \times m$ matrix

$$\Pi_m = m^2(2m-1); \quad (28)$$

and for $n \times n$ matrix

$$\Pi_n = n^2(2n-1). \quad (29)$$

2. Let matrixes with dimension $m \times n$ are reduced to quasidiagonal type and $m/p = n/t = k$. Then its number of operations is equaled

$$\Pi_{ptk} = p^2(2p-1)+k; \quad (30)$$

$$\Pi_{tpk} = t^2(2t-1)+k. \quad (31)$$

3. Multiplication of squarte matrixes:

a) general case –

$$\Pi_n = n^2(2n-1); \quad (32)$$

б) diagonal case –

$$\Pi_n = n^2; \quad (33)$$

в) quasidiagonal cases –

1) $n/p = n/t = k \;\; (p = t)$;

$$\Pi_{k_1} = t^2(2t-1)+k; \quad (34)$$

2) $n/p = k;\; n/t = l;\; k \neq l$;

$$\Pi_{nkl} = p^2(2p-1)+k; \quad (35)$$

$$\Pi_{nlk} = l^2(2l-1)+k; \quad (36)$$

Proper estimations were received for functional and block matrixes too [1, 10].

Criteria of estimations of effectivity of calculations may be proofed from formula (25). For matrix calculation it may be represented in next form:

analog of normalized measure of calculations

$$\Delta_i = \frac{\Pi_i}{\Pi_{\max}} \quad (37)$$

and inverse to Δ_i quantity

$$\delta_i = \frac{1}{\Delta_i} = \frac{\Pi_{\max}}{\Pi_i}. \quad (38)$$

The proper estimations of quantity δ_i were received for various types of matrix calculations. For each type of matrix multiplication we must select proper Π_{max}.

For example for squarte and other matrixes multiplications δ_i may be have various functional forms [1, 10].

Calculative gain δ_i for some types of matrixes multiplications may be >10^3.

Systemic approaches of polymetric analysis led to functional logic where every logic element is an element of polymetric measure. It should be noted that the synthesis of logic and probability theory led to the theory of fuzzy sets. In any science in which is the main measurement, assessment and forecasting of obtaining relevant results and question the truth of certain judgments are usually decided by experimental data and history.

In polymetric method the number theory is synthesized with the theory of generalized mathematical transformations that success can be attributed to all sets of transactions that are or will be used in modern computer science.

Polymetric method was used for the determination of measure and quantity of the information with system point of view [28]. These results are added the famous A. Kolmogorov results about three approaches to the determination of measure of information [29].

In addition, hybrid systems theory can be considered as an alternative solution to the problem of the twentieth century in cybernetics by S. Beer (the problem of complexity - simplicity) through calculation (computation theory of information), as provided J. Castey. Therefore polymetric analysis is metatheory for information theory and computer science.

Problem of complexity of calculation is one of unresolved problem of modern computer science and mathematics (5-th Smale problem [8]). Therefore polymetric analysis (hybrid theory of systems) may be represented as method for resolution of this problem.

V. Conclusions

- The concept of polymetric analysis is analysed.
- Basic structure of PA (functional numbers, generalizing mathematical transformations, informative lattice, theory of informative calculations, hybrid theory of systems, polymetric theory of measure and measurement) are represented.
- The problem of measurement in PA and quantum mechanics is discussed.
- The questions about the presentation PA as natural concept of foundations mathematics and foundation of science in Descartian sense are analyzed too.
- Basic applications of PA for the resolution of some problems of modern cybernetics and computer science (the problem of the twentieth century Beer in cybernetics by S. Beer, unsolved problems in the theory of algorithms, 5-th Smale problem) are represented.

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