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Application of Techniques and Methods of Technical Creation for the Research and Refinement of the Pendulum-Type Oscillator

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Abstract

Current Status: *Mechanics is not an exclusive branch of mathematics but also a component of the science of physics. Science works according to the scheme: hypothesis-prediction-denial-rejection. The rejection of the hypothesis is based on direct observation data, respectively, experiment. The results of the measurements of the pendulum experiments, analyzed in the Newtonian paradigm of interaction between bodies, also highlight unexpected results (anomalies). The pendulum-type oscillator is the physical system that has in the formula of the potential energy a cosine term, similar to the potential of the simple pendulum. The anomalies indicate a poor viability of the pendulum measurement system (a fact reflected by the lack of measurement control, the lack of observation/causality, and the lack of other characteristic properties of a system) and, a reduced physical consistency of the paradigm of construction of the experiment, data collection and analysis of the measurement results, respectively.*

To date, there is no systematic research in the literature that highlights the heuristic approaches, techniques and methods of technical creation that have been used over time in the field of creation, development, validation and refinement of pendulum oscillators as a technical object/tool/system. The paper summarizes the results of the pendulum-type oscillator domain research (the appearance of the initial system, the development, testing and refinement of the gravitational, microscopic, quantum model). The results of the application of the logical-combinatorial methods of technical creation (the idea diagram method, respectively, the sequential-selective method) refer to the definition of new solutions for the pendulum oscillator. Also, the paper goes through the nine stages of the inventive problem-solving method (Synthesis of Solutions by Eliminating Contradictions) to find the optimal physical solution of the pendulum oscillator model.

Objectives: *Increasing the viability of the pendulum oscillator by optimizing the physical consistency of the experimental construction paradigm.*

Methods: *Synthesis of solutions by eliminating the contradictions of the pendulum oscillator (Application of the Altshuller algorithm for innovative problem solving to find the optimal solution for the research topic). c)*

Results: *A new mechano-electrical paradigm for the construction, data collection and analysis of measurement results and a complex mechano-electrical oscillator (model)/system.*

Conclusion: *The optimal physical consistency of the mechano-electrical interaction paradigm used for the construction, collection and analysis of data leads only to expected results of the measurements(perturbations).*

Keywords: Pendulum Experiment, Anomaly, Technical and Method Creation, Complex System, Perturbation

Introduction

Science works according to the scheme: hypothesis-prediction-denial-rejection. Rejection of the hypothesis is based on direct observation data, respectively, experiment. Based on the analysis in the Newtonian paradigm of the results of pendulum measurements, unexpected results (anomalies) are also highlighted, which indicates an unviable system at the basis of the experiment design. Although mechanics is not an exclusive branch of mathematics but also a component of the science of physics, most often, an appropriate mathematical formalism is used to save the physical-mathematical model. This situation is also clearly evident when solving the anomalies present in the case of pendulum experiments [1-3].

To describe mechanical oscillations, methods of approximation of equations are used whose solutions describe their dynamics as close to reality as possible [1]. Solving the problem related to the presence of anomalies involves perfecting the physical-mathematical model and optimizing the paradigm of the experiment construction. To date, there is no systematic research in the specialized literature that highlights the heuristic approaches, techniques and methods of technical creation used over time in the creation of the pendulum oscillator as a technical object instrument, technical system, complex technical system [3-17]. The paper briefly presents some conclusions resulting from the research on the pendulum-type oscillator from the appearance of the initial technical object (Merkhet or merjet - Ancient Egyptian: mrḫt, 'instrument of knowing' was an ancient surveying and timekeeping instrument) to the present [18-23]. It also briefly presents the method of using the results of applying the techniques and creation methods for optimizing the pendulum oscillator in order to highlight disturbances and, consequently, eliminate anomalies.

Methods and Apparatus

The mechanical pendulum is a testing instrument presented and analyzed as an isolated physical system with reversible processes, Figure1.

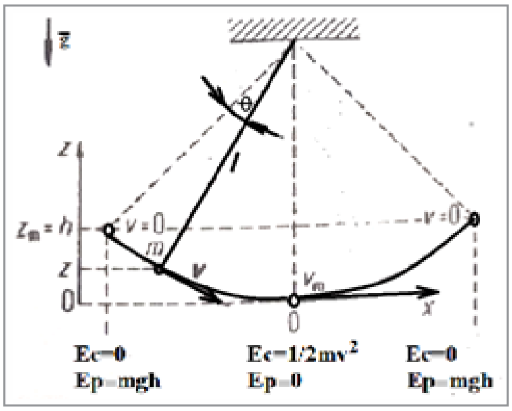


Figure 1: Resonance of the potential energy Ep with the kinetic energy Ec according to the mechanical pendulum model: -oscillation angle m- bob mass , l- wire length, h-bob height, v- mass speed, g-gravitational acceleration [1].

Any physical object (instrument, system) also represents a technical object (instrument, system) [17], Figure 2.

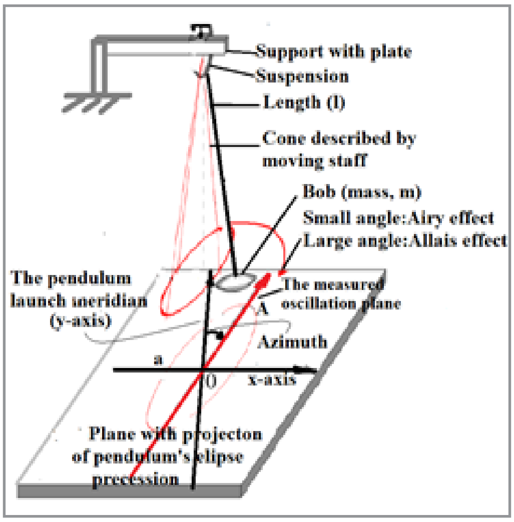


Figure 2: Constructive and dynamic elements of the paraconical pendulum in the Newtonian paradigm of experiment design

Pendulum- type oscillators are physical systems that have a cosine term in the potential energy formula, namely:

$$V(\theta)=V\_(0\ )(1-\cos n\theta) \qquad (1)$$

similar to the potential of a simple pendulum,

$$Ep(\theta\ )= mg\ (1-\cos\theta). \qquad (2)$$

Analyzed in the Keplerian-Newtonian paradigm of interaction between bodies of measurements with the pendulum-type oscillator also highlights unexpected results [2-22], Figure 2. These unexpected results (anomalies) highlight the fact that there is no controllability (measurement control), observability (causality) and others in the pendulum-type oscillator system[13]. The research of the pendulum oscillator field and the application of techniques and methods of technical creation aim to synthesize a viable pendulum oscillator system.

Research by the Method of Heuristic Approaches of the Pendulum - type Oscillator Domain

Systematic research of the creative act in the field of the pendulum oscillator with the heuristic approach method, has highlighted (through the higher frequency of occurrence) the approaches with high heuristic potential that have been and can be used further for the optimization of the pendulum oscillator, namely: o.4. The use of the basic object for the synthesis of objects of a differentiated destination, close or different as a working process with a frequency of occurrence = 31 and, o.19. Synthesis of an ideal construction and its gradual transformation into a real one that can be used in the main part of this act as well as the meaning of the modeling development with a frequency =11, Figure 3. The research through the heuristic approach method has highlighted the decisive link with the biological model "birth – childhood – development – decline – death" for the pendulum oscillator domain, i.e. the S curve of development that was used by G. H. Altshuller to illustrate the evolution of a technical system [4-17].

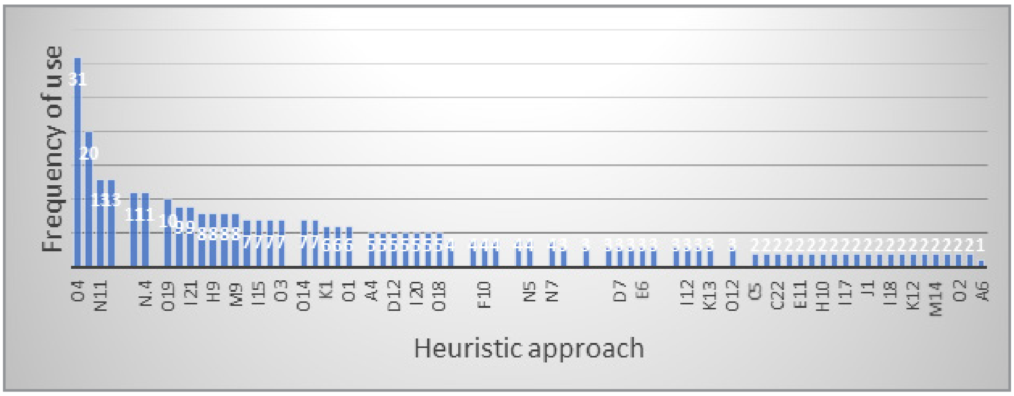


Figure 3: Diagram with the frequency of heuristic approaches used in the field of pendulum-type oscillator.

As a result of the research of the pendulum-type oscillator field with the help of heuristic approaches and, respectively, the laws of evolution of the technical system resulted the Table with the principles and physical effects in the field and respectively, the proposal for the research topic -Synthesis of a pendulum-type oscillator system that would capitalize on the interactions with the near and distant environment.

Application of logical-Combinatorial Methods of Technical Creation to Pendulum-Type Oscillator.

For the synthesis of a new pendulum-type oscillator, logical-morphological methods of technical creation were used, observing the following stages, namely: Definition and visualization of the elements of the main morphologies of the pendulum-type oscillator domain (the assemblies forming the physical principles, the degrees of internal/external freedom, the types of transfers that modify the energy of a system, the respective component parts, the assemblage forming the main technical-economic and functional conditions; Research of morphologies defined by diagrams of ideas in order to define new solutions and constructive variants, evaluation of solution and, conclusions; Application of the Zwicky-Moles morphological matrices of ideas method to find valuable solutions by combining existing solutions [3-17].

The application of the above techniques and methods of technical creation allowed the preparation of the List of valuable solutions for solving the problems established by the research theme. The sequential-selective morphological research has allowed to highlight some solutions by combining the existing solutions in the field of the pendulum-type oscillator. Following the evaluation of the solutions in the light of the research theme there were highlighted existing solutions, respectively compatible solutions and apparently compatible solutions for the synthesis of a pendulum-type oscillator system that capitalizes on the interactions with the near or distant environment [21]. To find a solution in the conditions of the problem, next, the Creative Problem-Solving Algorithm method of creation is applied.

Synthesis of Solutions by Eliminating the Contradictions of the Pendulum-Type Oscillator

Problem Analysis

Statement of the Basic Conditions of the Search Problem Without Specialized Terminology:

The unexpected results (anomalies) observed in the data collected from pendulum-type oscillator experiments cast doubt on the viability of the adopted model—specifically, the paradigm used for constructing the experiment.

Identification of the Conflicting Pair: Workpiece and Tool.

The workpiece (A) refers to the element that must be processed (e.g., executed, moved, modified, improved, protected from harmful influences, detected, measured, etc.).The tool (B) refers to the element that interacts directly with the workpiece (e.g., a milling cutter, drill bit, plow blade, or a Portion of the Surrounding Environment), Figure 4.

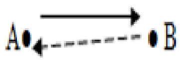
2.	**Combined Action** 	The beneficial action of A on B (solid line) is accompanied by a harmful secondary action (dashed line). The harmful reactions must be eliminated.

Figure 4: Graphical diagram of the contradictions in the pendulum-type oscillator.

From the analysis of points 1.1-1.2,a inconsistencies in the general formulation of the problem can be observed. These inconsistencies are eliminated by recording only the specific issues of the simple pendulum, which encompass the creation problem common to all pendulum-type oscillatory systems, namely, the realization of interactions with the nearby and distant environment.

Recording the Basic Conditions of the Search Problem Without Specialized Terms

It was assumed that the mechanical pendulum exhibits harmonic oscillator-type dynamic behavior for a launch angle value less than 3-4 degrees and nonlinear behavior for launch angles greater than that. In the absence of an explanation consistent with Newton's axioms, the results of the experiments with the simple pendulum were associated with effects recognized in physics, namely the Coriolis Effect, the Euler Effect, and the Foucault Effect, which are based on (pseudo)forces. The results of the azimuth measurements of the oscillation plane (R1-R5) from the experiments with the mechanical pendulum (pendulum-type oscillator), analyzed in the paradigm of the aforementioned effects, highlight the presence of unexpected results (anomalies), which indicate that the model is unfeasible. These anomalies, in the absence of a causal explanation, are in turn considered as effects (Lunar-Solar Effect, Eclipse Effect, etc.) that occur when various astronomical events take place during (or around) the experiment, namely: eclipse, conjunction, opposition, etc.

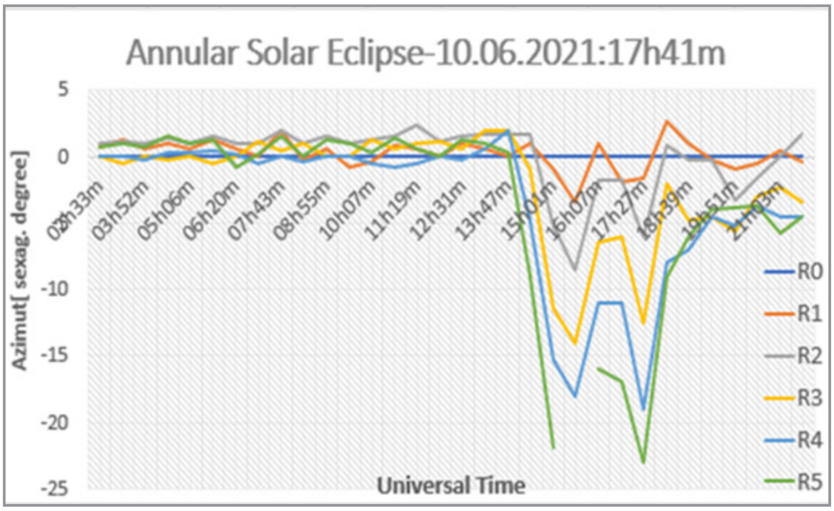


Figure 5: Diagram with the anomalies of the azimuth of the pendulum oscillation plane during the solar eclipse where, R0-R5 the result of the measurements of the azimuth of the plane of oscillation at intervals of 7 minutes for each of the 16 series that have a duration of 35 minutes highlighted on the x-axis by the universal time of the pendulum launch (Iassy, 2021).

Development of Graphical Diagrams of the Technical Contradictions of the Mechanical Pendulum.

CT1 - (the first technical contradiction): if the pendulum's oscillation is modeled using one of its properties, namely mass m, the oscillation process is reversible, the system is simple, but unexpected results (anomalies) occur, meaning the system is unfeasible;

CT2 - (the second technical contradiction): if the oscillation is modeled using the mass m property and other forms of non gravitational interaction, the system is complex, but no unexpected results appear, meaning the system is feasible, Figure 6.

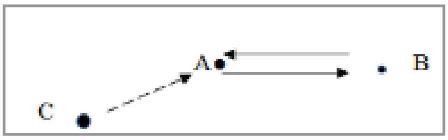


Figure 6: Graphical diagram of the contradictions in the mechanical pendulum.

It is necessary to make minimal changes to the system to increase the feasibility of the pendulum-type oscillator model psychological revision of the concepts used is required. The construct of MASS should be eliminated from a psychological perspective—by using a term that reflects its basic function, such as 'energy converter,' 'interface element,' or 'interaction element'—which can be a construction not necessarily solid, but also liquid, gaseous, or plasma in nature.

Highlighting Conflicting Pairs
The part – the pendulum characterized by the existence of interaction elements (forms of motion of mechanical matter, ..., electric, magnetic, electromagnetic, ...).

The tool – the mechanical interaction environment.
- **CT1:** There is an interaction element.
- **CT2:** There is no interaction element.

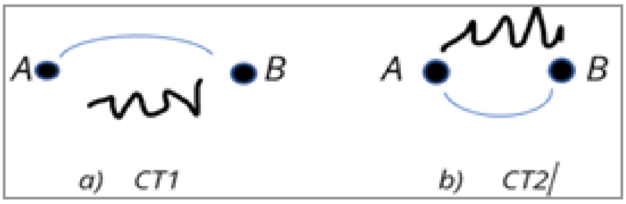


Figure 7. a, b: Diagram with conflicting pairs- a) The first contadiction; b-The second contadiction

Choosing between the conflicting schemes (contradictions) based on the one that most ensures the function of the mechanical pendulum, Figure 7. a, b.

CT1 is chosen: Simple system, but lacking non-gravitational interactions with the environment, Figure 7. b.

Intensifying the Conflict (contradiction) by Specifying the Boundary States of the Elements
The pendulum that consumes all the energy from the system to create forms of non-gravitational motion of matter, while in the 'energy converter' / 'interaction element' / 'interface element,' none of the corresponding interactions occur, related to the forms of motion of matter in the pendulum (the bob) during mechanical oscillation.

Formulating the Problem Model by Specifying: the Conflicting Pair, the Amplified Conflict that the Introduced Element X Must Resolve.

Conflicting pair – A system composed solely of non-gravitational forms of motion of matter and the LACK of an 'interaction element' / 'energy converter' / 'interface element,' which prevents the production of the non-gravitational interaction between the environment and the pendulum. An element (phenomenon) X must be found, as part of an 'interaction element' / 'converter,' which, while preserving the functions of the oscillating mass, also enables the non-gravitational interaction between the pendulum/bob and the environment.

Use of Standards for Finding the Physical Solution to Resolve the Contradiction (extras)

Standard applied: Class 1: Construction and destruction of subfield systems.
- 1.1. Synthesis of subfields
- 1.1.1. Construction of the subfield
- 1.1.2. Internal complex subfield
- 1.1.3. External complex subfield
- 1.1.4. Subfield in the external environment
- 1.1.5. Subfield in the external environment with additives (extras) [4-8].

Construction of the Gravitational Subfield
The gravitational subfield g is constructed by preserving the structure, organization, and functions of the gravitational pendulum with reversible processes (resonance between potential and kinetic energy) — Class 1, 1.1. Synthesis of subfields, 1.1.1. Construction of the subfield, Figure 8.
External Complex Subfield sS1

The near subfield of the pendulum (Pi) is constructed/used, characterized by the parameters: electrical conductivity (σ), magnetic permeability (μ), and electrical permittivity (ε), with magnitudes dependent on the characteristics of the influencing fields at a given time during the experiment — Class I/1.1./1.1.3, and 3.1.1. Systematic Transformation: Creation of bisystems and polysystems [4-8] Figure 8.

The Internal Complex Subfield of the pendulum sS 2 placed in interaction with the nearby electromagnetic medium (Pi) is constructed—Class I/1.1./1.1.2.Internal complex subfield, and Class 3 — Transition to supersystems and micron-level, Figure 8.

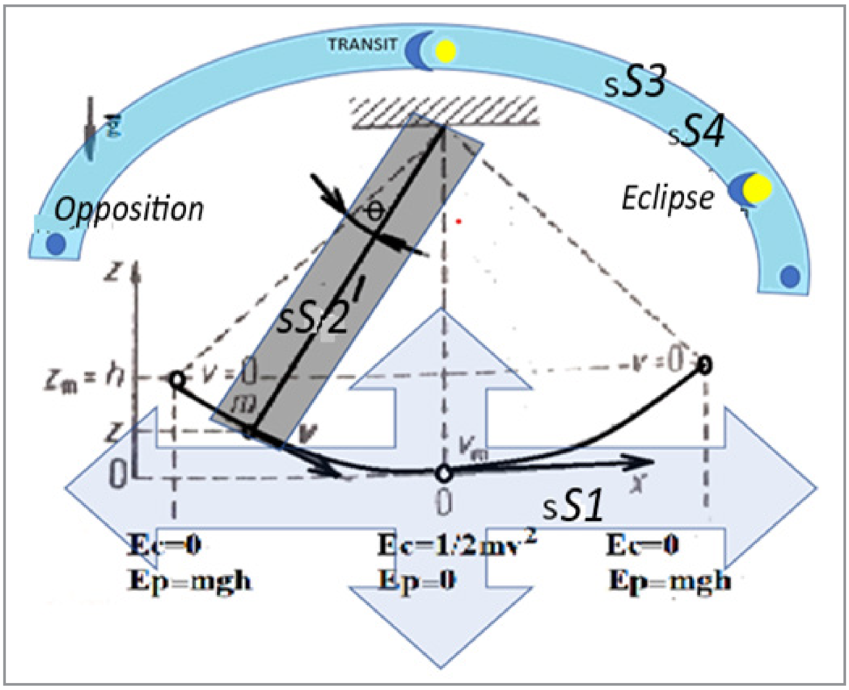


Figure 8: The Physical Solution to Resolve the pendulum Contradiction

g - The gravitational subfield, sS1- External complex subfield, sS2 –. Internal complex subfield sS3 – Subfield in the external environment, and sS4 -Subfield in the external environment with additives

The External Subfield sS3.

The subfield S3 (related to the celestial sphere rotating from East to West is constructed— Class I/1.1./1.1.4. External complex subfield, and 3.1. Transition to systems and polysystems, 3.1.1. Systematic Transformation I: Creation of bisystems and polysystems [4-8].

Subfield in the External Environment with Additives sS4.

The subfield sS4 (related to predominant influence near ecliptic celestial bodies) rotating from East to West is constructed — Class I/1.1./1.1.3; 3.1. Transition to systems and polysystems, 3.1.1. Systematic Transformation: Creation of bisystems and polysystems; Once the physical contradiction is resolved, it is no longer necessary to go through paragraphs 2-5 of the Altshuller algorithm.

The Transition From the Physical Solution to the Technical Solution

The application of the analytical method leded to the transition from the physical solution (S1, S2, S3, S4 subfields as physical solutions) to the identification and adoption of the structure, organization, and functions of the S1, S2, S3 complex subsystems respective, the synthesis of the complex oscillator system type pendulum [10-20]. Class 4. Standards for detecting and measuring systems,

Forcing measuring subfields

Using physical effects [4-8]: The Complex Subsystem of the Environment of the Experiment Location S.

It is noted with Pi the parameters electrical permittivity ε [F/m], electrical conductivity σ [Ωm], and magnetic permeability μ [H/m]. Using the criterion of electrical properties of the constituent media it is possible to characterize the environment from an electrostatic and an (electro)magnetic point of view, depending, namely: a) on the mode of variation of Pi according to the strength of the electrostatic/electromagnetic field (|E |, |H) respectively, b) position and direction in the environment, as well as c) depending on the relative value of electrical and magnetic parameters ε , σ , μ, Figure 9. a-c. [1-16.]

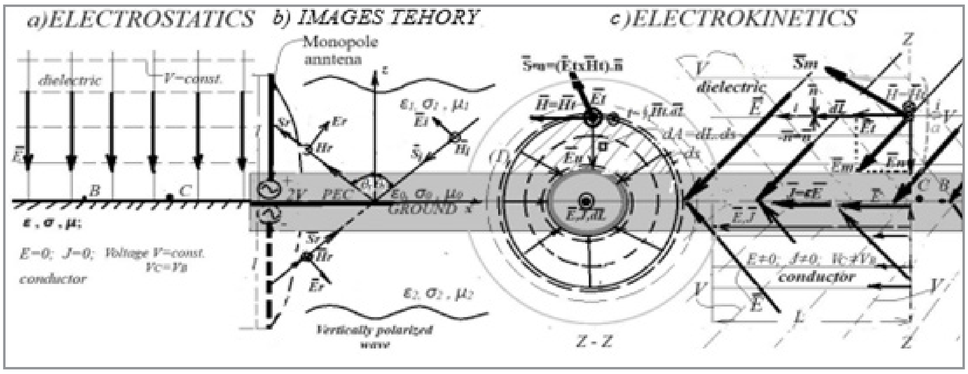


Figure 9. a-c: The complex subsystem of the environment of the experiment location S1

a) The atmosphere–Earth's crust interface characterized by ε electrical permittivity, σ electrical conductivity and magnetic permeability, μ according to electrostatic theory: E - electrostatic field: V-electrostatics potential, J- conduction current. b) The images theory for pendulum at rest respective, vertically polarize wave subsystem S1: PEC-perfect electrical conductor l- pendululum (monopole antenna) length, S = Ex H- Poyinting vector with reflected (r) and incident (i) components. c) The atmosphere–Earth's crust interface subsystem S1 according to electrokinetics theory: (E , H) - electromagnetic fields components with tangential component (H_t) and normal component (H_n) , J = ε E -conduction current, and currents i=_Γ(H_t) (dL) respectively i =_Γ(E_t) (dL) .[13]

The Complex Pendulum Subsystem S2.

The application of the analytical method led to the identification and adoption of the structure, organization, and functions of the pendulum in rest (placed in S1) as a technical subsystem S2 [13-20], Figure 10.

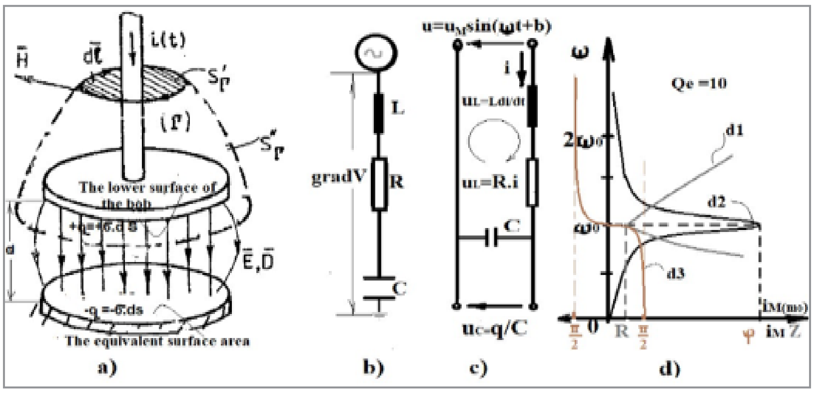


Figure 10. a-d: The complex subsystem of the mechano-electric pendulum at rest S2 [13].

a) The diagram with the application of Ampere's law of the pendulum placed in the medium Pi specific to the experiment site; b) Series electric oscillating circuit RLC of pendulum; c)Electrical diagram of calculation; d) RLC diagrams: d 1 - d impedance frequency dependency, d2 - resonant behavior of current i in AC electric circuit respectively, (d3) phase shift between current i and voltage of u.[12].

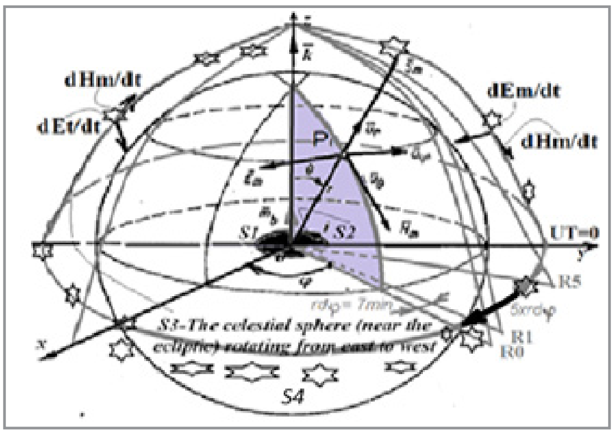


Figure 11: The complex perturbative subsystem S3.

The celestial sphere subsystem S3 in apparent motion from east to west around the Earth considered fixed: dEm/dt, dHm/dt -the variation of the components of the fields radiated by an elementary magnetic dipole (celestial bodies); (H_m) , (E_m) , (U_r) , (U_φ) , (H_θ) - the components of the fields radiated by the pendulum subsystem S2 (placed in subsistem S1) at the point M(φ, , r) in the wave zone, where, φ -longitude, -latitudine, r- distance, (Sm) - Poynting vector ; R0- The position of the celestial sphere (S3) at the beginning of the series (the launch of the pendulum); R1-R5- The position of the celestial sphere (S3) at the time of measurement (five measurements at an interval of 7 minutes)

The Complex Subsystem S3.
The application of the analytical method led to the adoption of the structure, organization, and functions of the celestial sphere as a whole (with the mixture of substance incorporated) as perturbative subsystem S3) [11-20], Figure 11.

Synthesis of the Analytical Complex Pendulum-type Oscillator System in accordance with Standard ARIZ-, namely: Class 4. Standards for detecting and measuring systems,

Forcing measuring subfields, Using physical effects, Using the resonance of the controlled object, Using the resonance of the associated object [4-8], Figure 12. a-c.

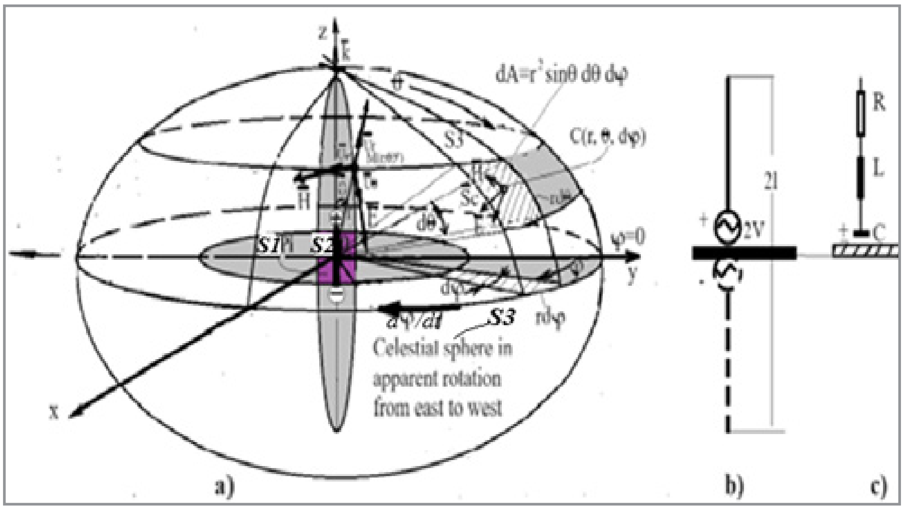


Figure 12. a-c: The complex pendulum-type oscillator system at rest adopted for validation [13].

a) S1 - the complex subsystem of the Pi environment at the experiment site; S2 - the complex subsystem of the pendulum at rest where,); (H_m), (E_m) , (U_r), (U_φ), (H_θ) - the components of the fields radiated by the pendulum subsystem S2 at the point M(φ, r) in the wave zone :S3 - the complex perturbing (Celestial sphere in apparent rotation from east to west) where, (E H) - electromagnetic fields, (S_c) = E x H - Poyinting vector, b) monopole antenna-S2. c) RLC-electric circuit -S2 [13].

Analysis of Methods for Eliminating Physical Contradictions Verification of the Response
For the experimental validation of the analytical models developed/adopted, the following steps were undertaken:

Analysis of Results From Prior
experiments conducted within the mechanical paradigm of experimental design [2-22].

Conclusion – The presence of anomalies reported by experimenters is confirmed.

Development of Original Experiments, Data Collection, and Analysis within the mechanical interaction paradigm.

Conclusion – The presence of anomalies is confirmed (see Figure 5).

Analysis of Measurement Results from both prior and original experiments, in correlation with: a)the relative position of celestial bodies on the celestial sphere with respect to the location of the experiment (e.g., sunrise, sunset, transit, noon, midnight, elongation, etc.), and b) the relative position between celestial bodies themselves (e.g., conjunction, eclipse, opposition, etc.) at the moment of measurement.

Conclusion – A correlation is observed between the unexpected results and the relative positions of celestial bodies at the time of measurementd.

Execution of Original Experiment within the new interaction (gravito-electrical) paradigm, involving the pendulum at rest. Electrical data were collected (DC -voltage, AC-voltage).

Conclusion – A correlation is observed between voltage perturbations (DC, AC) and the relative positions of the pendulum to celestial bodies (celestial bodies system) at the time of measurement, Figure 13.

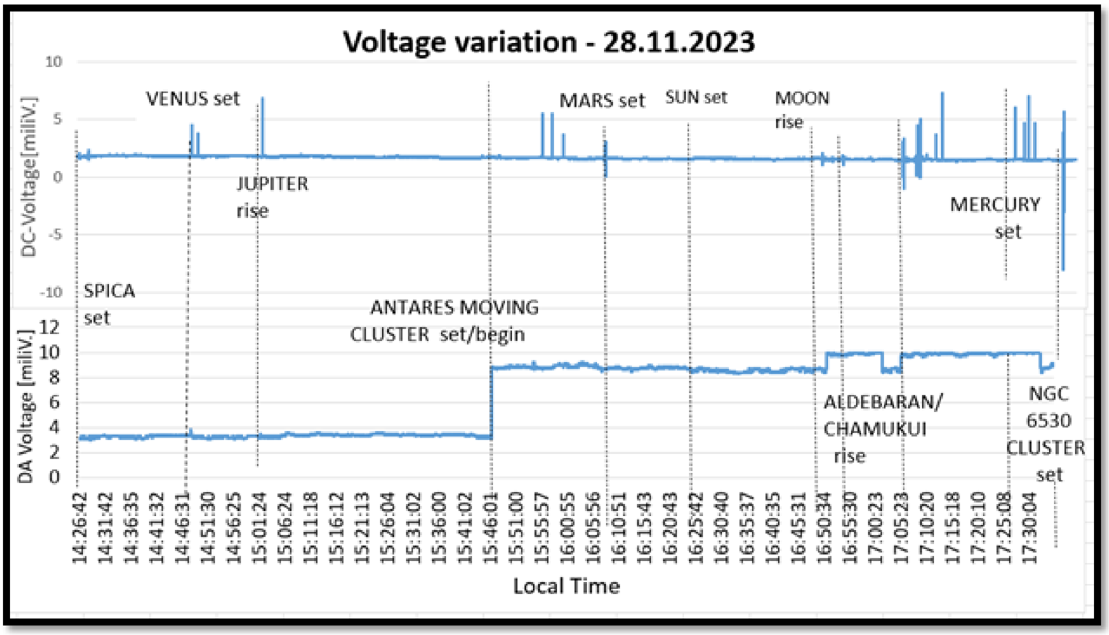


Figure 13: The diagram showing the variation of DC voltage and DA voltage in correlation with the relative position between celestial bodies (close to the ecliptic zone) and the location of the experiment with the paraconical pendulum[13].

Adoption of a new paradigm with optimal physical consistency—the gravito-electric interaction paradigm—for both data collection and analysis of measurements obtained using the pendulum at rest Figure 11, Figure 12.. The laws of physics are used to model the gravito-electric interactions of the pendulum, assuming a fixed Earth and a celestial sphere rotating from east to west. Non-gravitational interactions enhance the physical consistency of the construction paradigm as well as the analysis of the results of the pendulum experiment. Thus, electric perturbations can be highlighted during the pendulum experiment [11-13], Figure 13.

Application of an Instrument Based on a Well-Substantiated Theory namely, the Electroconvergence of the Entropic Matrix of natural bodies in the Universe [10,11].

Conclusion

The stages (a-f) outlined above correspond to the epistemology of a viable experiment:

- Experimental verification and calibration using known phenomena.
- Reproduction of previously known artifacts.
- Elimination of plausible sources of error and alternative explanations for the results.
- Utilization of results to argue their validity.
- Application of a well-correlated independent theory of phenomena to explain the results .
- Use of a device based on a well-substantiated theory [24].

Preliminary Evaluation of the Solution Found Using Control Questions.

Does it ensure the main attribute of the ideal solution?

The technical solution found ensures the main attribute of the ideal solution, namely: the achievement by the pendulum-type oscillator of (non)gravitational interactions with the environment (both nearby and distant).

Which physical contradiction is eliminated by the obtained solution?

The contradiction between the existence of conjugate degrees of freedom in pendulul structure and the lack of non-gravitational interactions between the pendulum system and the environment (both nearby and distant) is eliminated.

Does the obtained solution contain a well-controllable element? Which one? How should the control be achieved?

The voltage of the alternating current and the voltage of the direct current highlight the perturbations of the pendulum's electrical oscillations, depending on the relative position between the experiment location and the position of the predominant influencing bodies (sunrise, transit, etc.), as well as the relative position of celestial bodies (conjunction, opposition, eclipse, etc.) on the celestial sphere at the time of measurement during the experiment, Figure 14.

Verification of Patentability

The solution is original and util (patentabil).

Use of the Obtained Result

Determination of the Supersystem in Which the Complex Physical Pendulum System is Included. A new system of pendulum-type oscillators is created — the "mechano -electric oscillator" — which combines the characteristics of the mechanical/gravitational oscillator with those of the electric oscillator, respectively, the monopole antenna, Figure 13.a-c.

Verification of the use of the Gravito-Electric Oscillator System

a. On a technical level

The gravito-electric system can be used for detection based on operative intra-/periterrestrial currents (momentum, mass electric, magnetic, electromagnetic, fluxes.). Also, the gravito-electric system can be used for the propulsion of objects in weightless environments (vacuum), etc.

b.On a theoretical level

Testing the relationship between inertia and the principles of equivalence, respectiivelly.

Analysis of the Problem-Solving Process

Comparing the Actual Problem-Solving Process with the Theoretical one According to ARIZ

The actual problem-solving process was based on the known theoretical algorithm, with small particularities, considering the complexity of the problem to be solved.

The Result Obtained is Original for the Pendulum-type oscillator system and is based on the use of ARPC standards, approaches, physical effects, and the application of the laws of the evolution of technical systems (increasing the ideality of the pendulum technical system).

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