Invariance principles and system analysis of realization of physical laws symmetry for contemporary signal energodynamics

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Вказані причини й наслідки своєрідного роздвоєння і навіть розщеплення мислення фізиків, спричиненого всеохопним пануванням так званої загальної теорії відносності. Наведено системний аналіз зародження ідеї та терміну інваріантності замість релятивістських і справжнього усвідомлення симетрії фізичних законів для дослідження ші конечного для навчального процесу.

There is shown the cause and effect of some kind bifurcation and even dissociation of physicists fhinking which have been provoked by pandomination of so-called general relativity theory. A system analysis of invariance concept and term origination instead of relativity ones and real perceiving of physical laws symmetry for investigations and its necessity for education process is given

Introduction. Many scientists (mainly physicists) and engineers have contributed to the arising and development of electromagnetic theory and to invention of wireless telecommunication. But physics is the unique substratum of all technical applications. From the inertial law in mechanics it follows the invariance with regard to rectilinear and uniform motion e.g. the motion of Sun does not reflect on planets motion. Situation has been substantially changed with appearing of electromagnetism - in experimental investigations of Faraday and theoretical works of Maxwell, summarized in Maxwell's equations. Some later Hertz by producing wireless waves validates the theory of Maxwell. This leads to invention of wireless signaling by means of Hertzian waves. And simultaneously from here by works of Lorentz and especially of Poincar? commenced real investigation of physical laws symmetry which describes such their property (we can say even their peculiarity) as invariance. But, by the way, herewith the physics (being stimulated by the experience obtained in the process of setting of quantum theory and its application to atom investigations) divaricates into signal energodynamics which results into radiocommunication and into another branch namely in researching space - time relations which has been called extraordinary unfortunate as relativity theory.

Above mentioned circumstances call forth the urgent necessity to expose this phonomenon to detailed system analysis.

Therefore in this publication which represent somewhat extended and completed version of the report[1], the role of sections of modern physics, which have become standard in publications of researchers and educators, including a section that has become standard under unsuccessful name "relativity theory" and was originated from the theory of Faraday-Maxwell electromagnetism to be analyzed. Entire modern radio physics with the theory of signals as its foundation comes from it due to works of Heaviside and Hertz. But the steep bias, taken by physicists-theorists towards the so-called general relativity theory and cosmology (after Einstein), has broken the relations between these areas so hardly, that serious problems of the theory of signals have fall out from the view of physicists, and students including PhD students have difficulties in wade through relativity terminology. Although a trend of research of invariance (or, in fact the same as symmetry) of physical laws and not only in this issue, but in all areas of physics (started by Poincare) is still developing as if separately. Therefore a system analysis of this phenomenon is required.

II. Motivation for the problem and the state of its investigation

1. In fact, the term signal in science (even though originated from common Latin signum - a sign, especially conventional one) played a significant role in astronomy: in order to observe celestial bodies, an investigation of the signals from them - all kinds of radiation (first light, and then - the flow of particles, X-rays and, as yet astrophysicists hope, gravitational waves) is needed, as well as in biology, including the famous second signal system. However aphorism of modern Estonian philosopher Gustav Naan is popular: "All means of modern theoretical physics came to us from heaven", when he had in mind that epicycles of Ptolemy were prototype of Fourier series representation.

A modern interpretation of this notion is as a physical process, which serves to transfer in time-space data about the investigated object, because the source of messages about the research object can be only the object itself - directly or through other objects that act as signals. This interpretation comes from the radio physics [2], which is due to intense development of radio engineering in the late 19 - early 20 centuries. A term derived from Latin radiare - to send out rays. This term emphasizes that the question is about the use of energy radiation in the open space [3] through the generation of electrical oscillations, and managing them in order to transmit needed signals, converting them into electromagnetic waves radiated in space, receiving them and inverse conversion them into electrical signals, which provides a form suitable for reception of messages

addressee.

A management tool to control flows of electrical charges in solids, gases and vacuum performs generation of vibrations, reinforcement, and transformation and processing them. The combination of electronic and radio tools provide radio electronics.

2. In the history of mankind physics was always a source of concepts and formal means of investigation (first in the form of the so-called natural philosophy) that with the advent of the experimental study was also the base for technology. Considering this recognition by researchers, scientists and engineers the physical basis in their subject areas is significant. Specific situation happened in our time in the so-called information technology, because there is no clarity what the achievements of modern physics should be learned by training specialists. Now comes the aphorism: not bits are "running" in the computers but electrons. Therefore, the computer is a typical masterpiece of electronics with all that that implies: its future is determined by electronics.

3. Because the signal is a means of transferring information in timespace, it is even intuitively obvious that physics of motion, physics of processes comes to the forefront [4]. History records the motion concept of Aristotle: the movement has to be supported by the relevant efforts, hence it must be enforced. It was replaced by the concept of free inertial movement of Galileo-Newton, even though in XII - beg. XIII century parisian natural philosophers advocated "causeless" movement (discard efforts for movement [4]). And not without reason Newtonian work in mechanics is entitled "Mathematical Principles of Natural Philosophy." Inertia (rectilinear and constant velocity movement) law has found expression in the so-called Galileo transformations much later: the transition from one inertial reference system K to another K' leads to recalculation of position in space and consideration of time equality according to formulas (in the case of one-dimensional movement):

$$x' = x - vt, \qquad t' = t,$$

here v is the speed of mutual movement of systems.

Such notion is defensible by the fact of extreme success and effectiveness of Newton dynamics application, which became something like a standard of scientificness.

The situation changed dramatically with the emergence electromagnetism when electrical engineering has made considerable progress and encouraged scientists to think on the problem of wireless data transmission means. Because from the works of Faraday (the idea of electromagnetic fields), properly formalized by Maxwell, out of his equations emerged the existence of electromagnetic waves and sustained rate of their propagation (in vacuum), equal to the velocity of light. This led to the identification of light as a wave (electromagnetic theory of light), and to study the properties of these waves, which became possible after Hertz discovered the opportunity of their generation and properties, similar to the properties of light, which were interpreted as very high-frequency electromagnetic waves.

But this case revealed the existence of the problem: when the speed of electromagnetic waves (including light) is universal constant, the principle of speeds addition from Newton mechanics is revealed as wrong. It was found that instead of Galileo transformations another ones that are related to space and time simultaneously should be used. Such transformations considered for different purposes by several researchers (e.g. by Fitzgerald), together recorded by Lorentz, slightly improved some formulas by Poincar?, which itself had considered the problem of measuring time before (witch was then referred to by Lorentz). Poincar? noticed that the transformations form the group in algebraic sense and he called them as Lorentz transformation and the group - Lorentz group, and introduced imaginary coordinates ict for time (see history [5], biography of Poincar? [6], and analysis of Poincar? publications [7]). They are:

$$x' = k(x - vt), \qquad t' = k\left(t - \frac{v}{c^2}x\right),$$

where $k = \dfrac{1}{\sqrt{1 - \dfrac{v^2}{c^2}}}$ is the so-called Lorentz-factor, even though it was derived by Heaviside [8], c - velocity of light. Similar results were published by Einstein, Pauli says about it [5]: "Fundamentals of new theory were reduced to the known completion by Einstein".

Einstein's results are examined, clarified and revised by well-known publications on the so-called information theory, particularly on its relations to physics, French physicist Brillouin in the book [9], based on the systems analysis. He says: "First we need to distinguish between "partial relativity theory" and "general relativity theory". The first of these is stricter and it is based on massive physical and astronomical observations, generalizations of which led to the notion of "inertial reference system"…Einstein introduced the concept of "partial" in connection with his attempts to extend later this principle (relativity - authors) on the general situations. However, recently such a generalization has been criticized by scientists in different countries, who have found many weak points in assumptions of Einstein independently of each other (see [6-11]; Fok and even ardent Einstein's apologist Ginsburg [12], gave analysis of them - authors)... general relativity theory - is a brilliant example of a beautiful mathematical theory, built on sand and which leads to more accumulation of mathematics in cosmology (a typical example of science fiction)". Then Brillouin provides a number of inconsistencies of this theory to the observation data and raises the issue of building Grazer - a powerful amplifier of gravitational waves that would be a laser analogue. This could reveal interesting facts about the nature, and features of such waves.

4. Grazers would have opened the opportunity to develop gravitational transmitters and receivers able to compete with radio and would be "an indispensable tool for scientific research; therefore, grazer is needed!" - ending his book says Brillouin. And while this doesn't exist, let's return to the sources and reject the name "relativity" (of what and to what?), which was arise, when it was in doubt (and then abandoned) concept of ether as an absolute frame of reference, and the opposite hypothesis was called the

relativity principle (Poincar?) and postulate of relativity (Einstein). As the words of Mandelstam, provided by Terlets'ky [10], say: "Name "relativity principle" is one of the most unsuccessful: independence of phenomena from the constant movement of the closed system is claimed. What is called the "relativity principle", is deceptive and makes the conclusion (quite reasonable) that these names don't represent the true meaning of the theory, when the question is about the invariability of physical laws under the groups of transformations". It is therefore natural to continue the tradition of Poincar? and this feature call Lorentz-invariance (or shorter, L-invariance), but remember that physicists use the term a relativistic physics (as relativistic Dirac equation for electron, which "foresaw" positron).

As to Einstein it should be said that after 1915 under influence of authority of his so called general relativity theory (which in fact is some version of gravitation theory) he steps aside from the problems of contemporary of that time physics and even from his own former achievements for which he was awarded by Nobel Prize. This as has witnessed Lanczos [13] by Einstein awn words said to his friend: "If somebody was lucky enough to discover something very important then his life cannot be as before". Remainder of Ensteins life were devoted for attempts to unify all known physical fields in one united theory but this his intention suffer a rewers. He has not any disciple. Besides of many tendentious apologetic publications as [12] the whole dramatism of this unordinary person's life ascertains the most complete his biography [14]

It should be added likewise that, well known Maxwell equations haven't been recorded by him, but these are - modifications of his equations by the Heaviside and Hertz, and Einstein's famous relativistic formulae $E = mc^2$ and $m(v) = km_0$, where m_0 is the mass of the particle in rest, $m(v)$ is its mass at a movement speed , were derived by Heaviside long before Einstein [8]. And, as Leningrad philosopher Mostepanenko writes [11]: "as is known, Lorentz and Poincar? received basic relations of the special relativity theory before Einstein. However, the limitations of their philosophical views prevented them from making the correct physical interpretation of established mathematical apparatus. Hendrik Lorentz was convinced materialist, but he was too loyal classical physicist, and could not abandon the classical ideas about time and space. Henri Poincar? was ready to abandon the classical conceptions and was not subjected to dogmatism, but did not believe in the objective reality of space and time. He lays that we choose our space-time representation by convention (agreement) for reasons of convenience and expediency". That is elucidation of the fact, how one of Einstein's biographers writes, that yet Lenin "branded" Poincar?, and this circumstance, perhaps, was one of the reasons for silencing the role of Poincar? in the former Soviet Union, though Poincar?'s "conventionalism" in our time is interpreted as a necessity of acceptance of argued mathematical model not only depending on the object examined, but also on the research tasks.

III. Contemparary tendency in problem solution

In spite of Brillouin's appeal regarding special and general relativity theory is relevant, we return to the analysis of physical laws in the theory of signals, and in general scientific and technical sphere of radio electronics as symbiosis of radio engineering and electronics [3]. But first of them is commenced by the works of Hertz (vibrators, antennas, first indicators), Branly (coherer), Lodge (jolting mechanisms to increase coherer sensitivity), Pylchykiv (protector, telemechaonics), Tesla (telecontrol), Fessenden (wireless telephony, broadcast - voice and music). Popov (streamlining of jolting connection sensitive relay), Crookes (the idea of the frequency setting system, "receiver-transmitter", preventing interception, coding), which was the means of practical realization of wireless transmission of messages, using electromagnetic waves in space. And yet in 1885 Edison applied for a patent for "transfer of Morse code alphabet signals without wires", which had to be bought by Marconi, who patented device for wireless telegraphy in 1896 in England [3].

Electronics whereas has arisen (after the Edison's discovery of thermal electron emission) with the invention of triode by de Forest in 1906, as a means of amplification the weak electrical signals, and in transfer technology - Meissner's invention of method for generating electrical vibrations in 1913. Further development gave: Losev's "crystadyn" - crystal detector instead of lamp (1922) and "solid" Lilienfeld's amplifier (1925) and Bardeen's and Brattain's transistor (1948) (see [3, 15-19]).

After engendering so many problems, some of them were mentioned in the paper, Maxwell's equation, opened the way for a new modern view on the physical laws, which actually applies to radio electronics (because science faces speeds of the order of magnitude of c in the microworld). Feynmann [20] has expressed this point of view most clear: "Space and time are in separately linked ... hence exact form here it is the beginning of study of symmetries of physical laws. Exactly Poincar? suggested exploring what can be done with equations, while not changing them (it is exactly his idea to draw attention to the properties of symmetry of physical laws). Symmetries didn't have a particular depth concerning spatial transfers, time shifts etc. Symmetry under rectilinear uniform motion is very interesting, and it has most diverse consequences. Moreover, these consequences can be extended to laws that we do not know".

IV. Conclusion

Facts which presented by Feynman[20] as well as by Wigner [21] (Nobel Prize winner, 1963 for the application of fundamental principles of symmetry) confirm the perspective (and productivity) of this way in radio electronics on the whole, and in theory of signals in particular, and the necessity of more complete using of these principles in investigation and education processes.

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Автоматизація виробництва альтернативних палив на основі переробки вуглецевмісних відходів

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Розглянуто засади автоматизації виробництва альтернативних палив на основі переробки вуглецевмісних відходів. Наведено дані про фізико-хімічні перетворення вуглецевих сполук в процесах переробки. Вказано на перспективи використання запропонованих технологій в енергетиці.

The automation basis of technology for the alternative fuels production by carbon bearing waste materials processing are discussed. The data concerning physical-chemical transformations of the carbon com-pounds during processing are presented. It is appointed on the perspectives of the proposed technology intro-duction in energy industry

Проблема утилізації відходів у XXI столітті набуває глобального характеру через прагнення суспільства до прискореного промислового і соціального розвитку без належної уваги до забруднення навколишнього природного середовища, в тому числі у промислово-розвинених країнах світу. Для утилізації токсичних і небезпечних відходів використовуються спеціальні технології, які не можуть бути запропоновані для масового використання.

Основна маса промислових і побутових відходів традиційно знешкоджуються шляхом їх захоронення, що у зв'язку зі зростанням кількості відходів, різноманітності інгредієнтів та великими термінами їхньої природної деструкції приводить до неконтрольованого негативного впливу на довкілля. Утилізацію відходів шляхом безпосереднього спалювання також не можна вважати оптимальним вирішенням проблеми оскільки на сьогодні воно має високу вартість і не гарантує дотримання екологічних стандартів.

Сортування відходів з вилученням корисних компонентів, які можуть бути повернуті у промислове виробництво в якості вторинної сировини, безумовно, є корисним і дозволяє заощадити зна-чну частину ресурсів, однак їх використання часто призводить до ускладнення виробничих технологій і не дозволяє повноцінно замінити оригінальну сировину.

Особливістю переважної частини промисло-вих і побутових відходів є те, що вони можуть бути згруповані за деякими спільними ознаками, які дозволяють застосовувати певні технології переробки. На-приклад, аналіз морфології твердих побутових відходів - ТПВ (Рис. 1, [1]) показує, що біля 82% від маси відходів є вуглецевмісні матеріали. Дерев'яні будівельні відходи та відходи вуглевидобутку, деревообробної промисловості, сільськогосподарського виробництва, пластмаси, низькосортне та некондиційне вугілля, торф та інші також є вуглецевмісним матеріалом.

Вуглецевмісні матеріали можуть бути використані, як додатковий енергетичний ресурс, однак, не шляхом прямого спалювання, а шляхом екологічної конверсії у синтетичне газове і рідке паливо. Для цього технології конверсії повинні відповідати наступним вимогам:

- універсальність технології конверсії щодо виду вуглецевмісних матеріалів;
- енергетична достатність синтезованого газового і рідкого палива;
- відсутність негативного впливу на природне середовище;
- мінімальна кількість інертних залишків переробки;
- енергетична збалансованість технології;
- можливість адаптації за потужністю і розташуванням виробництва.