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Virtual Science

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Abstract: The paper discusses a huge stream of low-quality publications that form a virtual scientific quasi-reality, which may not have anything to do with science as such. Using the method of analyzing the problem of fakes in the media, performed in the publication of S. Ilchenko, the article approaches the task of analyzing the flow of scientific and not quite scientific publications with the same criteria and with the same reasoning methods. The article is intended for graduate students (doctoral students) studying the subjects "Academic Writing" and "Research Methods".

Key words: science, publications, citation, expertise, fake, pseudoscience, pseudoscience, virtual reality.

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On Possible Causes of Incorrect Modeling of Locked Dynamical Systems

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Abstract: Sometimes, when modeling locked-loop control systems, researchers make mistakes, in which case the simulation results cannot be trusted. It may not show up at all. One of the reasons that modeling errors will not be revealed may be that the paper did not arouse anyone's interest, even the authors themselves do not intend to use its results. This, unfortunately, happens when a paper is written only for the sake of the fact of publication. In this case, invented objects are used for modeling, with models that do not correspond to any real object. No one is going to check in practice the performance of the calculated regulators. Another reason may be overly ideal modeling, which does not make a difference between a realistically possible simulation of the operation of a system using signal transformation, and purely mathematical operations that do not use the determination of estimates of derivatives from their signals, but the ideal derivatives of signals based on knowledge of the mathematical models of used signals. It cannot be ruled out that in some cases the reasons for errors are the lack of competence of the authors. In any case, it is useful to deal with such examples of insufficiently careful modeling and publication of papers claiming achievements that the researchers did not actually receive. In one article, of course, it is impossible to deal in detail with all the erroneous publications, even in one very narrow area, but even individual examples can serve to restore the scientific approach. This paper analyzes some typical errors in modeling locked dynamic systems and in designing a controller for them. The paper may be useful not only for students and graduate students, but also for some teachers in the subject “Theory of automatic control” in the course “Control in technical systems”.

Key words: PID controller, nonlinear plant, simulation, robust system optimization, MATLAB, Simulink, VisSim.

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Testing of Effectiveness of the Regulators by the Method of Localization

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Abstract: The scientific school of NSTU in the field of control of closed dynamic systems widely uses and advertises the method of designing regulators based on the principle of localization. This method is also in some cases called the method of separation of movements, although there are other methods that are not related to it in any way, aimed at solving the same problems, bearing a similar name. New articles are published regularly, confirming the effectiveness of methods based on the principle of localization. This publication uses a numerical simulation method to explore in detail the advantages, possible disadvantages and limitations for the application of this method.

Keywords: automation, PID controller, PI^{2}D controller, PID^2 controller, PI^{2}D^2, PL controller.

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Control of a Non-Linear Plant with Many Non-Linear Feedbacks

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Abstract. The control of non-linear objects is becoming increasingly important. The numerical optimization method is the most effective for these purposes. Checking the result by the response of the resulting system to a single step action, often practiced when designing control systems for linear objects, is often applied to control systems for non-linear objects, which is a mistake. This article demonstrates that even in the case of successful control demonstrated with such a test signal, the system may have insufficient quality when processing signals of a different amplitude. Therefore, it is necessary to check the stability of the system and the quality of the transient process, including accuracy, overshoot, and the absence of fluctuations in a much wider range of reference signals. It is shown that the optimization result significantly depends on the type and amplitude of the signals used as a test task during the optimization procedure. It was found that the system may be unstable in small things, i.e. for small nonzero signals, the system may be prone to oscillations. It is also shown that a system that demonstrates itself as sufficiently high-quality by many test signals can exhibit unacceptably poor quality, including large-amplitude self-oscillations as a response to a signal that first jumps from zero to non-zero, and then jumps back to zero. condition. For the first time, it was proposed to use just such the most complex signal for some types of nonlinear systems as a test signal for the duration of the numerical optimization procedure. It is shown that in this case the best possible setting of the PID controller is obtained, such a system significantly suppresses even noise with an average of zero, while a system optimized by a step jump, under such conditions, goes into a state of self-oscillations with a significant amplitude.

Key words: automation, PID controller, control, nonlinear plant, numerical optimization, simulation, cost function

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Investigation of the Stability Margin of a Control System for a Nonlinear Plant with Many Nonlinear Feedbacks when the Parameters of its Model Change

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Abstract. The paper [1] describes the method and result of designing a controller for a nonlinear plant. A PID controller is proposed, test signals are proposed that are not typical for a similar problem of controller synthesis for a linear plant, and a specific numerical solution is also proposed. In the final part of the article, modeling was carried out, confirming the success of solving the problem. However, this article did not carry out a detailed check of how this solution of the problem is stable in the event of a change in the coefficients of the nonlinear model of the object. This can be verified by additional simulations. The situation is complicated by the fact that, firstly, transient processes depend on the amplitude and shape of the input signal, and secondly, there are several coefficients in the object model. In particular, there are two coefficients that determine the depth of non-linear feedback. The article proposes a method for this verification and its results.

Key words: verification, testing, robustness, roughness, automation, PID controller, control, nonlinear plant, numerical optimization, modeling, cost function

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Unified field theory

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Abstract. The paper reports on the creation of a new axiomatic theory, which claims to be called the "unified field theory". The method of constructing the unified field theory, developed by the author, is presented. Based on the hypotheses put forward by generalizing the mathematical expressions of physical concepts and laws, the so-called "basic relation" was revealed as the basic law of physics, which made it possible to draw a complete picture of the world in the form of Euler-Venn diagram. The logical consequences derived from a holistic picture of the world made it possible to construct a system of axioms of the theory. The basic law of physics and the system of axioms of the theory was the basis for the assertion that the field of rational numbers is the mathematical structure of physical laws. The theorems that characterize a given mathematical structure form the core of the theory. The automorphism groups of this mathematical structure made it possible to classify and systematize physical laws. Within the framework of this theory, Newton's first law, the principle of relativity, the second law of thermodynamics are for the first time expressed in the form of theoretical laws, and the existence of a law on non-inertial frames of reference and a law, a particular manifestation of which is the lens formula, are also predicted. In the presented theory, all the laws of philosophy "find" their mathematical expressions. Making the laws of physics as laws of causality makes them universal, universal, and the theory - unified. The theoretical laws of physics of the unified field theory combine the fundamental theory with the theory of relativity. At the epicenter of the theory is a person, more specifically, the organization of his thinking on the basis of cause-and-effect relationships. Human thinking is built in such a way that it is able to analyze exactly the cause-and-effect sequence of any processes, i. e. this way of cognition was originally incorporated in the structure of the human brain. We cannot refuse the human factor in understanding the laws of nature. The unified field theory unites not only classical mechanics with the theory of relativity, it unites all fundamental physics through its “Newtonization”.

Key words: unified field theory, physical laws, field, mathematical structure, cause-and-effect relationship, equivalence relation, law of composition, integral picture of the world, axioms of the theory, core of the theory.

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Derivation and Integration of Functions in a Complex Degree

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Abstract: Some mathematical problems reach such complexity that their solution and engineering interpretation is no longer possible, or at least extremely difficult for researchers without the use of artificial intelligence tools. Mathematical relations for such problems are very difficult to interpret. In connection with the development of means for mathematical calculations, such problems have partially lost their relevance. However, new problems can be posed in mathematics, for which the existing means of mathematical calculations may still be insufficient. Presumably, such problems include the problem of differentiation and integration to a complex degree. Differentiation of various functions is widely used in many branches of mathematics, technology, and science. Historically, differentiation was known for cases where the exponent of the degree of differentiation was a positive integer, which meant the multiplicity of taking the differentiation operation. Later, this operation was extended with the notion that the exponent can also be negative, which means multiple integration. Differentiation to a negative power is defined as integration, and integration to a negative power is defined as differentiation. Subsequently, the question of the possibility of non-integer differentiation and, accordingly, integration was raised and positively resolved. This extension of the mathematical apparatus proved to be very useful, since it allows the design and implementation of more efficient controllers, for example, for systems with negative feedback. Publications about taking the derivative to a purely imaginary degree have already appeared, but, apparently, the question of differentiation was also discussed in the literature, in which the degree of taking the derivative would be expressed by a complex number. The article proposes an approach to solving this problem, which may not have been discussed yet. If this complex number, denoting the degree of differentiation, has a positive real part, the operation is better called a special form of differentiation, but if the real part of the degree of differentiation is negative, then the operation is more consistent with the concept of integration. Formally, inverting the exponent of the degree of differentiation turns the operation into integration and vice versa. Throughout history, it has been repeatedly confirmed that mathematics, from time to time, solves problems that, at the time of their discovery, have no obvious applied value; however, the development of a theory is valuable in itself, even if there is currently no obvious applied value of such development. In addition, experience shows that each new mathematical tool will eventually be used to solve an important practical problem.

Key words: artificial intelligence, automation, non-integer differentiation, non-integer integration, Laplace transform, complex numbers.

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Design of PID-controller for Controlling a Non-Linear Plant with Positive Non-Linear Feedback

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Abstract. Annotation. The most difficult to control are non-linear objects, among them the most complex are objects with non-linear feedbacks, in this class of objects the most complex are those objects in which these non-linear feedbacks are positive. This means that each deviation from the equilibrium state in this object increases additionally due to the action of feedbacks, provoking an avalanche-like process of deviation from the equilibrium state with increasing speed. Such a process can develop to very large values, which are limited only by the physical possibilities of forming the maximum output deviation from equilibrium, which, when modeling or analytically calculating the output state, gives an infinitely increasing value. Some models of objects of this class can be so complex that the solution of the control problem can be carried out only by the most efficient of all known methods, which consists in creating pseudo-local stabilizing feedbacks in addition to the traditional PID controller. If we do not take into account this method, which can also have its drawbacks, and focus only on the traditional scheme of a sequential PID controller, then very little is known about the design methods for such a controller. The most effective method is numerical optimization in simulation, however, the first experiments with one of these simulation experiments ended in failure. This article reveals the reasons for this failure and proposes a method for overcoming this failure, the effectiveness of solving the problem in this way is confirmed by its successful solution.

Key words: automation, PID controller, control, nonlinear plant, numerical optimization, simulation, cost function

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Moscow Workshop on Electronic and Networking Technologies, MWENT-2022

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Abstract: Main contributions of III Moscow Workshop on Electronic and Networking Technologies MWENT-2022 based on "R&D SPELS" are considered. The seminar will be regularly organized by the A.N. Tikhonov Moscow Institute of Electronics and Mathematics of National Research University Higher School of Economics and Tomsk Chapter of the Institute of Electrical and Electronics Engineers for support a specialized discussions and interaction among scientists and the engineers working in microelectronics and networks, to establish cooperation among participants by activities of the IEEE professional communities. Importance of professional events in the field of electron devices and electronics and interaction expansion between business and university designers are shown. The information on new IEEE service is given. Additional possibilities of continue professional dialogue within the frameworks of the IEEE Electron Devices Society, chapters and other IEEE units are discussed.

Key words: professional events, scientific publication, conference, professional networking, science metrics, electron device, scientific database.

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