ABSTRACT AND REFERENCES

INFORMATION AND CONTROLLING SYSTEM

## USING STABLE DISTRIBUTION LAWS DURING EVALUATION OF SIGNAL PROCESSING EFFICIENCY IN OPTOELECTRONIC SYSTEMS (p. 4-10)

**Tatyana Strelkova**

The changes in the statistical properties of the output signals of the optoelectronic systems with limited dynamic range when forming spatial-temporal distribution of optical radiation in the photodetector plane were analyzed. It is shown that selecting statistical models based on the central or generalized limit theorems requires considering the system operation conditions and spatial-energy characteristics of signals. Studies of the asymptotic behavior of tails of the distribution densities of the output signals have shown the possibility of using stable distribution laws for describing the signals in the optoelectronic systems. ustainable distribution laws for describing the signals in optoelectronic systems. Comparative analysis of the system detection errors, depending on the selected statistical model of output signals has shown that using stable laws is essential in evaluating the signal processing efficiency. Improving processing algorithms in optoelectronic systems taking into account a statistical model of the output signals based on stable laws allows to avoid detection errors.

**Keywords**: optoelectronic systems, Poisson model of signals, signal fluctuations, Gaussian and non-Gaussian statistics, generalized limit theorems.

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## NEW DATA CLUSTERING HEURISTIC ALGORITHM (p. 10-16)

**Volodymyr Mosorov, Taras Panskyi**

Clustering is the data mining technique that is used to place or collect objects into groups in such a way that objects in the same group are more similar or related among themselves than to those in other groups. These groups, called clusters, resemble each other but differ from other groups in objects which those contain. In this article the method of data clustering on the example of random data with uniform distribution was proposed. This article is focused on clustering in data mining. Data mining represents solving the problems by clustering large data sets with different data types and properties. The main task of the research was investigating data clustering and finding out how many clusters the data set contains. In particular, we were interested in answering the question whether there is more than one cluster in this data set. New method includes the decision rule. Decision rule uses the following parameters: area of regions found by the density distribution of input data, the number and magnitude of local maxima (peaks) found in each region, the number of elements (of the total number of primary elements) that fall into each found region. Proposed clustering method differs from existing, that the input parameter is the only data set and the criterion for evaluating the correctness of this method, is an objective assessment of a person or group of people based on visual logical analysis. All manipulations with the data mentioned in this article were made by using the Matlab software.

**Keywords**: clustering method, cluster, heuristic algorithm, density distribution, density based.

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## ESTIMATION OF THE CORRECTING CAPABILITY OF CYCLIC CODES BASED ON THEIR AUTOMATION MODELS (p. 16-24)

**Vasyl Semerenko**

We have considered a new method of presenting cyclic codeswith the use of finite automata in binary fields of Galois-linear subsequent schemes(LSS).The automatic presentation allows using new positions in the approach to solving the fundamental problem in the theory of noise-immune coding, which entails identifyingand correcting the capacity of a given code.

Instead of the conventional minimal code distance, which is not a comprehensive description of the code and is difficult to calculate, we suggest direct identifying of the number of detected and corrected errors by the automatic and graphic models of the cyclic code. The paper proves that the structure of LSS zero cycles gives the most accurate assessment that can be applied for different types of errors (both occasional and error packages) as well as for all subclasses of cyclic codes (Hamming, Bose-Chaudhuri-Hocquenghem, Fire, and others). We have presented an algorithm for building an automatic code mode and evaluating its capacity.

We have introduced new characteristics of correcting and revealing properties of cyclic codes. These are ranges of different kinds of errors, with precise indication of the number of occasional errors and error packages that are revealed and corrected.

**Keywords**: cyclic codes, code distance, correction capability of the code, linear subsequent scheme.

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## MODEL OF EVOLUTION OF SCHEDULING SUB-CHANNELS TO IMPROVE QUALITY OF SERVICE IN WIMAX NETWORK (p. 25-29)

**Haider Dheyaa kamil Al-Janabi, Hussam Dheyaa kamil Al-Janabi, Al-Dulaimi Aymen Mohammed**

Based on the Flaws of the known mechanisms of the frequency resources scheduling in the download channel; the problem, which is raised in this paper is assuring QoS by available resources which directly influence the quality of the equipment design. The WiMAX resource allocation algorithms determine which users to schedule, how to allocate subcarriers to them, and how to determine the appropriate power levels for each user on each subcarrier. We present a brief survey of recent scheduling research. The goals of scheduling are to achieve the optimal usage of resources, to assure the QoS guarantees, the mathematical model introduced by a number of linear and nonlinear conditions-limitations is analyzed in this research. Therefore, the model that consists in the statement of the sub-channels scheduling task is proposed. This model gives a solution of tasks of rescheduling of the accessible capacity of the download channel of the WiMAX technology for the information transmission in the direction of users stations, taking into account their territorial remoteness.

**Keywords**: WiMAX, IEEE 802.16, wireless network, allocation of sub-channels, self-organization, mathematical model, scaling.

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## THE VIRTUAL MODEL METHOD IN THE METROLOGICAL PROVISION OF AUTOMATED DESIGN AND CONTROL (p. 30-35)

**Alexandr Stanovskyi, Lyubov Bovnegra, Julia Shichireva, Oleksandr Shmaraev**

For the metrological provision of design and control, involving processing intermediate measurement results in the form of images, existing compression methods of the latter are not suitable. This is caused by the need to replace the inverse optimization problems with the set of lines and a sharp increase in time complexity. The virtual model method was created. The positive technical effect when using the proposed method in construction was experimentally confirmed.

The theoretical foundations of the virtual model method, representing the latter as an imaginary mapping of the object into the environment, impracticable in real conditions of existence were developed. When carrying out calculations on a virtual model in the imaginary environment, followed by a return to the real environment, the method allows significantly (by orders of magnitude) reduce the search time for the optimal solution for CAD systems and ACS.

The proposed virtual model method was tested in the environment of the general metrological system «INMER», designed for measurement and control of thermal process parameters during the reinforced concrete hardening in the cold due to processing infrared fluxes from the surface of such products. Within the ACS of the building construction process, «INMER» system was built in as a separate link in the overall automated control system, namely, in the ACS feedback loop.

In particular, the «INMER» system tests were carried out at the construction site of "Stikon" Ltd (Odessa). As a result of the tests, increase in the strength of reinforced concrete building products (columns, diaphragms, floor slabs) by 16–19 % was observed.

**Keywords**: metrological provision of CAD and ACS, image processing, virtual model method.

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## METHODICAL BASICS OF EXPERIMENTAL RESEARCHES OF FUNCTIONING OF INFUSION PUMPS IN MEDICINE (p. 36-41)

**Elena Bulygina**

Analysis of the test results of infusion pumps that are used for administering solutions to patients in resuscitation units, intensive care units, as well as during transportation was performed in the paper. The process of drug administration in the neurohumoral system is critical, so the problem of determining the dosage accuracy of the solution volumes, administered to a patient is very important. The tests of infusion pumps to determine the dosage accuracy, according to the international standards ISO 606601-2-24 and ISO 606601-1-8 were carried out in the paper. Based on the results, conducted in clinics, the errors of the injected volumes in accordance with existing standards were calculated. As a result of data processing, the incompliance of the current dosage volumes with guidelines was found. To prevent administering a doubtful amount of drug, prediction model using artificial neural networks was developed. This model, together with a computerized information system will help to predict the unauthorized administration of drugs over time and allow the medical staff to prevent a critical situation.

**Keywords**: test, infusion pump, solution delivery speed, test results error, prediction model, artificial neural networks.

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## DESIGN OF THE INTELLIGENT CONTROL SYSTEM TRACTION DRIVES (p. 41-46)

**Dmitro Kulagin, Igor Romensky**

This paper studies for the creation of intellectual control system for electric traction. The analysis was further developed methodology development of intelligent control systems for electric vehicles by developing a neural network systems using swarm intelligence for optimum traction rolling electrical complex that lets you set partial traction by means of electric transmission with minimum mean square error values. The paper presents the intellectual electric traction control system based on the following sequence: synthesis control system to provide the necessary connection between the parameters of the dynamics and traction characteristics necessary traction motors using Particle swarm optimization, which makes it impossible to establish a clear connection between the parameters of traction dynamics and the desired characteristics of traction motors; development of appropriate neural network technology to ensure the functioning of the developed system.

**Keywords**: Electrical Complex, traction drive, method, neural network, Particle swarm optimization.

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## SIMULATION OF SUPERHET RETRANSMITTING METER WITH ANALOG-DIGITAL SIGNAL PROCESSING (p. 46-52)

**Anatoly Velychko, Dmytro Velychko, Sergiy Velychko, Aleksey Vichkan, Anna Klyueva, Kostyantyn Netrebenko**

Process control errors, caused by radio wave reflection from foreign objects, can be reduced by applying spatial filtering, implemented in a retransmitting method. Even greater benefits in measurements can be obtained using the superhet receivers and digital data processing techniques in this system. In the paper, a functional diagram of the superhet retransmitting meter with analog-digital processing was synthesized, a description of the main units was given. The mathematical formulas that determine the signal and wave conversions, occurring during operation of the measuring retransmitting system and processing of the received signals were presented. These formulas were written for previously unstudied operation cases of the measuring retransmitting system on the set of stable and fluctuating reflectors. Their application field is limited by the Fraunhofer zone. The main purpose of the mathematical description is a computer simulation of the processes occurring during the measurement and obtaining the statistical characteristics of the signals, received by the system. It is expected that using the formulas obtained, pseudo-random sequences of independent combinations of stable and fluctuating reflectors will be converted. The resulting mathematical description is the basis for computer simulation of the system under study and will allow to obtain and compare the statistical characteristics of the signals of the retransmitting system and radar sensor.

**Keywords**: measuring retransmitting system, interference reflection, phase, simulation, analog-digital conversion.

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## RESULTS OF USING GAS-ANALYTICAL HARDWARE-SOFTWARE COMPLEX TO ASSESS CARDIOVASCULAR DISEASES (p. 52-58)

**Viktoria Iakymchuk**

The relevance of a new method based on the analysis of the chemical composition of exhaled air to assess pathological conditions of the cardiovascular system was considered. The process of detecting cardiovascular diseases is realized using the developed gas-analytical hardware-software complex, the main component of which is the selected set of electrochemical sensors of ampermetric type.

Practical use of the complex has allowed to collect a database of practically healthy examinees and patients with CAD and MS. Measurement data obtained from gender-homogeneous groups were analyzed using the apparatus of statistical methods. Also, ROC-analysis: finding significant factors and their limit values of the onset of the disease investigated was used to compare the results.

The results have confirmed the need to divide the examinees into age groups. The proposed method of analysis of the indicators of chemical sensors has calculated the marginal factors that show the time of tracking the studied pathology.

High rates of the results and using such systems allow to improve the diagnostic process and enhance screening methods of the studied functional system. At the same time, versatility of the approach to creating such complexes offers great opportunities to improve and perform basic tasks of medicine: prevention of diseases, timely appointment of remedial measures and reducing the number of fatalities.

**Keywords**: gas portrait, chemical sensors, tidal air composition, cardiovascular diseases, screening diagnostics.

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## DEVISING A MATHEMATICAL MODEL FOR PATTERN-BASED ENTERPRISE DATA INTEGRATION (p. 59-64)

**Ilona Galushka, Sergey Shcherbak**

The paper considers the problem of centralized automation policy at domestic enterprises that leads to a decreasing quality of subdivision interaction and productivity of an enterprise operation. To solve such problems, we have suggested an approach based on collective use of the concept of combined data and the enterprise service bus. The devised classification of the existing patterns of corporative data integration and brief characteristics of integration platforms IBM WebSphere, TransparentGateways, and OpenLinkVirtuoso have secured an adequate decision for integration at the data level in favor of adaptable, easily customizable, and intuitive integration tools. We have suggested a mathematical model for the specialized integration system of corporative data as part of the enterprise service bus. The model provides logical consistency and formal description for the structures of integrated data as patterns for hierarchically arranged distributed objects with unified access interfaces. The model contains mapping functions that formally describe integration processes on the basis of related data and object-oriented approach. This allows increasing the interaction productivity for inherited enterprise information systems at the expense of integration patterns.

We have considered practical aspects of corporative data integration that demonstrate advantages and efficiency of decisions based on the suggested model, the selected integration platform OpenLinkVirtuoso, and the SPARQL protocol. The devised architecture of the specialized system for integrating corporative data is based on the enterprise service bus and related data technologies. The architecture means a complex of integration brokers and describes, in terms of related data concepts, the relay of the integrated message between the sources of inherited information systems.

**Keywords**: information systems, enterprise service bus, related data, distributed objects, integration patterns.

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## METHOD AND INFORMATION TECHNOLOGY FOR CONSTRUCTING A NONPARAMETRIC DYNAMIC MODEL OF THE OCULOMOTOR SYSTEM (p. 64-69)

**Alexander Fomin, Masri Masri, Vitaliy Pavlenko, Anna Fedorova**

Method, information technology, computational algorithms and software tools for constructing a nonparametric dynamic model of the human oculomotor system were proposed.

A method for constructing the nonparametric dynamic model of the human oculomotor system with regard to its inertia and nonlinear properties based on the data of experimental studies "input-output", as well as efficient computational algorithms and software tools for processing the data of identification experiments were developed.

Nonparametric nonlinear dynamic model of the oculomotor system based on processing the data of experiment "input-output" - pupillary response to a disturbance in the form of a light spot was obtained. Using the algorithms for intelligent processing of the captured video sequence of the pupil position change, the function of the oculomotor system response to a disturbance is simulated. Description of the oculomotor system properties is made using the most versatile nonlinear nonparametric dynamic models in the form of Volterra series. The technology for tracking the pupil behavior using the video recording, which has allowed to determine the dynamic characteristics of the oculomotor system according to the observational data "input-output" have got further development.

The proposed technology for tracking the pupil behavior is available for widespread use in modern applications with an expanded set of personalized features, such as medical and athletic training machines, authorized access to data, testing human-machine systems and so on. An important feature of the technology is indiscriminateness to the hardware that allows its use in the applications of modern mobile devices.

**Keywords**: oculomotor system, modeling, nonparametric dynamic models, Volterra kernels, multi-dimensional transient characteristics.

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