EFFICIENCY IMPROVEMENT OF AUTOMATIC CONTROL SYSTEMS OF POWER SOURCES FOR SELF-CONTAINED DRILLING PLATFORMS (p. 4-10)

Vladimir Zhukov, Anton Zhilenkov, Oleg Bezjukov, Ivan Titov

The topical problem of ensuring stable parallel operation of two or more gas-diesel generators as a part of the self-contained power system of offshore drilling platforms and water transport facilities is considered. The operating conditions of such a system as a part of the self-contained drilling platform, where sudden changes in electric network load make it impossible to use gas-diesel generators since the latter are characterized by high instability of speed are examined. Gas-diesel generator speed depends on the load on the generator bars, which causes the need to adjust the dynamic characteristics of speed regulators of gas-diesel generators, depending on the operation mode. Analysis of the operation of the self-contained power system of the drilling rig revealed that switching processes caused by connecting or disconnecting the loads lead to fluctuations in voltage and frequency, the spectrum of which is in the same frequency range as the fluctuation spectrum of GDGS, which gives rise to the exchange fluctuations of power between parallel operating generators.

Based on the experiment, the gas-diesel generator model, allowing to solve a wide range of problems concerning both management of self-contained power generation, and providing the necessary power quality indicators in power systems where the main power sources are parallel operating gas-diesel generator sets was developed.

The proposed dynamic model allows to take into account non-linear properties of the gas-diesel engine, considers the operation features of the turbocharger. In addition, the model allows to reconstruct the parameters of controllers depending on the load on the shaft.

Keywords: gas-diesel generator, load, fluctuations, drilling platforms, generator, turbocharger, exchange fluctuations of power, modeling, diagnostics.

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FORMATION OF A CONCEPTUAL APPROACH TO THE CREATION OF AN EXPERT SYSTEM FOR THE IDENTIFICATION OF THE PROCESSES OF INTELLECTUAL ACTIVITY (p. 11-16)

Olga Serdiuk

Reliable identification of the level of intellectual activity, analysis of the development dynamics and diagnostics of intellectual processes require the creation of a new class of expert systems. One of the main points that should be taken into account in creating expert systems and in the works aimed at identifying the processes of intellectual activity, is the evaluation not of intelligence, in general, as a single complex system, but its individual processes. Only in this case, it is possible to undertake an in-depth analysis of the current state and development dynamics of the processes of intellectual systems, gain access to the possibility of implementing an effective diagnostics of possible problems and identify ways to resolve them.

As it was found in the research, a prerequisite for the implementation of these approaches is the use of system grounded evaluation criterion. Such criterion should be consistent with the criterion of the efficiency of open systems. The evaluation criterion, the choice of which was done in this paper, allows to take into account the complexity level, the deviation of response from the standard and time of the test or task solution.

Using the system grounded evaluation index allowed to propose a unified methodology to characterize both the dynamics of the processes and the maximum achievable level with an unlimited range of its change. Use of the trend dependence, approximating the dynamic series allows to obtain additional opportunities to assess the degree of concentration, and other influencing factors in the form of standard deviation indicator. Also, the proposed criterion provides the possibility of evaluating the entire process as a sequence of evaluation operations, which potentially allows to optimize the parameters of operations that are set prior to carrying out the experiments.

Keywords: identification of intelligence processes, evaluation index, diagnostics of intellectual activity.

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DEVELOPMENT OF TECHNOLOGY FOR CONSOLIDATION AND SYNCHRONIZATION OF DATA OF INDUSTRIAL-PURPOSE INTEGRATED AUTOMATED SYSTEMS (p. 17-22)

Vyacheslav Treityak

The technology for synchronization and consolidation of production data of industrial-purpose integrated automated systems was developed. The technology is the architectural concepts of constructing and using a single consolidated information environment of the industrial enterprise. The functioning of a single consolidated environment occurs via the central link – a single integrated automated system that performs the functions of management of integration and exchange of data between various production systems. For "correct" presentation of data in various integrated automated systems, the mathematical model of production data transformation in a single intermediate format, which uses data transformation templates and establishes links between objects in these industrial-purpose systems was developed. Using a single consolidated environment provides information support of administrative decision-making on the major life cycle stages of the product. This support is based on presenting credible and operational design, production, planning and reference data used by various integrated automated systems in various departments and services of industrial enterprises. The research results as the basis for the integration methodology of automation processes of technical training, planning and operations management.

Keywords: production data, data integration, integrated automated systems, single consolidated environment of enterprise.

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EFFECT OF ELECTROMECHANICAL EQUIPMENT WEAR ON STARTUP PROCESS INDICATORS (p. 23-30)

Valerii Tytijuk

The operation of most manufacturing processes begins with the electric drive startup, which determines the importance and urgency of optimization of EMS startup processes.

In determining the objective function of optimum systems of controlled EMS startup, it was proposed to use the principle of focus on the value added. To implement this approach, various types of input and output products of the EMS startup process were investigated. It is shown that in the analysis of startup processes, it is important to consider accelerated wear of the electromechanical equipment, which is an essential component of the input products of the startup process. The design formulas and models for determining the estimates of input and output products of the EMS startup process, the startup duration were proposed. To overcome the dimensionality problem when dealing with heterogeneous products, it is advisable to use cost estimated of these products. This approach is an economically sound kind of the expert evaluation method.

Based on the known efficiency indicator of resource conversion, an expression of the startup efficiency indicator, taking into account the potential economic risks of the startup failure was obtained.

By the mathematical modeling methods using Matlab/Simulink, dependences of power consumption, wear and efficiency indicators of the EMS startup process on the control action were obtained. The extreme nature of the dependence of the startup process efficiency indicator on the control action was shown.

The results can be used in the synthesis of the optimal control systems of the EMS startup process.

Keywords: controlled startup, power consumption, electric motor wear, startup efficiency indicator, extremum existence.

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IDENTIFICATION OF TARGET SYSTEM OPERATIONS. 4. THE PRACTICE OF DETERMINING THE OPTIMAL CONTROL (p. 30-36)

Igor Lutsenko, Elena Fomovskaya

Classic methods for determining the functional extrema can be successfully applied to solve a relatively narrow range of practical tasks. This is due to the fact that, in general, the quality of the studied output product in the process of movement varies. The traditional methods lose their main advantage associated with the assessment of the process quality at each step of the trajectory change.

In this paper, we have used the example of identifying the process of batch liquid heating to illustrate the use of the devised efficiency criterion for practical determining the optimal control on the basis of experimental data and analytical determining of the value of the heating mechanism depreciation.

Studies show that a necessary condition for finding a reliable optimality criterion is the account of technological equipment wear in situations where its impact on the assessment of efficiency is significant. The question of whether to consider or ignore the equipment depreciation (when searching the optimum) must be justified in each case.

It was found that the maximum efficiency shifts relative to the minimum cost and maximum added value (profit in open systems) towards higher productivity. This is due to the fact that the growth rate of cost, in the vicinity of the minimum cost, is much lower than the decline in the rate of operation (productivity). Ultimately, this leads to an increase in the integral added value if the cyclic operations are handled more efficiently.

The devised optimization criterion has a peculiar feature of its natural sensitivity to both the variation in the values of the system products' cost and the operation time.

Keywords: optimal control, target signature, target operation, efficiency, efficient use of resources/resource efficiency.

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MODELING THE DEVELOPMENT OF COMPLEX STRUCTURES ON THE EXAMPLE OF THE MARITIME INDUSTRY (p. 37-46)

Natalya Logunova, Sergei Chernyi, Anna Semenova, Inna Antypenko

We have justified the prospects of the integrated development of cruise tourism in Ukraine and emphasized the necessity of a detailed study of the international experience of the leading tourist cruise destinations and its implementation in the national cruise industry. We have determined the parameters that influence the productivity of the enterprises and organizations involved in the creation of the cruise tourism product and affect their dynamics and competitiveness.

The designed economic mathematical model for the effects of the strategic development of cruise tourism establishes the econometric dependence of the rate of direct revenues from cruise tourism on the economic, social and resource factors. This model can serve as a base for prognosing the development rate of cruise tourism in a lack of statistical information and justifying the major directions of economic policy in the tourism sector. The desired rate of the national cruise tourism is simulated on the basis of the parameters of the derived regression equation via the geometric interpretation of actual achievements of the Ukrainian cruise market and possible changes of these results if some of the factors (the rate of productivity, capital investments in the tourism sector, or the number of tourists who prefer cruises) vary.

We have proved that the development of cruise tourism is mostly affected by the factors such as: the degree of the labor productivity that is directly related to the level of the employees' professional competence, and investments in the facilities of the port, tourism and related infrastructures, which requires a set of appropriate measures aimed at the development of the key components.

Keywords: cruise tourism, econometric dependence, direct revenues, productivity, tourist destination.

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ENSURING THE INVARIANCE OF THE PATTERN RECOGNITION SYSTEM OF THE MARINE VESSEL SYSTEMS IN THE PROCESS OF FISHING (p. 47-54)

Aleksandr Zhelezniak, Yuri Katorin, Nadezhda Smetuch, Volodimir Dorovskoy, Sergei Chernyi

Analysis of the existing algorithms for processing and transmitting video information for decision-making in information systems has shown that the existing algorithms do not consider the objective identification moments on the fishing fleet vessels. The problems of the impossibility of visualization of real images, clear separation of the object and the background, spatial arrangement of the points in the automated segmentation of digital images are displayed through the dependence by the features of adjacent frames in feature description methods.

This necessitated the development of more detailed algorithms for the digital video data analysis, devoid of these shortcomings.

This method involves the extraction of the contours of the object, which allowed to obtain a set of features and served as a basis for its analysis and recognition. Using the module of the normalized scalar product enabled to effectively solve the basic recognition problems – transfer, rotation and zooming of the object image.

The assessment methods of digital video information were investigated. The main result of this study was the development of a tool for an integrated objective quality assessment of the data transmitted. The feature of the developed tool is that it is integrated into the Scanmar model that allows to simulate the multimedia processing and transmission networks with the assessment of quality losses in real time.

The experiments, conducted using the developed tool, to assess the quality of video encoded by existing compression algorithms have shown that H.264 codec, which showed a higher video quality level than in similar compression by MPEG-4 and MJPEG codecs appears the most effective.

Keywords: digital video information, fish shoal, identification, information system, clustering.

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