



INFORMATION TECHNOLOGIES

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STRATEGIC AUDIT OF INFRASTRUCTURE PROJECTS AND PROGRAMS

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As a research object, models, methods and processes of strategic audit of infrastructure projects and programs are considered. The problems of complex infrastructure projects and programs that are carried out under uncertainty relate to refinement and changes in the strategy under the influence of critical external and internal influences. The analysis of the factors shaping the strategy for the implementation of infrastructure projects and programs in the light of uncertainty takes place within the PEST analysis, which is an integral part of the methodology of strategic audit. The relationship between the «organizational development strategy» and «strategic audit of infrastructure projects and programs» concepts is determined. Approved approaches to the auditor's assessment of the ability to react to a system of management of infrastructure projects on uncertainty factors, changes in the external environment and the degree of adequacy of organizational and economic elements of the management system that ensure the achievement of strategic goals. The algorithm of carrying out of strategic audit on the model of technological maturity of organization (IPMA OCB) is presented. In the model that is being used, five groups of organizational competence competencies in the field of project management are evaluated:

1) management of projects, programs and portfolios as a component of corporate governance that is related to projects, programs and portfolios;

2) management of projects, programs and portfolios as a component of the management system of the organization and implemented by managers of different levels of permanent and temporary units of the organization;

3) coordination of projects, programs and portfolios that ensure achievement of the goals and expectations set by senior management;

4) resource support of projects, programs and portfolios aimed at achieving the goals and expectations set by senior management;

5) competence of the staff of projects, programs and portfolios which is associated with the development of competence, increased productivity and incentives for employees working in projects, programs, portfolios.

Examples of forms of self-assessment on strategic aspects of implementation of infrastructure projects and programs are given. An example of the form of self-assessment of the project manager and his team on behavioural competence in pursuit of strategic goals is shown. An example of an audit of the project implementation strategy for the Confinement Chernobyl NPP (Ukraine) is presented. The conclusions emphasize the impor-

ance of using strategic audit tools in the process of implementation of infrastructure projects and programs.

Keywords: strategic audit, model of technological maturity of the organization, strategy of the infrastructure project, self-assessment of the competence level of the organization.

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DEVELOPMENT OF DATA COMPRESSING CODING METHODS ON BASIS OF BINARY BINOMIAL NUMBERS

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The object of research is the methods of compressive coding, which are used for economical presentation of data in information systems. Compression methods can be used at various stages of data processing, in the transmission of messages and their storage. One of the most problematic places for the application of com-

pression methods are high requirements for computing resources, significant hardware and software costs for their implementation and low coding/decoding speed. In this case, of particular interest are methods, on the results of compression of which computational operations are possible without reversing them.

Within the framework of the approach, when at the basis of any code it is possible to detect a structural number system, mathematical models of compression based on binary binomial numbers are developed. In the structure of sequences, the corresponding binomial numbers are determined on the basis of systems of code-forming constraints. As a result, each combination is assigned a binomial number, which is its compressed image.

In the course of the study, theorems on a one-to-one correspondence between the initial sequences and binary binomial numbers are formulated, which demonstrate how to implement mappings based on simple analytical relations. The examples given confirm the simplicity of the transformations under compression coding and decoding.

The models of the processes of compression and recovery are obtained, which are characterized by a small number of simple operations. As a result, the considered methods are characterized by high speed with good compression ratios. At the same time, the amount of hardware and software costs in practical implementation is small. An additional positive effect is that compressed images have the properties of numbers.

The research results demonstrate the effectiveness of the use of compression based on binary binomial numbers in information systems in order to increase their productivity and reduce the cost of data processing. At the same time, compared with similar known methods, there are minimal costs for their implementation when achieving a high conversion rate and a good degree of compression of binary data of any kind.

Keywords: binary binomial numbers, binomial number systems, binary information compression.

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SYSTEMS AND CONTROL PROCESSES

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ANALYSIS OF THE METHODS OF MEASUREMENT OF THE CYLINDRICAL GEAR INVOLUTE

page 19–24

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The object of research in this work is the process of measuring the involute of a cylindrical gear by using coordinate measuring machines based on new physical principles, equipment and methods. To date, the metrological assurance of measuring the parameters of gears has been based on tools for the tooth and other equipment. All of them have a limited range of measurement parameters, different accuracy and nomenclature of measured values. Many of them are morally obsolete, not automated, do not have access to computer tools and do not provide the modern level of accuracy, information content and speed. By vir-

tue of this, metrological support of gears is increasingly used in practice, and measurements of the geometric parameters of their involute surfaces are found on coordinate measuring machines. A significant advantage is the fact that several geometrical parameters of the surface of a gear can be measured on coordinate measuring machines in one installation. At the same time, the developed software allows to estimate the measurement errors and give them a graphic display. The paper reviews the reference base in the field of involuetry, which requires its creation on the basis of a detailed analysis of new measurement principles, the need to justify their accuracy, expansion of the range and range of measured parameters. Consequently, the production of new modifications of Ukrainian measuring instruments, based on new principles of control and control and measuring instruments of leading foreign manufacturers in the field of involuetry, is promising. The complex of works on the creation of a system for ensuring the uniformity of measurement of geometrical parameters of gears is also considered. This requires a review, systematization and development of methods and means of metrological assurance. A mathematical description of the gear involute curve is proposed by the method of triangulation of multiply connected domains and the description of a geometric model of an involute using a trend. Recommendations on the application of the method of describing cylindrical gears with an involute profile are given. The proposed method allows to improve the measurement accuracy on coordinate measuring machines.

Keywords: involute profile, gear, measurement error estimation, measurement accuracy, coordinate measuring machine.

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DEVELOPMENT OF A METHOD FOR SELECTING A WAY OF RAW MATERIAL TRANSPORTATION FROM THE OFFSHORE DRILLING PLATFORM TO THE ONSHORE INFRASTRUCTURE

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The object of research is the process of transportation of mined resources from offshore drilling platforms in the shelf of the seas to onshore reservoirs. One of the most problematic places is the need to choose the means of transport and the method of transporting the extracted hydrocarbons from offshore drilling platforms (ODP) to the onshore infrastructure.

Using the method of equivalent values, the limiting values of the use of pipeline transport are established depending on the distance of offshore drilling platforms from the coast.

During the study, an algorithm was developed to improve the organization of transportation of hydrocarbons produced in the seas to substantiate the mode of transportation depending on the distance between the ODP and the coast. As well as a reasonable criterion for choosing a vehicle was proved and a system of indicators for the formation of the criterion was considered. Methodical approach for the choice of transport consists of the following steps:

- indicators of capital, operating and reduced costs for each type of transport are formed;
- threshold value of the reduced costs for pipeline transport and for the delivery by shuttle tankers and with the help of marine barge-towing vehicles depending on the distance of the ODP from the coast is determined;
- criterion of the effectiveness of the choice of transportation mode is displayed;
- indicator of unit costs for marine and pipeline transport is calculated;
- threshold value of the use of one of several transportation modes is determined.

A methodical approach is developed that ensures a reasonable approach to the choice of the transportation mode and type of transport when organizing the delivery of the extracted raw materials from the ODP to the onshore infrastructure, ensuring the lowest unit transportation costs.

Compared with similar known methods that are used to select transport for land production and transportation, such methods have not been used in the offshore oil business.

Keywords: pipeline transport, cable laying vessels, delivery by shuttle tankers, offshore drilling platforms, onshore infrastructure, delivery by barges towing vessels.

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ENSURING A SPECIFIED RELIABILITY LEVEL OF COMPLEX SPECTRAL-BINARY DIAGNOSTICS BY THE «QUANTON» METHOD

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The object of research is the reliability level of non-invasive complex spectral-binary diagnostics using the «Quanton» method. One of the most problematic issues of this method is ensuring a given reliability level of diagnostic results with the maximum process performance. In the course of the research, logical-mathematical models of a typical problem of structural-parametric optimization and methods of increasing the reliability were used, providing for the repetition of measurements and the introduction of an additional channel for obtaining information. The model of the general criterion for the reliability of the information obtained in the diagnostic process is presented taking

into account the probabilities of errors in obtaining information from two independent channels (spectral and binary) and the possibility of its repetition. To calculate the performance, an additive dependence is proposed, which takes into account the sequence of operations and the structuredness of the total length of time for the main, preparatory and final parts. Based on the obtained dependencies, the problem of optimizing the diagnostic process by the maximum value of the performance criterion under the constraints on the reliability level of its results and the number of measurements from one biologically active zone is posed and solved.

It is established that the diagnostic process according to the «Quanton» method, which consists of two operations and is optimized by the performance criterion, has sufficiently broad possibilities to influence the reliability level of its results. This level is provided by the original measurement accuracy and the availability of repeated measurements. With real, fairly broad values of the output errors of the spectral and binary diagnostics processes, by repeating the measurements, the total error of the method can be reduced by a factor of 10 or more.

According to the proposed dependencies, it is possible to perform an analysis of the suitability of various technical means used in spectral and binary diagnostics, by the reliability level and by the level of process performance. It is also possible to determine the feasibility of introducing an additional channel for obtaining information.

Due to obtaining high reliability of diagnostic information, it is possible, based on the «Quanton» method, to determine the most optimal effect on physiological processes in a living organism with the aim of correcting them. At the same time full non-invasiveness, safety and high efficiency in a short period of time are ensured.

Keywords: biological object, complex diagnostics, «Quanton» method, non-invasive diagnostics, spectral method, binary method, reliability level.

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MATHEMATICAL FOUNDATIONS OF NAVIGATION PARAMETERS OF THE AIR TRANSPORT BY MAGNETOMINAL CIRCULATION BY USING THE METHOD OF LEAST SQUARES

page 37–42

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Modern processes of air traffic control are realized on a single information platform called globally-localized information clusters, which are united in a single information environment. The main information component for such a system is navigation information about the location of each aircraft, containing dynamically updated data on its current coordinates and motion parameters. Under such conditions, there is the task of integrating navigation information obtained from various information sources that make up the aircraft avionics. Traditional approaches do not provide joint smoothing of coordinate information invariant to synchronization of measurements; therefore, the statistical analysis of experimental samples of navigation parameters is determined by the object of research.

The paper deals with a mathematical apparatus for providing multidimensional smoothing of the navigation parameters of an aircraft using the least squares method. To implement the proposed approach, the method of affine mapping of the coordinate space is used. This provides independent functional dependencies of the coordinate field of the aircraft for their joint processing by the method of least squares.

The developed software for multidimensional smoothing of the navigation parameters of the aircraft can be used to study the processes of evolution and maintenance of the software of the on-board computer complex of the aircraft. A feature of the approach is the time coordination of the obtained measurements at the model level, reduces the requirements for synchronization of the primary navigation parameters and expands the possibilities in the list of parameters that are processed together. This provides

an increase in the accuracy of determining the current position of the aircraft compared to traditional approaches by attracting additional data redundancy.

The proposed approach can be extended to a wide range of applied industries related to the measurement, evaluation and prediction of changes over time in interrelated processes.

Keywords: air traffic control processes, aircraft avionics, navigation information, least squares method.

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DEVELOPMENT OF INNOVATIVE LEARNING TECHNOLOGY IN SYSTEMS WITH DUAL PROCESSES

page 43–45

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The paper proposes the development of innovative learning technologies in systems with dual processes. The object of research is information technology processes and phenomena that occur in systems with dual processes. Creation of a virtual student experimental studio for modeling professional knowledge is proposed. One of the most problematic places is the creation and testing of a digital platform of disciplines in the specialty. The study further suggests a transition from traditional learning methods to methods of consulting the formation of students' professional knowledge in their specialty based on simulation modeling. The tasks of the students are development of a model of disciplines and the formation of their individual models of professional knowledge in their field. In the course of the study, the basics of the theory of systems were used to build a methodological base for the development of innovative learning technologies and statistical methods to assess the possibility of creating models of professional knowledge. An innovative educational technology is obtained, which has a number of features. In particular, it involves the development of a model of professional knowledge, which consists of a multitude of studied disciplines, practical exercises, technical learning aids, assessments and self-assessments, relationships between elements of the model, and temporal relationships. The scheme of the organization of the educational process using a specially built digital knowledge platform is proposed. A comparison of the traditional learning pattern and the learning pattern based on the digital knowledge platform is shown. In addition, the possibility of creating models of professional knowledge is assessed, while calculating the consistency of expert assessments is carried out using the Kendall's coefficient of concordance. This ensures the possibility of obtaining indicators of the relevance of the proposed innovative learning technologies in systems with dual processes. Expert evaluations have shown that the creation of professional knowledge models by students will allow to systematize their knowledge in systems with dual processes.

Keywords: innovative educational technology, systems with dual processes, digital knowledge platform, model of professional knowledge.

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ANALYSIS OF THE RELIABILITY OF THE INFORMATION SYSTEM OF MASS NOTIFICATION WITH «CLIENT-SERVER» ARCHITECTURE AND USING GOOGLE MAPS SERVICE

page 46–49

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The object of research in this work is the information system that is restored after the failures, consisting of a finite number n of the hardware and software client systems that are connected via the corresponding interface to the server S . This system is a «client-server» model for a modern public notification system in emergency situations. The system provides for the use of services of interactive terrain maps for processing or supplementing data transmitted from mobile devices of the victims, which have already been received by the server and worked through the algorithms programmed in it. In the course of research, mathematical models of the considered information system were constructed and used. The «client-server» information system that is restored after a failure with a finite number of states is approximated. A state graph is obtained that describes its behavior, and a system of Kolmogorov differential equations is also compiled. The direct Laplace transform from a system of differential equations is used. A mathematical model is built to describe the behavior of the system, taking into account the ultimate reliability of the Google Maps service system. Also, to determine the reliability of the model, a special case of the system operation is calculated without taking into account the failure of the client. This is due to the fact that the client part of each potential victim has its own individual characteristics and depends on the type of used device. The behavior of the information system in the presence of failures is analyzed, which is described by a system of differential equations with variable coefficients. This analysis shows that the information system has a fairly high reliability of the main characteristics. Through the use of the proposed mathematical model, it is possible to obtain various characteristics of the reliability of information systems such as «client-server». The solution of the obtained differential equations allows to study these characteristics in a wide range of changes in failure rates and restoration of system components.

Keywords: information system of mass notification, reliability of information systems, «client-server» architecture, interactive map services.

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