



INFORMATION TECHNOLOGIES

THE ANALYSES OF PROJECT MANAGEMENT METHODOLOGIES BASED ON GENOME MODELS

page 4–12

Many existing methodologies for project management, programs and portfolios, as a rule, are poorly structured, lacks the fullness of knowledge representation and the possibilities of comparative analysis. Development of the structure of project management methodologies based on the idea of the use of the genome code (the double helix) made it possible to create effective modeling tools in the form of ontology knowledge. Formalized genome model of project management methodologies, programs and portfolios of projects comprising methodologies algebra and a set of operations allows realizing the integration of methodologies of project management, programs and portfolios of projects under the corporate governance system. This example for modeling methodologies of project management, programs and portfolios of projects shows the possibility to carry out a comparative analysis, quickly generate or develop new methodologies adapted to the needs of organizations. The results showed the possibility of using genome models in the development of corporate project management systems, programs and portfolios. In this adaptation of the well-known methodologies and their integration into the corporate system is made in a single formal model on the principle of a hypothetical full knowledge of the system.

Keywords: methodology, genome methodology model, mechanism of methodology interpretation, ontological knowledge model.

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DEVELOPMENT OF EVOLUTIONARY METHODS OF THE STRUCTURAL AND PARAMETRIC IDENTIFICATION FOR TABULAR DEPENDENCIES

page 13–19

In the article the problem of structural and parametric identification for table dependencies is considered. Mathematical formulation is done for problem of building an analytic function in explicit form that best by some criterion extrapolate a given relationship. Evolutionary method of structural identification is developed. It is allow based on a given linearly independent system of basis functions to determine the optimal structure for some criteria such function that corresponds to the mathematical model of the problem. Using the developed evolutionary method allows to specify the following characteristics of the resulting function as parity, periodicity, monotony, range of values and other. Evolutionary parametric identification method is developed. It allows based on a study of character of input parameters to determine the resulting function without the need for complex mathematical transformations and solving systems of nonlinear equations of several variables. The experimental verification of the developed methods for solving applied problems of identification table dependencies using single- and two-factor analysis is done. Advantages of the proposed evolutionary methods over regression models according to the values of mean square error and Fischer ratio are proven.

Keywords: structural identification, parametric identification, tabular dependence, evolutionary method.

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APPROACH DEVELOPMENT TO THE EXPERT COMMITTEES FORMATION FOR THE ASSESSMENT OF TEAMS OF HIGH-TECH PROJECTS PERFORMERS

page 20–25

The object of research in this work — activities of innovative enterprises to implement high-tech projects (HTP). Subject of research — decision support tools on the formation of alternative teams of HTP performers as one of the key stages of forming teams of HTP performers at innovation enterprises is the selection of experts for collective assessment of applicants in the project team.

The essence of the proposed approach is to create a sequence of stages for formation of the expert committee: the choice of a rational number of the expert committee members; generate a list of possible candidates for experts; creating preliminary list of the expert committee members and assessment of their competence; a final commission of experts indicating the competence of its members.

Research results:

- methodology for determining the limit values (upper and lower) of expert committee size and assessment of the total number of experts in the committee;
- tool for determining the competence of individual members and expert committee as a whole, it is a special verbal-numeric scale and range of analytical expressions;
- four-phased approach to the formation of expert committees, which is a part of the management of high-tech projects for innovative enterprises.

Use the proposed approach to the formation of expert committees for assessing the quality of teams of high-tech projects performers will enable enterprises to increase the efficiency of these projects by reducing the level of uncertainty about competence compliance and personal qualities of performers to complexity of the project.

Keywords: expert committee, team of project performers, high-tech project, innovative enterprise, competence.

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DEVELOPMENT OF THE COMPLEX DESCRIPTION OF BUSINESS PROCESSES IN THE ORGANIZATION

page 25–32

The analysis of graphic and formal methods and techniques for description of business processes is conducted.

It is revealed the lack of a common approach to information presenting of all business processes lifecycle. The proposed information technology for combining different descriptions in a unit and methods of transition from one description mode to another is not yet possible to implement without loss of information and ensuring all participants of business processes lifecycle in a single conceptual framework.

A comprehensive interrelated description of all aspects of business processes is proposed. This description appears in text, image, formal and algorithmic species as different forms of a single process models, which complement each other and can best solve various problems.

This approach provides a convenient way of describing the process by specialists of different levels: from the head in the conceptual process design (planning) to direct performer during his work in securing the conditions for monitoring and control process.

The basis for the creation of an information technology and software environment for planning, modeling, analysis, support and performance management of business processes is developed.

Keywords: business process, comprehensive description, meaningful description, graphic description, formal description, description for program implementation.

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BUILDING OF MULTI-FACTOR MODEL OF WORLD UNIVERSITY RANKING SYSTEMS

page 32–37

Now we have a lot of world ranking system that are based on a set of indicators for the universities evaluation, so it is difficult

determine which indicators are essential in the ranking systems. So the aim of the article is to provide an integrated multi-factor model of university ranking systems. The influential world and world university ranking systems are analyzed. Factor analysis of the influential world and world university ranking systems based on a retrospective analysis of three years were applied. Research in several groups and with normalized ranking indicators values for stable and the objective result was conducted. Integrated multi-factor model of world university ranking systems is proposed. The proposed model allows to evaluate the majority of the world’s universities.

Keywords: multi-factor model, world university ranking systems, factor analysis, retrospective analysis.

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MATHEMATICAL MODELING

THE MATHEMATICAL SIMULATION OF GROWTH AND PRODUCTIVITY DYNAMICS OF CROSS CHICKENS «HISEX BROWN» AND «LOHMANN BROWN»

page 38–44

Feasibility of using T. Bridges, A. Putter and L. von Bertalanffy mathematical models to predict and describe the dynamics of the growth of chickens of different crosses and distribution classes, as well as the use of McMilan mathematical model to predict and describe the egg productivity of chicken was studied. It was established that to predict, describe and analyze the age dynamics of bird body weight the most suitable are T. Bridges and A. Putter models. The accuracy of T. Bridges model is within 85,5–93,8 %. Adequacy of A. Putter model is within 96,0–93,8 % when comparing the actually received and theoretically certain indicators of body weight

T. Bridges model is most suitable to differentiate the two cross chickens, the value of the asymptote (W_{∞}) ranges in 2016,2–2155,5.

A. Putter model can most definitely use to differentiate the three classes of distribution of body weight: for «Hisex Brown» coefficient « ρ » is in the range: $(-0,6156) - (-0,6463)$, while for «Lohmann Brown» it is much lower: $(-0,7476) - (-0,8627)$.

Simulation of laying curve using McMilan model revealed contrast in the standards of its recession and increasing with age of layers. An adequacy of the model ranges in 81,2–81,6 %. «Hisex Brown»

cross chickens have a delayed rate of egg production decline after the peak than «Lohmann Brown cross chickens». These mathematical models are important because they accurately describe the dynamics of the growth of chickens of different crosses and distribution classes, as well as their laying (the average percentage of deviation does not exceed 5 % threshold judgment on the validity of the data).

Keywords: bird crosses, distribution classes, growth dynamics, laying curve, mathematical models.

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VERIFICATION OF CIRCLE_3D COMPLEX TO JUSTIFY THE STRENGTH OF CRITICAL EQUIPMENT OF NUCLEAR POWER STATION

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The article deals with the development and verification of CIRCLE_3D complex, which is used for calculation of technical parameters (first of all – the strength characteristics) for survey of critical equipment of nuclear power plant, such as mechanical equipment of the first circuit unit. The calculations are necessary to evaluate the technical condition of equipment considering its degradation and aimed at ensuring nuclear and radiation safety in dealing with mechanical equipment life extension of reactor unit of nuclear power plants. A brief description of the purpose and operational conditions of the critical equipment of nuclear power plant, and the algorithm for technical condition assessment using computer codes to determine the predictive value of the residual life are given. Verification of CIRCLE_3D complex is performed to validate the software implementation of computational methods based on the finite element method. The comparison of simulation results by code CIRCLE_3D and standard PNAE G-7-002-86 and the test results of internationally recognized code ANSYS is given. An excellent reproducibility of test results is noted.

Keywords: technical condition, code, mechanical equipment, residual life, strength, verification, degradation.

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RESEARCH OF ELASTIC-PLASTIC DEFORMATION OF THE FINNED OBJECTS OF FINITE SIZE

page 53–59

Finned conical and cylindrical bodies of finite size are used in many industrial processes such as the manufacture of pipes for various purposes, chambers of detonation presses et al., which are essential elements supported by different numbers of ribs with optimal geometrical parameters. This structure is subjected to stresses that lead to the appearance of elastic-plastic deformation, but it does not destroy it.

To study the problem of determining the stress-strain state of finned cylindrical and conical bodies of finite size an approach based on the theory of small elastic-plastic deformations is proposed. The system of nonlinear equations is linearized using the method of variable elasticity parameters.

Approximate solution of the linearized elastic problem on each the k -th iteration is constructed with use of the theory of R -functions into a single analytic expression.

The solution of problems in this case allows to explore a wide class of technological elements without restrictions on the area form and loading types, find the allowable load value, which does not exceed the liquid limit, but greater than the elastic boundaries. Determination of the allowable load holds a saving of material resources and optimizes the geometric parameters of the design elements and predicts the optimal mode of operation of the assembly. Furthermore, it is possible to set the strength of the loaded structures, which are designed for continuous operation under load.

Keywords: elastic-plastic deformation, nonlinear equations, linearization, R -function, structural model, computational experiment.

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STATISTICAL PROCESSING OF TRANSIENT PARAMETERS IN BIORHYTHMS OF CORTEX

page 59–64

Modern medicine is focused on the implementation of non-invasive diagnostic tools and forecasting body dysfunctions of operators in extreme activities. To evaluate psychophysical condition of operators, special software and expert systems are developed, but they have several disadvantages, the main of which are: the complexity of electroencephalographic data interpretation; imperfection of integral evaluation parameters of psychology health conditions of operators in extreme activities; usually no graphical interface designed for physician specialist. This paper presents a statistical approach to evaluating options of information and energy fields in cortex based on processing biopotentials of the cortex with accounting the psychological subgroups of operators. The present approach is a computerized expert system that provides medical-specialist to analyze quantitative parameters of stationary record signal and electroencephalogram transient, which in turn allows assessing and predicting psychophysiological cortex state of the operator. Algorithms of presented approach are based on the use of robust methods of data analysis and iterative simulation using Monte Carlo method.

As a result of research it was obtained normalized values of cephalography, electroencephalography, blood tests for operators in extreme activity of a psychological subgroup, and graphical and analytical statistical regression model of tolerance, which is based on parameters of cephalography, electroencephalography and time. Due to the obtained results can not only assess the current psychophysiological state of the organism for operators in extreme activities, but also to predict its changes.

The results of research can be used in the medical field of transplantology for donor selection or monitoring of the rehabilitation process after transplanting internal organs.

Keywords: robust method, Monte Carlo, electroencephalograph, evoked potentials, expert system.

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COMPARISON ANALYSIS OF COPULA-BASED AND MARKOWITZ PORTFOLIO METHODS

page 65–72

In this paper, the objects of study are securities (stocks) and portfolio.

The main problem of the study is portfolio optimization. One of the first portfolio methods was presented by Henry Markowitz with his Modern Portfolio Theory (MPT), which is considered as a classic and the most popular one in modern investing. MPT provides the following assumptions: variance is used as a measure of risk, portfolio stock returns distribution is considered as a normal one. However, these assumptions do not represent real processes in the modern economy. First, in terms of modern volatile economy portfolio stock returns distribution curve has heavy tails, which is not typical for normal distribution. Secondly, in case of variance as a measure of risk probability of extreme events, such as a simultaneous increase or decrease of stock prices, are not taken into account.

So Markowitz method no longer meets the requirements of the modern financial market and there is a need to study alternative and more valid portfolio methods.

In this paper, copula-based approach is considered in contrast to the classical one. In the method assumption about the normality of stock returns is rejected and Value-at-Risk (VaR) is considered as a valid risk measure. VaR assessment is based on an information about random distribution. Since the normality assumption was rejected, to assess portfolio stock returns distribution need to be defined. To do these copula-functions was used.

Stochastic optimization problem using VaR was solved with a modified Nelder-Mead method.

As a result of the dynamic optimization return of copula-based portfolio for 2015 was 12,1 % of the initial investment sum, while the portfolio, constructed with the classical method, showed losses of 4,1 %.

Since in copula-based approach incorrect normality assumption is rejected and a valid risk measure is chosen, copula-based portfolio is much more effective than the Markowitz one.

Keywords: portfolio, financial risk, copula, hierarchical copula, Archimedean copula.

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JUSTIFICATION OF CONDITIONS FOR UNIQUE SOLVABILITY OF MATRIX EQUATIONS WITH TWO TRIANGULAR UNKNOWNNS AND MUTUALLY INVERSE COEFFICIENTS

page 73–77

In the article the object of research are the matrix equations. The role of the matrix and the matrix equations in the theoretical and practical issues is well known. In its simplest form it arises in different theoretical and applied problems related to the solution of systems of linear algebraic equations. For example, in mechanics, physics, electrical engineering, hydraulics, economy.

A unique solvability of the two abstract matrix equations is investigated for the next form:

$$AX^+ + Y_- = B, \quad (1)$$

$$A^{-1}X_+^+ + Y_{1-} = B, \quad (2)$$

with unknown lower X^+ , X_+^+ and the upper Y_- , Y_{1-} , triangular matrices and mutually inverse matrices — the coefficients A , A^{-1} . The approach is based on the interpretation of equations (1), (2) as the implementations in the ring of matrices of corresponding equations in the abstract ring with a pair of factorization, based on the basic provisions of the theory of rings and operators. In particular, special developed projections are used. It is characterized by significantly less than the maximum order of determinants of matrices, which have to operate using the proposed approach and its results. It is substantially less than the orders of the determinants that arise in the transition from (1), (2) to systems of linear algebraic equations by equating the corresponding matrix elements in their left and right sides.

The theorem on the unique solvability of these equations with matrix representations of the solutions is formulated and proved, which gives an accurate method for solving specific equations (1), (2) and their corresponding tasks.

An illustrative example is given.

Keywords: mathematics, mechanics, analysis, equation, matrix, triangular, solvability, theorem, factorization, projection.

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