ABSTRACT AND REFERENCES

CONTROL PROCESSES

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MODIFICATION OF THE PERT METHOD FOR PROJECT TIME EVALUATION TAKING INTO ACCOUNT UNEXPECTED DELAYS (p. 6–13)

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The PERT-based method for estimation of project implementation time, which uses Rayleigh distribution instead of β-distribution, was proposed. The modification of the PERT, which made it possible to involve the quality of an expert into the assessment and to simplify the examination procedure was proposed. We offered a new method for project evaluation, based on the properties of Rayleigh distribution and taking into consideration the peculiarities of plotting a network diagram in IT-projects with a high degree of work detailing in the face of the existing possibilities of extending the time of particular tasks. Three different methods project time evaluation, based on two different statistics and two different methods for calculation of project time, were compared. Comparison was performed with the view to search for the simplest method in terms of information acquisition and suitable for algorithmic implementation. It was shown that the estimation result is more consistent with specificity of complex IT-projects and makes it possible to reduce the number of iterations within project implementation time, as well as to use an objective assessment of the main sources of errors in determining time, giving evaluation with the probability that was assigned beforehand. It was shown that the estimate of the most probable and minimum time of project completion during the calculation by the new method is consistent with the results of the calculations using the PERT method, while the evaluation of maximum time differs strongly, as the new method is more pessimistic in this sense, and it matches better the characteristics of complex IT-projects that have a high probability of unexpected delays during implementation. We draw conclusions on the possible application of results in creation of a project time evaluation system based on the methods of artificial intelligence, and determined parameters for setting such a system.

Keywords: PERT, evaluation of project implementation time, quality of expert, sources of evaluation errors.

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DEVELOPMENT OF A METHOD FOR RANKING FACTORS THAT INFLUENCE THE MATURITY OF PROJECT QUALITY MANAGEMENT PROCESSES (p. 14–28)

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According to the results of the theoretical analysis of well-known and widely practically applied standards of quality management and project management, as well as models of maturity assessment of processes, 13 key risk-dominant factors influencing the maturity of project quality management processes have been identified.

A methodology of ranking risk-dominant factors, which highly influence the organizational maturity of quality management processes in projects, has been developed. The basis of the developed methodology is the expert method. A distinctive feature of the methodology when it is implemented is to obtain a nomenclature of ranked key risk-dominant factors, taking into account the expertise of experts. This result is achieved through the involvement of two target groups, «Process Implementers» and «Consumers of the Process Results and Stakeholders», for peer review. A systematic scientifically-based ranking of risk-dominant factors in accordance with the proposed methodology contributes to the objective assessment of the potential of quality management processes in projects. In addition, it will increase the likelihood of obtaining expected results of processes and will determine the priority directions of growth and organizational changes of processes to achieve the target levels of maturity. The proposed methodology can be implemented in the processes of certification, self-assessment and auditing in a QMS.

The practical testing of the proposed methodology was carried out using the example of the «Project Launch» process. According to the results of the expert evaluation of the «Process Implementers», it has been established that the factor «The degree of documenting the process» and, to a lesser extent, the «The degree of applicability of the process evaluation results for its improvement» is influenced to a greater extent by the maturity of the investigated process. According to the results of the expert evaluation «Consumers of the Process Results and Stakeholders», the following has been established. To a greater extent, the maturity of the investigated process is influenced by the factor «The degree of the possibility of integrating the process with other internal and external processes. «To a lesser extent, the factor is «Behaviour of the process implementers». There is a high degree of consistency between expert assessments within each group and a significant connection between the assessments of the two groups of experts.

Keywords: risk-dominant factor, project quality management, organizational maturity of processes, expert evaluation.

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DEVELOPMENT OF THE METHOD FOR STRUCTURAL-PARAMETRIC OPTIMIZATION IN ORDER TO IMPROVE THE EFFICIENCY OF TRANSITION PROCESSES IN PERIODIC SYSTEMS (p. 29–35)

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In order to get the most out of the enterprise's operational processes, the operational processes of functional systems are optimized. However, in the process of optimization, controlled systems over a significant amount of time operate under sub-optimal modes. In addition, changes in external conditions, quality parameters of raw materials, or cost estimates of the input and output products in a system operation, necessitate the repeated optimization process.

It is not uncommon that the duration of the optimization process is comparable in terms of time, or even exceeds, the system operation time. That means that it is required to optimize the transition process itself.

Currently, intensive research is conducted mainly into the development of a systematically substantiated multidis-

ciplinary optimization criterion, and into search for methods of optimal control. Studies that investigate methods for improving the effectiveness of a transition process are carried out mainly by mathematicians, within the framework of the problem on the advanced search for an extremum. Accordingly, the well-known methods could be applied to improve the efficiency of a transition process through parametric optimization.

By using the periodic system of proportional heating of a liquid, we considered the task on improving the effectiveness of the transition process by applying the method of structural-parametric optimization. We employ, as the optimization criterion, an estimated indicator, which was tested for its use as a formula of efficiency.

The results of a comparative study into the reference technological process of a standard and a modified functional system have shown that the time required to enter the region close to optimal decreased by almost twice.

In addition, the application of the new architecture for the functional system makes it possible to improve its reliability and service efficiency.

Keywords: effectiveness of transitional processes, structural-parametric optimization, optimal control, efficient use of resources.

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MODELING OF DYNAMIC STABILITY OF THE WELL DEEPENING PROCESS BASED ON THE CATASTROPHE THEORY (p. 36–46)

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Theoretical aspects of the catastrophe theory were considered and the possibility of application of the catastrophe theory methods in estimation of actual data of geological and technical control of the well deepening process were described. A method for recognizing dynamic conditions of well deepening was studied for the purpose of controlling this process. Expediency of using not only the R. Thom's elemental catastrophe of the «gather» type but also phenomenological Vapor Pressure model has been proven.

As a result of the study, such feature as «the time of drilling 1 m of rock» has been determined to recognize dynamic stability of the process which is prone to stepwise changes.

The main arguments for application of the catastrophe theory regarding modeling of dynamic stability of the well deepening process were determined.

It was shown that behavior of the system in a catastrophic state can be described not only by a canonical cubic equation solution of which is performed according to the Cardano formulas but also by a phenomenological model based on the principles of holistic approach.

Using the holistic approach to solving the problems of modeling dynamic stability of wells, a structure of basic phenomenological mathematical model of dynamics of catastrophe development was proposed.

It has been proved that at the initial stages of emergency development when an increase in the time spent on drilling one meter of rocks in the well is observed, dynamics of emergency development can be simulated with the help of the proposed phenomenological mathematical model. With further deepening of the well when there is a decrease in time spent on drilling one meter of rocks, dynamics of the catastrophe development can be described by this law but the model coefficients and their signs will be different. It has the ability of identifying the model parameters with a single algorithm as well as predict the occurrence of emergency at the stage of its development. This helps to prevent complications and accidents in the process of well deepening. According to the simulation results, theoretical inferences on the choice of the model type optimal for describing emergencies in the well deepening process were confirmed and it was established that the proposed phenomenological model is adequate to real processes.

At the same time, it is necessary to adhere to the basic principles of the catastrophe theory which makes it possible to provide effective forecasting and detection of pre-emergency situations and complications that arise in the well deepening process.

The obtained data are useful and important because they make it possible to improve the mathematical and software system of automated control of the well deepening process and reduce accident rate in drilling.

Keywords: catastrophe theory, well deepening process, dynamic stability, modeling, holistic approach, phenomenological mathematical model.

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DEFINING THE MEASURES TO RATIONALLY MANAGE THE SUSTAINABLE DEVELOPMENT OF AGRICULTURAL LAND USE (p. 47–53)

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The issue of socio-economic development of rural areas was explored. It was substantiated that the state policy should be aimed at mobilizing labor, financial, material and organizational resources, strengthening the social security of rural population, rehabilitation of social infrastructure, development of entrepreneurship, and maintaining ecological stability. It was proved that within the integrated management of the development of rural areas, the development of the system of local self-government in rural territory communities requires special attention.

The factors that led to an unprecedented socio-economic and ecological crisis in agricultural land use were explored. Based on the solution of the optimization problem, the negative trends in the dynamics of key indicators of agricultural production, determined especially clearly on the basis of the results of the correlation data analysis. The obtained mathematical model of the dynamics makes it possible to foresee the consequences of unsustainable management of the development and even to predict the sad ending, unless certain priority factors of management are accepted. The prediction based on such a mathematical model of dynamics can be made by any indicators of agricultural production.

It was noted that the modern period of development of land relations in rural areas will be able to satisfy the interests of the peasants only on condition of harmonious combination of economy of different spheres of activity in rural areas, which are reinforced one after another. The innovative approach to ensuring deficit-free balance of humus in soil as a condition for the sustainable development of agricultural land use was substantiated. It was determined that the policy, aimed at the environmental land use stabilization is based on the development of organizational-legal forms of economy of a cooperative type, based on the common share ownership of land plots of land share owners.

Keywords: management of development, dynamics of agricultural production indicators, land market, land plots, land use, land reform.

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METHOD FOR FORMING THE PORTFOLIO OF PROJECTS TO REDUCE LOSSES IN ELECTRIC NETWORKS BASED ON THE LEAN APPROACH AND A FEEDER-TO-FEEDER ANALYSIS (p. 54–65)

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This research aims to develop an approach for forming the portfolio of projects for reducing losses in distributive electric networks. The purpose of this paper is to substantiate the selection of projects for reducing losses in distributive networks for the portfolio of projects. The project management of the reduction of losses is based on the principles of value-oriented organization and economic production. We proposed a step-by-step method of formation of a portfolio of projects for reducing losses, in which it was proposed to use a feeder as the unit of analysis. This approach enables a power supply company to create the optimal portfolio of projects by the criteria of value, risks and costs.

The portfolio of the projects for reducing electric power losses in distributive networks of a power supply company includes a set of technical and organizational projects. The proposed approach to formation of the projects' portfolio includes five stages. Stage 1 involves the identification of the components of the portfolio projects, the basic among which are initiatives, projects, programs, and sub-projects. The projects are grouped at stage 2. To group the projects, we proposed four templates that characterize technical and organizational projects in the portfolio. Stage 3 involves evaluation and selection of projects by the quantitative and qualitative indicators. Value, risks and costs were determined as the main criteria to substantiate the selection of projects. The analytical sample of the projects according to given criteria becomes the basis for the selection of projects. Stage 4 implies prioritization of projects by their ranking. Ranking is performed by means of comparing the values of the indicators of value and attractiveness of a project by the project group or by the entire portfolio of projects. Stage 5 implies balancing the projects' portfolio by identifying discrepancies between the indicators of project groups and «smoothing». Based on the formed portfolio, the flexibility of losses reduction management increases, since it makes it possible to redistribute the composition of projects by priorities and regulate the use of investment resources.

Keywords: distributive electrical networks, electric power losses, portfolio management, portfolio of projects, feeder-to-feeder analysis, projects' portfolio balancing, reduction of electric power losses.

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