

ABSTRACT AND REFERENCES

CONTROL PROCESSES

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RESEARCH INTO THE PROCESS OF MULTI-LEVEL MANAGEMENT OF ENTERPRISE PRODUCTION ACTIVITIES WITH TAKING RISKS INTO CONSIDERATION (p. 4-12)**Vitalina Babenko**V. N. Karazin Kharkiv National University, Kharkiv, Ukraine
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The study considers the process of management of the production activity of an enterprise during a certain interval of time. It takes into account components of the production process and an influence of various production and external factors, including risks. We developed the content and a formulation of the problem of a multi-level process of management of the production activity of an enterprise in the presence of risks. Multi-level management involves a use of two levels of management based on the proposed stages. It involves formation of a set of alternatives to possible levels of management and contains output product volumes. Also, formation of a set of replenishment of material, labor resources and investment resources (second level of management). We developed the method based on the construction of sets of areas of reach taking into account risks. On the basis of its application, we proposed the solution of the discrete optimization problem with a help of minimax. The established optimal management provides a guaranteed result for a solution to the problem of the process of management of production activities of an enterprise under the influence of any risks from a set of permissible ones. At the same time, we reduced the complex problem of dynamic optimization of multi-level management with the consideration of risks to the realization of a finite sequence of one-step problems of discrete optimization. The results of the practical application of the proposed method make possible to increase the efficiency of management of the production activity of an enterprise at the expense of optimum volumes of production, reduction of expenses for replenishment of resources, and also reduction of negative influence of risks.

Keywords: dynamic optimization of management process, multi-level management, set of reach, minimax guaranteed result.

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MODELLING OF MANAGEMENT ACTIVITY OF THE ORGANIZATION CONSIDERING THE IMPACT OF IMPLICIT FACTORS IN BUSINESS PROCESSES (p. 13-21)

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The article presents a further development of theoretical investigation of management activity of the organization considering implicit factors of influence of the economic system and questions of effective usage of intangible resources. The authors substantiate the objective need for improvement of the mechanism of assessment of implicit factors from the position of maximizing the efficiency of business processes of the enterprise and formation of its potential. Creation of such mechanism, in the term, allows developing the economic and mathematical hierarchical model of the assessment of the influence of implicit factors on further successful activity of the organization, which is aimed at improvement of the process of business process management in conditions of informational economy.

The essence of the proposed method is to use expert assessments, which quantitatively characterize the object of the research, for the description of the economic problem. In the future, reasonable management decisions are made on their basis. At the same time, the traditional mathematical apparatus does not include tools that can help to reflect the fuzziness of the assessments of the group of experts. During the modelling of complex business processes, it is also necessary to consider a significant number of subjective and implicit factors. Therefore, the traditional quantitative analysis will not be practical under the condition of its acceptable accuracy.

The methodology of expert assessment was proposed in this paper. It is based on the main provisions of the fuzzy set theory and the construction of the membership function by means of analytical procedures. For this purpose, two interconnected tasks were consistently solved. Firstly, we made a quantitative assessment of the degree of expert consistency based on the calculation of fuzzy indexes. Secondly, we made aggregation of the results obtained by means of construction of the membership function, which is adequate to the investigated system. Practical realization of these tasks was accomplished by means of the well-known algorithms of the apparatus of the fuzzy set theory.

The effectiveness of the proposed model was tested on the example of the assessment of the investment potential of the sustainable development of the mining exporting company “Limited Liability Company “Hlukhiv quartzite quarry”” (Ukraine) with the usage of the expert method. The article includes the comparison and economic substantiation of the results of the assessment of the influence of implicit factors on the specified company before and after application of the proposed methodology.

The proposed mechanism of taking into account implicit factors on the basis of the hierarchical economic and mathematical model allows optimizing management decisions in business processes and provides the possibility of developing the adaptive management system of the modern manufacturing organization.

Thus, the proposed methodology allows quantifying the influence of implicit factors on the investment potential of the sustainable development of the enterprise in the form of aggregated assessment. The last one is determined by means of the expert method. This will give the possibility to make economically sound management and technological decisions on major business processes. In particular, regarding the expediency of increasing the volume of quartz production at the enterprise under review in the short run.

Keywords: implicit factors, fuzzy set theory, business processes, management activity, investment potential.

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ESTIMATION OF FLUCTUATIONS IN THE PERFORMANCE INDICATORS OF EQUIPMENT THAT OPERATES UNDER CONDITIONS OF UNSTABLE LOADING (p. 22-29)

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The dynamic model of change in the performance indicators of sophisticated equipment was proposed. The proposed model consists of two parts. The first part concerns modeling of a random process of changes in the level of equipment loading and is described by the

stochastic equation in the form of Ito. The second part concerns modeling of dynamics of equipment wear depending on changing in the levels of its loading and is described by the differential equation. As a result, the stochastic dynamic model of changes in performance indicators of sophisticated equipment, which takes into account random fluctuations of equipment loading, was obtained. Using the proposed model, we analyzed dynamics of average total specific costs of equipment in the case when a degree of equipment loading is subject to random changes. Quantitative ratios of average total specific costs of equipment, level of fluctuations of these costs during possible random changes in loading and terms of equipment replacement were established. Studies have demonstrated that changes in average total specific costs of equipment can be insignificant for a certain time. In this case, the spread range of the level of costs of equipment within the same time range can increase significantly. That is why it makes sense to reduce the service term of equipment. This would lead to an insignificant increase in the mean values of equipment performance indicators, however, their stability level will improve considerably.

Keywords: wear of equipment, equipment replacement, efficiency of equipment operation, stability of performance indicators.

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DEVELOPMENT OF THE METHOD FOR MODELING THE PROPAGATION OF DELAYS IN NONCYCLIC TRAIN SCHEDULING ON THE RAILROADS WITH MIXED TRAFFIC (p. 30-39)

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The main goal of present study is to develop a method for modeling delay propagation in non-cyclic train scheduling on a railroad network with mixed traffic. This will make it possible to explore the dynamics of delay transfer between trains and to identify the most vulnerable points in the timetable of trains. We have devised a method for modeling delay propagation in non-cyclic train scheduling for the rail networks with mixed traffic. It is proposed to apply as a basis of the developed method a mathematical model for the construction of a non-cyclic train timetable. A distinctive feature of the objective function of the mathematical model is taking into consideration the patterns of building a non-cyclic train timetable under conditions of mixed traffic of passenger and heavy-weight or multi-car freight trains, for which it is important to minimize the cost of stopping during motion. The proposed mathematical model was solved based on the multiagent optimization. To account for delay propagation on the railroad network of great dimensionality, we devised a procedure for connecting interdependent sections, which makes it possible to decompose the general problem based on the construction of schedule of trains for separate estimated sections taking into consideration the network effect. We performed an analysis of the dynamics of propagation of secondary delays in non-cyclic train scheduling with detailed patterns of changes in all parameters in time and space. We obtained dependences of the number and duration of delayed trains on the point of occurrence in the timetable of trains along the estimated line of the Ukrainian railroad network. The approach proposed allows the automatization of determining a time reserve in the standard non-cyclic train scheduling based on forecasting the consequences of train delays.

Keywords: railroad network, section, train, non-cyclic train scheduling, delay, mixed traffic, multiagent optimization.

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ANALYSIS AND ALGEBRAIC-SYMBOLIC DETERMINATION OF CONDITIONS FOR SAFE MOTION OF A VESSEL IN A NON-STATIONARY ENVIRONMENT (p. 40-49)

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We have proposed a method for the algebraic formalization of predicative determining of zones for safe and dangerous areas of navigation for the criterion “Computational stability – continuity”.

It is not possible to build effective mathematical models for all cases of direct application of integrated and differential equations that describe statistical correlation functions of the space-time continuum. At the same time, there are always significant difficulties in operative processing of large volumes of information. Numerical results determine known long-time delays in the work of computers in the systems of navigation and operational control over the motion of a vessel.

We have analyzed and obtained conditions for the effective technology of structuring a safe maneuvering trajectory based on typical sequences of formalized symbolic elementary zones. Brief predicative fragments describe effective steps to maneuver in a safe area of navigation. Analytical description of the structural processes that transform the input informational situational parameters into controlled effective parts and integrated models makes it possible to increase technological speed of operational decision-making. Situational symbolic control over the qualities of adequate safe motion of a vessel is executed under specific non-stationary changes in the influence from a dynamic external environment.

Actual effects of the influence from external factors in a non-stationary environment that surrounds the hull of a moving vessel were symbolically formulated. In this case, typical estimates of degrees in the non-stationary environment are algebraically collapsed into integrated safety criteria. We have established the target effect of modeling in terms of computational dynamics of processes for operational rapid control over motion of the vessel. In this case, vector regularized parameters of events are continuously entered in real time as corrections for initial data. We have solved the problem on predictive modeling of maneuvering variants for the criteria that guarantee current safety of motion along a planned strategic route.

To effectively solve the task on stable safety of motion, numerical methods to solve integral-differential nonlinear dynamic systems are typically employed. However, they are effective only for the substantiation of strategic routes. Delays in time at these stages are significant and accepted.

It is proposed to manage and control algorithmic processes in real time by using alternative methods of symbolic algebra. The models proposed would make it possible to find variants that are guaranteed to be adaptive to a specific current situation based on the transversal trajectory of a vessel motion.

It is proven that in the areas where there may occur situations of conflict and risk, local rules that guarantee a safe motion trajectory are implemented by connecting the boundary conditions for safe navigation area taking into account the presence of adjacent zones with threats, perturbations, obstacles.

Keywords: effective safety, conditions for preventing collisions, system of adaptive motion, positioning dynamics.

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MODELING OF CUSTOMERORIENTED CONSTRUCTION PROJECT MANAGEMENT USING THE GENDER LOGIC SYSTEMS (p. 50-59)

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The specificity of the feminine and masculine contexts of managing the customer needs in the construction project is highlighted. It is substantiated that the customer-oriented context of the gender logic systems of construction project management allows improving existing management approaches on the platform of values, which is wider than the traditional “triangle of design constraints” (time, cost, quality). The existing gender cognitive gap of project management standards (PMBOK, PMBOK Construction) is described in terms of defining the place and role of customers.

The gender-balanced model of the customer-oriented system of construction project management in the parameters of processes, methods and tools of project management is proposed. The developed corresponding matrix, which includes analytical tools for managing the customer needs, deepens the integration of participatory (feminine) management in the “body of knowledge” of the PMBOK. The dynamics of application of customer-oriented project activities at different phases of a construction project life cycle is taken into account. The customer-oriented components of the characteristics of the corresponding processes were formulated by extrapolating the feminine logic system into the matrix of customer-sensitive construction project management processes. The correlation between the feminine customer management system and the formation of a qualitative context of architectural and planning decisions of construction projects is demonstrated.

The results of customer-oriented modeling are discussed on an example of Construction Project Management Office (CPMO). Four phases of client-orientation are revealed: “I – customer interest (to hear his voice)”; “II – implementation of “individual customer requirements” in architectural and spatial, design and technical solutions”; “III – customer-oriented execution of construction and installation work”; “IV – loyal customer of the company-developer”. The proposed evaluation tool will allow the top management of the companies-developers, CPMOC to carry out a self-assessment of progress in the development of client-oriented construction project management and to choose the actions necessary to move from “initiation” to “completion” of the project.

Keywords: project management, construction project, gender approach, Project Management Office.

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STUDY OF THE INFLUENCE OF ELECTRIC TRANSMISSION PARAMETERS ON THE EFFICIENCY OF FREIGHT ROLLING STOCK OF DIRECT CURRENT
(p. 60-67)

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The negative impact of non-uniformity of current distribution in the power circuit of a freight direct current rolling stock on its operation efficiency was experimentally established. In contrast to existing approaches, the presented study reveals the entire range of factors that together affect non-uniformity of current distribution.

The method of calculation of comprehensive influence of structural, technological and operational factors on current distribution was developed. It made it possible to determine conditions of elimination of the difference of currents and to increase traction properties of locomotives when controlling freight trains. The proposed coefficients allow analyzing the effect of various factors on current distribution and relationship between parameters of motors, connected in parallel. They visually show that deviation of currents at interaction of a locomotive with freight wagons affect not only particular parameters of wheel-motor units, but also their connection. The merit of this approach is the possibility of evaluation of non-uniformity of current distribution depending on the structure of electric machines and connection of structural parameters of a wheel-motor unit. Results of the study can be used during repairs of freight direct current rolling stock and in designing automatic control systems.

Keywords: transportation mechanics, traction motor, coefficient of traction, traction force, resource saving, current distribution.

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DEVELOPING THE METHOD OF RATIONAL TRUCKING ROUTING BASED ON THE MODIFIED ANT ALGORITHM
(p. 68-76)

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The method of rational routing based on the modified ant algorithm with introduction of a quality function that characterizes the qualitative state of roads was proposed. Comprehensive assessment of potential routes takes into account practical throughput, actual state of the route sections and the vehicle traffic intensity.

The function of quality of the transportation process was formed. Formalization of the roadbed condition on selected sections of the route was proposed to be carried out with the use of a fuzzy set apparatus for describing the membership function. The roadway condition was estimated on the basis of empirical data and was reduced to the appropriate coefficients that characterize unsatisfactory,

partially satisfactory and satisfactory road conditions. Description of practical throughput in individual sections of the designed routes was formalized. The probability of occurrence of vehicles of diverse types in the travel line was taken into consideration when determining theoretical throughput of road sections with a subsequent reducing to corresponding expert coefficients.

Introduction of additional parameters through the quality function into the model of ant algorithm makes it possible to improve its efficiency and expand possibilities for taking into account additional conditions of transportation, such as the road relief, existing service infrastructure, appearance of emergency road situations, climatic conditions, etc. The proposed approach may be useful in solving the synthesis problem since it will enable prompt taking into consideration complex and varying actual conditions of the transportation process.

Comparison of effectiveness of the classical and modified ant algorithm was carried out on the example of transportation routing from the point of departure to the point of destination on an example of a road network between Odesa and Dnipro. Implementation of the classical and modified algorithms proved effectiveness of the proposed approach and made it possible to determine the route that avoids road sections with unsatisfactory road conditions.

The proposed modified algorithm makes it possible to focus on not only the distance indicators but also on qualitative characteristics of the road. Calculations using the modified algorithm in the MATLAB programming environment have allowed us to determine the most rational route.

The results obtained in the study can later be used in the decision support systems for management in the process of rational routing. The proposed methodological approach can be useful in solving the synthesis problem since it will enable consideration of complicated and changing conditions of practical realization, in particular, in a real-time mode.

Keywords: rational route, trucking, modified ant algorithm, qualitative state of roads, throughput of route sections.

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DEVELOPMENT OF INFORMATION TECHNOLOGY FOR SUPPORTING THE PROCESS OF ADJUSTMENT OF THE FOOD ENTERPRISE ASSORTMENT (p. 77-87)

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The work aims to study the processes of production management at the multiproduct food enterprises. To improve management effectiveness, application of the created information technology to support the process of adjusting the product assortment was proposed. This is achieved by reducing the total product cost price and obtaining an additional profit. The proposed information technology consists of five main stages which provide a deep analysis of production based on the accumulated business information about the company's activities, sales, market demand, quality and quantity indicators of the products, formulations, etc. The stages of the developed information technology include application of the data mining methods such as clustering, decision trees, forecast methods based on time series. Each proposed method of data mining was substantiated and tested for each of the stages of the proposed information technology. The essential feature of the proposed technology is that adoption of the forecast level of cost price and demand are estimated using graphical and analytical methods of break-even calculation. The use of this technology will improve efficiency of economic activity of enterprises. This is achieved by reducing the product cost price. The proposed technology can be used both in the food industry and in other similar industries.

Keywords: multiproduct food enterprise, intelligent data analysis.

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