ABSTRACT AND REFERENCES

CONTROL PROCESSES

DEVELOPMENT OF A MULTI-SCENARIO APPROACH TO INTELLIGENT MANAGEMENT OF HUMAN RESOURCES IN THE FIELD OF MEDICINE (p. 4-14)

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The issues of human resource management in the field of medicine were studied and the strategic importance of the human factor and its intellectual potential in improving the quality of health indices were shown. The potentials of using intelligent technologies in management of medical specialist demand and offer adequately reflecting the rapidly changing situation at the labor market were observed. For that purpose, the procedure of intelligent management of demand for and supply of medical personnel was developed. The models of interaction of demand and supply from the standpoint of individual labor market participants (medical specialists and employers) and their behavioral strategies were offered. Formulation of the problem of making a decision concerning the choice of a proper policy of matching supply of and demand for medical specialists reducible to the fuzzy pattern recognition was given. The pattern recognition is based on a fuzzy situational analysis and determining the degree of similarity of fuzzy situations. The degrees of fuzzy inclusion and fuzzy equality were used as the criterion of degree of proximity of two fuzzy situations. The multivariate nature of supply and demand relationship was shown, possible scenarios of their matching were offered and a procedure of decision-making for employment of medical specialists was elaborated. A phased implementation of the multi-scenario procedure of managing demand and supply was carried out by the example of solving the problem of real selection and recruitment of medical specialists for concrete vacancies. The advantage of this approach consists in ensuring possibility of making decisions adequate to the current situation in the human resource management in medicine and its practical implementability. The procedure can be used in management of human resources in various sectors of economy with adaptation to their features.

Keywords: medical specialists, demand model, supply model, fuzzy situations, fuzzy similarity.

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DEVELOPMENT OF A SIMULATION MODEL OF SAFETY MANAGEMENT IN THE PROJECTS FOR CREATING SITES WITH MASS GATHERING OF PEOPLE (p. 15-24)

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The model-scheme of threats during management of projects of creating sites with mass gathering of people (SMGP) was proposed. Its feature is consideration of the main events of operating activities of the site and possible safety threats. The usage of principles of identification of the threats to the SMGP at the planning stages was proposed. An abridged structure of decomposition of operation of a site with mass gathering of people at the planning stage was developed. The classifications of complex systems in management of projects and programs in the system of civil defense were proposed. They are tree-like models of the classification objects according to various classification features. A comparative analysis of methods and algorithms as for usage of imitation modeling in projects of this type and their division into three groups were performed. As a result, in order to conduct further simulation research, we selected the method of simulation modeling. The simulation model of a life cycle of the project of creating the SMGP in the software complex AnyLogic was proposed, and based on it, a dynamic model of simulation environment of the life cycle in projects of this type was proposed. It provides an opportunity to assess the major parameters of safe operation of a site with mass gathering of people: throughput of a site, peak hours of critically permissible loading, maximum number of visitors.

Keywords: project management, simulation modeling, safety-oriented management, site with mass gathering of people.

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RESEARCH ON DRIVERS' REACTION TIME IN DIFFERENT CONDITIONS (24-31)

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The study has determined the peculiarities of forming the reaction time of drivers in laboratory and real conditions. The fastest response time in the real conditions was found to be 1.37 seconds in the second age group of the tested drivers. The drivers' reaction time was by 25 % longer in the first group and by 60 % longer in the third group. The smallest impact of the functional state on the drivers' reaction time in the laboratory conditions was produced on the drivers of the second age group; the biggest impact was recorded for the drivers of the third group. The duration of the latent period relative to the total duration of the drivers' reaction time of the drivers varied on average from 30 % to 45 %.

It was found that in all age groups the reaction time of male drivers on average was 15 % shorter than of female drivers. The functional state of the drivers was evaluated by the following factors: the stress index, the activity rate of the regulatory systems, as well as the frequency and the average amplitude rhythms on the electroencephalogram. These indices were obtained using the experimental software packages NeuroCom and Cardio Sens. Testing in the real conditions

revealed that the drivers' reaction time was on average twice the value obtained in the laboratory conditions.

The reaction time was proven to depend on the drivers' psychophysiological characteristics, which should be taken into account while determining the safe vehicle speed in projects of automated systems of traffic management.

The safe speed modes and speed limits were determined with regard to the patterns of the drivers' reaction time formation.

Keywords: functional status, reaction/response time, high-speed mode, automated traffic system.

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ESTIMATION OF TRANSPORT ACCESSIBILITY OF THE CAPITAL ECONOMIC REGION (p. 31-40)

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The methodology for estimation of potential transport accessibility of the region, which requires merely open data, was identified. The choice of the Capital Economic Region as the region for estimation of transport accessibility was validated. The study solved the problem of adapting the foreign approach to calculation of potential transport accessibility of the Capital Economic Region.

The highlight of the given research is the application of Euclidean distance between the cities (nodes) and the total of activity types available in the destination node as the initial data for estimating transport accessibility.

The proposed methodology of potential road transport accessibility estimation of the region enables revealing of the potential deficiencies in the transport infrastructure of the region. This is provided by the special feature of the methodology which is based on the suggested equation for calculation of transport accessibility and the scale developed in the paper. The scale contains seven levels of potential transport accessibility of the Capital Economic Region and it enables quantitative evaluation of the transport accessibility values for the given city (node) in relation to the set of other cities (nodes). Thus, the degree of spatial separation of the cities related to the regional center can be defined.

The given methodology can be applied for other regions of Ukraine to evaluate current efficiency of the road transportation network. It is recommended to devise a new scale for evaluating

potential transport accessibility while applying the proposed methodology to another region. Other possible applications of the methodology include urban planning, transport planning, creating and/or developing regional transport systems.

Keywords: transport accessibility, transport planning, transport network, road.

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ANALYSIS OF INTERRELATIONS BETWEEN THE CRITERIA OF OPTIMAL CONTROL OVER THE PROCESS OF DRILLING THE WELLS (p. 40-50)

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We analyzed one of the promising directions of optimal control over the process of drilling wells – the realization of automated control in real time by the criterion "minimum specific energy consumption".

A comprehensive assessment was conducted of the relations between the two optimality criteria of the drilling process – the minimum cost per meter of drilling and specific energy consumption. We used the Farrar-Glauber method for the analysis

This is predetermined by the fact that the models that are employed for computing the cost per meter of drilling include the duration of drilling with one bit and footage per bit. However, they can be defined only upon completion of the bit run, which lasts for several tens of hours. This prevents applying the criterion "minimum cost per meter of drilling" to solve the problems of control in real time. In contrast to that criterion, specific energy consumption can be controlled continuously in the course of drilling a well.

With the help of the Farrar-Glauber method, we established that there is complete multicollinearity between the criteria "minimum cost per meter of drilling" and "minimum specific energy consumption" at the change of axial force on the bit and the frequency of its rotation. The degree of completeness in the multicollinearity among the examined criteria is found:

– at the change in axial force to a bit F: det t=0,305; (16.003>3.8); F>Ftable (31.808>4.60); t12>ttable (5.639>2.145).

– at the change in rotation frequency ω: det t=0,114; (30.011>3.8); F>Ftable (94.913>4.49); t12>ttable (9.742>1.746).

At the change in the consumption of a washing fluid, under conditions of the experiment, the multicollinearity between the investigated criteria of optimal control is missing: Q: det t=0.84; (2.35<3.8); F>Ftable (2.662<4.60); t12>ttable (1.631<2.145).

The obtained results are important and useful for the application of a dualistic approach to solving the problem of optimal control over the process of drilling in real time and the formation of optimality criterion based on the principles of energy-informational approach. This makes it possible to directly process information on the specific energy consumption and to provide intelligent support for the decision-making processes when a drilling master defines optimal drilling mode parameters.

Keywords: optimal control, drilling process, optimality criteria, interrelations, the Farrar-Glauber method.

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CONTROL OVER GRAPE YIELD IN
THE NORTH-EASTERN REGION OF UKRAINE
USING MATHEMATICAL MODELING (p. 51-59)

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In the practical cultivation of cultures, including grapes, prediction is an inherent attribute, since, under weather actions, it is possible to immediately take measures before one or another degree of the vegetation of culture is affected. In order to develop mathematical software of an information system for determining the probability of reduction in the yield of grapes, we observed the annual variation in temperatures. Moreover, to manage this process, its comparison was conducted with the development of grapevine by the phases of its development for 16 years. By employing the method of binary logistic regression, we revealed three most significant indicators (radiation background, the sum of efficient temperatures during flowering, annual total precipitation in the previous year), which were included into the mathematical model developed. The results obtained make it possible to estimate the risk of reduction in the harvest of grapes, which is grown under conditions of the Northeastern forest-steppe region of Ukraine (Kharkiv region). The developed model as a whole and its separate coefficients are statistically significant. It is also established that all the predictors, in accordance with the chi-squared test, impact the prediction of reduction in the yield of grape. The obtained results might be used when making a decision about the need of change in the agrotechnical methods for the purpose of improving productivity by changing the course of specific phases in the vegetation of grape.

Keywords: harvest prediction, logistic regression, information system, control over yield, a grape culture.

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REPRESENTATION OF PROJECT SYSTEMS USING THE MARKOV CHAIN (p. 60-65)

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The known approaches to project management are typically based on the intuitive decisions by project managers, not on theoretical foundations, patterns and laws of project management. In order to solve this contradiction, it is necessary to conduct the generalization and develop applied aspects for using the Markov chains to represent and model the weakly structured project management systems. To construct the Markov chain, we used a modified system of project management, which is represented in the standard of project management and defines the scheme of interaction between project participants. A method for the transformation of this scheme into a homogeneous Markov chain with discrete states and time is developed. It is demonstrated that iteration solution of the system of equations of the Markov model makes it possible to construct a "trajectory" of development of virtual or actual project systems. We examined practical aspects in measuring the effectiveness of "trajectory" of project development by using the devised Markov model. An evaluation of results of changing the probability distribution of project states in the coordinates of probabilities of the system states by steps revealed a significant effect on the progress and efficiency of a project only in the case of variation of terms of cooperation within a project team.

Keywords: project participants, communications, Markov chain, discrete states, project trajectory.

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