ABSTRACT AND REFERENCES

CONTROL PROCESSES

IMPROVING THE PROCESS OF DRIVING A LOCOMOTIVE THROUGH THE USE OF DECISION SUPPORT SYSTEMS (p. 4-11)

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The process of driving a train was represented in the form of fuzzy situations, given in a table. The conformity between all possible situations and a set of driving decisions was established. The table size is determined by the number of situations which, in turn, depends on the degree of concretization of values. An algorithm of actions of a locomotive driver when driving a train is presented in the form of fuzzy probabilistic graph. Fuzzy numbers, the values of which are recorded in the matrix graph, represent the weights of transitions between vertices. The choice of decision by a locomotive decision support system (DSS) is carried out using the utility criterion. The training system is implemented with the use of the fuzzy classifier that represents fuzzy knowledge base, the input of which receives signals about current state of the traction rolling stock and of the environment. The model of dynamic knowledge base was obtained.

As a result of analysis of existing types of intelligent systems, hierarchies, and algorithms of their work, taking into account the working conditions of locomotive crews and railway transport as a whole, the parameters for locomotive DSS were developed. We defined the minimal time it takes for a locomotive driver to make a decision about driving a train and to identify emergency situations. The functions of person that directly affect the efficiency and safety of the locomotive and require support using the intelligent systems were determined. The results of the work allow implementing intelligent DSS in modern locomotives. This will enhance the level of safety and efficiency of driving a train.

Keywords: driving a locomotive, decision making, intelligent system, knowledge base, fuzzy classifier.

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DEVELOPMENT OF PARAMETRIC MODEL OF PREDICTION AND EVALUATION OF THE QUALITY LEVEL OF EDUCATIONAL INSTITUTIONS (p. 12-21)

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The purpose of the study was the development of a parametric model for prediction and actual evaluation of the quality level of work of educational institution.

We created the structure of the processes of educational institution, which includes 7 levels of processes in the sequence of their execution.

To determine parameters of influence of some processes on others, the links between each process and other processes were analyzed. With the help of expert assessment, we defined values of parameters of influence on each process. We performed selection of experts, for whom a statistical analysis of the results of expert evaluations demonstrated consistency in judgments at the medium and high level – 91 %, the significance of these assessments reached 78 % by the criterion of Pearson.

The defined values of parameters helped to create the model of the process of educational institution. This model allows calculating consistently by the levels of processes the quality of work of each process by the determined function that takes as its basis the level of quality of initial resources and uses the defined parameters and the structure of processes for the calculation. The calculated quality is predictable, demonstrating either increase or decrease in the quality level of each process and the entire educational institution in future.

The actual assessment of quality of each process of educational institution is recommended to perform based on verbal questionnaires, the basis of which is the developed table of ten degrees of estimation of quality level. The scale of degrees of assessment was expanded in comparison with the recommendations of the ISO 9004 standard to align actual evaluations with the process of prediction of quality level and consequent comparison of their results.

As a result of the study, we created a parametrical model which enables us to predict the quality of work of educational institution based on rational allocation of initial resources. Based on the model, it is possible to realistically evaluate the quality of work of all processes of educational institution for further improvement in their work and adjustment of the model for prediction.

Keywords: educational institutions, quality assessment, proactive management, quality prediction, quality forecasting, parametrical model.

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CLUSTER ANALYSIS OF FRACTURING IN THE DEPOSITS OF DECORATIVE STONE FOR THE OPTIMIZATION OF THE PROCESS OF QUALITY CONTROL OF BLOCK RAW MATERIAL (p. 21-29)

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As a result of the performed research into regularities of formation of fracturing of deposits of labradorite, we identified the main types of the samples describing the elements of occurrence, and formed the reference samples, the analysis of which allowed us to substantiate the optimal methods of cluster analysis for selecting the systems of fracturing.

To predict the direction of development of mining and management of the processes of extraction of decorative stone, we obtained analytical expression of dependency of the quantity of cracks on the strike azimuth in the form of polynomial of the second degree.

The possibility of forecasting the quantity of cracks, proved in the work, depending on the strike azimuth of vertical cracks based on the mathematical description of the given dependence by analytical expression will make it possible to increase the efficiency of planning of mining works at the enterprises that use technologies, the efficiency of which is determined by the vertical fracturing. These are, first of all, crack-formation technologies, for which anisotropy and defectiveness of array play a crucial role.

For the estimation of prospects of development of deposits, or separate sections, we proposed the new cluster-geometric technique of determining the blockiness and presented the example of its implementation for the conditions of Nevyrivskiy deposit of labradorites. In addition, the proposed technique makes it possible to estimate the probability of each of the obtained results, which significantly increases efficiency of risk assessment when designing mining works. It also allows increase in the degree of taking account of the genesis of fracturing and mutual angular correlations between the systems of fracturing, which provides for the possibility to increase the accuracy of assessment of quality of both entire deposit and its separate sections.

Keywords: cluster analysis, decorative stone, fracturing, blockiness, orientation of the front of mining works.

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IMPLEMENTATION OF INTELLIGENT INFORMATION TECHNOLOGY FOR THE ASSESSMENT OF TECHNICAL CONDITION OF BUILDING STRUCTURES IN THE PROCESS OF DIAGNOSIS (p. 30-39)

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This work considers the technology of implementation of intelligent systems in the area of lifecycle management of building objects at the stage of operation. The main goal of the research is the integration in the process of diagnosis of automated systems for gathering, accumulation, systematization and use of generalized expert knowledge, acquired in the exploration of different objects under different operating conditions. The paper demonstrates the technology of management of the base of rules, with the help of which we built fuzzy knowledge base for the assessment of technical condition of reinforced concrete structures. The rules are formed when comparing the results of inspections to the results of monitoring of the environment.

Authors believe that the use of modern universal automated systems of calculation and design, which create information models of buildings and calculate loads on separate structures, provides experts with the possibility to automate forecasting of technical condition of structures under conditions of uncertainty and in cases when a deterministic model of destruction is complicated for practical use or lacking. The results of the conducted research may be used to develop the decision making support systems that are capable by themselves to analyze dynamic information, find regularities in it, perform prediction and explain to the user the logic behind the system's reason of obtaining this or that result.

Keywords: knowledge base, building structure, intelligent information technology of diagnosis, fuzzy logic, technical condition.

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DEVELOPMENT OF MATHEMATICAL MODELS FOR PLANNING THE DURATION OF SHUNTING OPERATIONS (p. 40-46)

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The studies we conducted address the subject of setting the standards of shunting operations in rail transport. Existing methods of standardization of shunting operations in rail transport are analyzed and their deficiencies are revealed. A mathematical model of technological time of the transposition of shunting train sets was built. We developed regression models of technological time for the semi-flights of the rounds of shunting locomotives for a train set and their transpositions at different speeds of shunting operations. Based on the analysis of tabular norms of duration of the execution of shunting operations, we proposed to use polynomial models as more convenient in practical application and reflecting the influence on the value of technological time not only from separate variables (factors) but their interaction as well. As a result of a full factor experiment with effects of pair interaction, the model is obtained of technological time of the transposition of shunting train sets, which adequately reflects the element of transportation process. We carried out calculations that confirm the adequacy of the developed model. The dependencies that we obtained are more convenient to apply in comparison to the tabular method of representation of the norms of time for the operations, it is recommended to use them when constructing simulation models of operation of the railway stations.

Keywords: rail transport, shunting operations, length of semi-flight, experiment, regression model.

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AN IMPROVED METHOD OF DETERMINING THE SCHEMES OF LOCOMOTIVE CIRCULATION WITH REGARD TO THE TECHNOLOGICAL PECULIARITIES OF RAILCAR TRAFFIC (p. 47-55)

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This paper focuses on new analytical solutions in the area of building locomotives' circulation plans to handle individual applications for route transportation of freight. Such a domain has been little researched for the railway network of Ukraine, whereas the present study provides a basis for automating the planning process. The main aim is to improve the methods of determining the schemes of locomotives' turnover in the railway network of Ukraine under the condition of an accelerated handling of individual railcar traffic and with regard to technological peculiarities. The developed mathematical model simultaneously makes it possible to determine the weight of trains on the routes they follow, to outline the circuity of locomotives with regard to deploying various series of locomotives within the network, and to regulate the system of locomotive crews' operations in view of the existing technical and technological features of locomotive facilities and the railway infrastructure. The suggested mathematical model is processed in the study through the use of an integer genetic algorithm with its own system of coding the solution. The results have confirmed the adequacy of the developed mathematical model. The use of the suggested mathematical model on the basis of the genetic algorithm can help automate the complex process of determining the schemes of locomotives' circulation with regard to the technological peculiarities of railcar traffic and, consequently, improve the accuracy and speed of decision-making for servicing individual applications for route transportation of freight.

Keywords: railway network, railcar traffic, locomotive planning, locomotive crew, genetic algorithm.

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