ABSTRACT AND REFERENCES

CONTROL PROCESSES

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DEVELOPMENT OF METHODICAL PROVISIONS REGARDING THE SUBSTANTIATION OF THE COMBAT STRUCTURE OF FORCES FOR ACTIVITIES IN THE AIRSPACE (p. 6-15)

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The determining factor for success during modern warfare is the struggle for supremacy in the air. The main task for a defending side is to prevent the enemy's superiority in the air. Various means of destruction are used for this purpose. A criterion to avoid enemy's superiority in the air is considered to be the assigned balance of aviation by parties, which is determined by their fighting capabilities. To substantiate the required fighting strength for activities in the airspace, this article proposes appropriate methodological provisions. In this case, the combination of various means that are used when fighting for superiority in the air is treated as a system aimed at destroying troops and enemy targets.

Four tasks have been solved in the study.

When addressing the first task, we decomposed the system into components, the scientific result being a morphological pattern of the system. That made it possible to determine the joint effect from the activities of the system's components at inflicting losses to combat capabilities of the warring parties.

The second task of the study addressed the development of a methodological approach to the substantiation of combat forces to fight in the airspace, which is based on calculating the saved combat capabilities in the components of the warring parties. We have constructed a structural scheme for the technique of substantiation the required combat forces to prevent superiority or strengthening the enemy's advantages in the airspace. The force required is determined based on the criterion of the ratio of aviation forces by parties to ending fighting operations using an iteration method.

The result of solving the third task is the derived mathematical expressions for calculating the saved combat capabilities of parties' components to end the hostilities, which form the basis of the devised procedure.

While addressing the fourth task, we considered the sequence of application of the devised procedure using an example of determining the structure of strike aircraft to prevent enemy's superiority in the air.

The devised methodological positions could prove useful when developing appropriate mathematical software to be used by military administrative bodies.

Keywords: effectives, balance of power, systems analysis, air supremacy.

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ANALYSIS OF THE ROAD TRAFFIC MANAGEMENT SYSTEM IN THE NEURAL NETWORK DEVELOPMENT PERSPECTIVE (p. 16-24)

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The research goal of the paper is to present the issues connected with road traffic management systems and to illustrate a management system that uses Intelligent Transportation Systems and neural networks. The use of Intelligent Transportation Systems (ITS) is a method of improving the conditions of communications, making it independent from the development of communications infrastructure. The attributes of neural networks are focused on solving the problems of optimisation, which involve the development of optimal strategies for traffic management. The proposed road traffic management system that uses ITS and neural networks can be applied in prediction of the conditions of communications in road traffic management.

The paper presents the results of qualitative research carried out in the aspect of traffic volume forecasting on selected national roads, supported by a scientific search and discourse on logistic aspects of traffic management, with particular emphasis on Intelligent Transport Systems, in order to verify the effectiveness of the implementation of neural networks. The above mentioned issues are extremely important due to the necessity of knowing the expected load of routes. Traffic fluctuations related to factors such as time, traffic, road architecture and capacity utilization are important elements of traffic intensity. The study served to verify the effectiveness of four independent neural networks, forecasting the traffic volume, for seven days of the week, at particular time points. Empirical data utilised in presented qualitative research was derived from motion sensors, installed on selected national roads, at specific time intervals. It enabled prospects for the development of neural networks to be determined in a model perspective, constituting a set of artificial intelligence methods, in the context of vehicle traffic volume, which is characterised by certain repetitive regularities. The author's model of introducing an algorithm based on neural networks in application to measurements performed in transport in terms of quality, quantity and methods of data acquisition affects into the presented results. Different systems have been analyzed that are used to obtain data for modeling. As a result of various doubts, system maladjustments or excessive costs, alternative solutions have been proposed that can eliminate the presented problems. Solutions have been proposed that limit some of the problems reported by the authors in this regard. The presented research results justified the use of neural networks in measurements in transport. The results of the measurements were obtained in accordance with the actual observations and compared with the results of other systems. The authors analyze further required work and the possibilities of improving the solutions used.

Keywords: Intelligent Transportation Systems, neural networks, road traffic management.

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CONSTRUCTION OF AN INTEGRATED CRITERION FOR ESTIMATING THE CONSEQUENCES OF EMERGENCIES INVOLVING DANGEROUS GOODS (p. 25-31)

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The paper reports a method for estimating the consequences of emergencies involving dangerous cargoes when they are transported by railroad transport. The method is based on constructing an integrated criterion, which takes into consideration those factors that influence the magnitude of risk, which in turn depends on a specific arrangement of wagons in a freight train carrying dangerous cargoes.

The criterion chosen is a conditional confidence in the occurrence of greater consequences as a result of an emergency. The criterion depends on: the number of groups of wagons carrying dangerous goods in a train being formed; the total number of wagons with dangerous goods. The criterion is also affected by: the degree of danger in a group to which wagons with dangerous goods are assigned and the number of cases for the co-arrangement of wagons from various risk groups.

It was established that the factors' values are constantly changing, so they were described using an apparatus of fuzzy logic and fuzzy sets. The use of such an apparatus has made it possible to comprehensively identify the mutual influence of these factors on a safer option for train formation at marshalling yards.

Modeling of possible situations has led to a conclusion about correspondence of the magnitude of values for input fuzzy parameters to the magnitude of values for conditional confidence in the occurrence of greater consequences as a result of an emergency.

The obtained results logically indicate the occurrence of greater consequences when a train has the maximum values for fuzzy variables, the medium ones – at medium values, and the minimal consequences at minimum values for fuzzy variables.

The relationships have been identified for fuzzy input data, whose analysis revealed that an increase in the value for any fuzzy parameters (and their combinations) leads to an increase in the total value for the magnitude of conditional confidence in the occurrence of greater consequences as a result of emergency.

Keywords: dangerous goods, conditional confidence, fuzzy logic, emergency, risk assessment.

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IMPROVEMENT OF EFFICIENCY IN THE ORGANIZATION OF TRANSFER TRAINS AT DEVELOPED RAILWAY NODES BY IMPLEMENTING A "FLEXIBLE MODEL" (p. 32-39)

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We have studied the efficiency of organization of transfer trains at developed railroad junctions based on the criterion of total hours of railroad wagon downtime under accumulation. We have constructed discrete-event simulation models (Java SE, AnyLogic) of the organization of transfer trains in line with a "rigid schedule" and under accumulation to the standard for trains. The models take into consideration the stochastic nature of wagon arrivals to the accumulation points and meeting the established norm for the mass of trains. It is considered at modeling that track development of railroad stations and intranodal passages is rational and does not significantly affect delay in the motion of transfer trains. The transfer trains schedule is rational and rhythmic. The throughput capacity of open tracks at a node and the processing capability of subsystems at railroad stations are sufficient.

We have experimentally compared the efficiency of four models of the organization of transfer trains, including a "flexible model", which combines dispatch upon accumulation to the standard of a train and a "rigid schedule" at the same time. It was established that the minimal hours of wagon accumulation are achieved when transfer trains are organized via a combined variant: a simultaneous dispatch in line with a "rigid schedule" and at accumulation to the standard. Organization of transfer trains in line with a "rigid schedule" requires the organization of additional trains, otherwise there is an increase in the queue of wagons at accumulation points. When increasing the number of daily trains by 10–11 %, the process of forming and dispatching becomes sufficiently reliable and efficient.

The specified recommendations would make it possible to improve the typical process of operation of railroad junctions in terms of dispatcher control over the formation, dispatch, and passing of transfer trains during intranodal traffic.

Keywords: developed railroad junction, delivery time, schedule of trains, imitational simulation, stochastic flow.

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DEVELOPMENT OF THE METHOD OF DISTANCES FOR PROCESSING EXPERT ESTIMATES IN INFORMATION SYSTEMS (p. 40-47)

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Current research focuses on expert estimation of indicators by employing a limited number of qualified experts, which involves considerable time and cost. The advent of modern information technology allows rapid and efficient assessment of indicators that characterize performance of enterprises. The main tool for solving the issue related to the credibility of such an estimation is the development of new methods for processing its results.

We have proposed a method of distances to treat the results from expert estimations of indicators and examined the results of its work.

To this end, theoretical substantiation of the method has been performed, based on the concept of proximity (distances) among estimates relative to the average value, coefficients of experts' competence, and normalization of the point scale of assessment.

We have explored three variants of expert point- and verbal-based estimates of independent and dependent indicators in line with the method of distances, which showed that the convergence rate of iteration process for all cases varies from 1 to 4 orders of magnitude at each iteration. That makes it possible to draw a conclusion about a very small number of computations by the information system and sufficient speed of processing expert estimates.

A comparative analysis of the method of distances with a similar method of square deviations has revealed almost the same rate of convergence up to 3–5 iterative steps, but the proposed method yields an estimate close to the average estimate of each indicator. It also enables the processing of results in information systems by 99 % faster, from dozens, even hundreds of times, more estimates than that in the methods of expert selection, which is important under current competitive environment. Average efficiency of the method compared to the method of expert selection is 5.8 %.

Keywords: expert estimates, estimation of indicators, on-line assessment, processing of expert estimate, analysis of expert estimation, information technology.

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METHOD FOR CONFIGURING THE COMPOSITION OF A PROJECT TEAM BASED ON THE CRITERIA OF SUBJECTIVE WELLBEING (p. 48-59)

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The method for configuring a project team by the criterion of subjective well-being was developed. The method is aimed at searching for such a configuration of candidates at which a team with high commonality is formed based on the importance of values (factors) of subjective well-being and their actual satisfaction at the moment of team formation. The method is based on two conceptual provisions-axioms. Firstly, the most appropriate results of construction of a personal profile are achieved during self-analysis of the attitude of a candidate to indicators of subjective well-being. Secondly, ranking makes it possible to construct a series, in which the least achieved indicators act as the most important.

On this basis, it seems possible to compare profiles of candidates with each other and identify the most similar ones. It was theoretically substantiated that the configuration of the closest profiles is a prerequisite for the formation of a positive working environment as a necessary factor for comfortable interaction of team members and a significant integrating factor of involvement in a project. The developed method of the construction of a candidate's personal profile ensures necessary accuracy and increases reliability of obtained information. Two "working zones" of a personal profile (first five and the following seven comprising 27 indicators) that determine close profiles of candidates were identified empirically. The indicators of the overall total rank for indicators of zones and the team coherence coefficient were introduced to compare the profiles.

To interpret the value of coherence coefficient in the empirical way, the evaluation scale from seven interval zones for the teams consisting of two to ten participants was constructed. Its effectiveness and adequacy were proved based on the results of experimental testing, the possibility of using the criterion of subjective well-being as a parameter for the formation of project teams.

Keywords: project team formation, personal profile, subjective well-being, team coherence coefficient, evaluation scale.

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THE MODEL SELECTION FOR MICRO AND SMALL ENTERPRISES (MSES) FOR HANDICRAFT PRODUCT DESIGN INNOVATION IN MALANG (p. 60-66)

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Micro and small enterprises (MSEs) are noted to be the important sector which plays role in economy of a country. In Indonesia, there are 62.9 million units of MSEs which consisted of 62.1 million micro enterprises and 757.090 small enterprises. All of these MSEs contributed for 57.94 % of Indonesia's Gross Domestic Product or worth IDR 4.303 trillion, and permeate up to 110.8 million workers. Malang City is a city in Indonesia, which has a lot of MSEs that are engaged in the field of food, clothing, and various home industries producing handicrafts as souvenirs. The potential of handicrafts in this city is promising. With the locals marketizing different kinds of handicraft product themselves, it in fact eases the tourists to find handicraft products as souvenirs typical of Malang. Typical in this sense means that handicraft products produced by the MSEs are based on the historical and cultural aspect of the city. Problems that exist were that there was no best model that could be used by the MSEs to create handicraft products identifiably typical of Malang. The aim of this study is to compare several alternatives of the structural model so that the best model can be obtained. It was done by using Partial Least Square (PLS) method in which customer needs were identified. This research gives the best structural model among the alternatives created for the MSEs so that they could design the handicraft products based on historical values, local culture and consumer needs. The designs as the innovation are products putting the word "Malang"; using the picture of "City Monument"; the image of "Lion's Head" and "Lotus" as symbol of the city; the handicraft product must be beautiful when being enjoyed visually; it has to have sharp colors, unique and dynamic impression, functional aspect and be easy to carry.

Keywords: Handicraft, Innovation, Malang City, MSEs, PLS, Product Design, Structural Model.

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