ABSTRACT AND REFERENCES

CONTROL PROCESSES

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DEVELOPMENT OF A GENETIC ALGORITHM FOR PLACING POWER SUPPLY SOURCES IN A DISTRIBUTED ELECTRIC NETWORK (p. 6-16)

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The problem of substantiation of developing complex distribution systems of electric power supply was considered as a hierarchy of problems at the first stage of which the problem of choosing a rational configuration of the power system was solved. A mathematical model of solution of the problem of optimal placement of several power sources in the power supply system and assigning to them consumers using genetic programming algorithms was developed. The proposed methods make it possible to obtain optimal routes of transmission lines connecting consumers with power sources taking into account the terrain restrictions.

A modification of a simple genetic algorithm based on which an information system was implemented was developed. This system solves the problem of combinatorial optimization with respect to the choice of optimal location of power sources in a distributed electrical network.

Calculation time was estimated depending on the problem parameters. It was shown that the developed algorithm provides minimum computation time for problems of small and medium dimensionality. The results of solution of the problem for a concrete example demonstrate advantage of the genetic approach over the method of full enumeration. The results obtained can be successfully applied to solve the problem of optimizing placement of power sources in a distributed electrical network.

Keywords: genetic algorithm, electric power source, evolutionary algorithm, power supply system, combinatorial analysis.

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EVALUATION OF QUALITY LEVEL IN MANAGING THE DEVELOPMENT OF INDUSTRIAL ENTERPRISES (p. 17-32)

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The research focuses on the substantiation of theoretical aspects and practical support for assessing the quality level of managing enterprises development taking into account the influence of the external and internal environment.

The conceptual apparatus for estimation of quality development of enterprise management was refined, which makes it possible to determine reasonably the level of management

according to the generally known elements (economic, social and ecological) that are proposed to be supplemented with an energy component. A new conceptual approach to the procedure of evaluation of the quality of development management by levels, the stages of which are proposed to expand by: the formation of the database by levels of management (state, regional), choice and evaluation of indicators by components of development and spheres of activity, development of the tools for management improvement. The integrated indicator has been proposed, which differs from the existing ones by the fact that it estimates the quality of development management, rather than the development level. In contrast to the previously proposed ones, the integrated indicator takes into account the influence of external environment by the components of development and of the internal environment – by the areas of activity for each component. That is why it has practical significance, since it allows performing monitoring and detecting the negative influence of management on the enterprise development. Taking coke plants as an example, the structures of the indicators that characterize the management quality were determined. A large number of indicators were reduced by the method of expert assessments, which increases the validity of the choice. Indicator estimates were constructed solely based on relative indicators (indices), which improves consistency. Using the integrated method, the estimation of the indicators by individual components and on the whole was performed. The scale for evaluation of the quality level of enterprise development management was constructed using the Harrington function. The new approach to assessing the quality of the enterprise development management and a complex of mathematical support will lead to the uniform economic, social, environmental and energy development of enterprises.

Keywords: estimation of development management level, system of indicator estimates, components of development, integrated indicator, estimation scale.

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CONSTRUCTING AND EXPLORING THE MODEL TO FORM THE ROAD MAP OF ENTERPRISE DEVELOPMENT (p. 33-42)

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The study addresses the task on determining the optimal road map for the enterprise development – the choice of the sequence of projects and their parameters, which would ensure the achievement of the goal taking into consideration the basic requirements and constraints. The optimization of the structure and parameters of the development road map is carried out based on the "strategic network" that makes it possible to form alternative variants of the road map of development. This network is based on the principle of the formation of transport networks, and the space "time – indicators of the enterprise state" is accepted as the analogue of the topological space.

The elements of the strategic network – "nodes" – are the enterprise states and the projects that correspond to network transitions from one state to another. The network parameters include: duration of transition from state to state, determined by the intensity of project activities; duration of the project funding process; beginning of the project implementation (transition to a new stage). These parameters determine the following characteristics of the projects that form the characteristics of the road map: project costs; root mean square deviation of project costs; financial result after the project implementation; root mean square deviation of the financial result after the project implementation.

The model for establishing the optimal structure and parameters of the road map of the enterprise development was developed. This model makes it possible to determine the optimal road map of the enterprise development, taking into consideration the possibility of varying the time parameters: time of beginning of each stage, duration of transition from stage to stage, duration of funding phases. The model takes into consideration the probabilistic nature of investment costs and inflows of the funds of an enterprise after the implementation of development activities.

Experimental studies on the formation of a road map based on the developed model were carried out, which proved its operation capacity and reliability. The model can find a wide practical application in solving the issues on the construction of road maps of a step-by-step increase in production, or a phased replacement of equipment (technical development).

Keywords: optimal parameters, mathematical model, step-by-step development, investment, road map, strategic network.

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THE MODEL TO OPTIMIZE DELIVERIES OF PERISHABLE FOOD PRODUCTS IN SUPPLY CHAINS (p. 43-50)

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The probabilistic-statistical analytical model of optimizing the supply of perishable food products (PFPs) has been improved. The demand for PFPs is effectively satisfied by introducing into supply chain systems a possibility for additional delivery of PFPs in case of their deficit in the period between planned deliveries. It has been proven that the optimum size of basic delivery that corresponds to the maximum profit of a PFP supply chain system is affected by the following:

– the magnitude of profit from the sale of a single PFP unit earned from basic and additional delivery;

– the magnitude of loss incurred due to excess PFP units;

– the parameters of demand distribution between the periods of planned deliveries;

– technical-operational and economic indicators that characterize the operation of automobiles along multi-drop routes.

We have performed a comparative analysis of conditions for ensuring PFP deliveries in supply chain systems using the known and proposed improved variant of the probabilistic-statistical analytical model of PFP deliveries optimization. This analysis has revealed that the two-stage supply system, that is the one that implies additional delivery, is more economical-reasonable in terms of conditions for the operation of PFP supply chains. The expedience of increasing transportation expenditures related to transporting additional deliveries has been proven. It is their increase that predetermines a significant increase in the system's profit by achieving a high level of demand satisfaction and reducing losses incurred through the formation of unsold excess products.

Keywords: supply chains, perishable food products, supply management model, rational order size.

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DEVELOPMENT OF A MODEL OF THE SERVICE SYSTEM OF BATCH ARRIVALS IN THE PASSENGERS FLOW OF PUBLIC TRANSPORT (p. 51-56)

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A mathematical model of the queuing system for the passenger flow of urban public transport is proposed. The resulting model differs from canonical models of queuing theory by taking into account the fundamental features of real systems. Firstly, the service process is divided into different successive service sessions. Secondly, arrival and departures are batch. Thirdly, the arrival rates vary in different service sessions. Fourthly, the laws of distribution of the number of jobs in batch arrivals for different sessions are different. Fifth, the laws of distribution of the number of batch arrivals and departures are also different.

A criterion of efficiency of the service system is developed. The criterion is based on the calculation of the probability distribution of the service system states at the input and similar distribution at the output. These distributions are determined independently for each service session, into which the entire service cycle is divided. The numerical value of the criterion is set by the ratio of the average number of service rejections to the average number of jobs in the batch arrival for the entire service cycle. It can be used to assess the efficiency of the service system at any selected time interval during the day, because the value of the proposed criterion depends on the length of the interval between sessions, determined by the number of vehicles on the route.

The resulting models adequately reflect the functioning of the system, which makes it possible to predict many different situations and evaluate the consequences of proposed solutions. Thus, it becomes possible to predict the provision of the population with public transport and determine quantitative values of efficiency of the urban public transport system.

Keywords: queuing system, urban public transport, distribution of jobs in batch arrival, distribution of the number of rejections.

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MINIMIZATION OF TRANSPORTATION RISKS IN LOGISTICS BY CHOOSING A CARGO DELIVERY ROUTE WITH THE MINIMAL PROJECTED NUMBER OF ROAD ACCIDENTS (p. 57-69)

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A scientific-methodological approach to selecting a route with a minimal projected number of road accidents among several possible routes that connect the points of departure and destination has been proposed, which is based on three steps: the first step implies building a directed graph that contains the points of departure, delivery, as well as intermediate points, which are linked by edges with the specified distances between the points; the second step implies the calculation of the projected number of road accidents for each edge as the product of the distance that a truck must travel over a specific region by a road accident indicator, which is calculated for a given region; at the third step, a route is determined with the minimal projected number of road accidents.

A decision maker can be guided by two strategies: a first strategy is to choose the shortest delivery path – this would minimize the cost of delivery; a second strategy is to choose a route with the minimal projected number of road accidents – this minimizes accidents indicators. The current study has stated the problem of multifactor optimization based on distance and the projected number of road accidents and has proposed a Pareto-optimal solution.

The proposed method could prove useful for operations by transportation and logistics enterprises when substantiating the safest routes to deliver cargoes, taking into consideration the importance of minimizing the cost of delivery.

The software for interactive maps and navigation systems includes widely known methods for determining the shortest distance, a route that takes minimum time, or a route that avoids "traffic jams". It has been proposed to consider adding the algorithm, which was developed based on the proposed method for choosing a route with the minimal projected number of road accidents, as one of the alternatives to choose the optimal route.

Keywords: predicted number of road accidents; route selection, cargo delivery, Pareto-optimality of route, regional clustering.

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DEVELOPMENT OF THE PROCEDURE FOR SIMULATION MODELING OF INTERRELATED TRANSPORT PROCESSES ON THE MAIN ROAD NETWORK (p. 70-83)

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The article deals with the interrelated processes of cargo transportation on the main road transport network. The problem of distribution of available vehicles was stated. The flows of incoming orders are stochastic, but have no features of the simplest. On the specified territory, the orders for long distance transportations appear and are repeated with random periodicity during a fixed period. Each order has its time window. Vehicles of one carrier are placed on a transport network in random order, according to the latest run performed. To execute the orders, motor-vehicle trains take the cargo at the location point, or in the absence of loads, move to the nearest transport point, where such orders appear. The typical situation, when even if there are enough vehicles, clients are denied transportation or vehicles have to stand idle or travel unloaded, was analyzed.

The simulation modeling procedure was developed. With the help of the random number generator, the set of coordinates of the points of departure and delivery of random order cargo and the points where vehicles are primarily located, as well as time windows, transportation volumes, and periodicity of orders are obtained. The service is provided according to one of three strategies: without a no-load run and waiting, with a no-load run, with full forecast of the upcoming process. The number of refusals due to the absence of transport or its being engaged was calculated. The parameters for several cycles were calculated. The order handling strategy is implemented based on the correction of decisions of subjects of transportation process at obtaining additional information about previous iterations. The decisions of subjects are limited to the carrier's intentions. The procedure is applied in order to research the activity of the transport enterprise in the south-eastern territory of Ukraine during the agricultural cargo transportation during the harvest period. The indicators of the incoming flow service were found to have a fluctuating character. Three strategies were compared. The advantages and disadvantages of the application of no-load run, expectations, forecasting, and vehicles distribution by the volume of existing work were identified.

Keywords: simulation modeling, order flow, cargo transportation, main road network, agent approach.

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