INFORMATION TECHNOLOGIES

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ANALYSIS OF INFORMATION TECHNOLOGY OF THE MANAGEMENT SYSTEM OF THE HIGHER EDUCATIONAL INSTITUTION

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The object of research is the system of management of a higher educational institution. One of the most problematic places in HEI management system is the lack of consideration of the influence of external and internal factors that influence the HEI activity.

The analysis of information interaction between the HEI units is based on the complex use of graph theory – for the implementation of decisions on the collection of primary information.

The analysis of the influence of external factors on the activity of a higher educational institution is performed. An algorithm for the formation of the flow pattern of information flows in the HEI management system is proposed. Its peculiarity is the simplicity of software implementation and the reduction of the time for the formation of the information flow scheme due to software and hardware. An algorithm for optimizing the flow of information flows at the level of indicators has been developed, which makes it possible to eliminate the redundancy of information. HEI formal model is proposed, allowing to take into account internal and external factors that directly affect the management system.

The proposed algorithm for the formation of the flow of information flows in the HEI management system made it possible to shorten the time for the formation of the flow of information flows in the management system, that is, to reduce material costs for the analysis of the HEI management system. This became possible due to the software implementation of the proposed algorithm, as well as optimizing the flow of information flows at the level of indicators. However, the use of the proposed algorithm entails additional material costs for modernization of already implemented control systems related to the reorganization of existing databases.

Keywords: management system, information flow, external environment, information service system.

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SYSTEMS AND CONTROL PROCESSES

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DEVELOPMENT OF THE TOP LEVEL OF THE AUTOMATED SCADA SYSTEM OF FEEDING MOISTURE IN THE SOIL-VEGETATIVE COVER

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The developed automated SCADA system of water supply to the soil and vegetation cover will allow to control and select the optimal

mode of water supply in order to improve the yield and provide plants with water.

The water supply system has a number of advantages:
– system availability;
– support for various industrial communication interfaces;
– convenience in use;
– universality;
– possibility of developing graphic models.

Currently, additional functions (tags) are connected in the system, which are responsible for collecting current information about the operation of the equipment with the darling alarms, the primary transformation of the collected information; presentation of current information in the form of histograms, tables, graphs; printing of reports and protocols on the operation of equipment units and organization of communication with devices connected to the information display of data archiving and possible revision on-line.

Keywords: soil and vegetation cover, feeding regimes, system structure, top level of the system.

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USING OF METHOD OF REPLACEMENT OF INPUT VARIABLES IN MICROPROGRAM FINITE-STATE MACHINE WITH DATAPATH OF TRANSITIONS

page 18–23

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The object of research is a microprogram finite-state machine with datapath of transitions. In its structure, the input signals are fed to the input of the block that forms the codes for the transition operations. A large number of inputs of this unit does not allow to realize it in the basis of memory blocks. The only available basis is the basis of LUT elements of FPGA or similar.

To reduce the number of LUT elements used by the circuit of FSM, it is proposed to use the known method of replacement of input variables. Its application leads to the fact that an additional block is added into the structure of the FSM, which converts the input signals of the FSM into special intermediate signals, the number of which is much less than the number of input signals. This leads to a decrease in the input signals of the block that forms the codes of the transition operations, and makes it possible to synthesize it in the basis of the memory blocks without the use of LUT elements.

An additional unit that converts input signals into intermediate ones can be synthesized in the basis of multiplexers, which are standard functional blocks of modern FPGAs. This makes it possible to use a smaller number of LUT elements in the structure of the FSM with replacement of input variables than in the prototype structure. Saved in this way LUT elements can be used to implement other units of the FSM or elements of projected computing system.

The proposed approach contributes to the saving of hardware amount in the logical circuit of the microprogram finite-state machine with datapath of transitions. This makes this structure more preferable in comparison with the prototype structure from the point of view of hardware amount affecting the final cost of the control unit and the computing system as a whole.

Keywords: microprogram finite state machine, datapath of transitions, replacement of input variables, optimization of hardware amount.

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INVESTIGATION OF APPROACHES TO MODELING OF INTERCITY PASSENGER TRANSPORTATION SYSTEM

page 24–28

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The modern scientific approaches to the issue of establishing passenger correspondence using public routes between regional centers are investigated. The results of the analysis of the existing methods for calculating the correspondence of passengers find the impossibility of their implementation without a preliminary study of the features of the system and formalization of corrective coefficients – the components of the gravity functions. It is established that at present in the world practice gravitational modeling is used for forecasting the indicators of interregional passenger transport correspondence.

An empirical method is used to establish the parameters of the quantitative index of the gravity function. Unlike previous researchers, used for the invention of the parameters of the function of the attraction approach allows to obtain new knowledge about the studied system. Without the use of automated or non-automated means for examining the correspondence of passengers, it is possible to obtain indicators of the parameters of the experimental system without the influence of the human factor and any time interval.

The obtained research results provide an opportunity to carry out calculations of the correspondence of passengers between the regional centers of Ukraine on the routes of general transport using the gravity model. Unknown parameters of gravity function are established in the conducted research. They provide an opportunity in forecasting the correspondence of passengers in the investigated system.

Keywords: transport system, gravity model, passenger transport correspondence, intercity transportation.

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APPLICATION OF THE SYSTEM APPROACH TO THE DEVELOPMENT OF THE PROJECT OF A SAFETY MANAGEMENT SYSTEM FOR NAVIGATION IN UKRAINE

page 29–36

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The maritime transport industry of Ukraine has an extensive network of navigable routes, sea ports and river terminals, developed infrastructure and interacts with other types of transport in Ukraine. The State Service of Ukraine for Transport Security (Ukrtranssafety) is the central executive body implementing a national policy on security issues in land transport and security in maritime and river transport. The main shortcoming in the implementation of Ukrtranssafety is the lack of comprehensive methodological support for formation of the level of transport security, depending on the impact of technical and technological, organizational and management, environmental and anti-terrorist factors of impact.

To solve the problem of ensuring maritime and river safety, the implementation of a specialized safety management system for shipping is required. The basis of the development of a safety management system for navigation, a system model is used, which has been tested in the theory and practice of project management.

The proposed system model is a methodological tool for the generation and system design of an integrated safety management system for shipping that can be used at all stages of its development, including:

– conceptual design;

– design of functional and providing parts;

– design of the communication and documentation system;

– development of elements: models, methods, algorithms, programs and regulatory support (user guidance, corporate and system standards, methodologies, instructions).

The conducted study shows the main causes of the increase in accidents in the marine and river fleet. The construction of a safety management system for navigation will reduce the level of accidents and damage on the maritime and river transport.

Keywords: system approach, system design, safety management of navigation, safety factors.

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ANALYSIS OF THE FORMATION OF FLUCTUATIONS OF SERVICE TIME OF VEHICLES IN TRANSPORT-TRANSFER STATIONS OF URBAN PASSENGER TRANSPORT

page 37–43

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The conditions for formation of the character and state of random values of the deviation of vehicle service from the perspective of their influence on the temporary parameters of TTS operation are established. The object of research is the process of functioning of the transport and transfer hub of urban public passenger transport. It is proposed to consider the procedure for determining the planned service range of vehicles on the basis of taking into account the fluctuation processes of formation of the time of arrival and idle time of vehicles in TTS. Based on the identified general composition of the factors, by evaluating their possible consequences and analyzing the sources of formation, basic mechanisms for reducing the fluctuation of the service time are proposed. These mechanisms differ from existing ones in their orientation to ensuring a reduction in the range of time vehicles in TTS. Investigation of the constituent elements of the fluctuations, carried out on the basis of their analytical description, make it possible to determine the prerequisites and parametric regions for reducing the dispersion of the service time of vehicles in TTS. These prerequisites and parametric areas consist in stabilizing the time of their idle time within the total duration of productive technological operations.

Experimental studies have confirmed the practical relevance of the account of the fluctuation processes in the TTS organization and allow to prove the prospect of taking into account these processes by integrating them in the general functional model of evaluating the performance of urban public transport. It is found that by introducing priority traffic on the network portions dispersion level time of arrival of vehicles is reduced by 49.1 %, the dispersion service time by 40 %, and the average range of probable location of vehicles in TTS in the range from 20.5 to 37 % , 5 %. The proposed approach to the description of fluctuational processes of service of vehicles in the TTS opens new requirements for the use of slot-coordination models in solving the operational and strategic urban public passenger transport.

Keywords: urban public passenger transport, transport and transfer station, departure time deviations, service time.

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MATHEMATICAL MODELING

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PLANNING THE FLIGHT ROUTES OF THE UNMANNED AERIAL VEHICLE BY SOLVING THE TRAVELLING SALESMAN PROBLEM

page 44–49

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The methods for solving the traveling salesman problem: Monte Carlo, reduction of rows and columns, averaged coefficients for planning the flight paths of unmanned aerial vehicles, and the results of the work are analyzed. The solution of the traveling salesman problem allows to reduce the time for decision making and UAV costs when planning flights.

It is established that the first two solve the problem with some errors, and, when using the Monte Carlo method, these errors tend to increase, and the method of reduction of rows and columns minimizes. When using the method of averaged coefficients, the traveling salesman problem is solved more optimally in comparison with the methods considered by the distance and time criterion for solving the problem. This method gives a significant gain (5–10 %) for these criteria.

The relevance and importance of the application of this method is in civil or military operations using UAVs in the face of limited decision-making time in the planning and energy resources of the aircraft.

Keywords: traveling salesman problem, minimum route, route planning, unmanned aerial vehicles.

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MINIMIZATION OF BOOLEAN FUNCTIONS BY COMBINATORIAL METHOD

page 49–64

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The object of solving the problem of minimizing the Boolean function in this work is a block diagram with repetition, what is the truth table of the given function. This allows to leave the minimization principle within the function calculation protocol and, thus, dispense with auxiliary objects like algebraic expressions, Karnaugh map, Veitch diagram, acyclic graph, etc. The algebraic transformations of conjunctors are limited to the verbal form of information, they require active decoding, processing and the addition of algebraic data, therefore, as the number of variable variables increases and the resource of such minimization method is quickly exhausted. In turn, the mathematical apparatus of the combinatorial block diagram with repetition gives more information about the orthogonality, contiguity, uniqueness of truth table blocks, so the application of such minimization system of the Boolean function is more efficient. Equivalent transformations by graphic images, in their properties have a large information capacity, capable of effectively replacing verbal procedures of algebraic transformations. The increased information capacity of the combinatorial method makes it possible to carry out manual minimization of 4, 5-bit Boolean functions quite easily.

Using a block diagram with repetition in tasks of minimizing Boolean function is more advantageous in comparison with analogues for the following factors:

– lower cost of development and implementation, since the principle of minimization of the method remains within the truth table of this function and does not require other auxiliary objects;

– increasing the performance of the manual minimization procedure for 4-, 5-bit functions and increasing the performance of automated minimization with a greater number of variable functions, in particular due to the fact that several search options give the same minimum function.

The combinatorial method for minimizing Boolean functions can find practical application in the development of electronic computer systems, because:

– DNF minimization is one of the multiextremal logical-combinatorial problems, the solution of which is, in particular, the combinatorial device of block-schemes with repetition;

– expands the possibilities of Boolean functions minimization technology for their application in information technology;

– improves the algebraic method of minimizing the Boolean function due to the tabular organization of the method and the introduction of the device of figurative numeration;

– the minimum function can be obtained by several search options that reduces the complexity of the search algorithm, and is the rationale for developing a corresponding function minimization protocol.

Keywords: Boolean function, minimization method, minimization of a logical function, block diagram with repetition, minterm.

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SOLVING CERTAIN PROBLEMS OF SCHEDULING THEORY BY THE METHODS OF QUADRATIC OPTIMIZATION

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The flow shop problem of scheduling theory (flow shop) with the standard constraints, the variables of which are the times of the beginning of processing of each of the tasks on the corresponding device are investigated. Tasks of this type belong to the NP-complex class with the number of processing devices more than two. The number of calculations and the search time for the optimal schedule grow in proportion to n!, where n is the number of jobs.

By some transformations the constraints of the flow shop problem are reduced to analytical functions of the unknown variables, and the objective function to the linear function of these variables. The number of functions, the constraints of the optimization problem, depends polynomially on the number of tasks of the original flow shop problem. Then, using the method of exact quadratic regularization (EQR), let's pass to the problem of convex optimization. Since the number of constraints depends polynomially on the number of jobs, the search time of the optimal schedule will grow polynomially for a fixed accuracy of the solution.

Thus, the NP-complex problem of scheduling theory is transformed to the problem of convex optimization with a linear objective function. It is shown that any pipeline problem of scheduling theory reduces to the problem of a minimum of a linear function with a set of linear and quadratic constraints, that is, to a problem of convex optimization. A model example is considered and an optimal schedule with a given accuracy is obtained by the method of exact quadratic regularization.

Keywords: scheduling theory, convex optimization, exact quadratic regularization method.

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