ABSTRACT AND REFERENCES

INFORMATION TECHNOLOGY. INDUSTRY CONTROL SYSTEMS

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EVALUATION METHODS OF THE RESULTS OF SCIENTIFIC RESEARCH ACTIVITY OF SCIENTISTS BASED ON THE ANALYSIS OF PUBLICATION CITATIONS (p. 4-10)

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We propose the method for the evaluation of results of scientific research activity of scientists PR-q. This method allows us to calculate a scalar evaluation of the results of scientific activity. The method is based on determining a number of real coefficients, which determine citation of one scientist in the publications by other scientists. The basis of the method is finding the evaluations by solving a system of linear algebraic equations. In this case, the matrix of the given system consists of the constructed coefficients. The proposed method, in contrast to other known methods of calculating the indices of citation, does not lose information about any citation of the author and of any publication.

We proposed the method, based on the construction of vectors of scalar evaluations for each scientist in a multidimensional metric space. This method implies construction of the ideal point, which consists of scalar evaluations, the best in terms of achieving maximal effectiveness of scientific research activity. The evaluation of each scientist is calculated as a metric distance from the ideal point to the vector of scalar evaluations of the given scientist.

The proposed methods for the evaluation of results of scientific research activity might be used to build the modules for automated systems of evaluation of the results of the work of scientists, effectiveness of conducting scientific research by higher educational institutions.

Keywords: citation index, evaluation of scientific research activity, bibliometric indicators, integrated evaluation.

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METHOD OF FUNCTIONING OF INTELLIGENT AGENTS, DESIGNED TO SOLVE ACTION PLANNING PROBLEMS BASED ON ONTOLOGICAL APPROACH (p. 11-17)

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The problem of operation of intelligent agents of action planning with the use of ontological approach was studied. Operation of intelligent agents is possible based on the knowledge of the subject-area, in other words, the knowledge base is used. Ontologies became the standard of knowledge base. Therefore, there arises the problem of development of methods and means of operation of intelligent systems based on ontologies, in particular intelligent agents of action planning.

The method of functioning of intelligent agents of action planning based on ontologies was developed. For this purpose, weights of importance of concepts and relationships were introduced to the structure of ontology. These weights are used for finding a path in the space of states. The space of states itself is built by using the language of requests to ontology. Optimization problem, which assigns the rational behavior of an intelligent agent, is two-criterial. To solve it, we chose the method of the main component, if objective functions may be evaluated, or the method of complex criterion, if these functions are impossible to evaluate.

Dimensionality of the space of states depends on the completeness of the ontology, and behavior effectiveness of an intelligent agent depends on the relevance of ontology. With this aim, in the course of automated development of ontology, we developed a method for evaluation of reliability of information sources that are used for developing ontologies. As a result of the studies, it was found that this approach allows us to increase operational efficiency of intelligent agents, if the process of ontology development is relevant to the needs of a subject domain.

The developed approach may serve as a base for constructing a unified methodology for development of intelligent agents of action planning if ontology of a subject domain is the central component of this software complex.

Keywords: ontology, intelligent agent, natural language processing, concept, space of states, action planning.

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REALIZATION OF INFORMATION TECHNOLOGY OF CHARACTER RECOGNITION BASED ON COMPETING CELLULAR AUTOMATA (p. 18-24)

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We examined the possibility of applying cellular automata to solve the problem on recognition of text characters. For this purpose, we introduced the notion of competing cellular automata and developed algorithms of their functioning and interaction. In order to implement the proposed algorithms, we created modeling software. It allowed us to evaluate effectiveness of the cellular-automaton algorithms to conduct experiments on text character recognition using the English alphabet and to demonstrate a number of advantages in comparison with other methods.

We investigated a description of the solution to the problem on selecting the structural attributes in the images of text characters, which directly affect the quality of recognition. In the present work, it is proposed to use a set of cellular automata constructed on the diagrams of states of Moore and Mealy machines for each type of cellular automata, to determine the end points, junctions and cycles in characters. We considered operation of the modeling program.

The advantages of the given technology are the simplicity of rules of interaction, easy parallelization of the process of recognition, the possibility of recognition of distorted and partially overlapping characters. We compared performance quality and efficiency of the commercially available system ABBYY FineReader, which has demonstrated high performance indicators of the developed recognition technology.

Keywords: competing cellular automaton, moving cellular automaton, a Moore machine, transition graph.

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THE SAFE CITY: DEVELOPING OF GIS TOOLS FOR GENDER-ORIENTED MONITORING (ON THE EXAMPLE OF KHARKIV CITY, UKRAINE) (p. 25-33)

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The review of gender components of the social-spatial content of the safe city of Kharkiv was carried out using GIS mapping on the "Secondary city" platform. The following tasks are proposed: firstly, in the light of the modern concepts of a safe city, to analyze the characteristics of urban areas with the use of feminist optics; secondly, to identify the main methods of geo-research of the safety component; thirdly, to develop gender-sensitive geo-information maps of Kharkiv through explication of the problem of urban infrastructure security. The theoretical basis of scientific research is logico-structural analysis, as well as geo-information methods of spatial analysis on the platform ArcGISOnline. The gendered context of urban space security is revealed. Structural and logical analysis of the phenomenon of "safe city" in the context of sustainable development goals is provided. Geo-information layers for the interactive map of Kharkiv with gender-sensitive security parameters of urban locations have been developed.

Geolocation potential for identifying the safety/hazard coordinates of urban locations and assessing the quality of the urban environment, in general, are covered. Gender-segregated and gender-sensitive spatial data necessary to carry out gender monitoring of city security are visualized. The developed GIS layers for the map of Kharkiv are able to play an integrating role of the catalyst for the city's gender mainstreaming and allow the local executive authorities to efficiently perform information and analytical processes to develop appropriate solutions (generation of gender segregated data, data management and exchange, remote zoning) and others.

A "model of multi-criteria evaluation of gender-sensitive content" to improve the processes of "content management" of urban infrastructure projects and programs is developed. The model integrates PMBoK requirements for the project content management and specific gender GIS requirements for the content of the infrastructure project. It is noted that the application of the proposed model allows making effective design decisions by integrating gender parameters in the project database in the format of GIS mapping.

Keywords: safe city, gender, GIS, requirements tracking matrix, urban projects, content management.

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MODELING OF SOFTWARE DEVELOPMENT PROCESS WITH THE MARKOV PROCESSES (p. 33-38)

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The comparative analysis of the existing research on the application of formal approaches to the software development process modeling is performed. Based on the analysis, the urgency of modeling of the software development process as a Markov random process is substantiated. An information model of association rule mining and application in software development is developed. The information model represents the process and can be used in the design of appropriate information technology. The research, which determined the number of steps needed to develop one software component and the whole software is carried out.

The levels of detail of the software development process such as the level, representing the development of software, which is a finite set of software components; the level, representing a detailed description of the stages of development of a particular component; the level, representing a detailed description a certain stage of development of a particular component are identified. For each level, the relevant stages of software development are described. Modeling of the software development process with the Markov chains is conducted. This will allow using a single mathematical tool to represent the corresponding process at different levels of detail.

Keywords: Markov processes, Markov chains, software development, association rule mining.

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DEVELOPMENT OF A SYSTEM TO CONTROL THE MOTION OF ELECTRIC TRANSPORT UNDER CONDITIONS OF IRON-ORE MINES (p. 39-47)

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Based on the study of properties of an electric train as a control object, it has been proven that considerable speed fluctuations and shock loads caused by the presence of elasticity and gaps in the coupling devices take place during the train acceleration and stoppage. These loads cause current fluctuations in armature of the traction DC motors of electric locomotives, which adversely affects their service life. By studying the mathematical description of the dynamic system consisting of an electric locomotive and a set of wagons, a model was synthesized that allows one to investigate the processes taking place in this system when motion and coupling device parameters alter.

On the basis of the mathematical dependencies obtained, an algorithm was developed that enables parametric optimization of the system from the point of view of minimizing collisions of the train wagons during acceleration and braking. A characteristic feature of the algorithm that distinguishes it from existing ones is that the "locomotive – wagons" complex is considered with taking into account presence of elastic coupler and gaps between the train elements. The problem of eliminating dynamic loads caused by oscillating processes of the "locomotive – wagons" complex was solved which made it possible to conduct an analytical construction of a system for optimal control of the material handling processes of electric transport in conditions of iron ore mines. Application of this system makes it possible to optimally perform high-speed loading of wagons with raw materials and their unloading. It is expected that application of this approach thru shortening the time spent in shifting the wagons for their loading will increase productivity of the mine transport by 20–30 %.

Keywords: dynamic forces, wagon coupling, eigenvalues, control constraints, breaking distance.

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DEVELOPMENT OF A METHOD FOR THE ACCELERATED TWO-STAGE SEARCH FOR AN OPTIMAL CONTROL TRAJECTORY IN PERIODICAL PROCESSES (p. 47-55)

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Optimization of manufacturing processes is the main tool that can provide access to the maximum financial efficiency of the enterprise. At the same time, this important tool for maximizing the resource efficiency is practically not used by enterprises due to the complexity and imperfection of the theory of optimal control, which manifests itself by its contradictory nature. The way out can be found by applying the method of practical determination of the optimal trajectory which was developed in the framework of this study. The advantage of the method is that it ensures determination of the optimal trajectory for those production processes which show intermediate results incomparable with each other both quantitatively and qualitatively.

For example, to evaluate effectiveness of the operational processes associated with heating fluids, melting steel, crushing iron ore, etc. the costs and time alter nonlinearly at the intermediate stages. At the same time, qualitative parameters of the output product change which makes it impossible to use a direct method for estimating quantitative parameters of the output product at intermediate stages of the conversion process.

The proposed method provides a two-stage process of optimization. In this case, completion of the first stage of optimization quickly transfers control to a zone close to the optimum in an automatic mode. The further search process just corrects the control trajectory if external conditions permit it.

Thus, the proposed practical method of searching for the optimal control trajectory is essentially robust.

Keywords: optimal trajectory, practical optimization method, two-stage optimization, search optimization.

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DEVELOPMENT OF COMPUTER–INTEGRATED SYSTEMS FOR THE AUTOMATION OF TECHNOLOGICAL PROCESS OF ASSOCIATED GAS PROCESSING (p. 55-63)

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A procedure for constructing a computer-integrated system for automating the technological process of processing associated petroleum gas has been developed. Development of the technological process according to the proposed procedure makes it possible to identify and overcome the difficulties encountered in solving the problems of technological calculation and synthesis of an automatic control system. Difficulties are exacerbated by the influence of heavy disturbances in the flow and concentration of associated petroleum gas.

Using the procedure, a technological process for processing associated petroleum gases along with an automatic control system has been developed. The technological process was adapted to use in medium oil fields, such as Ukrainian, which are characterized by low bulks and territorial dispersion. This makes it economically inexpedient to design large gas processing plants operating at a fixed load and gas concentration, which are common in the main oil-producing countries. Therefore, the technological process ensures production of methane and propane-butane of a required quality in the conditions of deviation of composition, concentration and flow rate of the streams incoming from wells in a wide range.

The automatic process control system has a two-level structure. The upper level is used to ensure operability at heavy disturbances, which is achieved by changing the operation conditions. The lower level ensures stabilization of the process for small disturbances. Two alternative implementations of the automatic control system based on PID controllers and linear quadratic regulator (LQR) were considered. The results of simulation made in HYSYS program show advantages of the cascade system of the proposed structure based on PID controllers. The control system ensures operability in conditions of deviation of gas flow by ±30 %, when the mole fraction of the gas components alters by 30–50 % and when the gas temperature deviates by ±15 °C from the values of working conditions.

Keywords: distillation, methane, propane-butane, automatic control system, computer-integrated automation.

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