

ABSTRACT AND REFERENCES

INFORMATION AND CONTROLLING SYSTEMS

THE METHOD FOR PROVIDING QUALITY OF SERVICE TIME REQUIREMENTS IN RECONFIGURABLE COMPUTING SYSTEMS (p. 4-12)

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The process of calculations control in reconfigurable computing systems characterized by the time constraints of both the applications solved and the functional and structural organization of the system is investigated.

As part of this, the method is modified and mathematically substantiated for determining the time intervals of tasks. The proposed modification to the analysis of tasks acceleration index allows to evaluate the unproductive time expenditure taking into account the FPGA hardware limitations in the computer algorithms mapping to the reconfigurable computing structure.

The method of providing time parameters of service quality in the reconfigurable computing system that provides given application runtime by determining the amount of unproductive time-consuming reconfiguration and the choice of optimal service discipline for each task in terms of time and existing hardware limitations was proposed. The use of the proposed method of determining the time intervals, which the implementation of the method is based on determining the sequence of tasks for which the target architecture of the computer system is effective and the use of additional mechanisms to reduce overhead does not speed up calculations within the advertised time requirements. Application of the proposed method allows to determine and optimize the impact of space limitations the reconfiguration time and reduce the number of rejections of tasks in the dynamic mapping of task flows to the reconfigurable computational structure. The formalization of the method for determining the time intervals of tasks was developed, for which the optimal boundaries of the effective use of the proposed facilities in terms of the adequacy of the offered application time limits to the limits of the reconfigurable computer system were defined and justified.

The proposed tools can be used in modern high-performance reconfigurable computing systems during solving the problems of control of various technical and management processes and implementation of multidimensional calculations in complex information systems.

Keywords: reconfigurable computing systems, quality of service, reconfiguration overheads, Field-Programmable Gate Array (FPGAs).

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EXPLORING DEPENDENCE OF THE PATIENTS' RADIATION DOSE ON THE FORM OF POWER SUPPLY VOLTAGE OF X-RAY TUBE (p. 12-19)

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A brief analysis was conducted of organizational and technical methods of reducing the patient's dose during radiographic examinations that are used in contemporary medicine. The paper considers optimization of the form of power supply voltage of X-ray tube as one of the efficient, but not sufficiently explored, areas of solving this problem. For its analysis, we propose a method of numerical simulation of the process of X-ray screening based on the experimentally obtained data. The results of experimental research are presented.

Authors described the methods and results of calculation of influence of the form of power supply voltage of X-ray emitter on the total radiation dose of patients during medical examinations.

To model the performance of several types of power units that operate on different physical principles, we created mathematical models that made it possible to calculate the instantaneous and integral values of all electrical parameters of X-ray tube, to find the integral dose of radiation in the plane of patient's location and to simulate a generalized reaction of the X-ray receiver of images on the ray flow that runs through the object of examination.

Comparative analysis of the obtained results demonstrated that the total dose of radiation is significantly affected by the design and principle of operation of the power supply unit of X-ray tube, which is a part of the X-ray device. At the equivalent diagnostic quality of images, the difference in the X-ray dose of received by the patient in some modes may exceed 20 %.

The assessment we performed indicates the feasibility of modernization of the outdated X-ray equipment with low frequency power units for the purpose of reducing the radiation dose through the improvement in the form of high voltage.

Keywords: numerical modeling, equivalent doses, radiation exposure, medical X-ray examinations, power supply sources.

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DEVELOPMENT OF THE MODEL OF INTERACTION AMONG THE PROJECT, TEAM OF PROJECT AND PROJECT ENVIRONMENT IN PROJECT SYSTEM (p. 20-26)

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The world experience of solving the problems of project management is generally directed to the use of the best practices. But conditions for the improvement and development of organizational structures in management of organizations and enterprises are not always created. In this study, in the context of project management theory, the structure of communication between the main entities of the process: the team, the project and its environment was generalized. The assignment of these components of the project environment to specific discrete states, in which the project system may be, enables to display the system using a Markov chain with three discrete states. The transition probabilities of the Markov chain for the project environment determine its characteristics which vary in discrete time step by step in the form of a certain set of state probabilities. Cognitive features of the model which was built on the basis of a Markov chain allows to assign specific values to the transition probabilities of the system. In this paper, a new approach for determining the values of the transition probabilities is proposed. The transition probabilities are identified with the relative time of resource cost in each of the discrete states.

Using the cognitive model that was created by the interaction of the main entities of the project, namely, the team, the project and its environment, the trajectory of the projects development in the case of loyal cooperation and in the case of resistance of the project environment was studied. The received results reflect a strong growth trend of the time resource cost for system interaction with the environment of the project, which eventually will delay the implementation of the project.

The obtained results do not contradict the definition of the law of S. D. Bushuev. The structure of the project management in the stage of initiation of the project includes the team, the project and environment of the project. These entities are constantly interacting with each other. The change of the state probabilities of the project fully reflects the progress and impact of the project. This new understanding of the project systems leads us to the development of modern approaches as the basis for new practices in project management.

Keywords: project management; discrete conditions; Markov chains; marked graph; transition probabilities.

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IMPROVING THE ACCURACY OF DETERMINING ORIENTATION OF A RAPIDLY ROTATING OBJECT (p. 27-32)

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We developed a method for improving correction by the excess information of parameters of orientation of the object that rotates rapidly around the longitudinal axis. To control the motion of such an object, it is necessary to determine with high frequency and use the information on its triaxial orientation in space. In a general case this is achieved by using a platform-free inertial navigation system. The specificity of the object that rotates rapidly is the fact that the error of determining orientation is quickly accumulated in such a system, which is connected to error of the so-called scale coefficient for gyroscope and is proportional to the angle of rotation relative to its measuring axis. This leads to the fact that it becomes impossible while determining the control to use information regarding orientation by the factor of its unreliability. To solve this problem, we developed a method of correction of orientation of the object that rotates rapidly, devoid from the mentioned disadvantages. Underlying this method is a high-frequency correction of angle of heel based on the use of measurements of vector of imaginary acceleration, the projections of which onto the axes of sensitivity of accelerometers, as a result of rotation, have modulated character. To increase accuracy

of determining the angle of heel, we propose, with the frequency of rotation of the object increased by four times, to perform correction of its value by the readings of accelerometers. By registering the passage by the series of measurements of its local maximum or local minimum, the correction signal is formed, which corresponds to the true value of the angle of heel $0, \pi, 3/2\pi$ or $1/2\pi$. This method may be used to create high-precision systems of motion control.

Keywords: highly dynamic object, accelerometer, correction, angle of heel, error of orientation, inertial navigation system, motion control.

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DEVELOPMENT OF PPP-METHOD REALIZATION FOR LOW EARTH ORBIT SATELLITE TRAJECTORY DETERMINATION USING ON-BOARD GPS-OBSERVATIONS (p. 33-40)

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The results of development and testing of new PPP-method realization (Precise Point Positioning) for high-precision determination of Low Earth Orbit satellites (LEOS) trajectory parameters using the results of on-board GPS-observations and kinematic (geometric) positioning mode are presented. The peculiarities and features of the proposed variant of the PPP-method of GPS-observation processing with using of precise ephemerides and GPS satellites clocks as well as other information from the international IGS service and the French space agency CNES are described. The components of the observation error model and the results of “a priori” and “a posteriori” accuracy estimation of coordinate determinations are described. Using the example of on-board GPS-observations

processing from specialized LEOS COSMIC it is indicated that for observation intervals of 30–40 minutes and more sub-decimeter accuracy of LEOS positioning may be achieved. The results of comparison of convergence of “float” and discrete/integer (“fixed”) methods of carrier-phase ambiguity resolution are presented. The presented development may be used for high-precision positioning and timing support of modern satellite technologies to detect contaminants, erosion studies, support of scientific and applied projects in geodesy, geophysics, climatology, orbitography, meteorology. The research results may be used in solving the problems of the LEOS maneuvering and docking.

Keywords: global navigation satellite system (GPS), code and carrier-phase observations, Precise Point Positioning (PPP) method.

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DEVELOPING A METHOD FOR PREDICTION OF RELAPSING MYOCARDIAL INFARCTION BASED ON INTERPOLATION DIAGNOSTIC POLYNOMIAL (p. 41-49)

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In this paper, based on the estimations of expert opinions of the persons who make decisions, we determined a set of criteria for evaluation of the states of patients and of the classes of possible states for predicting the relapsing myocardial infarction. We propose a method for predicting the relapsing myocardial infarction on the basis of the designed interpolation diagnostic polynomial to determine the probability of occurrence of the relapsing myocardial infarction. The developed method is based on the methodology of verbal decision analysis. This method makes it possible, taking into account the totality of attributes of disease, their combination and mutual effect, to increase the accuracy of prediction by 2,7 % (in comparison to the method-prototype). This provides a possibility to prevent the relapse of disease and sudden coronary death. The proposed method is of practical interest and may be applied for the diagnosis and prediction of development of other human cardiovascular system diseases.

Keywords: method of prediction, relapsing myocardial infarction, ordinal classification of states, diagnostic interpolation diagnostic polynomial.

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