INFORMATION TECHNOLOGIES

DATA PRESENTING AND PROCESSING IN EXPERT INFORMATION SYSTEM OF PROFESSIONAL ACTIVITY ANALYSIS

page 4–8

The article is devoted to the results of formalization of linguistic variables: «Importance of job» and «Time of job fulfilling» being the basic parameter of data input modules in almost every existing information system of professional activities analysis and estimation, using the developing environment and FuzzyClips software.

The practical task of this research is to ascertain and substantiate the method of back transition from linguistic variables assessment to their numerical equivalent with the view of their further usage in the mathematical models of professional activities.

To solve the research objective the fuzzy set theory and logic have been used in describing linguistic variables that are components of professional activity models in FuzzyClips software annotation.

The results obtained allow to claim the possibility of using center of gravity method as a basis in calculation modules of professional activities estimation expert systems, while presentation of linguistic variables is advised to be performed using either the membership function or standard function, as this aspect doesn't influence the estimation result.

Keywords: analysis of professional activity, information system, software, expert system, fuzzy sets, linguistic variables.

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DEVELOPMENT OF INNOVATION THROUGH THE INTEGRATION OF STARTUP-PROJECTS

page 8–14

The problem of innovation development was studied in this article. This problem is actual because the level of maturity of innovation is directly proportional to the level of economics development. Global Innovation Index confirms this fact. The elements of startup-ecosystem were studied based on the experience of state Israel in the hi-tech area. The life cycle of startup-projects was shown. The statistic information about quantity of startups in Israel with index of success has been researched. The areas of investment have been allotted. The comparative analysis of investments volume in innovation activities of Israel and Ukraine has been performed. Information of Ukraine accelerators/incubators, R&D and scientists, the laws of innovation activities were considered. Also there were described stages of financing of startup-projects. Factors, which influence negatively on the level of hi-tech development, were determined in research. The model of support for development of innovation has been proposed that emend these determined factors. The results can be adopted for acceleration of hi-tech projects on the existing production facilities.

Keywords: innovation development, startup, ecosystem, innovations, business-model.

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METHOD DEVELOPMENT OF ORGANIZATION AND PLANNING MONITORING FOR REGIONAL GAS SUPPLY

page 14–20

In connection with the obsolescence of the gas supply equipment and increasing the volume of leaks in the gas pipelines, the problem of monitoring for regional gas supply at the moment is becoming more urgent. An analysis of previous studies in the article were identified outstanding issues in the problems of monitoring for regional gas supply system, formulated the aim of article and the basic objectives of the study.

Important steps that precede the process of synthesis of the monitoring system for regional gas supply are the organization and planning monitoring. Each of these steps can be decomposed, and the results obtained at the upper levels, will be the source data for the lower levels.

The research allowed developing a method of organization and planning monitoring, highlighting the basic steps in solving problems of organization and planning monitoring for regional gas supply. Based on earlier models of organization and planning at every stage of this method it is proposed to use a scheme of compromise or procedure max-min composition. This allows developers to make decisions under multicriteriality and fuzzy of initial data.

Keywords: monitoring, organization, planning, method, regional gas supply.

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DATABASE DEVELOPMENT OF INFORMATION SYSTEM FOR DETERMINING THE OUTCOME OF MYOCARDIAL INFARCTION

page 21–28

The article is devoted to the database development definition of information system for determining outcome of myocardial infarction that is designed to automate the analysis and storage of the data on the state of the cardiovascular system after myocardial infarction. The analysis of requirements developed by the database is shown the need for consolidation of heterogeneous information for IS to determining outcome of myocardial infarction. In accordance with the requirements it was developed a scheme of database and defined the parent and child entities between which have been defined and established links such as «one-to-many» and «many-to-many», and was designed physical model of database of information system for determining the outcome of myocardial infarction, and modeled its work with ErWin CASE-tools.

For a software implementation of the developed physical model was proposed to use the RAD-system of C++ Builder, which will simplify the download process, processing and manipulating data in a developed database. The proposed database is open and cross-platform, which greatly increases its versatility. Developed database can be used successfully in urban and municipal medical cardiological institutions, private clinics, as well as the laboratory model in universities in the training of bachelors and masters of the corresponding profile.

Keywords: information system, myocardial infarction, database, conceptual model, physical model.

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MATHEMATICAL MODELING

MATHEMATICAL MODELING AND OPTIMIZATION OF TRANSIANT THERMOELECTRIC COOLING PROCESS

page 29–34

Detailed theoretical and experimental studies of thermoelectric cooling, as well as its optimization carried out mainly for the steady state operation of the cooling modules. The process of transient cooling insufficiently studied. However, deeper cooling than under stationary conditions may occur in transient modes when optimization. Optimization problems of transient thermoelectric cooling are problems of optimal control of objects with distributed parameters. The article suggests a generalized mathematical model of transient cooling. This model takes into account the main physical factors that affect the process. The problem of optimal control of transient mode of operation of the thermoelectric cooler with an arbitrary number of stages is formulated. It is proposed a method of solving it. The method consists in sampling the object and moving the object with lumped parameters, which is used to optimize the Pontryagin maximum principle. The article gives examples of computer modeling of optimal process control functions of transient thermoelectric cooling. These functions can be used in the construction and auto-calibration PI and PID controllers for the automatic process control of transient cooling in the thermoelectric devices for different purposes.

Keywords: transient thermoelectric cooling, mathematical modeling, optimal control, distributed parameter object.

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MATHEMATICAL MODELING OF BULK MATERIAL BATCHING

page 35–40

The authors conducted mathematical modeling of the moving process of bulk material from the hopper of the linear weight butcher in receiving working body of the feeder. 5 typical areas of structural and mechanical condition of bulk material during its bulking from the discharge channel in the side of the bunker were considered. Formula describing the speed of material bulking was developed. Formulas that describe the thickness of the layer of bulking material on the feeder of linear butcher and the required speed of movement to maintain this thickness were developed too.

The butcher reached maximum speed providing matching of bulk material bulking from the discharge bunker channel and intensity of its movement on the supporting body of the feeder. To solve this problem it was conducted simulation of the intensity curve of moving process of bulk material using MATLAB software.

The article will be interest to designers, engineers and scientists who conduct research in the development and improvement of weight butchers. Also, the article will be useful for graduate students and senior students of relevant specialties.

Keywords: butcher, bulk material, linear weight butcher, bulking, intensity, accuracy, MATLAB.

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SYSTEMS AND CONTROL PROCESSES

DEVELOPMENT OF A NEW DUAL-CHANNEL GRAVIMETER FOR MEASURING THE GRAVITATIONAL ACCELERATION

page 41–44

It is considered a new dual-channel gravimeter (DG) of the automated aviation gravimetric system (AGS), accuracy and operation speed (fully automated) above is known gravimeters. It is described the principle of the new dual-channel gravimeter, its main advantages over the known gravimeters (no signals of the errors from impact of vertical acceleration and residual nonidentity of construction of two capacitive elements in the output signal of dual-channel gravimeter). It was solved of the problem of filtering the DG output signal from high-frequency noise by setting its own rate fluctuations of 0,1 rad/s, thus avoiding the need for additional low-pass filter in the structure of AGS. Thus, the accuracy of the DG with AGS exceeds all known analogs and allows measuring the acceleration of gravity and its anomalies with an accuracy of 1 mGal.

Keywords: dual-channel gravimeter, aviation gravimetric system, gravitational acceleration, sensor.

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EXPERIMENTAL VERIFICATION OF VALIDITY OF MATHEMATICAL MODELS OF THE OSCILLATORY SYSTEMS

page 44–49

In order to validate the previously developed complex of the mathematical models, it is conducted instrumental identification of the natural oscillations of a mechanical system, by comparing the model and experimental spectra of frequencies. The scheme of the developed experimental unit, the list of used equipment, instruments, and methods of processing numerical data of sets and software that used in the experiment is given. During the experiment it was carried out instrumental identification of mechanical oscillatory system, which results were vibration spectra of oscillations in the frequency domain obtained at different speed modes of its operation. It was conducted a comparative analysis of the accuracy of the applied methods for the determination of natural oscillations of the system. Oscillation waveforms of characteristic oscillations of the mechanical system in the time domain were obtained. Their comparison with the theoretically obtained solving of mathematical models showed a satisfactory result. It was obtained digitized spectrum of characteristic oscillations of the mechanical system by applying fast Fourier transform to process the signal of oscillation sensors. It is further developed the method of verifying oscillatory spectrum that realized using wavelet transform in MathCad. These spectra can be used in determining the technical condition of mechanical drives for their vibroacoustic characteristics.

Keywords: experimental verification, frequency spectrum, mechanical system, mathematical model, waveform, frequency domain.

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DEVELOPMENT OF FUZZY CONTROLLER FOR MAINTAINING TEMPERATURE COMPONENT OF COMFORTABLE MICROCLIMATE

page 50–55

The prospects of controllers based on fuzzy logic for maintaining the temperature component of systems for climate control in buildings and the results of research in this area are discussed in the article. The main aim of the research is developing automatic controller of temperature microclimate condition on the basis of technology of fuzzy sets, providing minimal overshoot and the transition process in the task of stabilizing the temperature. Using this method can reduce the overshoot of controlled parameters of ventilation systems, reduce their identification time and increase the robustness of the controller in the presence of incomplete information about the object control compared to regular algorithms. Ways to optimize the control system for maintaining the set quality parameters are outlined. It is proposed to use the controller based on fuzzy logic for air conditioning systems, in which there are uncontrollable external disturbances and there is incomplete information about the object of control. Research results can be applied by expert designers of automatic control systems involved in automation, the stages of development and control algorithms during commissioning works to reduce system setup time.

Keywords: regulator, fuzzy logic, fuzzification, defuzzification, terms, membership function, nonlinear systems.

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DEVELOPMENT AND RESEARCH OF COMPLEX ALGORITHM OF INERTIAL SYSTEM FOR HUMAN MOTION PARAMETERS ESTIMATION

page 56–68

Inertial motion capture is one most perspective technology for estimation of human motion parameters. Such systems use a network of inertial measurement units (IMUs) which are mounted on human body segments. To estimate kinematic motion parameters inertial motion capture systems (IMCS) is used data about body segments orientation. Algorithms which are used in IMCS are characterized by static and dynamic accuracy. Static accuracy of such systems is 0,2–0,5 degrees. But their dynamic accuracy during accelerating motions degrades to 2 degrees (RMS error). This study is intended for research and development of complex algorithm for work of one IMU of IMCS. Complex algorithm uses algorithm of strapdown inertial navigational system in geographical frame corrected by information of velocity and position data. These data are gotten using biomechanical skeleton model. The error level of such correction signals was estimated. A complex algorithm uses biomechanical velocities and positions to estimate velocity and position errors of data which are gotten from algorithm of strapdown system. These errors are used to form special correction signals in Poisson equation, equations for velocity and position calculation. It is shown effectiveness of proposed algorithm for kinematic human motion parameters estimation during accelerating segment motion. Maximal pitch and roll errors don't exceed 0,8 degree. Positional RMS error is 0,04 m, velocity — 0,38 m/s. Such results show effectiveness of algorithm for estimation of segment orientation and position. Segment's velocity signal has less error when it is gotten uses biomechanical skeleton model.

Keywords: biomechanical skeleton model, motion parameters estimation, complex algorithm, strapdown, INS.

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DEVELOPMENT OF THE METHODS OF COUPLING QUALITY MEASUREMENT BETWEEN STEEL-ALUMINIUM CASTINGS ELEMENTS

page 68–73

Structural components made of the same metal are not optimal in terms of the ratio of their shape and weight to mechanical properties, chemical resistance, wear characteristics, etc. Significant deficiencies have «single alloy» when trying to simultaneously solve the double, or even triple problems, such as to provide the required strength for some detail at a high thermal conductivity and low cost. Meet these conflicting demands is only possible through the use of bimetallic products. In the manufacture of such products it is drastically increased demands on the culture of production and, above all, to the strict maintenance of process parameters within the strict boundaries. In these circumstances, comes to the fore the need for methods and tools to accurately measure these parameters.

Methods and means for measuring the surface temperature of the steel insert are developed for automated control systems of bimetallic casting process, including the use for primary metrological data of the thermal imager and the further computer processing of digital video stream from the latter. Methods and means of measuring the degree of weldability are developed for automated control systems of bimetallic casting process, which are non-destructive ultrasonic testing of the inner cylindrical surface of the steel-tube insertion at the complex translational and rotational motion of the measuring head. Advantages of the main characteristics of the proposed methods in relation to their prototypes are experimentally confirmed.

The results have been implemented in a foundry with a positive technical effect.

Keywords: metrological support of measurement, bimetallic castings, temperature distribution, weldability quality of the elements.

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STATIONARITY DISTURBANCE MONITORING PLANNING OF THE FLOW OF WASTE EMISSIONS AT A FIXED OBSERVATION TIME

page 74–77

This article examines the stationarity disturbance monitoring planning of the flow of multicomponent pollution of flue gases of thermal power plants on local observation intervals. A characteristic feature of the considered monitoring process is a priori uncertainty, stationarity disturbance by mathematical expectation, dispersion and spectrum simultaneously constituting pollution. The limited observation time and economic costs of monitoring procedures brings additional difficulties in the condition of performing routine requirements to the monitoring. Monitoring planning of the flue gas flow control should take into account not only the volume of the sample, but also the order of their carrying out.

It was proposed the method of non-stationarity parameter assessment by introducing preventive control of borders separately for each component of flue gas pollution. Evaluation of stationary pollution processes can reduce the prior uncertainty in the monitoring planning and rank the pollutants in the degree of reducing the risk of their occurrence. This will perform maintenance standards and take into account the risk monitoring of the 1st and 2nd kind.

This approach is useful when monitoring planning of a multicomponent pollution, when it is necessary to determine the priority pollutant for a degree of stationary disturbances in local time intervals.

Keywords: monitoring, emissions, pollution, time, control and warning interval, statistical significance, reliability.

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DEVELOPMENT OF AUTOMATED SYSTEM OF ITERATIVE CONTROL OF VEHICLE ENGINE TECHNICAL CONDITION

page 77–82

The article describes the results of studies on the creation of automated system implemented an iterative method for monitoring vehicle engine technical condition, which allows to choose the right combination of control operations to reduce the time of diagnosis procedures. Diagnostic algorithm for automated control of vehicle engine technical condition is proposed. It is shows a part of the experimental data on the tests of automated system of iterative control. The main aim of these studies is to provide an automated control system and the algorithm of its work to be able to reduce production time required to carry out diagnostic operations and monitoring the technical condition of the internal combustion engine by using an iterative approach to the construction of diagnostic operations. The current diagnostic systems to evaluation of the technical condition of the internal combustion engine usually base on a consistent implementation of the developed diagnostic operations. This article discusses the possibility of optimizing the diagnostic operations by eliminating redundant information about the condition. It is proposed an iterative method for monitoring the vehicle engine technical condition. The method can significantly reduce the time of diagnosis and is sufficiently informative for the possibility of adopting diagnostician operator decision on the need for further maintenance or repair operations. The obtained results can be used in a commercial car service. The authors of this study suggest the use of an iterative method for the formation of a program of diagnostic tests for each type of engine.

Keywords: iterative method, algorithm, parameter, technical condition.

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INFORMATION AND CONTROL SYSTEMS

DEVELOPMENT OF THE COMPUTERIZED SYSTEM FOR CONTROL OF CURVED SURFACES WITH THE HELP OF INDUCTIVE SENSORS

page 83–90

The article presents the main results of research on the analog interface for remote measurement of linear and angular displacement values inductive sensors with high metrological characteristics. The main purpose of the study is to develop a computerized system for remote measurement and control of curved surfaces using inductive sensors, which provides increased performance and noise immunity.

This is achieved by creating a new multifunctional transducers based on iterative integrating converters differentially-current inputs, reduce the effects of stray capacitance electrical cables through the shunting effect is almost zero input resistance and can increase the frequency of the test signal. It is shown that at the same time increases the quality factor of the primary winding IDPTT and reduces the influence of destabilizing factors on the sensitivity of the sensor.

The presented system allows to combine in one unit features such as noise suppression, and general strengthening of the normal type and the desired signal. Commutative exchange of information between the sensors allows isolate the generator windings of the sensor from the measuring part of the analog interface, which considerably increases immunity.

The algorithm for error correction of the measurement channel using TEDS in terms of non-linearity of the channel and the inter-channel connections is proposed. Results of the study can be implemented in the instrument-making factory in the design and development of new instruments for improving the accuracy and speed of linear and angular measurements using inductive displacement sensor for remote measurements.

Keywords: remote sensing, moving, error correction, TEDS, sine-cosine rotating transformer, inductive sensors.

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