ABSTRACT&REFERENCES

INFORMATION AND CONTROL SYSTEMS

CONTROLLING STRESS STATE OF ROCK MASS IN ORDER TO OBTAIN CUBIFORM RUBBLE (p. 3-4)

Konstantin Tkachuk, Vladimir Savchuk

Taking into account a high strength of source material for cubiform rubble production, the only way to prepare material for its further mechanical processing is a complex of drilling and blasting operations. Stress state of rock mass, its physical and mechanical properties determine the nature of destruction. Presently, there is no convincing and accurate calculation of the stress state during blasting.

The task of optimal control of blasting lied in selecting the method of charges allocation in the rock mass and their mode of action in time, which would meet some technical and economic criteria. Finding the optimal blasting schemes was implemented as a search for extremum points of objective function in the space of controlled variables. Using mathematical models, laboratory research of the influence of deep-hole charges allocation on destruction of environment models was conducted. Analysis of key blasting results showed the advantage of such blasting schemes and charge structures which ensure maximum tensile force (and stress) in the rock mass in three mutually perpendicular planes. It was found that high efficiency of multi-directional charge initiation, which allows creating in the rock mass a complex-stress state with a predominance of tensile and shear stresses, promotes both crushing and softening of blasted rock mass

Keywords: blasting material, blasting, rock, stress, rubble

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POSSIBILITIES OF IMPROVING METHROLOGICAL PROVISION OF INDIVIDUAL HEAT ACCOUNTING SYSTEMS (p. 6-10)

Vasily Yatsuk , Pauline Buhaytsova, Yuri Yatsuk

The analysis of existing methods and instruments was made, the efficiency of using matrix system with wireless communication for individual accounting of thermal energy consumed in buildings with multi-tapped heat supply and collective heat meter was proved.

With regard to the current level of development of microelectronic and information technologies, the structure of precision thermometers for realization of matrix wireless systems of individual accounting of consumed heat was improved. It was theoretically shown that, according to the results of calibration at the one point only, precision thermometers can be used throughout the temperature measurement range.

The technology of development of relatively low-cost precision thermometer was proposed in order to automate calibration procedures and metrological verification of instruments for individual accounting of consumed heat. The methods of automated metrological verification of instruments for measuring the temperature at the operation site, as well as facilities and lines of communication and data transfer in dispersed systems of individual accounting of consumed heat, were developed

Keywords: precision digital thermometer, automation, calibration, metrological verification at operation site

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HARDWARE-SOFTWARE PLATFORM FOR LABORATORY EXPERIMENT AUTOMATION SYSTEMS DEVELOPMENT (p. 11-16)

Alexei Galuza, Ivan Kolenov, Alla Belyaeva

The problem of laboratory experiment automation, encountered by almost every experimenter, was considered in the paper. A great range of solutions is proposed by the industry. However, these solutions are rather sophisticated, expensive and do not offer a comprehensive approach to the problem solution. Therefore, the issue of developing software and hardware platform for laboratory experiment automation with minimum time, force and means expenditures is topical nowadays.

The ultimate objective of the paper is development and implementation of software and hardware platform for experiment control and data gathering and processing. The principle requirements for the platform include simplicity of design and use, portability and low cost.

The platform developed consists of three main blocks: an interface of stepper motors, data gathering system and software for digital signal processing and creation of client application for PC.

The interface of stepper motors includes control unit for stepper motors drivers, which is connected to PC via COM port, and stepper motors drivers themselves, which allow implementing a micro step up to 1/32 of nominal step of stepper motor.

Any analog-to-digital converter can be used as measuring instrument. In this case, standard PC audio card was chosen as the most affordable and cheap device for measuring signals with admissible metrological characteristics.

Software synchronous detector was applied for reducing the influence of background noise on the measured signal. It allows measuring signals with error not exceeding 1% and signal-to-noise ratio 10dB

Keywords: automation of experiment, control, signal measuring, laboratory experiment, synchronous detecting

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OPTIMUM OR SUBOPTIMUM METHODS OF THE SLAUGHTERING LINE RELOCATION DEFINITION DEVELOPMENT (p. 17-20)

Iana Savitskaya, Nina Chichikalo

Despite the existing automation level of processes in coal mines, the uniform displacement of slaughtering line solution is still not under control. In the article proposed methods of optimal or suboptimal decision of this question. It is based on coal mining management system quality requirements. The aim of this development is to provide the achievement of the optimal level of productivity of the coal mining process at the expense of layup minimization. The cause of layup is convergence of the deads. Given virtual inaccuracy displacement control model of the shore sections overlap based on the proposed methods. It provides keeping, analysis and cognitive information visualization. Defined precision of level control shore displacement inaccuracy according to the Coal Mining Rules process

Keywords: multiagent technology; level of shore displacement; displacement of slaughtering line solution; time factor

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MODAL ASTATIC CONTROL OF OBJECTS WITH DELAY BASED ON STATE OBSERVER (p. 20-26)

Mykhailo Lysytsia, Pavlo Lysytsia, Olga Lysytsia

The need for compensating delays in many technological processes, which are controlled by feedback systems, was justified. For ensuring discrete astatic control over such processes, the object was divided into active and passive parts. This simplifies the automation of control systems synthesis. According to the desired characteristic equation, using the Ackermann formula, the astatic control loop was synthesized. Based on the duality principle, the astatic state observer was constructed, which includes not only denominator coefficients, but also numerator coefficients of the object transfer function. The proposed system was studied under noise perturbations in the load sensing passage, as well as under divergence of parameters of control object. The studies of the synthesized system proved its better functioning as compared to the existing one

Keywords: modal control, delay, object model, astatic regulator, state observer

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INFORMATION-TECHNOLOGYCAL SUPPORT OF POST LAUNCH CALIBRATION OF OPTOELECTRONIC MONITORING SENSORS OF "SICH" SPACE SYSTEM (p. 27-38)

Yarema Zyelyk

We consider the study results directed to creation in Ukraine of postlaunch metrological assurance of remote sensing systems based on developed evidence-based techniques, deployed land-based infrastructure of control and calibration polygon (CCP) systems with the test objects (TO) and measuring instruments and created software and hardware systems. The CCP infrastructure in the area of National Space Facilities Control and Test Center (NSFCTC) (Yevpatoriya-19) is ground, using as the standard template for describing the CCP approved by the Working Group on Calibration and Validation of the CEOS Committee. Based on the results of experiments to determine the spectral reflectance characteristics of the selected TO on ground-based measurements which are synchronous with satellite imagery of the space system (SS) "Sich-2", GIS database is created. It contains the vector layers of polygonal natural and man-made objects of NSFCTC, layers of the spectral characteristics measurement points, satellite images of the SS "Quick Bird-2" and "Sich-2", the digital terrain model of CCP. Such devices for ground-based measurements are analyzed, which must be equipped the test plots of polygon for control and calibration activities: 1) as the number of available to researchers: the digital weather station, spectrometers ASP-100F, ASD FieldSpec 3FR, equipment for precision measurements of the geodetic reference mark coordinates, 2) and the instruments used at the polygons of the LANDNET Sites System of CEOS Committee: CIMEL sun photometers in the AERONET CIMEL network, portable sun photometers MICROTOPS II, gonio radiometric spectrometer systems

Keywords: Test and calibration site, Postlaunch calibration, Space system "Sich", Space monitoring

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POSITIONING AND TRACKING CONTROL SYSTEMS FOR MOBILE SATELLITE ANTENNA INSTALLATIONS (p. 39-45)

Oksana Mnushka

The use of tracking antenna installations (AI) in mobile satellite telecommunications systems (STS) was discussed in the paper. The main purpose of the study is an analytical overview of the methods of positioning and tracking of artificial Earth satellites (AES) and ways of their implementation in AI control systems (CS), meant for working during transport vehicle (TV) movement. The methods of step-tracking (MST), conical scanning and program tracking in terms of their applicability in AI of mobile STS are discussed in the paper. Based on the analysis of parameters of commercial mobile AI, extreme ranges of their parameters for different types of TV were defined. The features of application of open-loop and closed-loop CS of tracking AI were studied. It is shown that open-loop CS provide three or four times higher velocity of angular displacement of AI compared to conventional closed-loop CS, making them more preferable for use in high-speed TV.

On the other hand, open-loop CS require highly accurate determining of TV current position, they are susceptible to disturbances from buildings and tend to accumulate errors. Systems with PID and fuzzy controllers are the most widely used in closed-loop CS of tracking AI. Their use allows expanding the control range, improving the performance, enhancing the effectiveness of CS as a whole. The results of the study can be used by experts in the field of control systems for improvement of existing and construction of new mobile AI of STS

Keywords: control system, tracking antenna systems, fuzzy logic, satellite communications, telecommunications

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ARTIFICIAL ORTHOGONALIZATION IN SEARCHING OF OPTIMAL CONTROL OF TECHNOLOGICAL PROCESSES UNDER UNCERTAINTY CONDITIONS (p. 45-53)

Dmytro Domin

The paper describes further development of the methods of artificial orthogonalization of passive experiment designs describing the experimental values of the output function in a multidimensional factor space of a small sample of fuzzy data. This allows fuzzy clustering for the formation of subspaces and further local description of the response function; building local regression equations in the subspaces of full factorial space; calculating the values of the response function at the points of the orthogonalized design of experiment. The methods for processing the asymmetrical design of factorial experiment based on the use of procedure of forming a truncated orthogonal response design for elimination of insignificant factors and interactions in a small sample of fuzzy data, allowing the formation of the orthogonal design to calculate the coefficients of the regression equation, which describes the output parameters of the system in the space of fuzzy values of input variables; ability to select the most representative designs that minimize the maximum estimate of the variance of the output variable; obtaining of fuzzy data of adequate mathematical models on the multifactor space, relating the components of the output parameters of the system and parameters used in the description of the states of the system, are described.

The example of the application of the proposed methods of artificial orthogonalization for solving scientific and practical problems of creating the methodology for determining the structure and parameters of the models describing the processes of electrosmelting under uncertainty conditions, which allows finding the optimal technological process control in terms of the end state, is shown

Keywords: artificial orthogonalization, information-control system, mathematical model, optimal control

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