ENERGY, ENERGY-SAVING TECHNOLOGIES AND EQUIPMENT

MATHEMATICAL MODELING OF TRANSIENTS IN THE MINE ELECTRIC NETWORK USING MATRIX-TOPOLOGICAL METHOD

page 4–8

It is developed a mathematical model of the mine electric network, which allows us to analyze the transient and steady-state processes in normal and emergency modes. The model is a matrix differential equation in the form of Cauchy, compiled using matrix-topological method, which is different, taking into account the mutual influence of network components. The relevance of the analysis of transients in the mine electric network due to low precision of existing methods and the need to improve the technical and economic performance of the mining equipment. This mathematical model is applied in the form of a computer program with a graphical interface, which automatically calculates the matrix coefficients of the differential equation of condition of mine electric network and integrates its by hard-sustainable Gear-Nordsieck method. Using the proposed computer program by design organizations will increase the efficiency of the design process and increase the accuracy of determining the settings of protective devices.

Keywords: model, network, mine, differential equation, matrix, graph, tree, transients.

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THE CHOICE OF TRACTION MOTORS FOR BUILDING SYSTEMS FOR MOBILE ELECTRICAL SYSTEMS

page 9–12

The peculiarities of the choice of traction motors for different types and designs of mobile electrical systems. The analysis of the practical experience of building systems for traction drives on the basis of the selected traction motor and synthesis techniques for determination of parameters of the engine under certain requirements relative to the movement's electrical sector.

The study of building systems for traction drives with different types of engines are relevant from the point of view of achieving a maximum level of energy efficiency by performing all of the listed requirements. Means of improving energy efficiency and productivity of mobile electrical systems in the complex situation on the market of energy resources to help ensure the growth of the independence of the domestic transport sector from a number of economic and political factors that have a significant impact on key indicators of work of many enterprises and the budget of private vehicle owners and ensure optimal design and more efficient work of the various sectors of the economy. As a result of the analysis has been further development of the method of determining the type and parameters of the traction motors of the rolling electrical complex by taking into account the specific requirements from the side of the actuator. In particular, the analysis of the practical experience of choosing the traction motors and synthesis methods determine the type and parameters of the traction motors with the specified requirements by rolling electrical complex, which allows for accurate selection of the type and parameters of the engine depending on operating conditions of the electrical industry.

Keywords: traction motor, electrical complex, traction drive, the method.

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ANALYSIS OF ENERGY FLOWS IN SYSTEMS OF DIFFERENT PHYSICAL NATURE OF ELECTRICALLY DRIVEN OF TURBOMACHINES

page 12–17

A method of the energy flows in the different physical nature systems' electrically driven turbomachines analysis has been

offered. Energetic relationship between the Bond Graph models of the induction motor and centrifugal pump has been established. The study of a single electro hydro mechanical process of turbomachines work has been conducted.

At the current stage of scientific progress, solving the complex technical systems' operational calculation and optimization problem of mostly carried out by computer simulation. Therefore, the necessity of the electrically driven turbomachines computer-based models' development such modeling techniques that would not require special skills in the programming and made it possible to analyze the mutual influence of the different physical nature subsystems' components of the object's dynamic behavior have been arisen.

As a result of the research, numerical set and graphical depending on the instantaneous values of the electric motor power, mechanical shaft power of the hydraulic machine and hydraulic power on the pump discharge pipe have been received. The efficiency of energy conversion in each individual area of the turbomachine, based on the obtained results, has been analyzed. In the future, it will enable to develop and implement energy saving measures in the electrical complexes of the industrial enterprises.

Keywords: Bond Graph, power, induction motor, centrifugal pump, turbine, instantaneous power.

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RESEARCH OF KEY ASPECTS OF LOAD-FOLLOWING MODE IMPLEMENTATION AT NPPS OF UKRAINE

page 18–26

In the grid system of Ukraine HPPs are operated in the load-following mode (hereinafter referred to as LFM) and TPPs are operated to meet the power demand which HPPs cannot satisfy. The TPPs are characterized by high-cost electricity generation, high level of deterioration of equipment and of environmental stress.

The paper analyzes the international experience of NPP operation in the LFM, as well as the possibility of Ukraine's NPPs operation in this mode, and researches the influence of different features and key aspects of the possible operation in the mode.

The results of the research show that NPPs of Ukraine can be operated in the LFM, the implementation of the mode could improve economic performance of the NPPs on account of selling «maneuvering» electricity at a higher price, could give more maneuvering abilities to the Ukrainian grid, and decrease dependence on organic sources of energy (fossil fuels).

The research of the key aspects and possibility of the LFM implementation at Ukrainian NPPs is urgent and actual in the current political situation. Ukraine is faced with the power shortage in the Ukrainian grid system, especially shortage of «maneuvering» power and short supply of organic sources of energy.

Keywords: NPPs of Ukraine, load-following mode, daily variation of electricity production of NPPs.

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ABOUT RETAIL PRICE OF ELECTRICITY

page 27–32

Based on the physics of the normal operation of electrical power systems, the paper proposes a new methodological approach to the definition of retail electricity prices for industrial and equated to them users, which considers the electrical network of electrical power systems with a rated voltage of 110 kV as the counter of the energy market of Ukraine, from which power supplier supply to consumers the electric voltage that is seen as a potential condition of electricity, which is transformed by the receivers of electricity consumers in other types of electrokinetic energy to perform useful work.

The algorithms for determination of the retail price of electricity are proposed to specific consumers based on concepts and nominal voltage of their power at guideline value of reactive power factor of electricity transmission, the value of which is set at the state level and has a value of 0,25 r. u.

It is argued that the practice of calculating the fees of consumers for active and reactive energy, which exists in our time due to the fact that at the state level, there are regulations that require such fee, that neither theoretically nor practically not possible due to the fact that reactive power, as a separate commercial products does not exist. Obviously, such practice is contrary to the moral and legal standards and must be stopped.

Keywords: electricity, electricity supply, electrical voltage, voltage losses, electricity prices.

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CONSTRUCTION OF HYBRID AUTONOMOUS AND BACKUP POWER SUPPLY FOR COMPLEX SOLAR SYSTEMS

page 33–38

The perspective hybrid autonomous and reserve power supply system, which is used in a complex heliosystems was developed by using of renewable energy sources in the form of photovoltaic panels, rechargeable batteries, charge controller and inverter, that converts the low-voltage constant current 12–24 V to the consumer standard ~ 220 V. This hybrid system was used in a complex heliosystems (in the case of unstable lighting — the solar panels on the roof and walls simultaneously are disposed or on the East — West are disposed etc.).

Optimization (replacement) of the solar controller is the first step to the power generation increase by solar batteries, without solar panels adding. The most effective model of microcontroller unit for construction of a hybrid autonomous and emergency power supply system was investigated and developed by using of a Pulse-Width Modulation (PWM), as well as the solar battery Maximum Power Point Tracking (MPPT), which are used in a complex heliosystems maximum performance set up.

This paper also consider the possibility to use of «intelectual» microcontrollers as control elements of microcontroller block to build an effective model of hybrid power supply system microcontroller unit for it maximum productivity setup. Microcontrollers with the MPPT technology of maximum power point tracking show a considerable advantages over other types of microcontroller block, such as low power microcontroller MPT612 with 32-bit RISC-processor ARM7TDMI-S.

Keywords: microcontroller unit, solar cell, autonomous power supply system, photoelectric converter.

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THE STUDY OF THE DYNAMICS OF THE PROCESS OF FORMING A LAYER OF AGLOMERATION MIXTURE PREPARED FOR SINTERING

A study of the dynamics of the formation of polydisperse layer of feedstock material loaded on pallets of sintering machine is conducted in this article on example of the system «feeder — straight feeding chute».

The author proposes a technique which allows to calculate the distribution of the fractional composition of the charge adjustment layer, as well as a set range of parameters of considered chute for its efficient operation. Thus, it is defined a critical angle of the chute in which violated segregation processes in the feed material.

The calculation of the distribution of fractions of polydisperse sinter charge in the case of using the straight feeding chute. It was found that the chute of similar design is very bad for the sintering conditions of sinter mix in the upper layers.

This is made a prerequisite to the selection of the type of feeding device, capable of providing the required segregation of the material fractions.

Keywords: segregation, agglomeration, feeding chute, thermal regime, horizon layer, charge.

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ELECTRICAL ENGINEERING AND INDUSTRIAL ELECTRONICS

APPLICATIONS OF PHOTONIC CRYSTAL FIBERS IN NAVIGATION

Hollow core photonic crystal fibers are inhomogeneous dielectric media with periodic variation of the refractive index. In general, photonic crystals have a photonic band gap. In this paper we proposed to use of a hollow core photonic crystal fiber 1550 nm λ, ∅ 10 μm in optical gyroscope. A signal is launched into the fiber in both directions of the loop, i. e., clockwise and counterclockwise, where the optical path length would nominally be the same; however, the Sagnac effect results in a difference in the optical path lengths when the system undergoes rotation. By detecting the two signals on the receive end and combining

them, the interference and corresponding phase shift can be related to an angular rotation the interference pattern measured photometrically.

Keyword: photonic crystal fiber, Sagnac effect, fiber optical gyroscope, conventional fibers.

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FACTOR SPACE AND STUDY THE PROCESS OF ELECTRICITY CONSUMPTION OF IRON ORE ENTERPRISES

page 48–55

In article results of researches of the analysis of energy consumption of the domestic mining enterprises with underground methods of mining iron ore are given. The structure of energy consumption is given. It was found that the main type of energy use is electricity. The relationship is shown between the consumption of electric power enterprises and the cost of mined iron ore. The need for process control of energy consumption and planning of energy consumption of enterprises is justified. The authors present a classification of factors that influence the effectiveness of the regulation system of electric energy specific losses. A method of creating factor system and integral indicator for controlling the energy supply companies have formulated. It is proposed a reasonable technique to implement effective process of power consumption control of iron ore production from underground activities, which provides step-by-step implementation of that process, and also gives the possibility to plan the activities of the enterprise.

Keywords: power consumption, electric energy, iron ore production, control, electrical and energy efficience, factor space, integral indicator.

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MECHANICAL ENGINEERING AND MACHINE BUILDING

SIMULATION OF ORGANIZATIONAL-TECHNOLOGICAL AND TECHNICAL ASSEMBLY STRUCTURES OF ENGINEERING PRODUCTS

page 56–60

Given the trends in the development of mechanical engineering to increase the efficiency of the assembly of complex engineering products can be due to the wide use of computer-integrated manufacturing and mathematical optimization of virtual simulation. This makes it possible to make full use of the product information of different stages of production trends of modern production are continuously increasing the production of products both in the nomenclature and volume, leading to steady growth in specific labor-intensive assembly operations and, consequently, to an increase in demand for production areas and to increase the number of workers employed in assembly production.

This study sets out the principles of assembly system of engineering product. These principles further allowed directly move to the modeling of organizational-technological and technical assembly structures of engineering products, which greatly improves the efficiency of the assembly process at all its stages.

Keywords: assembly, simulation, process operation, integrator, semantic web.

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THEORETICAL WEAR RESEARCH OF CONICAL FRICTION BEARING

page 60–64

The wear value of related parts of conical friction bearing from the action of not only axial but also radial load was determined in the article. It was found that the pressure on the bearing surface is divided by a hyperbolic dependence. This work is conducted in order to increase the working life of a conical bearings used in the composition of the mobile mortar mixer URZ-3,8. During the experiments, we were able to find an expression for the resulting efforts in conical bearing, determine the expression of wear value of related parts. It is concluded that the service life can be increased, affecting the geometry of conical pins and bearing inserts. Also it is necessary to determine the material that resistant to wear for the manufacture of friction parts of bearing assembly. This work is important because the life of each machine depends on durability of components and parts. As a result,

increasing the durability of machine parts reduced the costs of parts and materials for their production, complexity of the operation, maintenance and repair, reduces the number of employees and the complexity of operation, maintenance and repair.

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MAINTENANCE OF LOADING AND UNLOADING PROCESSES OF SEA VESSELS AT TRANSPORTATION OF COMPRESSED NATURAL GAS

Analysis of the processes of loading and unloading of sea vessels has shown that they can proceed in critical and subcritical regimes. It is found that constant speed when loading the sea vessels is provided due to pressure gas source by the terms of the process in the critical mode. The process is characterized by constant discharge pressure decrease in gas tanks and gas flow that comes out of them. The maximum speed of the process is achieved by maintaining the critical regime through the phased introduction of the compressors. The defining parameters in determining the diameter of connecting collectors under that provided the necessary speed of the loading process are sources of gas. Collectors that selected taking into their accounting are provided the realization of loading process in the subcritical regime at the final stage in conditions of minimum overpressure of the compressor pressure filling capacity.

The obtained results can be used in the design of sea vessels to transportation of compressed natural gas. They can also serve as the basis for the acquisition of individual blocks by using the proposed global manufacturers of CNG modules. Using the tested algorithms it is possible to justify the loading and unloading modes of sea vessels under the terms of individual projects.

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METHODS FOR RESTORE THE WORKING BODIES OF GRAIN SEEDERS

In this paper, the analysis of recovery methods of disc coulters of grain seeders that are in service can have such trouble as deformation, warping, wear on the outside diameter. With a slight deformation it is applied its correction, and when diametrically worn of disc it is produced the sharpening of their cutting edge. There is a way to diametrically restore the surface of the disc by the method of contact seam lap-welding with the further consolidation of powder materials based on sormite.

The above methods do not adequately restore the quality of the processing, complex, have a low productivity and high cost.

In view of these disadvantages of the existing methods of disc coulter repair in the development of new recovery process using a vibrating hardening regime considered the following processing parameters: perturbing force, amplitude and frequency of oscillations of the working tool, its speed and processing time.

Large numbers of dislocations that provide a greater degree of hardening are occurred when vibrating due to grain crushing

deformation of the processed material and an increase in their slowness.

Keywords: disc coulters, hardening, wear rate, structure, technological process.

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