ABSTRACT AND REFERENCES

ENERGY SAVING. ENERGY-SAVING TECHNOLOGIES AND EQUIPMENT. MATERIALS SCIENCE

OPTIMIZATION OF INDUSTRIAL POWER-SUPPLY SYSTEM DURING ITS RECONSTRUCTION (p. 4-8)

Sergiy Tymchuk, Mykola Derenko

As a result of economic situation changes a problem of selecting the optimal solution for industrial enterprise power-supply system reconstruction has appeared. The solution is complicated by multicriteriality, vagueness of source information, nonlinearity and relatively great number of alternatives.

The vagueness of source information is solved by developing a fuzzy mathematical model of technical and economic evaluation of power-supply system efficiency indexes, which are used as objective functions.

Genetic algorithm has been applied for selecting optimal solutions.

The research has been carried out by the example of power-supply system of a particular enterprise. As a result, three optimal solutions for different levels of capital costs have been developed. The first solution allows electric power technological losses reduction and safety increase by 5 times, although it requires additional investments. The second solution allows electric power technological losses reduction by 5.8 times and safety increase by 2.3 times, herewith capital costs may be partially compensated by selling released equipment. The third solution ensures electric power technological losses reduction by 4.1times and safety increase by 2.3 times without additional capital costs. The third variant is more preferable for the example considered.

Fuzzy values of technical and economic indexes for optimal solutions allow assessing the risks of decision-taking.

Keywords: power-supply system, reconstruction, multicriteriality, optimization, vagueness (uncertainty).

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ANALYSIS OF IRREGULAR ELECTRICITY CONSUMPTION (p. 9-13)

Serhij Denysyuk, Taras Bazyuk

The paper analyzes the current electricity consumption modes. The problem of irregular electric power consumption has been noted. The advantages and disadvantages of systems of measuring electricity consumption of sinusoidal systems have been given and their inaccuracy under variable loading and non-sinusoidal operation modes has been proven. The influence of irregular energy consumption has been analyzed. It has been confirmed that the traditional power coefficient takes no account of uneven consumption. Power losses have been assessed, that appear in electrical network when its transfer to consumers, using the least possible value of power losses. The formula has been developed for calculating the power coefficient, which takes into account all inactive components of total power and describes any electricity consumption mode, while the $\cos\varphi$ - only in a particular case of symmetric sinusoidal load currents. The average value of power factor per time interval has been determined, which takes into account negative effects of irregular consumption, and depends only on a consumer. This coefficient also includes irregular consumption schedule. The corresponding conclusions were made.

Keywords: irregular consumption, power selection criteria, distributed generation, optimization.

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DYNAMIC PROPERTIES OF SYSTEM «RECTIFIER WITH BUCK CONVERTER - LOAD» (p. 14-17)

Vladislav Panchenko

The introduction of high-speed rolling stock, the growth of passenger and freight transportation are placing ever greater demands for power supply devices and electric energy quality in a contact

network. The application of direct current at traction substation along with uncontrolled diode rectifier of a controlled buck converter allows adjusting the average value of rectified voltage in the contact system. In addition, using the buck converter in a closed structure allows compensating the unwanted harmonic components of the load voltage.

The need for investigating the dynamic properties of the "rectifier buck converters - load" system is specified by the possibility of realizing the finite duration processes in the voltage regulation channel, allowing the load voltage harmonic compensation on the feedback circle.

The buck converter, operating in the pulse width modulation mode, allows using it as a wideband active filter.

All the above requires a mathematical description of dynamic processes in the described system for the task solution. The obtained system of equations allows describing the dynamic processes in rectifying installation with width-controlled BC.

Keywords: buck converter, dynamic properties, automatic control system, pulse width converter.

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CRITERIAL EFFICIENCY EVALUATION OF CURRENT CONVEYORS (p. 17-21)

Nikolai Filinyuk, Alexander Lazarev, Lyudmila Lishchinskaya, Vladimir Stakhov

Circuit design of information devices based on current conveyors is being intensively developed at present. There are many circuits of current conveyors. Therefore there is a problem of choosing the most efficient current conveyor circuit with respect to a set of key parameters for a particular application, which can be solved by the criterion evaluation of efficiency. Analysis of current conveyor circuits efficiency has been made for the based on them design of immittance converters and circuit negatrons - devices with negative resistance, inductance, capacitance, based on results of computer simulation of three current conveyors circuits on one, two, and 18 CMOS transistors. An integrated criterion of current conveyors efficiency has been developed in the paper. Its use allows choosing the optimal conveyor circuit for a particular purpose. Among the considered current conveyors the circuit on 18 transistors is the most functional and accurate, while still having the worst frequency and power parameters. The proposed integrated criterion of efficiency evaluation with respect to a set of key parameters has shown that the circuit on a single transistor is the most efficient for the circuit negatrons design on immittance converters, because high accuracy is not so important in this case, especially for devices of immitance fuzzy logic, and the best frequency and power properties allow synthesis of high-performance information devices.

Keywords: current conveyor, efficiency criteria, immittance converters, negatronics.

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CHARACTERISTICS OF FUEL DISTRIBUTION PROCESSES IN SPRAY AND NISHE SYSTEMS (p. 22-25)

Mikhail Abdulin, Alex Seryi

The paper deals with determining the stabilization characteristics of spray and niche-type burner units of using various gas feed schemes. Implementation and operational experience has shown the effectiveness of the spray and niche technology and is suggesting it as universal one. Today many fire engineering facilities, which consume natural gas, have been modernized based on SNT. Power engineering, metallurgy and food industry facilities are equipped with the new technology. Boilers yielded savings of boilers 5 to 15%, and in metallurgy they were up to 50%.

Today, an important issue linked to low-cost modernization is identifying the possibilities of increasing the capacity of individual burner units, whilst retaining the main advantages of the spray and niche technology.

The research considers the regularities of hydrodynamics and mass exchange in the spray and niche system with several rows of gas supply orifices. The largest diameter was in the first air flow row for organizing efficient fuel distribution in terms of oxidant volume. The relative spacing between orifices was the same in all rows.

The paper gives the profiles of turbulence intensity and the line axial velocity components for the three gas supply schemes. Also, the paper gives the results of numerical analysis of mass exchange between the main flow and the backflow zone in a niche for all gas distribution schemes. The gas pressure differential in the SNT air

path was defined for all gas feed options considered. Conclusions were made based on research results.

Keywords: spray and niche system, fuel distribution, sprays, computer modeling.

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PHISYCAL MODEL OF BOILING PROCESS ON POROUS SURFACE IN LIMITED SPACE (p. 26-31)

Olga Alekseik, Vladimir Kravets

Despite many publications concerning the features of the boiling process in a limited volume on smooth and extended surfaces, the majority of them deals with the forced liquid flow. At the same time, there is a need for studying the boiling process on porous surface in a limited space with natural current of heat carrier.

The paper gives the results of experimental studies of the boiling process, which indicate the influence of the free space size on the heat dissipation intensity during the boiling on smooth and porous surfaces.

Based on the experimental data analysis and the results of a series of visual studies, a physical model of the process has been suggested. In addition, the paper gives a number of systems of differential equations with boundary conditions, which can be used for constructing a mathematical model of the boiling process on the porous structure in a limited volume.

Keywords: boiling, porous structure, limited volume, model, equation

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INTEGRATED TECHNOLOGICAL SYSTEM OF BIOGAS PRODUCTION (p. 31-34)

Eugene Chaikovskaya

Existing support systems of biogas units operation do not always accurately take into account the temperature parameters of raw materials fermentation, which is caused by their high heat storage capacity. Moreover, under the fermentation temperature changes the wort consumption change functions as the regulating factor that can disrupt the required balance of fresh and fermented material. Analytical forecasting assessment of fermentation temperature change and the principle of intelligent control of heat pump energy supply have been proposed for changing the coolant consumption in the heat pump evaporator, depending on the temperature of discharged raw materials. This approach will provide the opportunity of predictive decision-making concerning the timely discharge of fermented materials in a biogas unit discharge mode and charging the equivalent consumption of fresh raw materials in the biogas unit charge mode. Using the discharged material in a heat pump in a discharge mode allows the decision-making on a temperature change of heating carrier in a charge mode. An integrated technological system of biogas production based on coordinated interaction of dynamic subsystems - biogas unit and the heat pump, allows, setting a balance between fresh and fermented raw materials, a constant biogas output under increased marketable value of a biogas unit up to 10-15%.

Keywords: biogas unit, heat pump, decision-making.

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THE TECHNOLOGY OF SYNTHESIS THERMITE GRAPHITIC STEELS (p. 34-37)

Yurij Zhiguts, Vasilj Lazar

The present paper the basic solutions to the problem of obtaining graphitic steels examined the use of thermite steels, the benefits of combining thermite steels with metallotermic methods of getting is showed. The advantages of metallotermic synthesis methods include: autonomy of processes, independence of energy sources, simplicity of equipment, high-performance process and easy transition from experimental research to industrial production. The need to develop the technology of synthesis thermite graphitic steels, as a result of aluminothermic reactions and establishment of technological features' of synthesis it all led. At the first phase of the study of chemical composition of the synthesized graphitic steels is determined. In continuation of studies microstructure, mechanical and technological tests were performed. Technological features of the synthesis process and the impact of components exothermic reaction were revealed. The result of comprehensive research was the development of fusion technology thermite graphitic steel "ЭИ293", "ЭИ336", "ЭИ366", setting of the charge for the synthesis of the specified steel, revealing the microstructure and mechanical properties of thermite steels, the research of technological properties of steel, namely the casting of properties and effects on the structure of individual alloying elements. In addition, the author has set the limits and boundaries of creep for thermite steel and their dependence on temperature.

Keywords: metallothermy, properties, structure, charge, graphitic steels.

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INFLUENCE OF ELECTRODES SUBSTRATE MATERIAL FOR DIAMONDLIKE FILMS DEPOSITION ON THE QUALITY OF BIOANALYSIS (p. 38-42)

Aleksandr Semeniy, Mykola Rozhitskii

The main objective of the research is determining the influence of substrate material for deposition of diamond-like films on the coating quality, as well as its further behavior as an electrode in electrochemical sensor for bioliquids analysis. Electrochemistry of aqueous-solutions and atomic force microscopy were used as the methods for the research. The obtained results led to the following conclusions. Molybdenum can be applied only when using it at the cathode. Platinum substrate caused the sample cracking, but since the gaps are sufficiently large, they can be used as microelectrode. Glassy carbon sample showed the best properties. The coating was uniform, without breaks and punctures. During the electrochemical studies, the sample showed the widest range of working potentials. These properties are the most applicable for various biosensors where a wide area of ideal polarizability in aqueous solutions is required.

Keywords: diamond-like electrodes, bioanalysis, electrochemistry, atomic force microscopy.

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THE KINETICS OF THE PROCESS OF LITHIUM IONS ELECTROCHEMICAL INTERCALATION INTO POROUS CARBON MATERIAL (p. 42-48)

Volodymyr Mandzyuk, Nadiia Nagirna

The method of electrode impedance spectroscopy allowed studying the kinetics of lithium ions electrochemical intercalation into the porous carbon material obtained by hydrothermal carbonization of plant materials at a temperature of 750 ° C. Based on qualitative and quantitative analysis of Nyquist diagrams it was determined that this process is phasic by nature, which lies in the formation of the solid layer, based on lithium fluoride and formation of non-stoichiometric phases of the LixC type, on the carbon particles surface. The equivalent electrical circuits were chosen for each of these phases, allowing the simulation of impedance spectrum in the whole frequency range studied. Physical interpretation for each element of the scheme is proposed. The dependences of the parameters of the equivalent circuit on the equilibrium potential of the LixC-electrode were obtained. Increasing degree of lithium ions intercalation leads to the growth of geometric size of the surface solid layer, accompanied by its resistance increase and volume reduction. At the final stage of implementation these two parameters do not undergo considerable changes, which is the evidence of its structure and properties stabilization. The coefficient of lithium ions diffusion in the electrode material was calculated and the analysis of its dependence on the degree of intercalation was carried out.

Keywords: porous carbon material, electrochemical intercalation, electrode impedance spectroscopy, diffusion coefficient.

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POROUS CERAMIC ADSORBENTS ON BASIS OF SYNTHETIC ZEOLITES (p. 48-55)

Ivan Solokha, Yaroslav Vakhula, Myron Pona, Andrii Chverenchuk

Notwithstanding manifold works devoted to the receiving of granulated zeolite-containing sorbing materials, controversial data exists regarding the types utilized binding agents as well as the conditions under which the composite materials are made with the appropriate firm and sorbing characteristics. The experimental data is conveyed concerning the elaboration of technology of receiving zeolite ceramic adsorbents with modified inorganic binding on the basis of highly flexible clay and synthetic zeolites NaA and NaX. Using standardized methods in ceramic technology to control structural physical and physico-mechanical parameters, the optimum conditions of modification of binding agent and its correlation with the zeolite component have been determined which allow to get the adsorbent with the proper parameters of firmness, sorbing capacity and porosity. According to the data of electronic microscopy of the composites of optimum composition the following has been specified: their structure belongs to the corpuscular type and represented by the individual crystals and units of zeolite phase which are linked between each other with the help of fragments of porosities clay binding. The results of low temperature adsorption of nitrogen indicate that the formation while smelting highly porous materials with the highly specific area and predominance of pores of the two groups of denomination: micropores and macropores. Hence, received materials thanks to the obvious sorbing properties and inherent to the zeolite phase of molecule sieve effect, can be used in the range of selective adsorbing processes, such as division of carbohydrate mixtures, deeply drying of gases and others.

Keywords: ceramic adsorbents, NaA and NaX zeolites, low-temperature nitrogen adsorbtion method

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