ABSTRACT AND REFERENCES

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

RELEVANCE OF MODELING DISTRIBUTED ENERGY SYSTEMS FOR EFFICIENT USE OF RENEWABLE ENERGY SOURCES (p. 4-8)

Vira Shendryk, Svitlana Vashchenko, Olha Shulyma, Kateryna Omelianenko

Significant losses of useful energy, arising during its transportation to the end users from large power stations, induce to look for alternative ways of network activity management. The MicroGrid concept allows reaching the optimum correlation between energy generation and consumption at the level of neighborhood or village, and the introduction of renewable energy sources allows not only generating their own electricity, but also "selling" it to the network. Unfortunately, integration of such sources with the traditional ones has many problems related to various fields of activity, therefore the paper discusses the relevance of using the RES during construction of distribution networks and possibility of their operation modeling.

The paper proposes to approach the problem from the following points of view: assessing problems in the existing energy system, analyzing the current state of using renewable energy sources, determining the state policy and existing methods of energy system operation modeling.

The research results can be used as the basis for developing a decision-taking support system, which allows modeling of MicroGrid processes and receiving summary information on the network operation, recommendations concerning its construction, etc.

Keywords: MicroGrid, renewable energy sources, computer modeling, energy model, geographic information system.

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ACTUAL CHARACTERISTICS OF COMPRESSOR STATION EQUIPMENT AND OPTIMIZATION OF LOADING MAIN GAS PIPELINE (p. 9-13)

Gennadii Varlamov, Kateryna Pryimak

In this paper we have developed and offered new cost-effective approaches to the implementation of control algorithms and optimization of equipment loading, units and installations of energy facility using integrated parametric identification of the actual characteristics of operation. The implementation of these approaches on the example of a particular unit offers a complex of positive effects, some of which are: the possibility of moving to a higher level of reliability assessment of the current of the object, efficient real-time estimation of the operation reliability and the potential for uncontrolled situations by constantly monitoring the parameters and the optimal prediction of the equipment, the possibility of extending of the equipment working life. These approaches make it possible to implement a complex system analysis of the real state of the energy facility and related to reliability, efficiency and environmental performance of the equipment, they are designed to optimize the processes in each unit and power facilities as a whole, which will lay the foundation for a more objective management of the gas transmission system.

Keywords: parametric identification, actual characteristics, energy object, compressor station, gas pipeline.

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POTENTIAL AND NECESSITY TO DEVELOP NONTRADITIONAL RENEWABLE ENERGY IN UKRAINE (p. 14-19)

Oleksiy Lymarenko

The article examines the potential and the pace of development of nontraditional renewable energy sources (NRES) in Ukraine. The arguments «pro» and «contra» the energy potential of NRES are analyzed with the help of technically reachable and economically feasible values' indicators.

NRES is classified by such kinds of energy: thermal and radiant energy (solar energy and energy of the Earth's heat); mechanical energy (wind and water energies), chemical energy (energy contained in the biomass).

In the study of NRES have been repeatedly engaged national and foreign scientists who studied the issues of use of solar energy, heat pump solar heating systems, wind-driven generators, ways to receive heat from the Earth's interior, etc.

The purpose of the article is to describe the energy potential of NRES in Ukraine, which will allow to determine the merits, economic efficiency and investment attractiveness of NRES projects.

Permanent increase of Russian gas price forces Ukraine to focus on the use of its own resources, to look for new suppliers of energy sources and to find new solutions to energy problems.

Considered in the article NRES are the fastest and the cheapest way to solve the problems of energy supply of remote hard-to-reach settlements, which are not connected to public networks; energy supply of small and medium-sized businesses. Using NRES it is possible to reduce the deficit of power and energy in deficit energy systems, to develop the innovative trends in the industry, to expand the domestic demand for engineering products and to expand export opportunities.

Keywords: nontraditional renewable energy sources, solar, wind, geothermal, biomass, energy.

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THE PROBLEMS OF SELECTION OF OPTIMAL MATHEMATICAL MODEL OF ENERGY CONSUMPTION AT INDUSTRIAL ENTERPRISES (p. 19-23)

Anatoliy Voloshko, Yaroslav Bederak, Tatiana Lutchyn

The determination of so called "standards" of energy consumption is one of the most essential stages of creation and efficient operation of energy consumption control systems that are widely used in foreign practice and are known in Ukraine as energy consumption control and planning systems. This "standard", in general, is a more or less complex mathematical model of fuel or energy consumption by certain technological objects (plant, unit, and processing line) depending on key criteria essentially affecting energy use of such object.

It is proposed to use multi-criteria optimization method in order to obtain the best mathematical model. The situations, when one mathematical model is more accurate according to generalized additive criterion, while the other one is accurate according to multiplicative criterion, arise in the process of selection of optimal mathematical model, applying the criteria of equal significance. In this case, it does not ensure unique determination of optimal energy consumption mathematical model. It is proposed to introduce a decisive generalized morphological criterion for "n" number of criterion cases in order to distinguish necessary model, concerning the precision of its description of incoming data for industrial enterprises using different types of resources.

Keywords: multi-criteria model, quality of data description model, morphological criterion.

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EFFECTIVENESS OF HEAT PUMP HEATING SYSTEMS USING PRE-HEATED AIR (p. 24-28)

Mihail Bezrodny, Natalja Prytula

The effectiveness of heat pump system of low-temperature water heating, using pre-heated air from burning a small amount of fuel, has been analyzed. Using this system improves the operating conditions of heat pump and increases its transformation ratio respectively, compared to the system with no furnace extension. It will allow, firstly, increasing the temperature range of air-water heat pumps, and, secondly, abandoning the reserve heat source, that in turn will decrease capital spending. Graphical dependencies of key parameters, characterizing the system performance, on environmental temperature are given in the paper. It has been found that the size of furnace extension was small compared to the heat removed from the air for meeting the heating purposes.

Keywords: heat pump, low-temperature heating system, fuel primary energy consumption coefficient.

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REDUCING SPECIFIC ENERGY CONSUMPTION OF MEDIUM -PRESSURE AND SMALL-TONNAGE AIR SEPARATION PLANTS (p. 29-34)

Georg Lavrenchenko, Alexander Plesnoy

Demand for liquid cryogenic products is constantly growing. The creators of cryogenic liquid air separation plants (ASP) aim at further reduction of energy consumption when producing liquid oxygen, its extracting from the air and liquation. The analysis of various ASP schemes allows finding an effective solution of this problem for further introduction into small-tonnage plants. Applying the medium-pressure of expander-compressor unit in the ASP makes it possible to reduce energy consumption from 1.10 to 1.04 kWh per kg of produced liquid oxygen without using additional source of cold. Modernization of the investigated ASP will yield energy savings up to 216.000 kWh per year, and also will increase liquid oxygen output by 56 t compared with conventional plant.

Keywords: cryogenics, air separation plant, liquid oxygen, expander-compressor unit, specific energy consumption.

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HYDRODYNAMIC CHARACTERISTICS OF ELEMENTARY LATTICES OF FRANCIS TURBINE RUNNER (p. 34-38)

Irina Tinyanova

The paper is devoted to development of methods for determining and analyzing the hydrodynamic characteristics of elementary lattices of hydro-turbine runner. The equations describing the kinematics of the flow both in absolute and relative motion at the input and output of runner lattice are presented. Based on the analysis of the kinematic and energy characteristics of runners in a wide range of pressure changes with high energy parameters it was determined that the optimum mode is reached at approximately equal positive circulation for all lattices; the coefficient of theoretical pressure is approximately equal for all components of the lattice. The method of calculating and analyzing the hydrodynamic characteristics of separate lattices allows assessing their effect on the energy and cavitational properties of runners. The method allows estimating the degree of coherence of separate lattices making up the space lattice of runners.

Keywords: Francis turbine, runner, hydrodynamic characteristics, energy characteristics, turbine setting.

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EXPERIMENTAL DEERMINATION OF TORQUE CONVERTER PARAMETERS IN CONDITIONS OF LOW-POWER DRIVE MOTOR (p. 39-45)

Vladimir Solovyov

The paper is devoted to the issue of conducting experimental studies of torque converters for accurate determination of their external and internal parameters of operating in conditions of low-power drive motor by selecting the optimal gear ratio and rotational speed of the impeller n_1. On the basis of the graphical optimization method the algorithm was developed based on imposing the constraints for the maximum motor power, the minimum Reynolds number and the resonance speed of impeller rotation. The theoretical issue of experimental studies of the torque converter in the area of quadratic losses of the VTI graph is resolved. The graph for the coefficient of hydraulic friction losses depending on several flow sections and the Reynolds number is shown. The diagram of dependence of the coefficient of hydraulic friction losses for several flow sections on the gear ratio $\lambda_{mn}=f(i)$ is presented.

Keywords: torque converter, experimental studies, Reynolds number, coefficient of hydraulic friction losses.

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PROBLEMS OF DEVELOPING MODELS OF ELECTRIC MOTORS OF ELECTRIC TRACTION DRIVE OF VEHICLES (p. 45-49)

Nicolay Khvorost, Konstiantyn Soroka, Andrey Besarab

The methods of modeling the system electric motor – control device were analyzed. Simulation based on Maxwell's equations, solution of the Cauchy problem, analysis of processes using vector diagrams and matrix representation methods was considered. The simulation package Simulink, Mat Lab using the integral Laplace transform was chosen as the most suitable for solving the problem of optimization of electric drives of vehicles in terms of energy saving. The problem of constructing models with nonzero initial conditions was considered. The models of electric traction drive with separately excited motor and simplified linear dependence of the motor magnetic flux on magnetizing force were constructed. The model of electric drive when taking into account nonlinear magnetic properties of steel was constructed. The models constructed allow effective research of the dynamics of electric drive and develop methods for its optimization. The models of direct-current motors were proposed, which take into account actual magnetization curves.

Keywords: model, Simulink, electric motor, flux linkage, moment, electric drive, electric transport.

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DISTRIBUTION OF MOISTURE IN EXTERNAL ENCLOSING CONSTRUCTIONS (p. 49-51)

Bohdan Kytnuy, Anna Borisyuk

One of the most common methods to reduce heat losses of building is its external insulation. However, insulation of external enclosing constructions has both physical and economic limits. Regulation of the building internal temperature is the second way of energy consumption reduction, aimed at energy savings. Namely, application of program heat supplied control.

However, the buildings with program heat supplied control are often subjected to periodic moistening and drying of enclosing constructions, that is caused by disturbed thermal and humidity regime of buildings. To analyze the processes of moistening and drying of enclosures it is necessary to determine the temperature and moisture content on the surface and inside these constructions from time to time. Therefore, combining the two above mentioned methods of energy consumption reduction - program heat supplied control with enclosing constructions insulation, provides energy savings by regulating internal temperature, thus reducing the insulation layer thickness.

The main task of the work is to prove the possibility of internal insulation of enclosures using program heat supplied control that will not lead to excessive moisture accumulation inside external enclosing constructions.

Keywords: moisture, program heat supplied control, insulation.

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THERMOPHYSICAL PROPERTIES OF METALS AND POLYMER COMPOSITIONS (p. 52-58)

Liliya Baziuk, Hennadiy Sirenko

The article investigates the matter of thermophysical properties of metals: copper, silver and gold and composite materials based on polytetrafluoroethylene (fluoroplastic-4), aromatic polyamide (phenylone C-2) and polyimide PM-69 depending on temperature and concentration of the fillers. The aim of work was: 1) to establish the dependencies of change of enthalpy, thermal conductivity coefficient, thermal capacity coefficient under stable pressure and linear coefficient of thermal dilation on temperature, radius and ordinal number of atoms of metals; 2) to search for correlation relationships and approximation mathematical models between these characteristics; 3) to study thermophysical properties of composite materials based on polytetrafluoroethylene, aromatic polyamide and polyimide depending on temperature and concentration of the fillers.

In our work we used the methods of thermophysical measurements of thermal conductivity and methods of probability theory and mathematical statistics. As a result, we have received approximate mathematical models of dependency of enthalpy, thermal conductivity coefficient, thermal capacity coefficient and linear coefficient of thermal dilation on temperature of copper, silver and gold.

We received new correlations of dependencies of thermal conductivity coefficient on temperature and concentration for composite materials based on polytetrafluoroethylene, aromatic polyamide and polyimide and type of the fillers. Theoretical analysis of concentration dependencies demonstrated divergences between experimental and estimated data according to equations of Maxwell-Aiken, Dulnev, Odelevskyi and Nielsen.

Keywords: metals, polymers, thermal properties, temperature, correlation analysis, regression analysis.

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EFFECT OF INITIATING SYSTEM ON THE STRUCTURE AND PROPERTIES OF HYDROGELS BASED ON POLYVINYLPYRROLIDONE COPOLYMERS (p. 59-63)

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The paper gives the results of studying the copolymerization of 2-hydroxyethylmethacrylate with polyvinylpyrrolidone in the presence of two-component initiating systems $FeSO_4$ - radical initiator. Benzoyl peroxide, potassium persulfate and azo-bis-izobutyric acid dynitryl were used as radical initiators. The main purpose of the research was to investigate the effect of the nature of initiating system, namely the type of radical initiator, on forming copolymers of polyvinylpyrrolidone and to define the possibility of their use as matrices for metals recovery by chemical method. The results of research of polymerization kinetics, structural parameters of network, structure of copolymers and properties of the obtained hydrogels showed that by changing the nature of initiating system, depending on the needs, it is possible to regulate the viability of original composition, porosity, strength properties of hydrogels and swelling ability in the water. By the example of silver, new metal-filled hydrogel composites were obtained by means of modification of synthesized materials using the method of chemical recovery of metals from their salts in the hydrogel matrix. The obtained results will be used in developing the production technology of HEMA-PVP copolymers and composite metal-hydrogels based on them.

Keywords: initiator, polymerization, polyvinylpyrrolidone, hydrogels, recovery, metals

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