ABSTRACT AND REFERENCES

ENERGY-SAVING TECHNOLOGIES AND EQUIPMENT

MODERNIZED METHOD OF TRAIN SCHEDULE PLOTTING TAKING INTO ACCOUNT ENERGY LOSSES (p. 4-8)

Konstantin Kalashnikov

The article presents the improved method of train schedule plotting, which differs from the existing by use of the heuristic algorithm to determine the rational sequence of departure and intervals between trains. The concept of sequence function consists in matching of the actual number to the sequence $[w_1,w_2,...w_n]$ according to the specified rule F. In particular, if it is necessary to run trains of various categories through the section n, for each sequence one should determine the loss of energy **Δ W**. Further, we solve the problem of definition of such sequence of trains running, at which the minimum of energy losses in the traction system is reached – $C=f(\Delta W \rightarrow min)$. For example, if w_i – i is a train category, and $i=\overline{1,4}$, the number of sequence variants of train running will be n!=24 , and each variant of train running will match a certain loss of energy in the traction system. Application of this method makes it possible to minimize energy losses in the traction system.

Keywords: train schedule, energy loss, heuristic algorithm, traction system.

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THE THERMAL STATE OF THE AD MOTOR AT THE REDUCE ROTOR SPEED (p. 8-10)

Michael Kotsur

Changing in the conditions of cooling in recursive short-time modes in wide range of rotor speed occurs under the exploitation of the crane electric drive based on AD motors. The aim of this article is to estimate the thermal state of the AD motor at low rotor speed, as well as comparative analysis execution of the AD motor ampacity calculated by the average loss of heat and equivalent thermal circuit (ETC) methods. Electrothermal model to consider peculiarities of electromagnetic energy transformation in thermal energy, heat transferring and heat interchanging processes was used for calculation and analysis of the thermal state of the AD motor by ETC method. Conducting evaluation of the thermal state of the AD motor with phase rotor by regulation of additional resistance under continuous (S1) and recursive short-time (S3) modes showed an increasing temperature in the range of large slip of the AD motor at the end investigation. Hence, the limiting values of current load of the AD motor were defined by ETC and average loss of heat methods. It was proved, that the definition of the AD motor ampacity by average loss of heat method led to underutilization of AD motor power.

Keywords: AD motor, thermal state, regulation, ampacity, slip, rotor, loss, current load, energy, transformation.

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INCREASE OF RESOURCE OF STEAM TURBINE (p. 11-14)

Tatyana Pugachova, Igor Nizinskij, Igor Kapyra

A significant part of heat-mechanic equipment has already developed standard and extended resources. The scheduled repairs are reduced and overhaul periods are increased. Operation of power units in peak load with a large number of start-stops leads to their rapid wear and cracking in high temperature zones of elements of turbo-installations. Cracks in the rotors cause the possibility of further emergency operation. The economic situation at present can-

not provide new equipment. There is a need to develop measures to increase the resource of a steam turbine.

The following measures are suggested to increase the resource of the steam turbine: change of operative conditions; preliminary heating of the rotor; removal of the damaged metal layer; change of the thermal circuit; reconstruction of thermal grooves.

Keywords: steam turbine, thermal stresses state, creep and long-term durability, low-cycle fatigue.

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INFLUENCE OF OPERATION OF LOW POTENTIAL COMPLEX ON TECHNO- ECONOMIC INDICATORS OF THERMAL AND NUCLEAR POWER STATIONS (p. 14-16)

Tatyana Bikova, Sergey Naydenov, Igor Shelepov

Taking into consideration the current financial situation of the country and energy in general, and the fact that since 1990 there have been no new facilities, the best way to maintain and ensure the energy security of the country is the restoration of the existing thermal and nuclear power plants in order to extend the service life of equipment for 15 - 20 years, and to increase its efficiency and ecological compatibility. The most significant connection of the low-potential complex with a power unit is carried out through the final parameters of stream (Pk, tk) and the consumption of electricity to drive the pumps of the complex.

The most significant connection of the low-potential complex with a power unit is carried out through the final parameters of stream (Pk, tk) and the consumption of electricity to drive the pumps of the complex, i.e. the low-potential complex affects the efficiency of thermal power plants, affecting their performance.

Keywords: low-potential complex, condensed steam, condensation units, low-pressure cylinder

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GASIFICATION IN VORTEX APPARATUS AS THE PERSPECTIVE DIRECTION OF GAS-GENERATING TECHNOLOGIES (p. 17-19)

Alexandr Nehoda, Victor Sobchenko, Olya Oraylo

The authors have performed the literature search on gasification of solid fuels in order to identify the least researched technologies. The article indicated the shortcomings and advantages of gasification in comparison to direct combustion technologies; and the ways of application of obtained gas synthesis. The authors provide extended classification of the gasification technologies.

Having analyzed the materials according to a given area, the authors concluded that the least researched process is the gasification of solid fuel in vortex devices. Despite the known shortcomings of such devices, they have significant advantages that provide their further improvement and creation of new technological schemes for them.

Based on the data the tasks for future research of gasification in vortex devices were formulated.

Keywords: gasification, gas generator, vortex device, gas synthesis, gasification agent, volatile components, fine-dispersed materials, carbon conversion.

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CERTAIN OF SUBJECT TO PASSING STEAM GASIFICATION OF SAWDUST IN FLUIDIZED BED
(p. 20-22)

Olya Oraylo, Victor Sobchenko, Alexandr Nehoda

In this article the relevance vapor gasification of sawdust in a fluidised bed, the analysis of literature data, formed the key challenges and factors affecting the process, the task of the study. The principles of the method of calculation program TERRA (the principle of maximum entropy). Also, the paper presents a physical model of vapor gasification of sawdust in a fluidized bed, a mathematical model calculating the heats of formation of the reaction products. An graphic concentration of initial components and calculated data (energy consumption and the amount of CO and H_2 output) at a temperature of 1100 ° C. The conclusions given in graphical and calculated data, set the basic conditions of the process - namely, temperature and oxidant ratio - sawdust.

Keywords: vapor gasification, temperature, oxidizing, sawdust, fluidized layer combustible gas.

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FLOW AROUND OF SINGLE CYLINDERS IN TRANSVERSAL FLOW (p. 23-26)

Alexandr Terekh, Alexandr Semenyako, Valeriy Tuz, Vadim Kondratyuk

The article is dedicated to the results of experimental studies of the pressure distribution on the surface of plane-circular cylinders, and to the flow visualization. The experiments were conducted in a wind tunnel of open type of rectangular cross-section in the range of Reynolds numbers from 15000 to 50000. The flow visualization on the surface of the studied samples was carried out by means of injection of carbon-kerosene suspension into the flow, and on the basis of numerical simulation. The findings showed that on the surface of plane-circular cylinder one could observe two boundary layer separations - at the coupling sites of curvilinear and plane parts. It was determined that the nature of the flow of the front and the stern parts of the round and plane-circular cylinder is qualitatively similar, at the same time on the plane parts of the plane-circular cylinder there is an increase of the hydrodynamic boundary layer.

Keywords: flow, pressure, separation, boundary layer, cross-section, cylinder, tunnel, plane-circular, visualization.

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USING QUALITY INDICATORS FOR ASSESSMENT OF OCCUPATIONAL SAFETY ORGANIZATION IN POWER INDUSTRY (p. 26-29)

Roman Trisch, Maya Smirnitskaya, Elena Kolotova

The article examines the statistical characteristics of the occupational safety organization at one of the Ukrainian nuclear power plants. The object of the study was the organization of control of awareness of the personnel of operational department on safety rules. Using the package STATISTICA and checklists, we have assessed quality and determined the basic reasons for its deterioration. There are conclusions about the possibility of usage in quality control of methods and tools, traditionally accepted for assessment of the quality of industrial plants and their products.

The article considers priorities in distribution of causes of quality deterioration of the system operation. The results of the statistical analysis of the characteristics were summarized in the form of recommendations of the appropriate structure of factor features (categories) of the occupational safety control system at power plants. These recommendations can significantly improve the efficiency of control of departments, ensuring reliability and culture of power plants.

Keywords: power industry, occupational safety, statistics, quality control.

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MATHEMATICAL MODELS OF HEAT TRANSFER SYSTEM FOR TWO- AND THREE-WAY HEAT EXCHANGERS (p. 29-32)

Igor Galyanchuk, Martha Kuznetsova

Usage of known methods of design and verification calculations when solving operational problems of detection of the effect of different operational changes on performance of thermal power equipment is not effective, because one have to operate a great amount of source information, which is hard-to-get under service conditions.

The article presents the method of operating calculations, which permit to determine the effects of changes in a heat exchanger based on specified input and output coolant temperature in the initial mode. On the basis of the method of operating calculations we have worked out the mathematical models of the heat transfer system for two-and three-way heat exchangers.

Usage of the developed mathematical models will enable the operational calculations of heating surfaces of operating boilers on the basis of specified operational parameters (such as coolant temperature in one of the operational modes of equipment); and object parameters (coolant flow rate, area and condition of heating surfaces) may remain unknown.

Keywords: thermal power equipment, mathematical model, operating calculations, parameters, temperature, pattern of motion, coolant, system, elements, heat exchanger.

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ANALYSIS OF PROSPECTS OF PERVAPORATION POLYMER MEMBRANES FOR BIOGAS TREATMENT (p. 33-37)

Inessa Burtna, Ludmila Rhuzinska, Mikhail Murashko

Markets of renewable energy are growing rapidly, and one of the main areas of this development is the application of biogas as an alternative energy source. One of the arguments in favor of biogas is the necessity to resolve the environmental problems, arising from the disposal of wastes at the present level. However, the application of biogas requires its profound purification from carbon oxide (CO), carbon dioxide (CO_2), hydrogen (H_2), hydrogen sulfide (H_2S), which are its invariable components.

Nowadays we know and apply different methods of purification, but the most of them require phase changes. The phase transitions lead to the significant energy losses during the division. However, the most promising area of the purification is the application of membrane technologies, in particular the pervaporation.

The polymer membranes with different monomers and of different morphology and geometry are especially widely used for the purification of gases.

The article concerns the analysis of prospects of the application of polymer membranes made of different polymers, their properties and ways of improvement, which in turn affect the purification of biogas.

Keywords: pervaporation, polymer membrane, biogas purification.

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EFFECT OF FERROALLOY GAS PURIFICATION RATE ON KINETICS OF RED MUD CARBONIZATION (p. 37-41)

Oleksiy Kyrychenko

The process of iron carburization by CO-containing gases of ferroalloy furnaces using as catalyst materials red mud from alumina production.

Red mud from alumina production and waste gases ferroalloy furnaces after appropriate training are quite suitable for the decomposition reaction of carbon monoxide. Ferroalloy gas sulfur compounds have toxic effect on the catalytic ability of the red mud. The most effective absorber catalyst poisons in the experiments was a solution of potassium permanganate. Iodine is an effective scavenger of catalyst poisons and their effectiveness increases with increasing concentration of the solution. Suspension of red mud, having in its composition HASN - Zeolite with a unique structure of pores and channels is an excellent adsorbent of sulfur compounds. Gas cleaning can be carried out under the existing conditions of ferroalloy production, using as sorbent soda solution after washing the red mud.

Keywords: carbon monoxide, red mud, ferroalloy gas

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DYNAMICS OF HEAT MASS EXCHANGE IS IN A LAYER OF DISPERSED MATERIAL DURING CAPSULATION IN A STATE OF FLUIDIZING (p. 42-44)

Yaroslav Gumnitsky, Oleg Nagursky, Andriy Nagursky

The article presents the results of studies of the complex heat mass exchange in a layer of dispersed material during the capsulation by film-forming solutions in a state of fluidization. We have singled out three conventional phases of the heat mass exchange with the irrigation of the solid material by the film-forming solution. It was shown that only a part of the surface of the solid material is involved into the heat mass exchange. We have worked out the equation to determine the combined coefficient of heat transfer from the air to the surface of a particle during the capsulation, depending on the height of the layer. We have determined the particle surface area, which is involved in the mass exchange. We have calculated the mass exchange intensity with the height of the layer of dispersed material. The adequacy of the mathematical model was checked by experimental data. The results can be used to calculate the technological parameters of the capsulation of solid dispersed materials in a state of fluidization and to improve the operation of the boiling bed devices.

Keywords: heat exchange, mass exchange, mass exchange surface, capsulation, physical model, dispersed materials, fluidized layer.

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ESTIMATION OF EFFICIENCY OF DMSPN TO PROTECT COOLING WATER SYSTEMS FROM SCALE FORMATION AND CORROSION (p. 45-48)

Olena Rudkovska, Julia Omelchuk,Mykola Gomelia

Despite many studies and publications on the development of effective stabilizers of scale formation and corrosion inhibitors, this problem is still topical. The most spread inhibitors of salt deposits are polyphosphate and diverse phosphonic acids. The disadvantage of polyphosphate is the capacity of hydrolysis at high temperatures and stimulation of biofouling. Phosphonic acids are expensive reagents. It is important that the substances, used as stabilizers of scale formation to be effective in protection of metals against corrosion in water. Phosphorus-containing complexons and their complexes with various metals in aqueous solutions are among the most promising inhibitors of corrosion of ferrous and non-ferrous metals. However, until now they are not very popular. Phosphonic acids can often be ineffective as inhibitors of corrosion of metals, and in some cases, they can encourage corrosion.

The development of highly efficient scale formation and corrosion inhibitors and treatment of water will ensure efficient operation of heat-and-power equipment with the possibility to refuse from expensive and cumbersome systems of water softening and deaeration. The article presents the results of studies on the effectiveness of the DMSPN as a stabilizer of scale formation and a corrosion inhibitor of metal corrosion for resource-saving water circulation cooling systems. It was found that the DMSPN is a promising inhibitor for stabilizing treatment of water circulation cooling systems.

Keywords: corrosion inhibitors, corrosion rate, scale formation stabilizers, stabilization effect, antiscale effect.

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RESEARCH OF TEMPERATURE FIELDS OF GLASS-WORKED FURNACE (p. 49-52)

Anatolii Zhuchenko, Vitalii Tsapar

The article provides the graphics of temperature distribution in a glass-worked furnace and considers the study of the temperature fields. The main goal is to analyze the temperature fields, constructed on the basis of a mathematical model. With the help of the software Matlab, the temperature distribution of liquid glass was built in the real sizes of the glass-worked furnace. The obtained temperature fields provide the conclusions about the dynamics of the distribution of temperature in the liquid glass layer and design various technological situations without intervention into the process. The results of the analysis of temperature fields suggest that to obtain the liquid glass of high quality it is enough to keep the temperature of the liquid glass at a given level at point of thermal peak, the coordinates of which can be determined from the given graphics. The results of the study can be used to determine main points of temperature measurement, and on their basis to develop a control system of glassmaking.

Keywords: glass-worked furnace, temperature field, mathematical model.

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APPROACH TO PARALLELIZATION OF COMPUTATIONS FOR TEMPERATURE FIELDS MODELLING USING ADAPTIVE GRIDS (p. 52-55)

Sviatoslav Lukianenko, Iryna Mykhailova, Taras Lemkin

The article studies the approach to parallelization of computations when modeling the non-stationary process of a plate laser radiation. The study aimed to determine the appropriateness of the parallelization and to analyze its results.

The process of laser heating is described by a non-stationary three-dimensional heat equation. To solve it we used a method of splitting along the coordinates with adaptive construction of difference grids. In the method for a grid construction to transfer to a new time step, we have assessed an error of computation. With this purpose, we have applied the method of splitting with different values of difference steps five times.

The study showed that time spent on calculation of an error and construction of the grid to calculate the next time layer was reduced at least 1.5 times. At the same time, the overall acceleration of computation is approximately 15%. Such a low value can be explained by the fact that a significant portion of processing time covers the formation of arrays for further display of the results recorded on the hard disk.

The algorithm of parallelization and the research results can be used in the construction of systems for computer modeling of processes with application of adaptive methods

Keywords: parallel computing; adaptive numerical methods, method of splitting along the coordinates

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