ABSTRACT AND REFERENCES

ENERGY-SAVING TECHNOLOGIES AND EQUIPMENT.

ANALYSIS OF METHODS FOR CONTROLLING POWER UNIT WITH A PRESSURIZED WATER REACTOR IN MANEUVERING (p. 3-10)

Yuriy Todortsev, Timur Foshch, Mark Nikolsky

The methods for controlling power unit with WWER-1000 reactor in maneuvering by the quantitative measure of stability, namely by the size of axial offset were analyzed in this article. The settings of the power regulator were calculated. The power regulator consists of two independent parts. One of them is an axial offset regulator of the reactor and the other one is a regulator of electrical power generator. In addition, the control program with sliding pressure in the second loop and control program with advanced combined-compromise method by the axial offset were compared, that is a quantitative measure of stability of reactor.

Keywords: automated control system, program with sliding pressure in the second loop, axial offset, simulation model, multizone reactor model, maneuverable mode, WWER-1000.

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METHOD OF CALCUCATION OF WATER CHEMISTRY OF THE INTEGRATED CIRCULATION COOLING SYSTEM WITH RECIRCULATION (p. 10-14)

Victor Kishnevskiy, Vadim Chichenin, Irina Shulyak

The new method of calculation of water chemistry of the open-loop integrated cooling system with recirculation cleaning of the part of the coolant at the pre-switched water-treatment plant (WTP) P'_3 and purges of the circulating circuit of the system P''_3 and clarifier with conditioning of the part of the purge by its softening is given in the paper. The calculation of water chemistry of the given scheme was carried out in the boundary conditions of precipitation of Mg $(OH)_2$ and $CaSO_4$ salts from the circulation water in the process of its evaporation in the cycle and liming in the clarifier. Based on the results of the calculation of concentration of carbon dioxide CO_2, HCO^-_3 ions , OH^-, pH index and experimental dependence $j_{dep} = f(Ж_{Ca})$, the specific weight and thickness of deposits on the heat-exchange tubes of the condenser, predicted for an interval of time is calculated.

The whole purge into the environment P''_3 or its part, except the regulation of the concentration of chlorides and sulfates in the circulating water, may be used as the base for hybrid WTP in the preparation of the make-up water of the steam generator.

The proposed calculation method allows choosing the operational values of COSO purges for liming P'_3 and release P''_3 into the environment as the specified quality of the make-up water and evaporation coefficient C_e for ensuring the specified concentration values of chlorides and sulfates and $Ж_{Ca}$ in the circulating water.

Keywords: circulation cooling system, recirculation, circulating water, purge water, concentration, deposition.

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ENERGETICALLY POSSIBILITY OF GAS TURBINE POWER PLANT AIR-HEAT RECOVERY (p. 15-19)

Vyacheslav Koval, Yuri Anurov, Anatoly Vasiliev

A scheme for gas turbine power plant running on "dry" without the participation of the recycling cycle steam working fluid. The scheme includes a core gas turbine engine heat exchanger and a secondary air turbine unit that produces more usable power. The results of numerical investigation of the basic parameters of the workflow on the efficiency of the machine. On the example of the actual implementation of the project unit GTE-050M possibility of using it as part of the power plant. The advantages of the use of the unit for production of electricity and heat. Comparative economic assessment carried out for the two circuits of power plants with the same unit capacity of 45 MW , working on a simple thermodynamic cycle (GTE-45) and the GTE-050M , show that the price of natural gas is the fuel of $ 500 U.S. and the operating time 7500 hours of annual economic impact will be about $ 10 million.

Keywords: gas turbine engine, air turbine assembly, recycling, heat recovery, efficiency, power.

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MODEL AND METHOD FOR DETERMINING CONDITIONAL FORMULA OF HYDROCARBON FUEL DURING COMBUSTION (p. 20-27)

Maksim Maksimov, Alexander Brunetkin, Andrei Bondarenko

The method and the model are proposed, based on the equations of chemical equilibrium, partial pressures of the gases included in the products of combustion, Dalton's law, relationship of volume flow rates of fuel and oxidizer and the stoichiometric balance of the valences of oxidation-reduction cells for gaseous fuel. The numerical solution of nonlinear model was found using the Newton's method by expansion of the system equations in a Taylor series on degrees not higher than the first. The developed method allows determing the quantitative composition of fuel and its conditional formula, fuel enthalpy, composition of the products of combustion. The method is based on using the measured consumption rates of fuel components and corresponding temperature in the combustion chamber as the input data. The method and model allow obtaining accurate calculation results with the known elemental composition of fuel [C], [H], [O].

The accuracy of the mathematical model allows using the results obtained on its basis to assess the parametric sensitivity.

Keywords: hydrocarbon fuel, determination of conditional formula, products of combustion, mathematical model.

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INVESTIGATION OF OF EFFECTIVENESS OF CHME3 DIESEL LOCOMOTIVES, WORKS ON TWO-UNIT SYSTEM (p. 27-31)

Anatoliy Falendysh, Victoria Gatchenko

Diesel fuel savings during the operation of locomotive fleet is the most important question of the railway transport of Ukraine. Nowadays, the expenses for diesel fuel are one of the major expenses of locomotive industry of Ukrainian railways.

Shunting diesel locomotives ChME3 operating on a two-unit system perform pulling the trains to the departure yard, maneuvering, idling, overtaking by a reserve, rearrangement of cars because of the difference in the height of automatic coupling and others. For each of these elements diesel-generator set operates in a specific mode.

The main directions of improving the efficiency of electric power plants of shunting locomotives is reducing the idling time and time of transient processes.

Many papers and technical solutions were dedicated to the issue of idle reduction. The main solution of reducing the idling time of diesel-generator set is to exclude one of the diesels from the operation.

Disabling one diesel-generator set of shunting locomotives operating on the two-unit system is possible when maneuvering and idling. But frequent stops of diesels require the development of a

new system of their start, since the current system can not provide frequent starts because of the lack of time to recharge batteries. Besides, frequent use of batteries boosts the requirements for their operating condition, which would increase the expenses for their maintenance, replacement and repair.

Keywords: shunting diesel locomotive, two-unit system, diesel-generator set, fuel consumption.

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AERODYNAMIC DRAG OF STAGGERED BUNDLES OF HELICAL TUBES (p. 31-35)

Eugeniy Pis'mennyi, Sergiy Reva, Alexandr Terekh

The paper is devoted to the experimental studies of the aerodynamic drag of staggered bundles of helical tubes in order to create highly effective heat exchangers with reduced weight and size.

The researches of the aerodynamic drag of staggered bundles of helical tubes at their airflow were carried out on an experimental setup, which is an open-circuit wind tunnel of rectangular cross section and conducted by the method of physical modeling in an isothermal flow, using the data of the drainage selection of static pressures before and after the bundle.

The influence of geometric characteristics of helical tubes and parameters of their placement in the bundle on the aerodynamic drag is shown. The comparison of the aerodynamic drag of the bundles of helical and plain tubes of the same outside diameter depending on the incident velocity was conducted.

The research results can be used in developing recuperative heat exchangers having high heat-aerodynamic efficiency and applied in thermal power engineering, petrochemical industry, gas compressor units of the gas transportation system of Ukraine.

The obtained results can be the basis for aerodynamic calculations in the design of new heat exchangers of helical tubes.

Keywords: tube, bundle, uniform surface, aerodynamics, drag, comparison.

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INVESTIGATION OF DEHYDRATION OF MICROBIOLOGICAL MATERIALS IN A ROTARY FILM EVAPORATOR (p. 36-39)

Alexander Obodovich, Sergei Kostyk

The comparative analysis of existing methods of dehydration of thermosensitive materials was conducted, the main advantages and disadvantages were highlighted.

The energy-efficient device for concentration (dehydration) of thermolabile materials in anaerobic conditions was proposed.

The required quantity of heat, the amount of heat transfer agent and the minimum surface area of heat-mass exchange for the dehydration process in the rotary film evaporator were calculated.

The experimental study of the dehydration of solutions of methanogen, grown on the molasses and distillery stillage showed the possibility

of obtaining the concentrated solutions, and the possibility of their application at startings and failures in the reactor operation. The activity of the obtained concentrates of methanogens is 1-3×107 cells/l.

The possibility of using the rotary film evaporator for concentration of thermosensitive materials in anaerobic conditions was studied. The optimal technological and thermophysical parameters of the concentration (dehydration) process were experimentally determined.

Keywords: rotary film evaporator, dehydration, biogas technologies, thermolabile materials

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SYSTEMATIC APPROACH TO SOLVING SCIENTIFIC PROBLEMS OF CREATING THERMOVACUUM PROCESSES OF DRYING HETEROGENEOUS MATERIALS (p. 40-44)

Vladimir Kutovoy

One of the promising directions of modern approach to the efficient use of natural and energy resources is the realization of the concept on the intensification of heat transfer processes during the removal of moisture from heterogeneous materials. One of the ways to solve the problem within the limited energy resources at this stage of development of industrial production is wider use of electrical energy in heat-technological processes. Thus, the development of new methods of drying and designs of thermal-technological installations is required.

The researches of heat and mass transfer processes, which allow accelerating the process of moisture removal from heterogeneous materials, depending on the operating parameters of thermal-vacuum drying installations are conducted in the paper. It is shown that the most effective way of dehydration of materials is the thermal-vacuum process that emphasizes the prospects of this direction.

Keywords: thermal-vacuum drying installation, heterogeneous materials, heat and mass transfer processes, energy saving.

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INFLUENCE OF GEOMETRICAL SIZES OF VORTEX DEVICE ON ITS AERODYNAMIC DRAG (p. 45-48)

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The paper deals with the modeling of vortex device with a minimum drag coefficient on a cold flow. The traditional method of intumescence of siliceous materials involves fast heating of raw particles in drum-type furnaces at temperatures of 800-1000 °C. It is very energy-intensive compared to the method of intumescence in the vortex device at the temperature up to 300 °C. The results of the calculation of aerodynamic drag of such cyclone are given in the paper. In order to determine the overall aerodynamic drag, pressure losses at all zones for the flow core are summarized, and wall, bottom and lid friction losses are taken into account. Mathematical modeling of 16 vortex devices which have different geometrical sizes was conducted. This allowed to find optimum ratios of the geometrical sizes of the device. The drag increases with the diameter of the inlet nozzles. The obtained calculation data coincide with of the calculation data of Ustimenko who investigated the change of distribution of velocities and pressure of vortex chambers taking into account a supply of thermal energy.

Dependencies of the coefficient of aerodynamic drag of the vortex device on geometrical and aerodynamic parameters are specified. The obtained results can be used for optimization of a design of the vortex device, including in the production dealing with the intumescence of porous disperse particles in the heated flow.

Keywords: aerodynamic drag, vortex device, optimal geometrical sizes.

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