

MECHANICS

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Study of influence of fluid compressibility on dynamics of flow divider

The dynamic processes of the working fluid flow divider of hydraulic systems and hydraulic automation are considered. The design of the divider is original and protected by a patent and differs from traditional dividers by the presence of a regulatory body made of elastomer, which significantly simplifies the design of the divider reducing its cost and sensitivity to contamination of the working fluid by wear particles of hydraulic control devices. The regulatory body of elastomer allows you to combine the functions of regulating the parameters of operating modes and sealing the working cavities of the dividers.

The presented results of the study of the influence of dynamic processes in the flow divider and compressibility of the working fluid on the accuracy of dividing the fluid flows define the criteria for these processes allowing a more rational development of the design of these regulators in accordance with the requirements in the hydraulic systems.

Keywords: flow divider, compressibility of the working fluid, flow and pressure of the working fluid of hydraulic systems.

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Contact pressure with guaranteed tight in coupling of bushing and long shaft

The article describes an analytical method for determining the average value of contact pressure in pressure coupling taking into account the geometric features of the parts to be connected by fitting. The calculated dependencies given in the publication are obtained by the author under the condition of uniform radial displacement of the mating surface of the male part calculated using the Lamé formulas.

The method is simple, clear, provides sufficient accuracy for engineering calculations. It can be used both in the design of smooth cylindrical joints with tension, and joints modified by shallow grooves.

Keywords: connection with tension, contact pressure, deformation.

POWER AND CHEMICAL ENGINEERING

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The analysis of temperature regime of low-speed stage with change in ratio of time and return stroke of piston

The paper presents theoretical studies on the control of a linear hydraulic drive by changing the ratio of compression time (forward stroke) and suction time (return stroke). The effect of the operating mode of the drive on the efficiency of the working cycle is estimated.

Keywords: linear drive, the law of motion, low-speed long stroke piston compressor, forward and reverse stroke workflow, adjustable drive.

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To the question of refrigerants application efficiency

The improvement of the refrigeration machine efficiency is an ever-relevant issue. Improvement of compressors, intensification of devices, as well as application of effective working substances and new materials can be attributed to the main directions of its solution. Currently, an increase of the cost of both materials and energy can be stated. In this regard, the modernization of the existing types of heat exchangers as well as the search of the most effective working substances may turn to be the most promising ways to intensify the devices. This problem is reflected in the study of the refrigeration machine with a piston compressor operating at different modes. R717, R32 and R410a are selected as working substances. In the course of research the characteristics have been received which are used as the basis for the given recommendations on the most effective application of the studied working substances.

Keywords: refrigeration machine, characteristics, cooling capacity, evaporator, refrigerant, ammonia.

AVIATION AND ROCKET-SPACE ENGINEERING

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Dilatometric Microdrive of small spacecraft with resonant microwave accelerator

The article contains the research of the authors in the field of jet propulsion systems with low energy consumption of small spacecraft (SSC) of nanosatellite class. The paper presents the concept of a Microdrive combining thermogasdynamic and electrodynamic methods of creating a jet thrust. We are talking about the propulsion system with resonance accelerating system, pre-heated and ionized working fluid. A toroidal volume resonator excited by a low-power solid-state microwave oscillator is considered as an accelerator.

The work has experimental and theoretical components. The experimental part is devoted to the development of a method for transmitting microwave energy to a volume resonator from an oscillator. The theoretical part includes the calculation of the accelerating gap, the dimensions of the toroidal resonator, the estimation of the working fluid velocity after preheating and acceleration.

This work is a continuation of works on creation of methodological bases for design correction engine micro thrust μ a with microwave acceleration of the working body.

Keywords: small spacecraft, nitrogen, traction, a resonant cavity, microwave, plasma, the gas passage.

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Features of test of air-fuel system of gas turbine engine

The article is devoted to the problem of ensuring the operability of rotary bearings of a gas turbine engine (GTE) with an air-fuel lubrication system. The relevance of the article is due to the unexplored processes occurring in the supports of the rotors of a GTE, in which the lubrication and cooling of the bearings is carried out by an air-fuel mixture. This makes it much more difficult to select the optimal parameters of the air-fuel mixture and the operating modes of the engine, ensuring the operability of its rotary bearings with the least loss of fuel and air pressure behind the compressor, which can lead to a significant deterioration of the main parameters of the GTE. The solution to this problem requires bench tests of the air-fuel lubrication system of the GTE under different operating conditions.

The purpose of this work is to develop a schematic diagram of the unit, which allows testing the GTE rotary bearings lubricated with an air-fuel mixture under different operating conditions (operating modes, parameters of an air-fuel mixture).

The paper identifies the parameters that affect the operability of lubricated with air-fuel mixture bearings, a universal scheme of unit for autonomous test of an air-fuel lubrication system GTE is proposed. The use of the data obtained from the results of these tests in the design of a promising gas turbine engine with an air-fuel lubrication system will be possible to select the optimal parameters of the air-fuel mixture and the operating modes of the developed engine, which will increase its reliability, efficiency and resource.

Keywords: Gas turbine engine, air-fuel mixture, lubrication system, bearing.