OMSK SCIENTIFIC BULLETIN. Series «AVIATION-ROCKET AND POWER ENGINEERING». 2019. Vol. 3, no. 1
SUMMARY and KEYWORDS

MECHANICS

P. D. Balakin
Hybrid power plant transport vehicles

The analysis of energy and technical capabilities of the hybrid power plant combinations on the example of a transport vehicle. The perspectivity of a combination of an internal combustion engine and an inertial battery, performed by a super-flywheel, is shown. An engineering calculation of the parameters of the super flywheel and the dynamics of the flywheel drive is given.

Keywords: hybrid power plant, energy battery, super flywheel.

Yu. A. Burian, G. S. Russkikh
On question of determining characteristics of porous rubber for wave sound proofing

To determine the characteristics of a distributed waveguide damper of hydrodynamic noise, it is necessary to know the magnitude of the modulus of the bulk elasticity of a material made of porous rubber with a filler in the form of metal balls filling the space between the pliable rubber wall and the rigid body.
The paper considers a computational-experimental method for determining the bulk modulus of such a material.
For cylindrical samples, the porosity of which was obtained by foaming in the process of vulcanization or cutting of cavities in the rubber massif, the porosity is experimentally determined; the relations of the force and volume change on the displacement are plotted.
Using the experimental values of the Young's modulus and Poisson's coefficients for an elastic medium, the magnitude of the bulk modulus of the sample are determined.

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

V. S. Korneyev, V. V. Shalay
Mathematical model of the rubber-cord shell of rotation for pneumatic dampers

The review of the fundamental scientific works on the mechanics of pneumatic tires is given.
A mathematical model is proposed for a rubber-cord shell, taking into account the tensile properties of the cord threads and the elastic resistance of the rubber matrix without limiting the magnitude of the deformations, which differs from the mathematical model of the moment-free theory of mesh shells used in pneumatic tires mechanics. The applied loads are assumed to be static and axisymmetric. Equilibrium equations are compiled in the form that excludes the emergence of a singularity at special points and does not require special techniques and tools for integration. To construct the constitutive relations reflecting the structural heterogeneity of the material and described by smooth functions of spatial coordinates, the principle of virtual displacements is used. The order of solving the equations of the mathematical model is indicated.
A critical analysis of the known variants of the theoretical description of the initial geometry of the rubber-cord shell after its manufacture is given. A modified method is proposed, based on the consideration of the process of deformation of the representative element of the workpiece and generally accepted assumptions. The redundancy and inadmissibility of the assumption of the

constancy of the pitch between the cords or the assumption of the constancy of the area of the elementary rhombic cell of the workpiece are indicated.
The developed mathematical model is designed to design air springs with optimal performance.

Keywords: pneumatic tire mechanics, air springs, rubber-cord shell, mathematical model, calculation method.

POWER AND CHEMICAL ENGINEERING

V. L. Yusha, S. S. Busarov, A. V. Nedovenchany, I. S. Busarov, R. E. Kobylskiy, D. S. Titov
Service life of low-speed long-running stages of compressor units and possible ways of its increase

The paper presents theoretical studies to increase the service life of piston seals made on the basis of fluoroplastic by changing the speed of movement of the piston and, accordingly, a more efficient cooling mode. A design with two oppositely moving pistons is proposed, which allows to increase the service life of low-speed long stroke stages.

Keywords: low-speed piston unit, lip seal, feature of the piston compressor, increase in service life in a friction pair.

S. S. Busarov, I. S. Busarov, D. S. Titov
Experimental determination of conditional clearances for cylinder piston seals of compressor units

The current problem of determining the dependence of the conditional clearance in the cylinder-piston seal on the operating pressure at a fixed piston is solved by the authors in this paper. The experimental studies have allowed to obtain the dependence of the conditional clearances on the pressure in the cylinder-piston seal of slow-speed long-stroke units with static purge. The data obtained made it possible to determine the best seal for piston low-speed long-stroke units. In the future, the results of research will allow to modernize the existing method of calculation of working processes of low-speed long-stroke units.

Keywords: long-stroke piston compressor, static purge, conditional clearance.

G. I. Chernov, V. L. Yusha, A. M. Kalashnikov
Parametric analysis efficiency screen-vacuum thermal insulation of regenerative heat exchanger heat loss recovery system mobile compressor plant

In this work, a study is conducted of the effectiveness of the screen-vacuum thermal insulation of the heat exchanger of the heat loss recovery system of a mobile compressor unit using the method of its calculation developed on the basis of the Ansys package (Fluid Flow — Fluent). According to the results of the numerical analysis of working processes in the flow part of the shell-and-tube recuperative heat exchanger, the interrelation between the parameters of thermal insulation and the characteristics of the heat exchanger has been established.

Keywords: heat exchanger, recovery, thermal efficiency, heat loss, screen-vacuum insulation.

V. I. Karagusov, I. S. Kolpakov
The impact of weather factors on operation of radiation heating system

Solar energy refers to clean and renewable energy sources. The operation of radiation heating systems does not require significant costs. The work of radiation panels is affected by a number of weather factors such as cloudiness, temperature and humidity of atmospheric air, precipitation, fog, season of year and day, sun position angles and inclination angles of solar panels. With an insolation area of a solar collector of 0.02 m^2, it is capable to produce about 1...2 W (50...100 W/m^2) in winter and 5...8 W (250...400 W/ m^2) in summer. With a living area of small farmhouse of 60 m^2, the area of the southern slope of the roof is 50...70 m^2, which makes it possible to get 2,5...7 kW of power for premises heating. With traditional thermal insulation, such power is enough for heating under light frost (up to –20°C), with stronger frosts, additional electric, stove or boiler heating is necessary.

Keywords: solar radiation, radiation life support systems, heat insulation, heating, renewable energy sources.

AVIATION AND ROCKET-SPACE ENGINEERING

V. V. Shalay, K. V. Shcherban
Design of modernized test bench for analysis of cooling systems with intensification under inertial forces field

The article discusses the design of a modernized test bench for the study of cooling systems with intensification of inertial forces in the field. This bench will allow investigation the efficiency of heating the hydrocarbon coolant in the field of inertial forces and verification of the calculation results obtained in ANSYS environment.

Keywords: liquid rocket engines, turbulization, heat transfer, cooling system, heat exchange, test bench.