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

MECHANICS

V. S. Korneyev, S. A. Korneyev, V. V. Shalay, M. I. Tribelskiy

Analytical method for calculating stress-strain state of rubber cord pipes with axial displacement of flanges

To determine the performance characteristics of rubber-cord pipes under the influence of internal overpressure taking into account the relative displacement of the ends (flanges), an unconventional method of approximate analytical solution and the subsequent increase in the accuracy of calculating the stress-strain state of rubber-cord shells with tensile cord casing is used. The fundamental difference between the force created by the rubber cord pipe and the spacer force is taken into consideration.
The calculation is compared with the results of experiments on fracture, the calculated value of the excess fracture pressure fits into the confidence interval of the spread of experimental data. Examples of constructing isobar power characteristics of sleeve-type pneumatic shock absorbers (sleeve tensilecompression shock absorbers) are shown and the features of their behavior are analyzed at different values of the operating and design parameters of the rubber cord pipe.
The results are intended for engineering calculations and the optimal design of rubber cord pipes used to connect pipelines, or as air shock absorbers to protect technical objects from vibration and shock.

Keywords: rubber cord pipe, linearized mathematical model, analytical solution, method for increasing the accuracy of calculations.

POWER AND CHEMICAL ENGINEERING

V. I. Karagusov, V. A. Nemykin

Thermal performance of radiation heater in summer period

One of main advantages of radiation life support systems is the use of renewable energy sources and ecological warmth. The promising areas of such life-support systems include radiation solar heaters, which have several advantages. The use of radiation heating systems in the offseason allows you to completely abandon the use of organic fuels or electricity and in cold season allows significant savings on heating buildings. Experimental and computational studies performed allow us to predict the thermal performance produced by the life support radiation system. Calculations made using experimental data showed that the heat generated by the solar radiation heating of water or non-freezing liquid in summer is sufficient for hot water supply around the clock, as well as for heating water and providing comfortable conditions in the rooms at night and in cold weather conditions.

Keywords: life support system, radiation heater, solar radiation, heat flux, renewable energy sources, thermal performance, insolation.

A. A. Dzino, O. S. Malinina
Estimation of the influence of heating source temperature on energy efficiency of single-stage absorption thermal transformer cycles

The effect of the heating source temperature on the energy efficiency of actual single-stage cycles of an Absorption Bromine Lithium Refrigeration Machine (ABLRM), an Absorption Bromine Lithium Step Down Thermal Transformer (ABLSDTT) and an Absorption Bromine Lithium Step Up Thermal Transformer (ABLSUTT) depending on the magnitude of the degree of internal heat recovery are analyzed in this article. Thermodynamic cycles with full heat recovery on the cold (for ABLRM and ABLSDTT) and warm (for ABLSUTT) sides of the regenerative heat exchanger of solutions in the absence of regenerative heat exchanger and cycles with a finite temperature difference between weak and strong solutions are considered.

Keywords: absorption refrigerating machine, absorption thermal transformer, degree of internal heat refrigeration, energy efficiency coefficients of cycles, heating source temperature, heat transformation.

A. S. Pugachuk, D. V. Muller, A. V. Chernyshev
Designing blade wheels for microturbine plants based on prototypes

One of the main microturbine plant elements is a turbine impeller. Development of effective turbines demands considerable costs, that is why the method of turbine design based on existing prototypes is offered. Microturbines have a high-speed rotor. Therefore, there is a problem related to strength ensuring of the turbine at high speeds of rotation. In this article it is said about gasdynamic and strength optimization of turbine impellers. The offered method allows to reduce stresses in a turbine impeller during an operating mode without changing of useful gasdynamic characteristics. Several modifications of blade and wheel joint are considered in this research and also strength analysis is presented. Verification of method of turbine design is carried out. It based on the strength and gasdynamic analysis of working processes in a flow channel of the microturbine.

Keywords: microturbine, turbine wheel, strength, gas-dynamic calculation, stress reduction method, blade.

S. V. Goryunov, D. A. Morozov, O. V. Belova, E. V. Krestovskikh, D. A. Kalinkin, K. A. Kolesov
Design of compressor unit based on wave compressor with magnetoelectric drive for extraction of hydrocarbons in Arctic shelf

For the use in such extreme working conditions as underwater offshore production on the Arctic shelf, the use of fundamentally new types of compressor units is required. The efficiency criteria for the Arctic gas-producing complexes are satisfied by a compressor based on the gas-dynamic vibration scheme, the principle of kinetic compression and volumetric gas injection during oscillatory movement of the piston-nozzle in the sound frequency range. The advantage of the compressor is the complete absence of mechanical friction of the structural elements. The paper considers a multi-stage scheme of a wave compressor with a magnetoelectric drive for the extraction of hydrocarbon raw materials and a calculation analysis of the latter's performance based on the calculation of a magnetoelectric compressor kinetic compression and volumetric injection as an analogue of a wave compressor.

Keywords: underwater oil and gas production, arctic shelf, wave compressor, compressor-pumping unit, linear drive.

M. V. Sinkevich, Yu. A. Borisov, A. A. Kosoi, E. R. Ramazanov, O. S. Popel
Analysis of working conditions of recuperative and heat recovery systems of compressor-less CCGT (Combined Cycle Gas Turbine)

A variant developed by the authors of the implementation of the oxygen-fuel cycles-compressorless combined-cycle plants in comparison with combined-cycle power plants is considered. The analysis of the working conditions of heat exchangers of a compressor-less combined cycle gas turbine (CCGT) is carried out. The proposed solution ensures efficient recovery and utilization of the heat of the exhaust working fluid, which ensures the fuel efficiency of the installation as a whole. Process heat utilization in these devices allows you to fully take advantage of the direct-contact heat exchangers. The proposed fundamental solution of the organization of the process of heat and mass transfer of the compressorless CCGT allows increasing the fuel utilization factor and reducing the amount of harmful emissions into the atmosphere.

Keywords: direct-contact heat exchangers, heat recovery, combined cycle gas turbine (CCGT), clean energy production, carbon dioxide.

AVIATION AND ROCKET-SPACE ENGINEERING

V. V. Shalay, K. V. Shcherban
Experimental study of cooling systems with intensification in field of inertial forces

The article discusses the results of an experimental study of cooling systems with intensification of inertial forces in a field, obtained on a modernized experimental bench. This stand made it possible to study the efficiency of heating the components of liquid fuel of a hydrocarbon coolant in the field of inertial forces and verify the results obtained in ANSYS.

Keywords: liquid rocket engines, turbulization, heat transfer, cooling system, heat exchange, experimental stand.