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SUMMARY and KEYWORDS

MECHANICS

Yu. A. Burian, M. V. Silkov
Vibro-isolation suspension with quasi-zero stiffness for vibroactive equipment

The work is devoted to the theory of vibration isolation of vibroactive objects, for example: engines, generators, pumps, compressors, fans, pipelines etc. A new design of vibration isolation suspension with quasi-zero stiffness is proposed, its mathematical model is obtained, which allows choosing its main parameters. Computer calculations have been performed that show that a significant shift in the natural frequency of the suspension towards low frequencies in comparison with relying only on coil springs with the same static load allows reducing the coefficient of transmission of force to the base at operating frequencies. The latter makes it possible to improve the vibration isolation of various technological objects.

Keywords: vibration isolation support, quasi-zero stiffness, mathematical model of elastic suspension, the coefficient of force transfer to the base.

Yu. V. Nemirovskiy, D. V. Mokhovnev
Stability of hybrid composite rod to high temperatures

The problem of stability of a rod made of two materials under temperature and force loading beyond the limits of elasticity is posed. The deformation law of materials is approximated by a cubic polynomial over the entire deformation diagram, which greatly simplifies the formulation of the stability problem. The influence of temperature on the deformation law is taken into account. The process of loss of stability is considered in the framework of the concept of continuous loading by F. R. Shanley. The stability problem is reduced to solving a linear homogeneous differential equation with linear homogeneous boundary conditions. Examples of the calculation of the critical parameters of thermal and force loading are given.

Keywords: stability of rods, plasticity, composite structures, temperature loading.

POWER AND CHEMICAL ENGINEERING

A. A. Kotlov, A. B. Burakov
Comparative analysis of single-stage reciprocating compressor compressing different gases

Ensuring the efficient and reliable operation of reciprocating compressors is an important issue. The quality of the designed equipment is determined by the level of knowledge of the object and the perfection of methods for calculating its state. The article presents the experience of JSC «Compressor» Saint Petersburg in the creation of advanced compressor equipment. Problems of mathematical modeling, calculation, research of a reciprocating compressor with consideration of real gas properties and actual operating conditions are considered using the example of a single-stage piston compressor. A brief description of the mathematical model and engineering program for calculating and selecting rational valve parameters is given. The results of comparing the results of mathematical modeling with the results of experimental studies are obtained.

Keywords: reciprocating compressor, real gas, methane, mathematical model, valve.

A. S. Pugachuk, O. A. Vorozheeva, A. V. Chernyshev
The analysis of working medium flow through flow cavity elements of pneumatic-hydraulic systems

The article discusses the issues of modeling the flow of working medium in the working cavity of ball valves with various types of designs of locking elements: with turned and stamped ball. Special attention is paid to obtaining the characteristics of hydraulic resistance depending on the angle of rotation of the regulating element. Mathematical modeling of the gas flow process in the considered types of ball valves is carried out, pressures and velocities in the working cavity of ball valves are determined. The analysis of the obtained data made it possible to estimate the error of the computational method based on a comparison with the published experimental data. Recommendations on the use of ball valves with turned and extruded ball are given.

Keywords: ball valves, milled ball, welded ball, mathematical modeling, flow of the working fluid, angle of ball rotation, hydraulic resistance.

M. D. Vulf, P. A. Rogov, O. V. Belova, S. V. Goryunov, D. A. Kalinkin
Technique for finding design solution for piston compressor with direct gas piston drive under conditions of depletion of the gas reservoir

The article discusses approaches for calculation of a piston compressor unit with a direct gas piston drive for the compression of natural gas during long-term production in a depleted gas formation. This task is relevant for gas companies from the standpoint of reducing the cost of gas production. The application of the proposed method allows reducing the final cost of products, which increases the overall profitability of the business.

Keywords: booster compressor station, piston compressor, gas reservoir depletion, calculation technique.

AVIATION AND ROCKET-SPACE ENGINEERING

V. I. Trushlyakov, I. Yu. Lesnyak, V. A. Urbansky
To selection problem of design characteristics of experimental stand

The analysis is done on the state of experimental studies of liquid evaporation in a closed tank in Russia and abroad. On the basis of the theory of similarity including geometric similarity, Reynolds, Nusselt, Prandtl criteria, as well as the real conditions of the evaporation system, the design parameters of the experimental stand (ES) are determined. Using the ANSYS Fluent software package the ES design parameters are refined on the basis of modeling the liquid evaporation process in closed tank. The structure and the scheme of functioning of ES is developed.

Keywords: evaporation, similarity criteria, liquid fuel residues, heat and mass transfer, heat carrier, experimental stand.