Abstracts

Troshchenko V. T. and Khamaza L. A. **Fatigue and Cyclic Inelasticity of Austenitic Steel upon Long-Term Operation under Various Loading Conditions** // Problems of Strength. – 2012. – No. 5. – P. 5–15.

The paper presents the results of study of fatigue and inelasticity of 08Kh18N12T austenitic steel under single- and two-frequency loading prior to and after operation for 100,000 h as a material of WWER-440 reactor coolant piping. The results obtained are discussed.

Lobanov L. M., *Pashchin N. A.*, *and Mikhodui O. L.* **Influence of Loading Conditions on Strain Resistance of AMg6 Alloy After Electrodynamic Treatment** // Problems of Strength. – 2012. – No. 5. – P. 15–26.

We have studied the electrodynamic treatment influence on strain resistance reduction and the Portevin–Le Chatelier effect for various tensile loading conditions of investigated specimens. The impact of electrodynamic treatment on the yield stress and the ultimate stress of AMg6 alloy is demonstrated.

Shlyannikov V. N. **Solution of Low-Cycle Fatigue and Fracture Problems under Complex Stress State on Base of Modern Strength Theories** // Problems of Strength. – 2012. – No. 5. – P. 27–44.

On the base the Pisarenko–Lebedev limiting state theory limiting strains equations for biaxial both static and low-cycle loading conditions are obtained and given their experimental background. The both numerical and experimental results for applying the generalized equivalent stress condition for solution of fracture mechanics problems under complex stress state are presented. The models and methods of crack growth direction, crack paths, crack growth rate and fatigue life under mixed modes static and cyclic fracture are considered.

Krivenyuk V. V., *Uskov E. I.*, *Avramenko D. S.*, *Sadovskii Yu. Yu.*, *and Prikhod'ko R. P.* **Preparation of the Data on High-Temperature Creep at Formation of the Standard Documentation for Metal-Intensive Power-Generating Equipment** // Problems of Strength. – 2012. – No. 5. – P. 45–55.

We substantiate that at formation of the standard documentation, the characteristics of high-temperature creep of metals and alloys are defined on the basis of the system analysis of the most representative known experimental data about regularity of plastic straining at static tension and creep and the data on long-term strength. Their definitive refinement should be made on the basis of the account of the respective results of field inspection.

Romashchenko V. A., *Babich Yu. N.*, *and Bakhtina E. V.* **Strength Estimation of Composite and Metal-Composite Cylinders under Pulsed Loading. Part 2. A Numerical Estimation of Strength of Multilayered Cylinders of Final Length Subjected to Internal Explosion** // Problems of Strength. – 2012. – No. 5. – P. 56–68.

Using the method of numerical experiment, we have solved a problem of optimization of three-layered metal-composite cylinder of final length loaded by axisymmetric internal explosion, by way of finding the best combination between thickness of layers and the reinforcement scheme of its anisotropic composit part based on the condition of the maximum safety factor by the Tsai–Wu criterion for fixed overall dimensions of the cylinder and specific mass of a charge. Usage of elastoplastic isotropic steel 20 in the capacity of an inside layer ensures significant strength increase, in particular, at the expense of a plastic flow of metal in metal-composite cylinder, in comparison with a pure composite. Usage of high-strength steels with high yield stress is undesirable. Application of fully metal shells is not rational from standpoint of material intensity – they are too heavy.

Kharchenko V. K. and Bukhanovskii V. V. **High-Temperature Strength of Refractory Metals, Alloys and Composite Materials on Their Basis. Part 1. Tungsten, Its Alloys and Composites** // Problems of Strength. – 2012. – No. 5. – P. 69–75.

Results of studies of mechanical characteristics of tungsten, alloys and composite materials on its basis used in space-rocket technics are generalized. The research has been conducted under the conditions of short-term, long-term static and low-cycle loading for small test time bases over the range temperatures 290–3020 K.

Stepanov G. V. **Assessment of *J*-Integral near the Tip of a Circumferential Edge Crack in a Thick-Walled Pipe on Rapid Cooling of Its Inner Surface** // Problems of Strength. – 2012. – No. 5. – P. 76–84.

The brittle fracture resistance of a pipe with the circumferential edge crack on thermal shock is determined by a maximum *J*-integral value at the stage of plastic strain development near the crack tip. In an elastoplastic metal, the value of *J*-integral on thermal shock reaches its maximum with an increase in strain energy near the crack tip.

Pelykh V. N., *Pogrebnyak A. D.*, *Regul'skii M. N.*, *and Romanova N. V.* **Method of Determination of the Fatigue Limit of Structural Materials at High-Cycle Asymmetrical Loading Using the Equivalent Stresses** // Problems of Strength. – 2012. – No. 5. – P. 85–97.

The problem of definition of a fatigue limit of metal structural materials is solved at an asymmetrical cyclic loading in a wide range of change static cycle components. Fatigue limit calculations are based on use of models of the limiting condition, allowing to present diagrammes of limiting ranges of stress at the restricted volume of the base experiment necessary for identification of parametres of models.

Giginyak F. F. and Bulakh P. A. **Life Prediction for 10GN2MFA Heat-Resistant Steel with Account for Damageability of the Metal in Pulsating Tension under Conditions of a Complex Stress State** // Problems of Strength. – 2012. – No. 5. – P. 98–104.

Based on the results of the investigations performed, a calculation-and-experimental method is proposed for assessing the life of structural materials under cyclic loading at a complex stress state taking into account the metal damage.

Jiang X.-J., *Zhang Y.-Y.*, *and Yuan S.-X.* **Analysis of the Contact Stresses in Curvic Couplings of Gas Turbine in a Blade-Off Event** // Problems of Strength. – 2012. – No. 5. – P. 105–119.

The contact pressure distribution of the curvic couplings in a heavy duty gas turbine under a blade-off load condition is investigated in a three-dimensional finite element model. Several blade-off positions on each stage disc may develop the different characters on the contact pressure distributions of the curvic couplings during the application of a blade-off load. Both the position and magnitude of the applied blade-off load and the distribution of the spindle bolts have an effect on the contact pressure distribution of the curvic couplings. Further the contact stress on the left and right sides of the teeth develops different characters during the application of torque load following not only a normal centrifugal load but also a blade-off load which produces an unbalanced equivalent bending force. Furthermore the stiffness of the connection body part of the rotor between the compressor end and the turbine end associated with its section thickness is crucial in deciding the contact stress distribution on the curvic couplings. This analysis shows a change in the magnitude of contact stress of each set of the curvic couplings.

Zubov V. I., *Olisov A. N.*, *Stepanov G. V.*, *Chausov N. G.*, *and Shirokov A. V.* **Effect of D16T Alloy Grain Sizes on Its Deformation Inhomogeneity under Static and Dynamic Loading** // Problems of Strength. – 2012. – No. 5. – P. 120–1126.

The effect of grain sizes on the strain homogeneity of a D16T sheet aluminum alloy in static and dynamic tension was studied. An increase in grain sizes is established to result in a significant growth of deformation inhomogeneity. This enhances the fracture of coarse-grained aluminum alloy specimens and contributes to localized strains arising outside the fracture zone. The effect of grain sizes on residual strain levels is shown to decrease with a loading rate, especially in the fracture zone.

Gotsulyak E. O., *Luk'yanchenko O. O.*, *Kostina O. V.*, *and Garan I. G.* **Stability of Supported Cylindrical Shell with Geometric Imperfections under Combined Loading** // Problems of Strength. – 2012. – No. 5. – P. 127– 134.

A numerical method for investigating stability of the supported cylindrical shell with account for geometric imperfection in the form of its deformation during in-service loading has been developed. The problem of nonlinear stability of the imperfect supported cylindrical shell under combined loading has been solved. The influence of the imperfection amplitude on the critical combination of loads and stability region of the supported shell has been evaluated.

Orynyak I. V., *Vlasenko N. I.*, *Kozlov V. Ya.*, *Andrieshin Ya. A.*, *Chechin E. V.*, *Buiskikh K. P.*,

Ageev S. M., *and Yanko O. A*. **Test Results for Edge-Notched Pipe Specimens within Framework of the Experimental Substantiation of the "Leak before Break" Phenomenon** // Problems of Strength. – 2012. – No. 5. – P. 135–149.

The experimental equipment has been upgraded and requirements to geometrical sizes of side notches of pipe specimens are formulated. A series of tests until fracture have been performed for static loading by internal pressure and bending moment of straight pipe specimens having longitudinal and transverse superficial insections, as well as for a pipe bend with longitudinal superficial insection. Experimental data are compared with the theoretical calculation results. The conditional boundary line between "leak" and "break" has been theoretically predicted and experimentally verified for internal pressure loading of a straight pipe with a longitudinal surface defect.

Mutas V. V., *Netrebskii M. A.*, *and Rabkina M. D.* **Analysis of Strength Estimation Methods for Cylindrical Structures with Local Surface Defects Operating under Internal Pressure Loading Conditions** // Problems of Strength. – 2012. – No. 5. – P. 150–156.

Various approaches to strength estimation of cylindrical structures operating under conditions of loading by internal pressure, axial and bending stresses. Presence of certain types and dimensions of defects in walls of cylindrical structures loaded by internal pressure, does not reduce their static strength. The key parameters controlling the structural strength are the defect length along the axis, depth of wall necking and the material plasticity.