

**Power Engineering**

- Skliarov V. P., Orlovsky V. P. and Dvornikov A. A.** Experimental research of thermal variations at sudden expansion of supersonic steam flow.....3  
*Temperature effects evolving at discharge of supersonic steam flow into exhaust nozzle of large section are described. It is stated that in exhaust nozzle can evolve both local supercooling and local overheating of steam during which temperature exceeds temperature before nozzle in 5–10 °C. Hypothesis is offered explaining this unusual phenomenon.*

- Levchenko Ye. V., Subotovich V. P., Yudin A. Yu. and Boiarshynov A. Yu.** Rotor blades efficiency increase at the last stage of steam turbines.....10  
*The results of the comparative researches of given and new profiles are offered. The new profile is received on the basis of inverse problem solving which allows to get aerodynamic loss minimization and necessary index of rotor blade's resistance in the zone with serving wires. The results are examined from the gas dynamics improvement of this zone of rotor blade in the area of transonic velocities point of view. It is shown that in this area new profile has a noticeably smaller loss profile coefficient than the given one which is used in real blade.*

**Aero- and Hydromechanics in Power Machines**

- Yershov S. V., Polivanov P. A., Sidorenko A. A. and Derevyanko A. I.** Numerical solution of the shock wave / turbulent boundary layer interaction problem.....16  
*The problem of shock wave / turbulent boundary layer interaction is considered. Numerical simulation is performed with numerical integration of the RANS equations and the two-equation turbulence model  $k-\omega$  SST. The numerical results obtained with modified solver FlowER-Y are compared with experimental data. The special attention is paid to the uncertainties and the troubles attached to considered problem.*

**Dynamics and Strength of Machines**

- Popov G. Ya. and Fesenco A. A.** About a new solving method of the space problem for the elastic layer .....24  
*The exact solution of the elasticity mixed problem for the space layer in the case of presence an arbitrary orientation concentrated force inside the layer was constructed, when stresses were set on the side and another one is fixed. As distinguished from traditional solving approaches to this problem based on Papkovich–Neuber and Trefftz methods which reduce Lamé equations to harmonic equations with indivisible boundary conditions what makes solving technique difficult. New method was used here, based on reducing Lamé equations to an independently solved one and two combined solved equations. Boundary conditions divide too. These two equations were reduced to the vector one-dimensional boundary problem by the method of integral transformations.*

- Govorukha V. B.** The strip dielectric breakdown model at the crack tip in a piezoelectric material .....31  
*The strip dielectric breakdown model is applied to the fracture prediction of piezoelectric materials containing electrically impermeable crack. It is assumed that the electric pre-fracture zone is localized on a line segment in front of the crack tip and the electric potential jump only arises in the strip. The exact analytical solution of the problem is found. An equation for the electric pre-fracture zone length determination and the stress intensity factor are derived from this solution. The influence of the applied electric field upon the fracture parameters are investigated.*

- Kurpa L. V. and Osetrov A. A.** Bending problem of multilayered shallow shells solution by RFM and spline-approximation..... 38

*Analysis of existing methods for investigation of stressed-strained state of multilayered shallow shells with complex planform, taking shift deformations in account, is carried out. Conclusion is made that there is a necessity of development of effective and universal methods to solve the stated problem. A numerically-analytical method, based on R-functions theory and variational Ritz method is proposed. The key difference of developed approach is usage of splines to approximate undefined components of solution structures. The proposed approach is performed in a form of programming complex using analytical package MAPLE. Using developed program package problems of bending of multilayered shells of convex planform with different boundary conditions are solved. results are combined with analogical using polynomial approximation. For shells with rectangular planform comparison with known results is presented.*

- Pantelyat M. G., Saphonov A. N., Rudenko E. K. and Shulzhenko N. G.** Mathematical modelling of transient electromagnetic fields in synchronous turbogenerator rotor fragments ..... 51

*A finite element technique for transient electromagnetic fields analysis in 3D formulation is described. Numerical investigation is carried out and peculiarities of the electromagnetic field, eddy current density and losses in turbogenerator rotor wedges joints are determined.*

#### Materials Science in Mechanical Engineering

- Pokhmursky V. I., Matsevyt V. M., Kalakhan O. S., Kazak I. B., Vakulenko K. V. and Liashok S. V.** Developing and investigating coating for protection from fretting-corrosion ..... 61

*Coatings with low adhesive activity for protection of steel and titanic parts from fretting-corrosion have been developed. It is set, that multi-layer vacuum-plasma coating is the most effective  $\{Cr+(TiCr)N\} \times 10$ , applying which provides increasing durability of a fatigue model in 20,30 folds at stress amplitude 200 MPa, in case of interaction of titanic counterbodies when coating is gummed only on a fatigue model, and also increasing durability of a fatigue model in 5,43 folds at stress amplitude 150 MPa, in case of steel parts' interaction when coating is gummed on two models – fatigue and hold-down ones.*

#### High Technologies in Mechanical Engineering

- Ugryumova K. M., Tronchuk A. A., Menyajlov A. V. and Afanasjevska V. E.** Evolutional method application for gas turbine engine unite parameters estimation on the base of measuring data by the operational process..... 68

*Conventionally correct problem definition value assessment of design functional element characteristic when in use gas turbine engine operation with common-cause failure on the base of symptom data dimensions is offered. Assigned task quasidecision synthesis was realized by smoothing functional extremum seeking regularization with A. N. Tihonov's method for solution uniqueness and stability assurance relative to input data low variation. Regularization parameter choice was carried out in concordance with misalignment generalized principle. Evolutional method of assigned task decision was developed, this method founded on genetic algorithm application. Suggested method realization examples were considered by diagnostics problem decision for modern turbojet engine of regional passenger aircraft.*