Aero- and Hydromechanics in Power Machines

Questions of aerodynamic optimisation of steam and gas turbine stages are considered. The problem statement is given; the method and the technology of computational investigations, which is based on using three-dimensional models of viscous flow in turbomachinery flowpaths, are described. Results of specific studies on aerodynamic improvement of bladings of steam and gas turbine stages are presented.

Heat Transfer in Engineering Constructions

The article analyses the problem of the heat propagation task solution using parametric identification. Method of errors estimation is considered which is based on determination of the common confidence areas or confidence intervals using sensitivity functions of measured object's temperatures to estimated parameters.

Dynamics and Strength of Machines

The paper presents the numerical method for predicting creep crack growth in structures. The continuum damage mechanics approach and generalized Neuber's rule are used. Experimental values of rupture lifetimes are shown to be closely predicted by the calculated ones. The paper also demonstrates how approximate solution for the elastoplastic stresses in crack zone allows obtaining the accurate solution while reducing the computational burden.

The analysis of the stress-strain state of the connection disc of 2^{nd} degree cylinder medium-pressure steam turbine blades in the castle by the method of finite elements. The resalts are compared with experimental data.

The problem of antisymmetric non-stationary bending vibration control for round double-layered plate "metal-piezoceramic" is solved using Laplace integral transform. Control is carried out electrically, thus a configuration of the electric signal providing set behaviour of the normal to a surface of the plate in its center, is a subject of identification. The mathematical model of the plate is written within the theory of thin electroelastic shells. By the developed method the problem is reduced to the system of Volterra's integral equations which is solved numerically using Tikhonov's regularization algorithm.

Applied Mathematics

The article presents a technique of cubic B-spline approximation of a point-defined curves. The technique allows the coupling of splines by the first and second derivatives. This is very important in the approximation of large arrays, which often occurs in practice of numerical control (CNC). The workability of the method is illustrated by examples.

Results of theoretical and numerical research of advantages of the constructed obvious formulas for interpolational cubic splines of two variables on triangulational grid of knots, offered earlier in works by M.Zlamala and A.Zhenisheka, are stated. These obvious formulas do not demand the decision of system of the linear algebraic equations for each triangle of a triangulation separately, that, according to authors of given article, will promote expansion of their applications in various sections of calculus mathematics.

High Technology in Mechanical Engineering

In work results of research of activation of an arch are resulted at orbital welding of pipelines. It is shown that activation allows to carry out not rotary joints of pipes with thickness of a wall to 6 mm without cutting of edges for one pass, and at welding of more thick-walled pipes provides a thickness of root pass to 5 mm. Arch activation sharply reduces dependence of a welding current on spatial position of a welding bath. It simplifies technics of welding and reduces the price of the equipment for its realisation.

Materials Science in Mechanical Engineering

The analysis of nature of heating steel SHCH 15 samples under high-frequency cyclic loading. Detected nonmonotonic heating. Found that the temperature rise depends on the increase of the amplitude of loading, and the increase in the time trials, and is quick with an almost constant rate. Data suggest that the heating characteristics of steel with a higher concentration of carbon.