Savenko P. O., Protsakh L. P.

VARIATIONAL APPROACH TO SOLUTION OF THE PROBLEM ON EIGENVALUES WITH NONLINEAR VECTOR SPECTRAL PARAMETER

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A variational approach to solution of generalized problem on eigenvalues with nonlinear degeneration of vector spectral parameter, is proposed. Equivalence of the spectral problem and the variational problem, put in correspondence to it, is proved. The idea of coordinate-wise descent makes the basis for construction of numerical algorithm for minimization of the functional, representing the square of discrepancy norm of homogeneous operator equation. The relaxation properties of iteration process constructed are proved.

Makhney A. V., Tatsij R. M.

EXPANSION BY EIGENVECTORS IN CASE OF SIMPLE EIGENVALUES OF SINGULAR QUASI-DIFFERENTIAL OPERATOR

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The asymptotic formulas with large values of parameter for solutions of singular quasi-differential equation allow us to estimate Green's function of the boundary-value problem. With the help of this estimation the expansion of singular quasi-differential operator by eigenvectors in the case of simple eigenvalues is constructed.

Vozna S. M.

CONVERGENCE OF TWO-DIMENSIONAL CONTINUED g -FRACTION

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In this paper we propose a two-dimensional continued g-fraction, which is generalization of one-dimensional case. We also investigate the convergence of such fraction in some region of the space $\mathbf{C}^2$, using the multi-dimensional analogy of the Stieltjes – Vitali theorem and convergence criteria for two-dimensional continued fractions.

Shuvar B. A., Mentynskii S. M.

BILATERAL ALGORITHMS FOR APPROXIMATION OF SOLUTIONS TO LA VALLEE POUSSIN PROBLEM

ISSN 0130–9420. Mathematical methods and physico-mechanical fields. – 2004. – 47, No. 3. – P. 33-36. – Ref.: 5 names. – Ukr.

A bilateral algorithm of approximate solution to La Vallee Poussin problem for one class of ordinary differential equations with overlinear character of inertia convergence is presented and analyzed. The investigation considers the specific character of the problem, which is caused by the need to construct the operators of corresponding structure in the linearized part of algorithm. To this end the constructions of A. M. Samojenko numerical-analytic method are used, in particular.

Bernakevich I. E., Vahin P. P., Shinkarenko G. A.

MATHEMATICAL MODEL OF ACOUSTIC SHELL-FLUID INTERACTION. II. PROJECTION-MESH APPROXIMATIONS AND THEIR CONVERGENCE

ISSN 0130–9420. Mathematical methods and physico-mechanical fields. – 2004. – 47, No. 3. – P. 37-44. – Ref.: 6 names. – Ukr.

For solution of variational problem of acoustic interaction of a shell with fluid the projection-mesh scheme, which contains the spatial Galerkin semidiscretization in FEM form and one-step recurrent time integration scheme, has been constructed. The estimations of Galerkin semidiscretization convergence are obtained, the stability conditions and one-step recurrent time integration scheme convergence are established. The analysis of numerical solutions has been made.

Meleshko V. V.

BIHARMONIC PROBLEM FOR A RECTANGLE: HISTORY AND THE STATE-OF-ART

ISSN 0130–9420. Mathematical methods and physico-mechanical fields. – 2004. – 47, No. 3. – P. 45-68. – Ref.: 100 names. – Russian.

This paper addresses the classical two-dimensional biharmonic problem for a rectangular domain. Selected topics in the history of the problem are elucidated. The method of superposition is effective for solving mechanical problems concerning bending of a thin clamped rectangular elastic plate and equilibrium of an elastic rectangle. The method is illustrated by several examples.

Zrazhevskii G. M., Ostrik V. I.

ASYMPTOTIC FORM OF CANONICAL PRODUCTS

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The asymptotic behavior at infinity of the first-kind canonical product with respect to the roots s_n *with asymptotic form* $s_n / a = n + b \ln n + c + o(1),\ n \to \infty$, *has been found. This result is used for asymptotic estimations of infinite products, arising at factorization of meromorphic functions in the Wiener – Hopf method.*

Burak Ya. Yo., Moroz H. I.

ON TWO VARIANTS OF VARIATIONAL FORMULATION FOR BOUNDARY-VALUE PROBLEMS OF NONLINEAR MECHANICS FOR ELASTIC SYSTEMS

ISSN 0130–9420. Mathematical methods and physico-mechanical fields. – 2004. – 47, No. 3. – P. 78-86. – Ref.: 7 names. – Ukr.

On the basis of complete energy functionals, the variational formulations of mathematical models for nonlinear mechanics of deformable elastic systems and corresponding variational statements of the boundary-value problems in terms of displacements and stresses are proposed. The conditions of convexity for functionals are formulated.

Prokopovych I. B.

COMMON PROPERTIES OF NONLINEAR EQUATIONS OF STRESS-FREE STRAIN

ISSN 0130–9420. Mathematical methods and physico-mechanical fields. – 2004. – 47, No. 3. – P. 87-94. – Ref.: 8 names. – Ukr.

Common properties of basic equations of strain for the stress-free body, written in terms of parameters of large strain – distortion tensor or Green and Almansi strain measures – have been investigated.

Prociuk B. V.

APPLICATION OF METHOD OF GREEN'S FUNCTIONS FOR DETERMINATION OF THERMOELASTIC STATE OF LAYER TRANSVERSALLY-ISOTROPIC SPHERICAL BODIES

ISSN 0130–9420. Mathematical methods and physico-mechanical fields. – 2004. – 47, No. 3. – P. 95-109. – Ref.: 14 names. – Ukr.

The procedure for solution of one-dimensional quasi-static thermoelasticity problems for layer transversally-isotropic bodies with spherical interfaces is presented. The procedure is based on application of constructed Green's function of boundary-value problem for ordinary partially degenerated differential second-order equation with discontinuous coefficients.

Sulym G. T., Piskozub J. Z.

CONDITIONS OF CONTACT INTERACTION (A SURVEY)

ISSN 0130–9420. Mathematical methods and physico-mechanical fields. – 2004. – 47, No. 3. – P. 110-125. – Ref.: 216 names. – Ukr.

A survey of using all possible boundary conditions in different contact problems, met at modeling and solving the complicated technical and technological processes, is made.

Loveykin A. V.

ON PECULIARITY OF ELASTIC FIELD IN INCOMPRESSIBLE HALF-SPACE WITH V-SHAPED INTERFACE CUT AT BIG ANGLES OF RIB PENETRATION

ISSN 0130–9420. Mathematical methods and physico-mechanical fields. – 2004. – 47, No. 3. – P. 126-133. – Ref.: 13 names. – Ukr.

Exact solution of the problem on equilibrium of incompressible half-space with V-shaped interface cut is constructed. Using this solution, the character of stress behavior near the intersection point of the cut rib with the half-space surface is analyzed.

Vaysfeld N. D.

NONSTATIONARY PROBLEM OF STRESS CONCENTRATION NEAR A SPHERICAL CRACK, SITUATED INSIDE A TRUNCATED CONE

ISSN 0130–9420. Mathematical methods and physico-mechanical fields. – 2004. – 47, No. 3. – P. 134-143. – Ref.: 12 names. – Russian.

Solution to the dynamic torsion problem for a truncated elastic cone, weakened by a spherical crack, to which tip the rotation center is applied, is constructed. Solution is based on the application of difference approximation of the second time derivative and the generalized method of integral transforms by the variable, where there is a discontinuity. The problem is reduced to a system of singular equations, which are solved with the help of the orthogonal polynomial method. Dependence of the stress intensity factor on time and the crack distance to the tip is calculated.

Kunets Ya. I.

LIMIT EQUILIBRIUM OF A BODY WITH THIN POINTED ELASTIC INCLUSION UNDER ANTIPLANE SHEAR

ISSN 0130–9420. Mathematical methods and physico-mechanical fields. – 2004. – 47, No. 3. – P. 144-148. – Ref.: 13 names. – Ukr.

The phenomenon of abrupt change of behavior of the stress-strain state in the vicinity of pointed thin elastic inclusions with large or small rigidity, when their moduli tend to zero or infinity, is explained. The method of asymptotic expansion agreement is utilized to explain this phenomenon. The method of singular integral equation and method of mechanical quadratures are used to construct the corresponding boundary layers.

Ulitko I. A., Nikitenko V. N.

FORCED VIBRATIONS OF THE THIN PIEZOCERAMIC CYLINDRICAL SHELL UNDER FAST ROTATION

ISSN 0130–9420. Mathematical methods and physico-mechanical fields. – 2004. – 47, No. 3. – P. 149-156. – Ref.: 4 names. – Russian.

Solution of the problem of bending vibrations of fast rotating thin piezoceramic cylindrical shell has been obtained in the form of forward and backward circumferential traveling waves. Resonance vibrations have been studied with the account of finite mechanical quality factor of the shell. It is shown that influence of fast rotation is expressed in the suppression of amplitudes of the both forward and backward traveling waves. The amplitude of forward wave remains greater than that of backward wave.

Zoriy L. M., Kushnir R. M., Sorokatiy M. I.

ON ESTIMATION OF EXACTNESS OF FREQUENCY EQUATIONS SOLUTIONS IN DYNAMIC PROBLEMS OF ELASTIC SYSTEMS WITH PIECEWISE-VARIABLE CHARACTERISTICS

ISSN 0130–9420. Mathematical methods and physico-mechanical fields. – 2004. – 47, No. 3. – P. 157-162. – Ref.: 10 names. – Ukr.

The paper presents general frequency equations of elastic one-step rod with variable cross-section, exposed to longitudinal and transverse vibrations. The equations are derived by the method of influence function for cantilevers and rods with the clamped ends. The examples of exact determination of frequency spectra are given.

Kravchyshyn O. Z., Chekurin V. F.

NON-LINEAR MODEL OF ELASTIC DISTURBANCE PROPAGATION IN ELASTICO-STRAINED CONTINUUM

ISSN 0130–9420. Mathematical methods and physico-mechanical fields. – 2004. – 47, No. 3. – P. 163-170. – Ref.: 5 names. – Ukr.

Geometrically and physically non-linear model of dynamic elasticity theory for initially strained solids, that are subjected to additional mechanical disturbance, is considered. In the model the tensor parameters of local stress-strain state, introduced relative to the actual undisturbed configuration, are used. In the frame of this model a linearized system of differential equations, that describe small elastic disturbance propagation in the non-uniformly strained solids, is obtained.

Yasinsky A. V.

INVERSE THERMOELASTICITY PROBLEM FOR A CIRCULAR PLATE FIXED ALONG ITS EDGE FROM ANGLE OF ROTATION

ISSN 0130–9420. Mathematical methods and physico-mechanical fields. – 2004. – 47, No. 3. – P. 171-177. – Ref.: 14 names. – Ukr.

Statement and construction of solution to the inverse problem on determining the non-stationary axially symmetric temperature field and thermostressed state of a circular plate, fixed along its edge from the angle of rotation, according to bending distribution and the value of edge radial displacements, are considered.

Karnaukhov V. G., Kozlov V. I., Revenko Yu. V.

HEATING OF VISCOELASTIC INCOMPRESSIBLE CYLINDER AT IT STATIONARY ROLLING ON A RIGID FOUNDATION

ISSN 0130–9420. Mathematical methods and physico-mechanical fields. – 2004. – 47, No. 3. – P. 178-185. – Ref.: 11 names. – Ukr.

The plane quasi-static problem about stationary polyharmonic oscillations and dissipative heating of viscoelastic incompressible cylinder, caused by rolling contact of the cylinder with a rigid foundation, has been solved analytically. The temperature field of the rolling cylinder, caused by outside friction, has been obtained and compared with the one, caused by dissipative heating. Influence of the cylinder thickness on the cylinder temperature has been investigated.

Hachkevych O. R., Mykhailyshyn V. S.

MATHEMATICAL MODELING AND INVESTIGATION OF STRESS STATE OF SOLIDS UNDER THEIR COOLING IN THE PROCESS OF HIGH-TEMPERATURE ANNEALING

ISSN 0130–9420. Mathematical methods and physico-mechanical fields. – 2004. – 47, No. 3. – P. 186-198. – Ref.: 35 names. – Ukr.

A variant of method, based on the finite element one, is proposed for investigation of thermomechanical behavior of solids during cooling after endurance in the process of high-temperature local annealing. The initial temperature and stresses distributions, thermal sensitivity and possibility of material hardening are taken into account. As an example, the influence of these factors on the stress-strain state of a shallow cylinder during cooling either under conditions of convective heat transfer with the environment or in some three-layer cylindrical system is studied.

Popovych V. S.

ANALYTIC-NUMERICAL SOLUTION OF HEAT CONDUCTION PROBLEM FOR THERMOSENSITIVE WALL UNDER CONDITIONS OF CONVECTIVE HEAT TRANSFER

ISSN 0130–9420. Mathematical methods and physico-mechanical fields. – 2004. – 47, No. 3. – P. 199-204. – Ref.: 10 names. – Ukr.

Analytic-numerical and exact solutions of heat conduction problem for thermosensitive plane, cylindrical and spherical walls under conditions of convective heat transfer at bounding surfaces are obtained and compared. The influence of thermosensitivity of the material on a grade and a character of the temperature distribution is investigated. The radius and the thickness of cylindrical and spherical walls, for which their temperatures can be calculated using the formula for the plane wall temperature with an error less than 1%, are determined.