

N. V. Saldina

**INVERSE PROBLEM FOR WEAKLY DEGENERATE PARABOLIC EQUATION**

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*The conditions of existence and uniqueness of the solution to the inverse problem for a parabolic equation with the second-kind boundary conditions are established. The unknown time-dependent coefficient tends to zero as a power function. In the proof the Schauder fixed-point theorem and properties of the Volterra integral equations of the second kind are used.*

N. V. Pabyrivska, V. A. Vlasov

**DETERMINATION OF LEADING COEFFICIENT  
IN PARABOLIC EQUATION**

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*Application of Schauder fixed-point theorem permitted to establish the existence conditions of the solution for inverse problem for parabolic equation for determination of leading coefficient in the form of quadratic function of the space variable with three unknown parameters depending on the time variable. The conditions of existence and uniqueness for solution of this problem are established separately.*

O. V. Gutik, K. P. Pavlyk

**ON BRANDT  $\lambda^0$ -EXTENSIONS OF SEMIGROUPS WITH ZERO**

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*We introduce the Brandt  $\lambda^0$ -extension  $B_\lambda^0(S)$  of a semigroup  $S$  with zero and establish some algebraic properties of the semigroup  $B_\lambda^0(S)$  with respect to the semigroup  $S$ . Also we introduce the topological Brandt  $\lambda^0$ -extension of a topological semigroup  $S$  with zero and study its topological properties with respect to the topological semigroup  $S$ . In particular we show that any topological Brandt  $\lambda^0$ -extension of an (absolutely)  $H$ -closed topological inverse semigroup  $S$  is (absolutely)  $H$ -closed in the class of topological inverse semigroups. Also we construct topologies on  $B_\lambda^0(S)$  which preserve the absolute  $H$ -closedness and  $H$ -closedness. Using the construction of topological Brandt  $\lambda^0$ -extensions of topological semigroups we give an example of absolutely  $H$ -closed metrizable inverse topological semigroup  $S$  with an absolutely  $H$ -closed ideal  $I$  such that  $S/I$  is not a topological semigroup.*

L. P. Protsakh, P. O. Savenko, M. D. Tkach

**METHOD OF IMPLICIT FUNCTION FOR SOLVING EIGEN-VALUE PROBLEM  
WITH NONLINEAR TWO-DIMENSIONAL SPECTRAL PARAMETER**

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No. 3. – P. 41-46. – Ref.: 7 names. – Ukr.**

*The nonlinear two-dimensional spectral eigen-value problem by the method of implicit function is reduced to investigation and numerical solving the Cauchy problem for the first-order linear differential equation.*

B. S. Khapko

**SOLUTION OF BOUNDARY-VALUE PROBLEM FOR PARTIAL DIFFERENTIAL EQUATIONS WITH IMPULSE COEFFICIENTS**

**ISSN 0130-9420. Mathematical methods and physico-mechanical fields. – 2006. – 49, No. 3. – P. 47-55. – Ref.: 17 names. – Ukr.**

*On the base of finite integral transforms method using the generalized functions the approach to solving the boundary-value problem for the second order partial differential equation with impulse coefficients and singular right part is proposed.*

G. I. Kalyta, A. V. Maksymuk, M. V. Marchuk

**ON APPLICATION OF INVARIANT IMBEDDING METHOD TO SOLUTION  
OF NONLINEAR CONTACT PROBLEMS**

**ISSN 0130-9420. Mathematical methods and physico-mechanical fields. – 2006. – 49,  
No. 3. – P. 56-64. – Ref.: 6 names. – Ukr.**

*A numerical procedure is proposed to investigate the nonlinear deformation of anisotropic plate with regard for compression interacting with a hard stamp by reducing the boundary-value problem to the equivalent Cauchy problem using the invariant imbedding method. The geometric and nonlinear theory is used for describing the stress-strain state. This theory considers the deformations of displacement and pressure. The obtained results of computations are presented in the form of graphs.*

F. P. Grigoryan

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**SYNTHESIS OF CONTROL WITH PREASSIGNED SPECTRUM  
IN STATIONARY INTEGRO-DIFFERENTIAL SCALAR  $n$ -TH DEGREE EQUATION**

*The problem of univariate control selection in stationary integro-differential scalar  $n$ -th degree equation, when preassigned spectrum is generated from one number of  $\mu$  multiplicity of  $n$ , is considered.*

V. V. Pabyrivs'kyy

**ON STATEMENT AND APPROACH TO SOLUTION OF SPACE  
ELASTICITY THEORY BOUNDARY-VALUE PROBLEMS USING HOLOMORPHIC  
TWO COMPLEX VARIABLES FUNCTIONS**

**ISSN 0130-9420. Mathematical methods and physico-mechanical fields. – 2006. – 49,  
No. 3. – P. 69-76. – Ref.: 24 names. – Ukr.**

*A mathematical statement and formulation of space elasticity theory boundary-value problems using holomorphic functions of two complex variables is proposed. In the present technique the representation of displacements vector in the Papkovich – Neuber form in terms of scalar and vectorial potential functions and corresponding generalization of Cauchy – Riman conditions for the base and conjugate boundary value problems are initial.*



V. V. Loboda, O. S. Filipova

**CONTACT MODEL FOR EXTERNAL ELECTRO-PERMEABLE INTERFACE  
CRACK IN PIEZOELECTRIC BIMATERIAL**

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No. 3. – P. 77-85. – Ref.: 13 names. – Ukr.**

*The piezoelectric bimaterial plane with two external interface cracks loaded by a system of concentrated forces is considered. The classical model is considered for both cracks, and for the right one – also a contact model. In the last case the problem was reduced to the combined problem of the linear relationship of Dirichlet – Riemann, which was solved exactly. The length of contact zone can be determined from the transcendental equation, and the simple formula for the corresponding stress intensity factor was obtained. Analysis of the dependence of the length of a contact zone and stress intensity factor upon a ratio of the concentrated forces and a point of their application was carried out.*

Yu. D. Kovalyov, Ev. N. Stativka

**BEND OF INHOMOGENEOUS LAYER WITH SLIDING SEAL OF ITS ENDS**

**ISSN 0130-9420. Mathematical methods and physico-mechanical fields. – 2006. – 49, No. 3. – P. 86-95. – Ref.: 11 names. – Russian.**

*The electroelastic state of inhomogeneous piezoceramic layer with sliding seal of its ends in the case of bend is studied. The boundary-value problem is reduced to a system, which consists of  $12k$ ,  $k = 1, 2, \dots$ , integral and differential equations. The expressions for stresses, which characterize the stress state of inhomogeneous layer, are found. The results of calculations of characteristic stresses are presented.*

S. A. Kaloerov, O. I. Boronenko, E. V. Avdyushina

**APPROXIMATE METHOD OF MAGNETOELASTIC STATE DETERMINATION  
FOR PIEZOMAGNETIC HALF-SPACE AND LAYER WITH CAVITIES AND CRACKS**

**ISSN 0130-9420. Mathematical methods and physico-mechanical fields. – 2006. – 49,  
No. 3. – P. 96-105. – Ref.: 9 names. – Russian.**

*A method for solution of the magnetoelastic problems based on the theory of complex variable functions is proposed in [3, 8]. The basic relations for complex potentials are given. The methods for solution of two-dimensional and plane problems are described for solids with cavities and cracks. In the paper, using this method, the approximate solutions for such problems for the half-space (half-plane) and layer (strip) with arbitrarily situated cavities and cracks are constructed. It is assumed, that the cavities and cracks are able to cross linear (plane) boundaries. As a numerical illustration, the half-plane and strip with cavities and cracks under surface mechanical and magnetic loads are analyzed.*

V. K. Opanasovych, M. S. Slobodyan

**BIAXIAL BENDING OF PLATE WITH CIRCULAR HOLE AND TWO RADIAL  
CRACKS CONSIDERING CONTACT OF IT'S EDGES**

**ISSN 0130-9420. Mathematical methods and physico-mechanical fields. – 2006. – 49,  
No. 3. – P. 106-119. – Ref.: 35 names. – Ukr.**

*The biaxial bending of an isotropic plate with a circular hole and two radial cracks considering contact of it's edges is investigated. Applying the methods of the theory of functions of complex variable and complex potentials, the solution of the problem is reduced to a system of integral equations, which is solved by numerical method of mechanical quadratures. The numerical analysis of the problem is made. The graphic dependence of contact pressure, intensity factors of moments and efforts is shown.*

L. M. Sen'kiv

**SHEAR-COMPLIANT ORTHOTROPIC CYLINDRICAL SHELL WITH LONGITUDINAL  
SLITS UNDER ANTISYMMETRIC LOADING**

**ISSN 0130-9420. Mathematical methods and physico-mechanical fields. – 2006. – 49,  
No. 3. – P. 120-124. – Ref.: 8 names. – Ukr.**

*On the base of distorsion method in the theory of thin shells the problem on elastic equilibrium of shear-compliant orthotropic shell with one and two longitudinal slits is reduced to a system of singular integral equations. The effect of orthotropy and crack length on intensity factors of efforts and moments is studied in the case of antisymmetric loading.*

S. P. Shevchuk

**INFLUENCE OF ELASTIC RIBBON INCLUSION ON ANISOTROPIC HALF-SPACE SURFACE DEFORMATION UNDER LONGITUDINAL SHEAR**

**ISSN 0130-9420. Mathematical methods and physico-mechanical fields. – 2006. – 49, No. 3. – P. 125-130. – Ref.: 6 names. – Ukr.**

*The antiplane problem of elasticity theory for an anisotropic half-space with the thin anisotropic elastic inclusion is solved by the jump function method. The influence of thin-walled inclusion parameters (its dimensions, deepening, elasticity) on field of deformations near an anisotropic half-space surface is investigated.*

O. S. Bogdanova

**ON LIMITED STATE OF ORTHOTROPIC PLATE WITH PERIODIC SYSTEM  
OF COLLINEAR CRACKS UNDER BIAXIAL LOADING**

**ISSN 0130-9420. Mathematical methods and physico-mechanical fields. – 2006. – 49,  
No. 3. – P. 131-140. – Ref.: 17 names. – Russian.**

*In this paper the limited state of orthotropic plate with periodic system of collinear cracks under biaxial loading is considered basing on the modified  $\delta_c$ -model. The material of plate satisfies the strength condition of arbitrary form. The solution in general form is obtained using the Kolosov – Muskhelishvili complex potentials. The basic equations to determine the stresses in the process zones are formulated. The equations for determination of the process zone size are given. The influence of biaxiality of external loading on the process zone near the crack tip and the critical state of the cracked plate is analyzed.*

V. A. Galazyk, G. T. Sulym, A. Y. Vaschyshyn

**EFFECT OF TANGENTIAL STRESSES AT RADIAL CONTRACTION OF ELASTIC  
HALF-SPACE BOUNDARY IN CIRCULAR DOMAIN**

**ISSN 0130-9420. Mathematical methods and physico-mechanical fields. – 2006. – 49,  
No. 3. – P. 141-152. – Ref.: 8 names. – Ukr.**

*A new statement of the problem of linear elasticity theory for half-space with mixed boundary conditions is proposed. The solution of this problem gives us a physically correct mathematical model of the stress-strain state (in particular, smallness of elastic rotations). The novelty of statement of the problem is that it contains, together with classical boundary conditions, the requirement (stipulated by hypothesis of entirety) of continuity of the vector's component of local rigid rotation  $\mathbf{\Omega} = 0.5 \text{rot } \mathbf{u}$  on the line of boundary conditions. In this connection all characteristics of the stress-strain state are continuous and, consequently, bounded on the line of boundary conditions.*



A. Ya. Grigorenko, T. L. Yefimova, S. V. Puzyryov

**STUDY OF NATURAL VIBRATIONS OF RECTANGULAR ORTHOTROPIC  
PLATES OF LINEARLY VARIABLE THICKNESS**

**ISSN 0130-9420. Mathematical methods and physico-mechanical fields. – 2006. – 49,  
No. 3. – P. 153-161. – Ref.: 10 names. – Ukr.**

*For calculation of eigen frequencies and eigen forms of vibrations of orthotropic rectangular plates of linearly variable thickness under complex boundary conditions the method of spline-collocation is used. The problem is formulated within the framework of linear theory of small vibrations. The materials with different elastic properties are considered. Calculations are made for different laws of linear change of thickness and for different sizes (in the plan) of plates. The obtained data analysis is conducted and comparison is made with the same information for the plates of constant thickness and equivalent weight under the similar boundary conditions.*

M. V. Belubekyan, S. R. Martirosyan

**ON PLATE FLUTTER PROBLEM IN SUPERSONIC FLOW IN A CASE  
OF CONCENTRATED MASS AT EDGES**

**ISSN 0130-9420. Mathematical methods and physico-mechanical fields. – 2006. – 49,  
No. 3. – P. 162-167. – Ref.: 5 names. – Russian.**

*The paper is devoted to the analysis of stability of a thin plate model in a supersonic air flow. The plate's mass is ignored, but it is considered that the concentrated mass is on the hinge supported edges. The critical velocity of the air flow is found, which is reduced to the fluttered instability.*

V. S. Popovych, H. Yu. Harmatyi, O. M. Vovk

**THERMOELASTIC STATE OF THERMOSENSITIVE SPACE WITH SPHERICAL CAVITY UNDER CONVECTIVE-RADIANT HEAT EXCHANGE**

**ISSN 0130-9420. Mathematical methods and physico-mechanical fields. – 2006. – 49, No. 3. – P. 168-176. – Ref.: 9 names. – Ukr.**

*The solution of non-stationary heat conductivity problem for thermosensitive space with spherical cavity with convective-radiant heat exchange with an medium of constant temperature is found. The influence of thermosensitive space material on the size and character of distribution of temperature and pressure, caused by it in the cases of presence and absence of force loading, is analyzed.*

R. F. Terletskii, O. P. Turii

**THERMOELASTIC STATE OF SEMI-TRANSPARENT COMPOSITE  
LAYER UNDER THERMAL RADIATION**

**ISSN 0130-9420. Mathematical methods and physico-mechanical fields. – 2006. – 49,  
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*The characteristics of thermal processes and stress state in a semi-transparent composite layer assuming ideal thermal and mechanical contacts between the layers are investigated. A composite is subjected to thermal radiation from a heated surface parallel to a composite surface. Dependences of heat sources, temperature and stresses in the layer on the radiation source temperature are studied.*