L. P. Plachta

REMARKS ON n -EQUIVALENCE OF KNOTS AND LINKS

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In this paper, we announce some new results concerning the relationship between Vassiliev knot invariants and canonical and classical genera of knots in a 3-space and study the behavior of finite order knot invariants under the special satellite operations. We also study n -equivalence of links in the sense of Kirk–Livingston in the context of satellite operations.

A. O. Lopushansky

CALCULUS OF NEGATIVE TYPE SECTORIAL OPERATORS AND COMPLEX INTERPOLATION SCALES

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The properties of degree semi-group in a sectorial operators class with negative type is described. It is established that one-parameter scale of the domains of definition $V_\vartheta = D\big((-J)^\vartheta\big),\ \vartheta > 0$, *for a sectorial operator* J *coincide with interpolation scale generated by complex method of Lions − Calderon.*

N. M. Hryntsiv

INVERSE PROBLEM FOR DEGENERATED HEAT CONDUCTION EQUATION IN FREE BOUNDARY DOMAIN

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We have established conditions of existence and uniqueness of solution to the inverse problem for a degenerated heat conduction equation with unknown time-dependent thermal diffusivity which vanishes at the initial moment as a power of time t^{β}, $0 < \beta < 1$, *when a part of boundary of the domain is unknown.*

U. M. Fedus’

INVERSE PROBLEM FOR GENERAL PARABOLIC EQUATION WITH UNKNOWN THERMAL CAPACITY COEFFICIENT

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We establish conditions for existence and uniqueness of solution to the inverse problem for one-dimensional parabolic equation of general type with unknown thermal capacity coefficient in the case of classic boundary conditions and condition of overdetermination.

R. M. Tatsij, O. O. Vlasij

EQUIVALENT RECURRENT FORMULA FOR 4-ORDER QUASI-DIFFERENTIAL EQUATIONS

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The fundamental matrix for 4-order generalized quazi-differential equations is constructed. The equivalent recurrent formula for such equations is obtained. The equivalent recurrent formula is verified by an illustrative example. The approximate method for solving the quazi-differential equations with the help of equivalent recurrent formula is considered.

B. H. Shelestovskyy, H. V. Habrusev

APPROXIMATE SOLUTION OF SOME ILL-POSED PROBLEMS OF ELASTICITY THEORY

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A way of approximation of solution of ill-posed problem in the form of partial sums of Fourier series by orthogonal functions is proposed. The methods of regularization of the first-kind Fredholm-type equation and orthogonalization of the functional equation for finding a linear algebraic equations system relative to the polynomial's coefficients are applied. The condition for choice of optimum quantity of its terms is obtained.

V. V. Gafiychuk, B. Yo. Datsko, Yu. Yu. Izmaylova

ANALYSIS OF DISSIPATIVE STRUCTURES IN DIFFUSION SYSTEMS WITH FRACTIONAL DERIVATIVES

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We investigate the dissipative structures in a fractional reaction-diffusion system. We use the model with cubic non-linearity to obtain the solutions in the form of dissipative structures. Further we use the developed earlier variational principle to find an approximate analytic form of such dissipative structures. Here we have discovered that nonlinearity plays the main role in structure formation, and space fractional derivatives do not destroy the form of dissipative structures.

V. V. Meleshko, Yu. V. Tokovyi

ON THE P. F. PAPKOVICH ALGORITHM IN METHOD OF HOMOGENEOUS SOLUTIONS FOR SOLVING TWO-DIMENSIONAL BIHARMONIC PROBLEM IN RECTANGULAR DOMAIN

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An algorithm developed by P. F. Papkovich for solving the two-dimensional biharmonic problem in a rectangular region is discussed. A short historical survey of the early stages of the method of homogeneous solutions is presented. Calculations and comparison of the results show an excellent agreement.

E. V. Altukhov, V. P. Shevchenko

METHOD OF HOMOGENEOUS SOLUTIONS IN 3-D PROBLEMS FOR GENERALIZED THERMOMECHANICS OF TRANSTROPIC PLATES

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The boundary-value problems of generalized thermoelasticity for transtropic plates are considered. On the flat plane plates different homogeneous mechanical and heat border conditions are given. By the I. I. Vorovich method the homogeneous solutions for the given class of problems of thermoelasticity theory are obtained. As a result the solution of the problem is reduced to integration of counting set of metaharmonic equations.

M. D. Hrylyts'kyy, Ya. I. Kunets, V. V. Matus, V. V. Porokhovs'kyy

DIFFRACTION OF SH–WAVES BY THIN PLANE TUNNEL INCLUSION OF LOW RIGIDITY IN HALF-SPACE

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The stresses near the edges of a thin plane tunnel inclusion of variable thickness and low rigidity that is in elastic half-space is studied. The elastic system is under the conditions of antiplane shear under the influence of a plane SH-wave. The procedure is based on utilization the method of singular integral equations and the method of orthogonal polynomials.

G. A. Manukyan

SURFACE ELECTROELASTIC LOVE WAVES IN LAYERED SYSTEM WITH ISOTROPIC ELASTIC SUBSTRUCTURE AND PIEZOELECTRIC LAYER

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The article investigates the existence and behavior of Love surface electroelastic waves in a layered system with isotropic elastic substructure and a soft piezoelectric layer of the class 6, 4, $6mm$, $4mm$, 622, 422 *with finite arbitrary thickness, depending on the physico-mechanical properties of the system. The characteristic equation of the surface wave is investigated in the case when free boundary of the layer is metallized and the substructure is a fine electric. It is shown that the existence, the structure and the behavior of Love waves are similar to the classic events. The qualitative graphs of dispersion curves are presented.*

L. V. Kurpa, G. N. Timchenko

INVESTIGATION OF FREE VIBRATIONS OF LAMINATED PLATES BY R -FUNCTION THEORY

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The problem on free vibrations of composite laminated plates with complex plan-forms and different boundary conditions is considered. It is assumed that slippage between the layers is absent, the physical characteristics and thickness of the core can essentially differ from the appropriate characteristics of the face layers. Mathematical statement of the problem is carried out using the Timoshenko-type theory. Numerical results for laminated composite plates of complex geometry and different types of boundary conditions are presented. The results obtained for square composite plates have been compared with the known ones what proves the effectiveness and validity of the offered method.

I. B. Prokopovych

EXPRESSIONS FOR EFFECTIVE DIELECTRIC PERMITTIVITY OF STRESSED ISOTROPIC MATERIAL

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By the method of free distortion, the general (non-linear) dielectric equation of the state of isotropic material is reduced to formulas with effective permittivity. Two different tensors of permittivity are constructed. The first of them depends directly on the actual stress tensor but is not coaxial to it. The second one depends on the tensor of actual accumulated elastic deformation and is coaxial to it. It is shown that the tensors of permittivity, elastic deformation and stresses are coaxial when vector of electric intensity is directed along the principal axis of the deformation tensor. For the tensor of dynamic permittivity, the expression depending on the initial elastic deformation and coaxial to it is constructed. So it is proved that non-linear effects of electromagnetic waves propagation in initially stressed isotropic material do not influence their polarization along the principal axes of tensor of initial stresses.

V. G. Karnaukhov, V. I. Kozlov, T. V. Karnaukhova

REFINED THERMOMECHANICAL TIMOSHENKO-TYPE MODEL OF COMPOSITE SHELLS WITH DISTRIBUTED TRANSVERSALLY ISOTROPIC SENSORS UNDER MONOHARMONIC LOADING

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Using the refined Timoshenko-type hypotheses and adequate to them hypotheses about electric field quantities, the thermomechanical model of thin-walled shells with distributed transversally isotropic sensors is presented with taking into account dissipative heating as a result of hysteresis in materials. Different types of electric boundary conditions are considered, when electrodes on the sensor are short-circuited or open. For these types of boundary conditions the formulas for sensor indices are obtained. If the material characteristics depend on temperature, investigation of the influence of temperature of dissipative heating on the indices is reduced to solution of complicated non-linear systems of differential equations. Otherwise the problem is reduced to solution of linear problems of mechanics and heat conductivity with a certain heat source. In such a case calculation of sensor indices is simplified. If temperature of dissipative heating exceeds the Curie point, the sensor becomes passive and specific type of thermal destruction takes place.

V. I. Ostrik

SLIPPING AND SMOOTH CONTACT OF STAMPS OF VARIOUS PROFILE WITH ELASTIC STRIP

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Contact interaction in the presence and in the absence of friction between stamps of various form (with rectilinear horizontal and inclined basis, wedge-shaped and parabolic stamp) and elastic strip is studied. Using the Wiener – Hopf method, the exact analytic solutions to the corresponding boundary-value problems is obtained.

O. R. Hachkevych, B. D. Drobenko

NUMERICAL ANALYSIS OF ELECTROMAGNETIC, THERMAL AND MECHANICAL FIELDS IN ELECTROCONDUCTIVE SOLIDS SUBJECTED TO HIGH-TEMPERATURE INDUCTION HEATING

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The method for mathematical and computer simulation of non-stationary electromagnetic, thermal and mechanical processes in electroconductive axisymmetrical solids subjected to high-temperature induction heating is proposed. The problem is solved by finite element method and a family of simple one-step finite difference algorithms with different time step integration of electromagnetic, thermal and mechanical problems. The method is applied to solving the problem of induction heating of a finite ferromagnetic steel cylinder.

A. P. Vlasyuk, P. M. Martinyuk

MATHEMATICAL MODELING OF FILTRATION CONSOLIDATION PROBLEM FOR INCREASING SOIL LAYER TAKING INTO ACCOUNT SALT TRANSFER UNDER NON-ISOTHERMAL CONDITIONS

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A mathematical model of filtration consolidation problem for increasing soil layer, taking into account non-isothermal salt transfer, has been formulated. The numerical solution of the corresponding one-dimensional boundary-value problem has been found by the stabilized finite element method. The influence of mass transfer of salt, non-isothermal conditions and progressive change of soil layer height on the filtration consolidation process has been numerically investigated.

Yu. V. Nemirovsky, A. P. Yankovsky

SOLUTION OF STATIONARY HEAT CONDUCTIVITY PROBLEM FOR MECHANICALLY AND PHYSICALLY INHOMOGENEOUS COMPOSITE RODS BY METHOD OF ASYMPTOTIC SPLITTING

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The three-dimensional stationary heat conductivity problem for the layered reinforced composite rods with constant cross-section is formulated. The external asymptotic decomposition of solutions of the problem under different boundary conditions on the lateral surfaces of rods are constructed. The obtained two-dimensional and one-dimensional resolving equations and boundary-value problems are analyzed and the asymptotic properties of solving the thermal conductivity problem are studied. Comparison with asymptotics, built earlier by other authors, is made.

V. S. Popovych, N. A. Horechko

TEMPERATURE FIELD IN THERMOSENSITIVE HALF-SPACE HEATED BY INSTANTANEOUS LINEAR HEAT SOURCE

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An approach to solve the non-linear transient heat conductivity problem for thermosensitive half-space undergoing heat exchange with the environment is suggested. The two-phase linearization (partial linearization with introduction the Kirchhoff variable and final linearization using the linearizing parameter method) is carried out to determine transient temperature field of the original problem. The method, based on solving one-dimensional transient problem by multiple error functions expansion, is developed for the obtained linear Kirchhoff variable problem. The temperature field distribution in half-space is investigated. The effect of material thermosensitivity on this distribution is analysed.

T. V. Zavrazhina

DYNAMICS OF INDUSTRIAL ROBOT WITH ELASTIC COMPLIANT ACTUATING DEVICES

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A mathematical model of the multi-link industrial robot with rigid links and elastic actuating devices is developed. It is constructed on the basis of the Lagrange formalism and includes a system of nonlinear interconnected ordinary differential equations. The problems of dynamic and kinematical control of the robot are put. An example of the two-link robot-manipulator is considered. The analysis of influence of change of rigidity coefficients of actuators on dynamics of this robot at dynamic control is made.