Petrychkovych V. M.

ON MULTIPLICITIES OF CHARACTERISTIC ROOTS AND DEGREES OF ELEMENTARY DIVISORS AND FACTORIZATION OF POLYNOMIAL MATRICES

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Let $A(x)$ be a regular polynomial matrix of degree m over the polynomials ring $\mathbf{P}[x]$, where $\mathbf{P}$ is an algebraically closed field. Let $(x-\beta_j)^{s_j}$ be their elementary divisors of degree $s_j > 2$, $j = 1,\mathrm{K}\ ,p$, whose remaining elementary divisors are of degree no more than 2. It is proved that if $s_1 + s_2 + \mathrm{K} + s_p = s \le m + p$, then the matrix $A(x)$ can be factored into factors $A(x) = (Ex - B_1)\mathrm{K}\ (Ex - B_t)C_t(x)$, $t \ge m + p + 1 - s$, where E is the identity matrix.

Shavarovs'kyi B. Z.

NOTE ON SIMILARITY OF COLLECTIONS OF MATRICES

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The canonical form is given for a certain class of polynomial matrices relatively to the semiscalar-equivalent transformations. It makes it possible to define the canonical form relatively to a simultaneous similarity transformation for the corresponding class of set of matrices over the field.

Polishchuk V. M., Ptashnyk B. Yo.

PERIODIC BOUNDARY VALUE PROBLEM FOR WEAKLY NONLINEAR HYPERBOLIC EQUATIONS WITH VARIABLE COEFFICIENTS IN LINEAR PART OF OPERATOR

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The conditions of existence and uniqueness of the periodic (for both variables) solution to the weakly nonlinear strictly hyperbolic – by Petrovsky – equation on the plane are established. The linear part of operator decomposes into the first order factors with time varying coefficients. In order to solve the problem of small denominators, that appear at investigation, the metric method is used.

Barans'ka I. Ye.

INVERSE PROBLEM FOR EQUATION OF PARABOLIC TYPE IN DOMAIN WITH FREE BOUNDARY

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We establish the conditions for existence and uniqueness of solution to the inverse problem for a parabolic equation with the unknown time-dependent leading coefficient in the domain with free boundary.

Herasymchuk O. B., Rybyts'ka O. M.

NORMAL SOLUTION OF THE FIRST KIND INTEGRAL EQUATION WITH WEAK PECULIARITY

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On the basis of meromorphic (relative to regularization parameter) solution representation to the normalized integral second kind Fredholm-type equation, the regularization of the Moor – Penrose inverse operator with weak peculiarity and also with peculiarity of Newtonian potential type, given on the manifold with an edge, has been carried out.

Bomba A. Ya., Prysjazhnjuk I. M.

PROBLEMS OF «CONVECTION-FILTRATION» TYPE IN THREE-COHERENT DOMAINS WITH BOUNDARY CONDITIONS OF AVERAGING

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The solutions to one class of problems of «filtration-convection» type in three-coherent domain, bounded by equipotential lines are obtained in the case, when the averaging condition is given on the unknown part of the flow output from one of internal contours – its compound border. The idea of conform transition from the given domain with a cross-section along one of the lines of flow to the appropriate domain of complex potential is in the basis of their construction. The results of numerical calculations are given.

Vlasyuk A. P., Martinyuk P. M.

NUMERICAL MODELING OF FILTRATION CONSOLIDATION PROBLEM OF THE BODY OF SOIL DAM TAKING INTO ACCOUNT HEAT AND MASS TRANSFER BY STABILIZED FINITE ELEMENT METHOD

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A mathematical model of filtration consolidation problem of the body of soil dam taking into account the salt transfer and non-isothermal conditions has been formulated. The numerical solution of the corresponding two-dimensional boundary-value problem has been found by the stabilized finite element method. The influence of the salt transfer and non-isothermal conditions on the filtration consolidation process has been investigated by means of the numerical experiment.

Voitovich N. N., Topolyuk Yu. P.

VELOCITY OF CONVERGENCE OF ITERATIVE METHOD FOR THE PROBLEM WITH FREE PHASE WITH ISOMETRIC OPERATOR

ISSN 0130–9420. Mathematical methods and physico-mechanical fields. – 2005. – 48, No. 2. – P. 71-78 – Ref.: 17 names. – Ukr.

The variational problem on pseudo-solutions of the equation with free phase in the case of isometric operator in Hilbert spaces is considered. The convergence of the simple iteration method, applied to the Euler equation of the problem, is proved. The geometric progression velocity of convergence of the method – without branching points – is established. A posteriori estimation of the convergence velocity is obtained.

Grigorenko Ya. M., Rozhok L. S.

APPLICATION OF DISCRETE FOURIER SERIES TO SOLVING BOUNDARY-VALUE STATIC PROBLEMS FOR ELASTIC BODIES OF NON-CANONICAL FORM

ISSN 0130–9420. Mathematical methods and physico-mechanical fields. – 2005. – 48, No. 2. – P. 79-100 – Ref.: 19 names. – Ukr.

The paper presents a nontraditional approach to solving two-dimensional boundary-value problems on the stress state of plates, shells, and spatial bodies. The approach is based on the reduction of two-dimensional problem to one-dimensional one using the discrete Fourier series. The two-dimensional problem contains the geometric and mechanical parameters as the multipliers on solving functions what makes it impossible to separate the variables. Introduction of additional functions, which include resolving functions, and their derivatives together with indicated multipliers, allows us to reduce the problem to one-dimensional one through expansion of all the functions into the Fourier series in one coordinate direction. At integrating the one-dimensional boundary-value problem, the amplitude values of additional functions are determined through the Fourier series of functions which are specified at the discrete set of points. The one-dimensional boundary-value problem is solved by the stable numerical method of discrete orthogonalization. The results obtained are presented in the form of plots and tables.

Butrak I. O.

ASYMPTOTICS OF FAR-FIELD OF DISPLACEMENTS AND STRESSES FROM SPATIAL CRACK DYNAMIC OPENING

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Within the three-dimensional statement, the harmonic wave diffraction problem for a spatial crack in an infinite elastic body is considered. The formulas for efficient determination of the far field displacements, stresses and scattering cross-section via displacement jumps across the crack faces are obtained by means of approximation of the kernels in the integral representations of the scattered wave components.

Shvab'uk V. I., Maksymovych O. V., Solyar T. Ya.

CALCULATION OF DYNAMIC STRESSES NEAR CURVILINEAR CRACKS UNDER SHEAR ON THE BASIS OF REFINED FORMULA OF LAPLACE NUMERICAL TRANSFORM

ISSN 0130–9420. Mathematical methods and physico-mechanical fields. – 2005. – 48, No. 2. – P. 106-113. – Ref.: 9 names. – Ukr.

The procedure for calculation of stress intensity factors near the curvilinear cracks for dynamic shear problems is presented. The problem is solved utilizing the inverse transformation, realized by means of Prudnikov modified formula.

Govorukha V. B.

FINITE ELEMENT INVESTIGATION OF INTERFACE CRACK IN PIEZOELECTRIC MATERIAL WITH REGARD FOR NEAR-TIP ASYMPTOTICS OF STRESSES AND DISPLACEMENTS

ISSN 0130–9420. Mathematical methods and physico-mechanical fields. – 2005. – 48, No. 2. – P. 114-120. – Ref.: 10 names. – Ukr.

An electrically permeable interface crack in piezoelectric biomaterial is studied. An asymptotic solution in connection with the finite element method is derived. For electromechanical loads, the complex stress intensity factor for an interface crack is obtained. For a particular case the numerical results are compared with the exact analytical solutions, obtained for a piezoelectric biomaterial plane with an interface crack.

Dovbnya E. N., Chernyshenko M. O.

INVESTIGATION OF STRESS STATE IN ISOTROPIC SHELLS OF ARBITRARY CURVATURE WITH SURFACE CRACKS

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The problem on determination of stressed-stained state of isotropic shell of arbitrary curvature with a surface crack is studied. The calculation result are presented for stress intensity factors at the central point of the surface crack for different relations of geometric parameters (*the value of the shell main curvature, depth and length of the crack*).

Popovych V. S., Kalyniak B. M.

THERMO-STRESSED STATE OF THERMOSENSITIVE CYLINDER UNDER CONVECTIVE HEATING

ISSN 0130–9420. Mathematical methods and physico-mechanical fields. – 2005. – 48, No. 2. – P. 126-136. – Ref.: 18 names. – Ukr.

The temperature field and stress-strained state in a circular thermosensitive cylinder induced by it is determined. The surface of the cylinder is subjected to constant loading and through this surface the cylinder is heated by the convective heat exchange with the environment, the temperature of which is time-dependent. The nonlinear heat conduction problem is solved using the method of linearizing parameters and the integral Laplace transformation. The quasi-static thermoelasticity problem is reduced to solving the integral Volterra second-kind equation. The last one is solved using the direct iteration procedure.

Filshtinskii L. A., Sirenko Yu. V., Filshtinskaya L. L.

COUPLED THERMOELASTIC FIELDS IN THE LAYER IN THE CASE OF CONCENTRATED PERTURBATIONS

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The full system of coupled thermoelasticity homogeneous solutions for the layer in $\mathbf{R}^3$ *has been obtained in the case of finite heat distribution velocity. The matrix of the fundamental solutions has been obtained with the help of homogeneous solutions, according to the time harmonic concentrated forces and thermal sources, acting in the layer. The examples of the concentrated harmonic and impulse layer perturbations have been studied.*

Humenchuk O. B.

THERMO-STRESSED STATE OF PARTLY TRANSPARENT LAYER UNDER CONDITIONS OF HEAT RADIATION

ISSN 0130–9420. Mathematical methods and physico-mechanical fields. – 2005. – 48, No. 2. – P. 147-156. – Ref.: 20 names. – Ukr.

The problem on definition of thermostressed state of a partly transparent layer under the conditions

of heat radiation, caused by real sources of radiation (*including the reflecting elements*) *is formulated. The effect of spectral dependence of characteristics of the layer material, radiation sources, and reflector on the heat sources, temperature, and stresses in the layer is studied.*

Nemirovsky Yu. V., Yankovsky A. P.

REVISION OF ASYMPTOTIC EXPANSIONS OF SOLUTIONS TO THE PROBLEM ON HEAT CONDUCTION OF ANISOTROPIC PLATES

ISSN 0130–9420. Mathematical methods and physico-mechanical fields. – 2005. – 48, No. 2. – P. 157-171. – Ref.: 6 names. – Russ.

The external asymptotic expansion of solutions to the problem on stationary heat conduction of anisotropic plates under various boundary conditions on the facial surfaces are constructed. The obtained bidimensional resolving equations are analyzed and the asymptotic properties of solutions to the problem of heat conduction are studied. Estimations of accuracy, with which the temperature in the plate outside the boundary layer can be considered linearly or quadratically distributed through the thickness, are obtained. Comparison with asymptotic integrations, constructed earlier by other authors, is carried out.

S. J. Matysiak[1], A. A. Yevtushenko[2,3]

TRANSIENT HEAT CONDUCTION PROBLEM FOR A COMPOSITE LAYER ON A HOMOGENEOUS SUBSTRATE

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The paper deals with the transient heat conduction problems of a periodic composite layer joined with a homogeneous half-space. The layer is composed of periodically repeated cells with rectangular cross-sections. The composite solid is heated on its boundary by a normal heat flux with uniform intensity. From the results, some solutions of the heat conduction problems for the particular cases of the composite structure are also derived. The influence of thermal and geometric properties of the composite components on the temperature distributions is presented in the form of graphs.

Monastyrskyy B. Ye.

METHOD FOR EVALUATION OF CONTACT THERMAL RESISTANCE OF CONTACT PAIR IN THE PRESENCE OF A SET OF SURFACE PENNY-SHAPED RECESSES

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The paper presents a method for evaluation of contact thermal resistance in the case of interaction between two semi-infinite solids in the presence of a set of uniformly distributed surface penny-shaped recesses. The axially symmetric model of such thermal contact is constructed. It takes into account the total influence of the conglomerate of defects in the vicinity of arbitrary selected one. The corresponding axially symmetric problem is reduced to the integral Abel's equation. The procedure for determination of the contact thermal resistance is based on averaging a real temperature jump on the surface of defect. Comparison of the results obtained with that known in the literature is carried out.