

Ivanchov M. I., Sagajdak R. V.

**INVERSE PROBLEM OF DETERMINATION OF LEADING  
COEFFICIENT IN TWO-DIMENSIONAL PARABOLIC EQUATION**

**ISSN 0130-9420. Mathematical methods and physico-mechanical fields. – 2004. – 47, No. 1. – P. 7-16. – Ref.: 7 names. – Ukr.**

*We establish the existence and uniqueness conditions for solution of the inverse problem, which consists in finding the unknown leading coefficient in two-dimensional parabolic equation. It is assumed that this coefficient depends only on time.*

---

Pukals'kyj I. D.

**UNIVERSAL LINEAR PROBLEM FOR PARABOLIC EQUATIONS WITH DEGENERATION**

**ISSN 0130-9420. Mathematical methods and physico-mechanical fields. – 2004. – 47, No. 1. – P. 17-24. – Ref.: 4 names. – Ukr.**

*In the space of classical functions with power weight the existence and uniqueness of solution to universal problem for parabolic equation with any power order of degeneration coefficients is proved. The estimation of solution to the problem in corresponding spaces is found.*

---

Bocenyuk A. M.

**ASYMPTOTIC BEHAVIOR OF SOLUTIONS TO SECOND INITIALLY  
BOUNDARY-VALUE PROBLEM FOR SEMILINEAR PARABOLIC EQUATION**

**ISSN 0130-9420. Mathematical methods and physico-mechanical fields. – 2004. – 47, No. 1. – P. 25-31. – Ref.: 3 names. – Ukr.**

*For solutions of semi-linear parabolic equation with the coefficients, dependent on the time variable  $t$ , we obtain an asymptotic formula with accuracy up to the exponentially decreasing function with  $t \rightarrow +\infty$ .*

---

Gnativ L. B., Kutniv M. V.

**MODIFIED THREE-POINT DIFFERENCE SCHEMES OF HIGH-ORDER  
ACCURACY FOR SYSTEMS OF THE SECOND-ORDER ORDINARY DIFFERENTIAL  
EQUATIONS WITH MONOTONE OPERATOR**

**ISSN 0130-9420. Mathematical methods and physico-mechanical fields. – 2004. – 47, No. 1. – P. 32-42. – Ref.: 7 names. – Ukr.**

*For nonlinear boundary-value problems with a monotone operator, three-point difference schemes of high-order accuracy on the irregular grid are constructed. The existence and uniqueness of solution to three-point difference schemes is proved and estimate of accuracy of both the solution  $u(x)$  and flow  $K(x) du/dx$  are determined.*

---

Nemirovskii Ju. V., Yankovskii A. P.

**NUMERICAL INTEGRATION OF INITIALLY BOUNDARY-VALUE  
PROBLEMS WITH LARGE GRADIENTS OF SOLUTION BY GENERALIZED  
RUNGE – KUTTA METHODS**

**ISSN 0130-9420. Mathematical methods and physico-mechanical fields. – 2004. – 47, No. 1. – P. 43-62. – Ref.: 13 names. – Russian.**

*The idea of generalization of Runge – Kutta methods on the 2D case for approximate integration of initially boundary-value problems, corresponding to differential equations in partial derivatives, is offered and approved. It is shown, that some classical finite-difference schemes of integration of transport equations and non-stationary one-dimensional heat conductivity equations may be obtained as consequence of such generalization. New schemes of high orders of accuracy for various problems of mathematical physics are obtained. Stability of these schemes is proved and results of calculations for problems with large gradients of solution are given. On the concrete examples it is shown, that classical schemes of low orders of accuracy unsatisfactorily describe the solution of such problems, and the schemes of high orders, constructed by means of the offered generalized Runge – Kutta methods, give good approximations to exact solutions.*

---

Shcherbyna N. M.

**APPLICATION OF NUMERICAL-ANALYTICAL METHOD TO SOLVE  
BOUNDARY-VALUE PROBLEMS WITH BOUNDARY LAYER**

**ISSN 0130-9420. Mathematical methods and physico-mechanical fields. – 2004. – 47, No. 1. – P. 63-67. – Ref.: 6 names. – Ukr.**

*Effectiveness of solving the one-dimensional boundary-value problems with the boundary layer by using the numerical-analytical method is demonstrated. The numerical results of concrete problems are presented and analyzed.*

---

Prykarpatsky A. K., Hentosh O. Ye.

**ON SOME CLASS OF GRADIENT DYNAMIC SYSTEMS ASSOCIATED  
WITH POLYNOMIAL DISCRETE PROBABILITY DISTRIBUTION**

**ISSN 0130-9420. Mathematical methods and physico-mechanical fields. – 2004. – 47, No. 1. – P. 68-72. – Ref.: 8 names. – Ukr.**

*Some gradient dynamic system, describing a stochastic process in the probability space of polynomial discrete distribution, is proved to be equivalent to the Lax-type Poisson flow on Grassmann manifold.*

---

Rvachev V. L., Semerich Yu. S., Sheiko T. I.

**R-FUNCTIONS METHOD IN PROBLEM OF INVESTIGATION  
OF WAVEGUIDES WITH GEOMETRIC SINGULARITIES**

**ISSN 0130-9420. Mathematical methods and physico-mechanical fields. – 2004. – 47, No. 1. – P. 73-79. – Ref.: 10 names. – Russian.**

*In the paper the problem of electromagnetic field determination in a waveguide with geometric singularities is considered. The R-functions method together with the Ritz one and new structures of solution are used to solve the problem.*

---

Lavreniuk V. I., Lavreniuk M. V.

**CONSTRUCTION OF FUNDAMENTAL SOLUTIONS OF CONTINUUM MECHANICS  
EQUATIONS ON THE BASE OF LENNARD – JOHNS POTENTIAL**

**ISSN 0130-9420. Mathematical methods and physico-mechanical fields. – 2004. – 47, No. 1. – P. 80-83. – Ref.: 3 names. – Ukr.**

*The fundamental solutions of the derived by L. P. Khoroshun system of equations in displacements for media, which particles interact with each other according to the Lennard – Johns law, were constructed. The solutions were obtained using the direct and inverse Fourier transformations of the generalized functions, where solutions, obtained for 3D and 2D cases, include both components of Kelvin-type solutions and components that directly describe interactions of particles according to the Lennard – Johns law.*

---

Ostrik V. I., Ulitko A. F.

**CIRCULAR INTERFACE CRACK WITH FRICTIONAL CONTACT OF FACES**

**ISSN 0130-9420. Mathematical methods and physico-mechanical fields. – 2004. – 47, No. 1. – P. 84-94. – Ref.: 17 names. – Ukr.**

*The stressed state of two rigidly connected elastic half-spaces from different materials with a circular crack on the interface is studied. The contact of crack faces close to its contour is taken into account. Friction forces are considered in the contact zone. Using Winner – Hopf's method, the solution to the integral equation of the problem is obtained in the closed form. The size of contact region of the crack faces and the distribution of stresses in it and on the interface of half-spaces outside of the crack are found explicitly.*

---

Kundrat M. M., Sulym G. T.

**PREFRACTURE BANDS IN THE VICINITY OF TOPS OF TWO INTERACTING  
ELASTIC RIBBON-LIKE INCLUSIONS**

**ISSN 0130-9420. Mathematical methods and physico-mechanical fields. – 2004. – 47, No. 1. – P. 95-102. – Ref.: 7 names. – Ukr.**

*The development of localized in thin bands, prefracture zones in a composition with two elastic ribbon-like inclusions in isotropic matrix is investigated by the method of jump functions. Zones of prefracture develop along the matrix-inclusions line from the tips to centers and are modeled by rupture of displacement. Using the complex potentials we obtain the dependence of the stress and displacement components on the load and unknown jump functions. Taking into account the interaction conditions of thin inclusions and matrix, the problem is reduced to a system of singular integral equations for the jump functions. Solution of such problem can be also used for study the development of prefracture bands at rupture of continuous inclusion. Numerical examples of zone sizes and distribution of longitudinal efforts in inclusions illustrate the method.*

---

Zolochevsky A. A., Sklepus S. N.

**CREEP OF DAMAGED SHALLOW SHELLS WITH COMPLEX  
FORM OF PLAN**

**ISSN 0130-9420. Mathematical methods and physico-mechanical fields. – 2004. – 47, No. 1. – P. 103-110. – Ref.: 7 names. – Russian.**

*A creep problem for damaged shallow shells with complex form of plan is investigated. The statement of creep problem, based on the Lagrange variational principle, is given. The constitutive equations, which describe different material properties in tension, compression and torsion, are used for creep strain. The  $R$ -function theory, Ritz method and the Runge – Kutta – Merson method have been used for procedure of solution. The numerical results for creep behavior of a shell with complex form are presented.*

---

Bedsir O. O., Shatsky I. P., Shopa W. M.

**METHOD FOR SOLUTION OF MIXED PROBLEMS OF FRICTIONAL CONTACT OF FILLER WITH SLOTTED SHELL ELEMENT**

**ISSN 0130-9420. Mathematical methods and physico-mechanical fields. – 2004. – 47, No. 1. – P. 111-114. – Ref.: 3 names. – Ukr.**

*The statement for mixed problem of frictional interaction between a slotted cylindrical shell and elastic filler, which is characterized by the presence of slippage zones and separation of contacting bodies, is made. On the basis of numerical solutions the effect of mechanical, geometric and tribologic parameters of contacting pairs on the width of separation zone, nature of distribution of contact pressure, rigidity and strength of the system is investigated. The estimation of the range of applicability of a simpler computational model, which is constructed without the separation zone, is presented.*

---

Kunets Ya. I., Matus V. V., Porokhovs'kyj V. V.

**INVESTIGATION OF ECHO-SIGNALS OF SH-WAVES FROM THIN-WALLED ELASTIC RIGIDLY SUPPORTED INCLUSIONS**

**ISSN 0130-9420. Mathematical methods and physico-mechanical fields. – 2004. – 47, No. 1. – P. 115-119. – Ref.: 6 names. – Ukr.**

*A procedure is proposed to study the diffraction of pulses of elastic SH-waves by thin-walled elastic curvilinear inclusions with rigidly supported wall. The procedure is based on utilization of Fourier integral time transform, the method of matched asymptotic expansion and modified method of null-field.*

---

Zavrazhina T. V.

**INFLUENCE OF ELASTIC PLIABILITY OF MANIPULATOR LINKS ON PRECISION OF ITS POSITIONING.  
II. TECHNIQUE AND RESULTS OF NUMERICAL SIMULATION**

**ISSN 0130-9420. Mathematical methods and physico-mechanical fields. – 2004. – 47, No. 1. – P. 120-128. – Ref.: 11 names. – Ukr.**

*In the second part the efficiency of considered models, used for the analysis of the manipulator positioning accuracy, is discussed. The technique to construct the solutions to the evolutionary problems for the systems of equations obtained in these models is presented. An example is considered.*

---

Rusynko A. K.

**STRENGTHENING OF METALS BY PRELIMINARY ULTRASONIC TREATMENT**

**ISSN 0130-9420. Mathematical methods and physico-mechanical fields. – 2004. – 47, No. 1. – P. 129-133. – Ref.: 8 names. – Ukr.**

*The work presents generalization of the plasticity synthesis theory on the determination of material plasticity limit that was preliminary ultrasonically treated. The analytic dependence of plasticity limit on the duration and acoustic radiation stress amplitude, which is in good agreement with the experimental data, is obtained.*

---

Budz S. F., Astashkin W. I., Drobenko B. D.

**INVESTIGATION OF PROCESS OF PHASE SPATIAL DISTRIBUTION AT RAPID COOLING OF STEEL SOLIDS**

**ISSN 0130-9420. Mathematical methods and physico-mechanical fields. – 2004. – 47, No. 1. – P. 134-139. – Ref.: 6 names. – Ukr.**

*A mathematical model for numerical description of phase content of steel products is proposed. The statistical theory for cooling conditions and steel chemical content influence on their phase content and also the results of investigation of temperature field in 2D solids are used for calculations. The phase distribution in steel profiles of rectangular and square cross-section during hardening is found.*

---

Datsko B. Yo.

**QUASI-STATIONARY STEFAN PROBLEM AND COMPUTER SIMULATION OF INTERFACE DYNAMICS**

**ISSN 0130-9420. Mathematical methods and physico-mechanical fields. – 2004. – 47, No. 1. – P. 140-147. – Ref.: 17 names. – Ukr.**

*The computer simulation of quasi-stationary Stefan problem has been realized. Different representations of the Laplacian growth model are considered. The main attention has been paid to the interface dynamics represented by integro-differential equations. Numerical solution has been realized using the interpolating polynomials and exact quadrature formulae. As a result the system of ordinary differential equations has been obtained.*

---

Maksymovych Ya. V., Solar T. Ya.

**SOLUTION OF BOUNDARY-VALUE HEAT CONDUCTION PROBLEMS FOR CYLINDRICAL BODIES ON THE BASIS OF MODIFIED METHOD OF SEPARATION OF VARIABLES**

**ISSN 0130-9420. Mathematical methods and physico-mechanical fields. – 2004. – 47, No. 1. – P. 148-157. – Ref.: 11 names. – Ukr.**

*A general solution to the non-stationary heat conduction problems for bodies of cylindrical shape is constructed. The bodies have heat exchange with the environment and are heated by internal heat sources. This solution is presented in terms of one-dimensional integrals from the products of solutions to auxiliary one- and two-dimensional heat conduction problems. The cases are noted, when the expressions for temperature are written in terms of solutions to three one-dimensional problems. The general solutions to auxiliary one-dimensional heat conduction problems are presented. The temperature fields under concentrated and normally-circular heating are analyzed in detail.*

---

Popovych V. S., Vovk O. M.

**METHODS FOR SOLUTION OF PROBLEM ON CONDUCTIVE-RADIAL HEAT EXCHANGE BETWEEN CYLINDRICAL AND  $N$ -ANGULAR PRISMATIC SHELLS**

**ISSN 0130-9420. Mathematical methods and physico-mechanical fields. – 2004. – 47, No. 1. – P. 158-168. – Ref.: 6 names. – Ukr.**

*A mathematical model is written and numerical-analytical technique for solution of the problem on conductive-radial heat exchange between a cylindrical shell and the surface of  $N$ -angular prism is proposed. The eight-nodal boundary elements are utilized for approximation of the flux density of incident radiant energy.*

---

Pjanylo Ya. D.

**ITERATION SCHEME CONSTRUCTION FOR DETERMINATION OF PRESSURE DEPRESSION DISTRIBUTION IN HORIZONTAL CONDUITS**

**ISSN 0130-9420. Mathematical methods and physico-mechanical fields. – 2004. – 47, No. 1. – P. 169-174. – Ref.: 5 names. – Ukr.**

*Gas flow in conduits in the non-stationary case is described by a nonlinear system of correlative differential equations in partial derivatives. The initial system linearization method is offered, the solution to this system is found and the iteration scheme construction for determination of the pressure distribution along the tube length is considered in the given work.*

---