

2. MATHEMATICAL METHODS IN MECHANICS AND PHYSICS

Abstracts

Aminov R. M., Ovsyannikov A. D. **Modeling of discharge scenario and its development in the ITER tokamak**

The article focuses on the mathematical model of discharge initial stage control in the ITER tokamak. Its construction implies creation of plasma disruption conditions, disruption and plasma current increase. Simultaneously, the system is constrained. Unfortunately, the obtained results don't satisfy in full the desired requirements due to initial data choice. Thus, optimization is necessary for obtained solution characteristics improvement.

Birukova E. S. **Analysis of galactic orbits chaos using the NAFF method**

The author bases his research on the Numerical Analysis of Fundamental Frequencies for systematic analysis of galactic orbits chaos. The unperturbed galactic potential is Keplerian, the perturbation is chosen as axisymmetric generalization of the Kuzmin–Veltmann model.

Burdyugov A. V. **Modeling of parameters of the gases analyzer by collisional electron spectroscopy method, and basic scalings obtaining**

Based on collisional electron spectroscopy, modeling of parameters is performed and basic scaling for microplasmous and photoionized gas analyzer are obtained. In the capacity of buffer gases, helium and air are considered. Author shows that the registration of electronic spectra in the atmospheric air is only possible in collisionless regime. Detectors' work is analyzed, and the most promising detector is chosen.

Vasiliev A. A., Bedrina M. E. **Modeling of fullerene molecules and nanotubes filling with hydrogen**

Comparative information of energy effects of the concerned processes is brought. The way of the most efficient hydrogen keeping is revealed. The obtained models are illustrated.

Voloshin M. V. **Analysis of irreducible error of decision vector components for systems of linear algebraic equations**

Based on the previously constructed algorithm, the irreducible error estimation is provided. The process is illustrated with numerical experiments.

Gabr M. V. S. O. **Wavelet decomposition of spaces of polynomial splines on a nonuniform mesh**

The goal of the article is to offer nonorthogonal wavelet decompositions of spaces of polynomial splines of the m order on a nonuniform mesh (α, β) by means of projecting operations of the Lagrange type. These operations are constructed based on a certain variant of continuation of a functional system on $C(\alpha, \beta)$. The functional system is supposed to be orthogonal to the coordinate splines of minimal defect.

Golovkina A. G. **On the computation of axially symmetric magnetic system geometry providing the given charged particles motion**

Proposed by V. I. Zubov, the approach to the magnetic fields formation problem in terms of electrodynamics reverse task is analyzed. The author makes attempt to connect numerical values of obtained magnetic field with particular physical object (by example of solenoid) that makes possible to realize this field in practice.

Golubeva N. Yu., Starkov V. N. **Estimation of the orbits of flight of the space apparatus from Earth to the Lagrange points**

Two cases of the Keplerian orbits of the space apparatus flight from Earth to the Lagrange points is considered.

Grekov M. A., Zaichenko T. S. **Anticrack at the circular inclusion boundary**

The plane elasticity problem on a circular inclusion in a plane is considered. It is supposed that a part of an interface called anticrack is rigid. Based on the Goursat–Kolosov complex potentials and the Muskhelishvili representations, the solution of the problem reduces to solving two independent Riemann–Gilbert boundary problems. As a result, explicit expressions are obtained for stresses in a form of analytic dependences upon elementary functions. Stresses behavior close to the ends of the interfacial anticrack is analyzed.

Demchenko N. S. **Nyström methods analysis for solving of Schrödinger equation**

The problem of transmission coefficient calculation for potential barrier is considered. Based on the Monte Carlo approach, the Nyström algorithms of different orders are tested. Comparison of accuracy and performance are carried out.

Dudoladova M. I., Starkov V. N. **Insolation effects on the phytoplankton and zooplankton evolution**

Based on two phytoplankton and zooplankton interaction models, insolation effects on its evolution are revealed.

Ivanov V. A. **Stress intensity factors for interfacial cracks in an arc of a circle**

In the article, the plane problem of elasticity solved for the infinite elastic plane that contains circular inclusion of another material and has interface part crack. The main attention is given to the stress intensity factors analysis in dependence on problem parameters.

Kireyeva M. V. **An algorithm for construction an approximate solution of the uniform Π -approximation problem on a given region**

The author proposes an algorithm for approximate solution construction of the problem of uniform approximating of continuous function of two variables by the product of continuous functions of one variable on given area. The approximate solution is constructed as interpolating natural splines by means of discrete approximation. The double-ended estimate for best approximation is constructed. Functions approximating on the ring and on the region bounded by the ellipse is demonstrated.

Kitaygorodskaya T. M. **On the system of nested space of spline on the uniform grid**

The author considers searching of minimal reduced generating spline of degree m , an approximation ratio and its various representations. Also, a special case that gives an approximation ration for mentioned B-spline of degree 2 is considered.

Kovalev D. A. **On a certain spline wavelet decomposition for Hermitian type**

The wavelet decomposition of splines which is suitable for Hermite interpolation problem solving (with first-order derivatives) is considered. Such splines have a property of minimal multiplicity of main base coverings with basic functions supports, and are called the Hermitian type splines (the first height ones). Decomposition and reconstruction formulas for wavelet decomposition of Hermitian type cubic splines is derived.

Kosovtsov M. E. **Nonlinear dynamics modeling adjusted for particle spin momentum**

In this article, the problems of electric dipole momentum existing, its measurement and equipment design are considered. The method of nonlinear spin dynamics is shown; it allows to fit in required modes of accelerator functioning.

Kostyrko S. A., Vikulina Yu. I. **Stresses in a thin coating of a variable thickness**

Two-dimensional model of an elastic body with a thin coating is considered as a composition of a half-plane-strip with a periodic slightly curved boundary. The exact solution of the problem is constructed in the form of functional series for the case of longitudinal tension. The numerical analysis of stress concentration dependence upon geometrical and physical parameters of the problem is carried out for two forms of the boundary.

Le Thi Nhu Bich. **Wavelet decompositions for model problems**

The author considers wavelet decompositions of space of the Hermitian splines type for several model problems. The formulas of decomposition and reconstruction of the first, second and third height are realized. The results are values of wavelet coefficients and values of difference between input and output flows.

Matveeva N. N. **Mathematical modeling of diode system with different dielectrics**

In this article, the algorithm of the electrostatic potential distribution searching on the example of diode electron-optical system is considered. For solving this problem, author uses the method of variables separation. Consequently, the distribution of the electrostatic potential in the internal area of the given system is obtained. Also, the influence of permittivity of the diode materials on the obtained potential is analyzed.

Mikheev R. U. **Wavelet decomposition on open and closed intervals**

Splines are a classic apparatus for numerical flow processing with approximation conservation as well as wavelets are one with basic spectral characteristic conservation. The article deals with the method of wavelet decomposition construction in the case of infinite flow (with grid on an open interval) and finite stream (with grid on a segment) for spline spaces.

Morozova A. Yu. **Finite element method in a curvilinear cylinder**

The finite element method algorithm (with application of the Courant approximation) for the numerical solution of parabolic equation with elliptic operator of the second order is considered. The choice of a plane triangulation and a simplicial refinement of a curvilinear cylinder are discussed. The estimation and the algorithm parallel form is obtained.

Ovod D. V. **On relaxation in smoothed field of stellar systems**

The author considers effective relaxation time for steady gravitational systems following the Gurzadyan–Savvidy paradigm. Calculations show that if Petrovskaya's distribution for a random force is adopted, the ratio of stochastization time to crossing time depends on N (number of stars). Actually, obtained results prove the Genkin time-scale of relaxation and provide numerical estimation for the proportionality factor.

Raik A. V. **Modeling of intermolecular interaction potentials**

The article deals with the intermolecular interaction potentials of water molecule with the MgO and ZnO crystals surface. The potentials were theoretically calculated in the 'Gaussian-03' software package and analytically approximated in the form of the Buckingham potential. Closeness of the curves in the area corresponding to the minimum energy in the equilibrium point is achieved.

Salakhieva M. R., Starkov V. N. **Calculation of the time of flight with a solar sail to asteroids zone and to outward planets**

The calculation of the time of flight of a space apparatus with a solar sail in the direction of asteroids zone and of outward planets is realized.

Sokolova O. B., Starkov V. N. **Temperature calculation into the surface layer with consideration of the cloudiness**

The heat transfer into the surface layer is considered taking into account the heat that comes from the land and the heat that comes from the clouds of various types.

Stepanova V. A., Mansurova S. E. **Modeling of large deformations of an elastomeric layer**

In the paper, three methods of the elastomeric layer deformations analysis are considered based on the equations of linear and nonlinear theories of a layer and on the numerical solution of nonlinear boundary value problem with the finite element method. For the generalized Hooke law, the Green strains components are found with three methods, and its comparison allows estimating the applicability limits of approximate theories of a layer.

Televniy D. S. **Modeling of triode electro-optical system**

In the paper, the modeling of triode electro-optical system is considered. The problem consists in a finding of function of potential distribution in the field of the system that is filled with two various dielectrics, at the set values on the cathode, the modulator and the anode. The variable separation method and the method of areas overlapping are used. In the result, the function of potential distribution in the system internal area is obtained.

Trofimov V. V. **Method of indirect measurement of low currents in emissive systems**

The method of the indirect measurement of current strength for emissive systems is considered in the article. In the result, the author obtains the calibration method of emissive images for the indirect current calculation. Obtained results are in good agreement with the theoretical calculations that are carried out for the tungsten tip. The method is suitable for experimental analysis of the emissive systems characteristics.

Ulanov E. A. **The Ferma–Torricelli–Steiner problem generalization**

In the present paper, the generalization of the Ferma–Torricelli–Steiner problem in case of arbitrary weights is considered. Analytical decision is offered (minima point localization of the objective function). Contingencies on the optimum point coordinate are obtained. It is analysed the dynamics of the optimum point coordinate conduct on plane in case of variable weights.

Fedorov A. G., Antonova L. I. **On analysis of nuclear structure of thin metal films with the field emission spectroscopy method**

In the present paper, the problem of the analysis of thin metal films structure is considered. Obtained results allow defining the area of applicability of thin metal films for analysis of its structure with the holographic method.

Chernyshev A. A. **"Russian sextuplet" optimization**

In the present paper, some problems of global optimization of focusing beam lines systems are discussed. Necessary for optimization analytical and numerical methods and tools are realized. Some solutions for "russian quadruplet" system are obtained. New results of improvement of "russian quadruplet" with two supplementary lenses are discussed.

Shymanchuk D. V. **On possibility of construction of return trajectory in the neighborhood of collinear libration points L1 and L2**

The moving of a spacecraft within the bounds of the rotary restricted three-body problem is considered. The possible return trajectory in the neighborhood of collinear libration points L1 and L2 is determined and analyzed. The numerical characteristics of the trajectory of a spacecraft are shown.