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Antonov A. Yu., Demchenko N. S. **Construction of electron trajectories in an emission system.**

The problem of the electron trajectories construction for a system with a tip field cathode is considered. Potential energy distribution in the interelectrode gap was found in prolate spheroidal coordinate system. Distribution of field strength on the tip surface was determined. Lagrange equations of the second kind for electrons were written down. Motion equations were solved numerically with Runge–Kutta type methods using the dense output. It was shown that the possibility of trajectories replacement by flux means task overrun.

Key words: field emission, electron trajectories, mathematical modeling.

Babadzanjanz L. K. **The Taylor series method.**

The Taylor series method to autonomous systems of ordinary differential equations with polynomial (in unknowns) right-hand sides is considered. The new fast algorithms for Taylor coefficients calculation and the a priori step size selection with the error estimation are proposed. All the algorithms are designed to allow computerized application of the method.

Key words: Cauchy problem, ordinary differential equations, Taylor series, error estimates, approximation, computerized application.

Ermolaeva N. N., Kurbatova G. I. **Thermal processes in expending spherical liquid shell.**

The algorithms for solving thermal problem in expending spherical liquid shell in the state of weightlessness is suggested. The solution of a hydrodynamic part of problem found earlier indicates that can to consider the layer thin. This makes it possible to divide the solution of thermal problem into two stages. For the first stage the computational solution of thermal problem in movable and changing area is suggested. In the second stage approximate ordinary differential equation that simulates dynamics of shell average temperature is obtained. Accurate development this equation is given for one of variants of boundary conditions that is of interest.

Key words: expending spherical shell, the computational solution of thermal problem in movable area with boundary conditions third type taking into account thermal radiation, the approximate analytical solution of problem about dynamics of shell average.

Kotina E. D. **On the theory of determining displacement field on the base of transfer equation in discrete case.**

The problem of determining a displacement field of a radiotracer in radionuclide diagnostics is considered. A mathematical model is constructed on discrete equations. For discribing of change of radoitracer density along trajectories the transfer equation for discrete case is used. The problem is reduced to an optimization problem for a discrete system, for solving which the iteration scheme is constructed. It is possible to use these model for the analysis of radionuclide images.

Key words: radionuclide diagnostic, mathematical modeling, discrete system, optimization problem, iteration scheme, displacement field.

Krivoshein A. V. **On approximation order of multivariate wavelet systems.**

For arbitrary matrix dilation, we study wavelet systems which are not a frame generally speaking, but a frame type decomposition with respect to such a system takes place in the weak sense in $L_2(R^d)$. Moreover, if all wavelet functions of the dual system have vanishing moments up order $n-1$, then the decomposition has approximation order n. A method for the construction such systems is developed.

Key words: wavelet frame, matrix dilation, approximation order, vanishing moments.

Mal'kov V. M., Kolesnikova S. S. **Construction of dynamical theory of an elastomeric layer by variational Lagrange method.**

The dynamical theory of an elastomeric layer which reduces a three-dimensional initial-value problem for three unknown functions to the solution of one two-dimensional wave equation for one unknown function is constructed. After this equation solution all other unknown functions, in particular displacements, are elementary found. Thus the solution of an initial problem extremely becomes simplier, the received wave equation does not contain small parameters at the highest derivatives and consequently there are no problems with its solution. Earlier the dynamical theory of an elastomeric layer had been constructed by an asymptotic method by V. M. Mal'kov but only for a case of harmonious vibrations. The case of non-stationary movement remained out of consideration. For a problem of harmonious vibrations a comparison of the results obtained by different methods is made. Though factors of the resolving equation and dynamic layer rigidity differ by the form, but within the limits of applicability of the dynamical theory of a layer by frequency the results of asymptotic and variational methods appeared to be close. The similar theory of a layer will undoubtedly find application in the solution of applied problems, in particular in creation of mathematical models for an object seismoisolation problem.

Key words: elastomeric material, dynamical theory of layer, variational method.

Novoselov V. S. **Integral invarianties and soliton solutions of the long wave equations.**

The initial equation describing the propagation of nonlinear waves in the one-dimensional case in a medium with dispersion is the Korteweg–de Vries equation (KdV) whose solutions are stable solitary wave structures (solitons). Solutions of the KdV equation were first obtained numerically. Later the method to solve the KdV equation analytically was found and exact solutions in the form of solitons were obtained. The fellowing equations describing the propagation of medium with dispersion are the regularised, long-wave equation (RLW) and the mixed, long-wave equation (MLW). In this paper three first integral invariants: the soliton solutions of the KdV, RLW, MLW equations are discussed. A new isometric soliton model (ISM) is proposed. An analytical construction of the one soliton and the two soliton solutions of ISM equation is given. As it is schown the two soliton solution of ISM equation represent the original isometric soliton with the variable velocity.

Key words: soliton, wave equations of long waves, integral invarianties.

Uteshev A. U., Tamasyan G. Sh. **On polynomial interpolation problem with multiple interpolation points.**

The paper presents a new treatment of the Hermite's generalized interpolation problem, i. e. for finding a polynomial of whose first few derivatives assume prespecified values at given points. The approach is based on construction of a polynomial of the degree albeit larger than the minimal possible one but with the coefficients explicitly expressible (in a linear recursive manner) via the entries of interpolation table.

Key words: polynomial interpolation, Hermite's generalized interpolation problem.

Shymanchuk D. V. **Modelling orbital controlled motion of a spacecraft in the neighborhood of the collinear libration point L_1.**

The problem of the stable orbital movement of a spacecraft in the neighborhood of the collinear libration point L_1 is considered. The numerical analysis of the control trajectory with different laws of control is conducted. The results of numerical integration are graphically illustrated. As an important result, the possibility of the stability of a spacecraft in the neighborhood of the collinear libration point L_1 is shown.

Key words: numerical modelling, orbital controlled motion, collinear libration point.

Balabanov M. Yu. **On initial control choice in charched particles beams dynamic optimization problems.**

The initial controls search task in nonlinear optimization problems is considered. The initial controls choice is very importaint in such problems. The controls search is a difficult task, because they have to satisfy the relevant constructional limitations and particles dynamics must have characteristics, satisfying the other given limitations. For automatisation of the controls search process the approach, based on knowledge gathering about the studed tast, is proposed. Also the controls analisis subject to dynamical characteristics of the considered system and genetic algorithm in the charged particles dynamics optimization problems are used in the approach. Mathematical model of programm and disturbed motion ensemble simultaneous optimization, proposed by A. D. Ovsyannikov in respect to charged particles longitudinal motion in RFQ acceleration structure is considered.

Key words: control, optimization, genetic algorithm, automatization.

Gerasimov M. A. **Huffman algorithm realization with given length of input stream segmentation on nearly linear time Turing machine.**

Huffman algorithm realization method coding input bit data stream in a binary alphabet is considered. One tape deterministic Turing machine with input and output tapes is used. Some time complexity estimations are made. Huffman algorithm realization discussed has a polinomial time and space complexity. An estimation theorem is proved. One case of NP-complete partition problem is discussed. This case has a polynomial time complexity estimation of the partition problem if the input data satisfy special conditions. In this case Huffman code tree and Shannon–Fano code tree are equivalent and the partition problem has an exact solution.

Key words: NP-completeness, approximation algorithms, computational complexity, partitions problem, Huffman code, Shannon–Fano code.

Klikunova K. A., Tregoubov V. P. **Mathematical modelling of movements controlled by muscles acting in opposite directions.**

The muscle contraction is a vitally important human organism function. All types of movements are realized by skeletal muscles. Mathematical modeling is an essential part of research directed to an understanding the contraction mechanism. For modeling the real human joint movements

it is necessary to take into consideration a fact that all cyclic movements are realized by muscles-antagonists acting in opposite direction to each other. The present paper is devoted to the modeling of oscillating limb movements around a joint which are realized by muscles-antagonists. The model of a muscle contractile component was incorporated into the mechanical model which takes into account elastic properties of the muscle. The equations of motion for a single muscle and for muscles-antagonists were obtained. Two fundamental schemes of movements around a joint were considered using the wrist and elbow joints as examples. The algorithm of muscle control by the central nervous system was constructed according to experimental data of oscillation movements.

Key words: skeletal muscle, muscles-antagonists, mathematical model, mechanical model.

Maksimov R. V., Stepanchuk V. P., Shvedunov V. I. **Magnet small-sized microtrone.**

Calculation permanent magnet of small-size microtron are presented. Analysis parameters of magnet system and compare this parameters with electromagnet of 5 MeV microtron are made.

Key words: microtron, electromagnet, permanent magnet, magnetic field.

Raba N. O. **Optimization of algorithm of coagulation in cloud model with spectral microphysics.**

Methods for calculating coagulation in the model of a convective cloud with detailed description of microphysics are presented. A new optimized algorithm is developed. The results of testing show significant speeding-up of calculations using this new algorithm. Methods of parallelization of computations by means of threads are also proposed.

Key words: optimization, parallel computing, threads, convective clouds, coagulation.