Aleksandrov A. Yu., Platonov A. V., Chen Y. **On ultimate boundedness of solutions for some classes of population dynamics models.**

The problem of the ultimate boundedness of solutions for certain classes of nonlinear differential equations systems is investigated. The systems considered are generalization of well known Lotka–Volterra model. For the solution of the stated problem the Lyapunov direct method is used. The approach for the Lyapunov functions construction is suggested. The conditions are determined under which, for systems investigated, there exist the Lyapunov functions of the preassigned form satisfying in the positive orthant all the assumptions of the Yoshizawa ultimate boundedness theorem. It is proved that, in a certain cases, these conditions are not only sufficient for the ultimate boundedness of solutions but also nesessary. The results obtained are also extended the systems of more general form. It is shown that if, in the systems considered, the predator-prey type relations between some of the spaces take place, the conditions found for the ultimate boundedness of solutions can be weakened. Moreover, hybrid models of population dynamics are investigated. It is assumed that the coefficients in the equations considered can be switched from one set of values to another. The conditions are obtained under which solutions of the hybrid system are ultimately bounded for any switching law.

Key words: population dynamics, ultimate boundedness, the Lyapunov functions, hybrid systems, generally homogeneous functions.

Barinov V. A. **Distribution of waves free surface of viscous liquid.**

The problem about gravitational-capillary waves free surface of viscous liquid is considered. For flat movement the invariant dynamic condition the free surface connecting pressure difference and viscous pressure is received. It is established that at small deviations of free surface from the position of rest the absolute size of tangents of pressure is much less than module of normal pressure. a forward and back wave slope of a tangent projection a pressure gallop tensor has opposite directions. the exact decision of a problem, and also expression as well is found in linear approximation for frequency, phase speed and a factor of attenuation of a wave. It is analytically certain that wave movement of viscous liquid can exist if the relation of viscous frequency to frequency of a wave for ideal liquid does not exceed 1.31. If this relation is less 0.46 it is possible to apply a model to the description of wave movement small viscous liquids. For such a model the decision is also received. It follows that frequency (phase speed) is less than frequency (phase speed) of a wave for an ideal liquid, and decrement of attenuation coincides with viscous frequency, i. e. it is twice less than under theory of Lamb.

Key words: gravitational-capillary waves, a viscous liquid, dispersive parities.

Demjanovich Y. K., Le T. N. B. **Wavelet decompositions of Hermite type splines based replacing of derivatives with differences.**

In this paper, we consider the wavelet decomposition of flows and construct the wavelet decompo-sitions of a space of Hermite type splines (generally speaking, not polynomial) based replacing of derivatives with differences. The basis of these splines is obtained from the approximation relations for the minimal (almost everywhere (α, β)) multiplicity of covering by supports of basis functions. Consequently, such splines are relative to the class of minimal splines. The decompositions are constructed; formulas of decomposition, reconstruction based replacing of derivatives with differences are deduced. The basic wavelets are continuous and have compact supports; moreover, an additional two grid points increases the dimension of the wavelet space by two (two basis wavelets are added to the original basis). As is known, in the classical wavelet theory, the question of constructing wavelets a segment is actual $[\alpha, \beta] \in \mathbf{R}$. Regarding this fact, we note that the proposed approach allows us to expand all the constructions to the case of a segment $[a, b] \subset (\alpha, \beta)$: it suffices to consider the restriction of functions to the interval.

Key words: wavelet decomposition, formulas of decomposition, reconstruction, basic wavelets.

Egorov N. V., Klemeshev V. A., Fomenko M. G. **Calculation of an electrostatic field diode emission system with the field cathode.**

The phenomenon of field electronic issue from flat surfaces of materials the basis of carbon, such as a film of diamond, a film on a basis nanotube carbon and amorphous carbon, is of interest as from the practical point of view, in view of perspectivity of creation of flat emission displays and use in various electronic devices, and for fundamental science. the reference to carbon materials in emission electronics was caused first of all by an opportunity of their use in conditions of technical vacuum. The ideology

of use of carbon fibres in field cathodes is based that they are steady against bombardment by ions of the residual gases, having a place in devices with a high-voltage feed and working in conditions of technical vacuum; character of dispersion of their surface provides dynamically steady configuration with presence of significant number emitting the centres (as it was established, in the specified conditions of operation one emitting the centres stopped the existence, others were formed again); they are a vacuum material. Already the first messages in the beginning of 1970th years about electronic emission of carbon materials (and it there were basically carbon fibres of unknown types) have shown basic perspectivity of such materials. For past years the huge experimental material research of emission from carbon materials is saved up. In this connection now detailed research of field emission from cathodes the basis of carbon nanotube is actual. In this paper the solution of Laplace's equation for the electrostatic potential distribution is presented for the diode emission system. It is used the method of the threefold integrated equations to found the unknown coefficients for the potential distribution. So the initial value-boundary problem is reduced to the decision of integrated equation Fredholm's of the second kind. The potential distribution is calculated for all region of the system.

Key words: field emitter, field emission, electron-optical system, electrostatic potential distribution.

Kozlovskaya N. V., Petrosyan L. A., Iljina A. V. **Coalitional solution in emission reduction model.**

Coalitional solution of the differential game is considered. the coalitional partition of the set of players is formed. Any player acts in the interests of coalition to which he belongs. The total cost of each coalition is divided among players according to Shapley value. Time-consistency is proved. the D. W. K. Yeung's condition is verified.

Key words: differential games, cooperative games, dynamic programming, Hamilton–Jacobi–Bellman equation, coalitional solution, Shapley value, Nash equilibrium, PMS-vector.

Provotorov V. V. **Method of the moments in the problem of exstinguishing fluctuations of differential system on the graph.**

The work is devoted to the study of the issue of searching the boundary control actions in the problem of extinguishing oscillatory processes which are described by linear partial differential equations the geometric graph-tree representing the chain of consistently connected stars. In additions the spectral method of analysis based sufficiently deep developed spectral theory of value problems the graph is used. The first part of the work is devoted to the analysis of an eigenvalue set structure of corresponding Storm-Liouville problem a graph, completeness (basic property) issues of an eigenfunction system in the function space with an integrable square the graph, conditions for uniform sequence convergence by eigenfunctions are presented as well. In the second part of the work a constructive procedure of reducing to the problem of moments concerning the damping boundary actions.

Key words: a boundary problem the graph-tree, extinguishing fluctuations, boundary control, a method of moments.

Proudnikov I. M. **Integral approximation of nonsmooth functions preserving local extremums.**

A new non-local approximation method is suggested. As a result we get twice differentiable functions preserving $\varepsilon(D)$-stationary points. With the help of these functions we can construct the second order optimization methods converging to $\varepsilon(D)$-stationary points with superlinear velocity.

Key words: Lipschitz functions, generalized gradients, Clark subdifferential, Lebeque integral, matrix of second derivatives, Newton's optimization methods for Lipschitz functions.

Byrkov I. A. **SELEN software package for computer-aided development of mathematical models for power system simulators.**

Equations of mathematical models for power system components and an approach for the development of a complex mathematical model are presented. A numerical diagram of the model developed by using the SELEN software package is shown. The paper outlines the software package and demonstrates its use in the development of the power system simulator for the nuclear-powered icebreaker "Rossiya".

Key words: power system, full-scale simulator, electric network, currents, voltage, flux linkages.

Kotina E. D. **Program complex "Diagnostics" for radionuclide research processing.**

Modern program complex "Diagnostics" for data processing in nuclear medicine. The complex has flexible component architecture. It provides help in research of organs' functional behavior conducted with the single photon emission computed tomograph. the scheme of the complex and its main diagnostics programs are considered. The complex includes diagnostics programs to process data of static, dynamic and tomography radionuclide studies in cardiology, pulmonology etc. This complex is based the first Russian digital two-detector single photon emission tomograph "EFATOM". Thus, it is possible to use the complex for the analysis of data taken with the help of other tomographs that support DICOM standard.

Key words: nuclear medicine, single photon emission computed tomography, single photon emission tomograph, programm complex, diagnostics programs.

Okunev V. V. **On optimization of the fractal image compression algorithm.**

The problem of fractal image compression algorithm optimization (in the sense of time cost) is considered. A method of classification by means of characteristic vectors is proposed. Practical application of the proposed method is illustrated by the examples.

Key words: image compression, fractal algorithm, block classification, optimization.

Simuni M. L. **Specifications of refactoring system for sparse matrix processing software.**

Program transformation and refactoring approaches to create sparse matrix processing software are considered. Specific features of the software development in this domain are studied. Benefits of the refactoring approach are studied. Functionality of the proposed refactoring tool is described. Design of the refactoring system, its organization and implementation are discussed.

Key words: program transformation, refactoring, sparse matrix.

Terentiev S. V. **On optimization of implementation an algorithm of localization of dynamical system invariant sets.**

Computer simulation of complex dynamical systems is widely applied to investigate their behaviour. The concept of an invariant set is one of the basic notions of the theory of dynamical systems. a localization of invariant sets allows to detect system dynamics. Design and implementation of localization algorithms are of great practical consequence because invariant sets often cannot be described analytically. Such algorithms are based set-oriented methods that operate with a finite covering of phase space (a set of sells) and the transformation of the cells under the system action. We use the symbolic image method (a variant of a set-oriented method) which allows us to construct the links between the sells of the covering and their images using an oriented graph. The cells are supposed to be interval vectors and their images using an oriented graph. The cells are supposed to be interval vectors and interval arithmetic is applied to calculate the image of a cell. The adaptive subdivision technique results in the construction of a sequence of approximation may be estimated by a cell diameter. The paper is devoted to the methods of optimization of the described algorithm such as parallel computations, mixed computations and application of R-trees for data storing. The last method allows us to speed the search of a cell in the covering. Numerical results and comparison characteristics of these methods are given.

Key words: dynamical systems, invariant set, symbolic image, interval arithmetic, mixed computations, parallel computations, index structure for high-dimensional data.