

## SUMMARIES

*Abbasov M. E.* **Finding stationary points of functions allowing nonhomogenous approximations of augment** // Vestnik St. Petersburg University. Ser. 10. 2012. Issue 1. P. 3–8.

Two approaches for constructing first degree approximations of a nonsmooth function (by means of exhausters and coexhausters) are studied. Advantages and disadvantages of each of them are discussed. A numerical method for finding stationary points of functions allowing nonhomogenous approximations of augment is presented. Convergence of this algorithm is proved.

*Key words:* nonsmooth analysis, nondifferentiable optimization, codifferentiable functions, exhausters, coexhausters.

*Arefina A. I.* **Design of  $H_2$ -optimal controllers for time-delay systems. Spectral approach** // Vestnik St. Petersburg University. Ser. 10. 2012. Issue 1. P. 9–17.

The problem of  $H_2$  optimization of a linear time-invariant system with delays is considered. The design method based on a spectral approach is proposed. The use of such approach for single input problems can greatly simplify the analysis and synthesis of optimal controllers in comparison with “2-Riccati” and LMI methods which are usually applied. Such simplification is highly important in implementing algorithms of adaptive adjustment of control laws for various dynamic objects in thereal-time mode due to the possible resource constraints of digital devices that are forming control inputs for dynamic objects and various embedded systems.

*Key words:* linear systems, optimization, space  $H_2$ , transfer function, delays, control laws.

*Bure V. M., Sergeeva A. A.* The model of service selection in the presence of different ways of ordering // Vestnik St. Petersburg University. Ser. 10. 2012. Issue 1. P. 18–26.

The company that provides services for processing customer orders is considered. The company offers several ways to implement the order, each customer chooses the best method for himself trying to minimize their costs. Company provides services through three types of an order technique. The existence of equilibrium for n person game where players are the customers of the company is used to solve this problem. All equilibria are explicitly found.

*Key words:* probability and game-theoretical modeling, queueing problem, n persons game, Nash equilibrium, the optimal strategy.

*Igolkin V. N.* A markovian variant of Lundberg-Cramer’s model of insurance com-pany ruin // Vestnik St. Petersburg University. Ser. 10. 2012. Issue 1. P. 27–32.

The model permits to compute  $P(u)$  unruin probability of an insurance company with an initial capital  $u$ . Beforehand some auxiliary values must be found as a solution of a system of integral equations. The Laplace transform is used for this purpose. Some unknown constants appears in this case. It is shown, how to find this constants. There are some numerical examples.

*Key words:* Markovian variant of the Lundber’s model, ruin probability, Laplace transform, unknown constants of the transform.

*Mazalov V. V., Kondratyev A. Y. Bargaining model with incomplete information // Vestnik St. Petersburg University. Ser. 10. 2012. Issue 1. P. 33–40.*

A theoretical game model of bargaining between buyers and sellers with incomplete information related to deals is considered. A player (buyer or seller) has a private information about his reserved price. Reserved prices are random variables with known probability distributions. Each player declares a price which depends on his reserved price. If the bid price is above the quoted price the goods is sold for the average of two prices. Otherwise there is no deal. Two types of Bayes equilibrium are derived. One of them is a threshold form another is a solution of a differential equation system. Some numerical results are presented.

*Key words:* bargaining model, seller-buyer interactions, incomplete information, differential equations for equilibrium.

*Matrosov A. V. Convergence of power series in the method of initial functions // Vestnik St. Petersburg University. Ser. 10. 2012. Issue 1. P. 41–51.*

An algorithm for constructing basic equations of the method initial functions (MIF) for plane problems of elasticity theory for anisotropic solids in an orthogonal Cartesian coordinate system in matrix-operator form using a general solution of elasticity theory equations in displacements through two arbitrary functions is presented. Displacements and stresses at an arbitrary point of an elastic body are obtained as a result of an impact of MIF operators to displacements and stresses (initial functions) defined on a coordinate line. The MIF operators are obtained in the form of power operator series in which the operator acts as a differentiation operator with respect to one of the independent variables. Regularity of MIF operators for an arbitrary anisotropic body is shown. Convergence of power series in the MIF solution in the case of the initial functions definition in terms of trigonometric sines and cosines is proved.

*Key words:* plane problem of elasticity theory, anisotropic body, method of initial functions.

*Makhinova O. A. Properties of finite-difference analog of one-dimensional Laplace operator on the graph // Vestnik St. Petersburg University. Ser. 10. 2012. Issue 1. P. 52–59.*

The finite-difference analogs of one-dimensional Laplace operator on the graph-star and the graph with a cycle are considered. At the same time differential operator characteristic continuity at its reduction to the finite-difference analog is essential: the structure of an eigenvalue set is similar to the structure of a proper value set of a differential operator, completeness of eigenvectors in the finite-dimensional space remains, the finite-difference analog of Laplace operator remains symmetric and positive.

*Key words:* one-dimensional Laplace operator, finite-difference analog of Laplace operator, characteristics of operator.

Provotorov V. V. Construction of boundary controls in the problem of oscillation damping of a system from  $m$  strings // Vestnik St. Petersburg University. Ser. 10. 2012. Issue 1. P. 60–69.

An elastic system of  $m$  strings fixed as a graph-star is considered. Such mathematical objects are a basis of mathematical models of fluctuation processes in antenna designs of various types. A method of finding boundary operating influences consisting of the transfer of the system fluctuation process from the appointed initial condition into the rest one is presented. The spectral technics (Fourier analysis) is used allowing rather easily to overcome the complexities generated by the graphgeometry. The main result of the research is presented in the form of the ready formulas defining required boundary controls as the function of time.

**Key words:** a boundary problem on the graph, boundary control, transfer of system from the initial condition into the rest one.

*Sidorin A. O., Shurkhno N. A., Trubnikov G. V. Parameters modeling for tungsten – caesium field emission systems* // Vestnik St. Petersburg University. Ser. 10. 2012. Issue 1. P. 70–86.

The mathematical model of the algorithm for calculating the evolution of the particle distribution function in transverse phase space and function of the energy spread for the synchrotron with a stochastic cooling system using a notch filter technique is described. Simulation results for the distribution function and momentum spread of the proton and carbon beams in accelerator Nuclotron are presented. The description and working principle of the proposed construction of a stochastic cooling system based on assembly of the ring slot-coupler pickups are also described and a notch filter design and assembly of the entire cryo-vacuum system for installation at Nuclotron are given.

*Key words:* stochastic cooling, Fokker–Planck, equation accelerator.

*Yudin I. P., Voloshina I. G. The calculation of the magnetic field maps for the integral statement for the analyzing magnet of the “Delta-Sigma-T” spectrometer* // Vestnik St. Petersburg University. Ser. 10. 2012. Issue 1. P. 86–96.

The problem of magnetostatics is considered in the integral formulation. A brief description of the method of calculation is given. The corresponding formulas and algorithms for solving the magnetostatic problem are presented. The results of the calculated field distribution of the analyzing magnet SP-94 with clearance of 13 cm for the experiment “Delta-Sigma-T” are shown. The magnetic spectrometer system consists of analyzing magnet 2-SP-94-1B with the interpolar gap of 0.13 m, it has external dimensions of 2.95 m  $\times$  2.12 m  $\times$  1.62 m and aperture of 0.30 m  $\times$  0.13 m. The calculation was performed for the volume 0.33 m  $\times$  0.0645 m  $\times$  1.02 m, the volume of overlapping dimensions which was shown in calculated data with experimental ones. The calculation of the spatial distribution of three components of the magnetic field of the magnet 2-SP-94-1B are conducted to obtain the information of magnitude and uniformity of a magnetic field and to build a working map of the field for different modes of spectrometer operation. The results obtained are planned to use in processing physical data.

*Key words:* integral equations, mathematical modeling, magnetic field, spectrometer for high energies physics.

*Shelabin D. A. Moving object classification using bayesian networks // Vestnik St. Petersburg University. Ser. 10. 2012. Issue 1. P. 97–108.*

Article is devoted to the moving object classifier. This classifier can be used to trace an object in a moving object detection system together with the other methods. The classifier is based on Bayesian network and uses an object's color distribution histogram. This feature allows to classify objects overlaid by other objects, rotated, reduced or partially distorted objects. The description and formalization of this approach is performed, its advantages and shortcomings identified during testing are indicated as well.

*Key words:* classification, moving object, tracing, bayesian network, network parameters, network structure.

*Sultanbekov A. A. Certain stability conditions of nonlinear non-autonomous difference systems // Vestnik St. Petersburg University. Ser. 10. 2012. Issue 1. P. 109–118.*

One of the important classes of the systems describing dynamical processes is the class of difference systems. In many respects the properties of solution difference equations are similar to those properties of corresponding differential equations. The problem of solution stability preservation is the actual one in passing from continuous systems to discrete ones. In certain cases the correction of difference schemes for maintaining compliance between solution properties of continuous and discrete equations is required. This correction leads to essential complication of computational schemes. Therefore the problem of system class allocation for which the preservation of qualitative characteristics at transition to a discrete system takes place without corresponding corrections is rather important. The problem of the zero solution stability for a certain class of essentially nonlinear difference systems is studied. The right hand-sides of the systems represent linear combinations of power functions of phase variables. It is assumed that the investigated systems are influenced by non-stationary perturbations. The case when perturbations are included into factors of the specified linear combinations is considered, the mean values of the perturbations are equal to zero. Theorems on the stability are proved by means of discrete analog of the Lyapunov function method. The estimates for the transition process duration for the nonlinear difference equations are found. It is shown that for the given class of systems the compliance of properties (in the sense of the stability preservation) of discrete systems and corresponding continuous system is performed.

*Key words:* difference systems, stability, Lyapunov functions, non-stationary perturbations.