1. MATHEMATICAL THEORY OF CONTROL PROCESSES

Abstracts

Angelov T.A., Sukach M.P. **The method of searching for the closest point to the origin inside a polytope**

In the paper the exact algorithm solving the problem of searching the point closest to the origin inside a polytope is described. Such question appears while solving the problems of computational geometry, pattern recognition and other problems. For instance, this algorithm is used in a program solving nondifferentiable optimization problems. Statements with their proofs which are the basis of the algorithm are given. The proposed algorithm supports concurrency.

Volkova A.S. **Generalized solutions for elliptic equations in the problems of boundary control on a geometric graph**

In the work we consider the generalized solution of boundary value problems for elliptic equations in the class $W_2^1(\Gamma)$ on a geometric graph Γ. The analogues of the Sobolev spaces is dense in $L_2(\Gamma)$ for $W_2^1(\Gamma)$, which deal with different types of boundary value problems and their spectral characteristics, are constructed.

Gnilitskaya Y.A. **Boundary control of vibrations of a string system**

In the paper, it is specified the method of searching the boundary controls for the class of smooth functions in the control problem of elastic system, that consists of m strings attached to the complete bipartite graph. To solve the problem it is used special cases – vibration damping system and the system's translation from the initial state of rest to the desired final state. To analyze this problem it is using a spectral technique (Fourier analysis). The main result of the work is presented as formulae those determine an unknown boundary control as the function of time.

Medvedeva I.V. **On the convergence method analysis for the time-delay system stability**

In the paper, it is proved the convergence of the algebraic method of the exponential stability analysis for the linear time-invariant differential-difference systems. This method is based on the positive definiteness investigation for the quadratic Lyapunov – Krasovskii functional on some special set of functions, and develops Lyapunov second method for the stability analysis of systems with delay. The algebraic method convergence allows it to find numerically the delay intervals of exponential stability or nonstability for the linear time-invariant differential-difference systems.

Slupko K.A. **On convergence of the method for the construction of Lyapunov matrices for differential systems with delay**

In the paper, the numerical method for the construction of Lyapunov matrices for linear time-periodic systems with delay is proposed. Convergence of the method

and the its observational error are investigated and analysed.

Sultanbekov A.A. **On the regular ultimate boundedness of nonlinear difference systems**

In the paper, the problem of regular ultimate boundedness of essentially nonlinear difference systems is discussed. The right hand-sides of the systems represent linear combinations of exponential functions of phase variables. The theorem of regular ultimate boundedness of the considered systems is proved. The conditions under which the perturbations do not destroy regular boundedness of the considered systems are found.

Sumacheva V.A. **The H_2 norm of a transfer function of a scalar neutral type time delay equation**

The norm of transfer functions plays an important role in synthesis of optimal control. In the work the method of computing the norm for a scalar neutral type time delay equation with use Lyapunov functions is presented. As a result the explicit formula is given.

Falkov E.A., Kvitko A.N. **A method for solution the control problem on the part of the phase coordinates**

The synthesizing control algorithm that guarantees the transfer of nonlinear time-invariant ordinary differential equation system from the origin to its neighborhood with respect to a given part of the phase coordinates is proposed. The algorithm consists in the solution of the problem of stabilization for the auxiliary linear system for all the variables and the subsequent solution of the Cauchy problem for the nonlinear system, closed with the control that obtained during the solving of the stabilization problem. The constructive selection criterion for final states, guaranteeing the implementation of the resulting algorithm, is given.

Firyulina O.S. **The computation of square (0,1)-matrices nondensity**

The problem of computation of the square (0,1)-matrices nondensity belongs to the NP-complete problems and is one the most important problems in the extremal graph theory. In this paper a new algorithm which allows to compute the stated invariant, based on the method of separation of structural features of (0,1)-matrices is proposed. Each branch of the search tree generated by the presented algorithm, corresponds to the unique maximal independent set. Supplementary procedures for the exception from consideration of not perspective nodes of the search tree can reduce the time of the algorithm to solve the problem.

Fominych A.V. **A method for the construction of the approximate solution of the differential equation system**

In the paper the nonhomogeneous system of the differential equations with the uncertain entry condition is considered. The problem of solving the system is reduced

to a minimization problem with constrains of strictly convex functional in normalized space. The general algorithm of the program, realizing the construction of the approximate solution of the problem in individual case is described. The solution is constructed in the form of polynomials with preassigned degree. The comparison of the exact and approximate solutions and the construction of the ensemble of trajectories is illustrated with the example. The application of the presented approximate solution to the control problems of ensemble of trajectories is mentioned.

Kholodnykh P. V. **The detailed model of the structure of complicated technical complexes in form of system of logic equations and its application**

The analytical model of the structure of technical complex with multiple devices is proposed in form of the modified system of logic equations, considering specific features of elements of various type and communications between them. The solution of such system of equations using method of consecutive fall of an order or a method of symbolical iterations allows to get function of working capacity of a technical complex without preliminary reception of the general solution and manual search in particular solutions.

Chumakov A.A., Tamasyan G.S. **Methods for searching the point of an ellipsoid nearest to the origin**

Several algorithms for searching the point of an ellipsoid which is the nearest to the origin are considered in the paper. Various approaches for solving this problem are presented, such as the method of Lagrange multipliers, the method of "balls the method of exact penalty functions, and some others. Some results of numerical experiments are presented.