1. MATHEMATICAL THEORY OF CONTROL PROCESSES

Abstracts

Abbasov M. E. **First order minimization in nonsmooth analysis**

The article describes a certain class of nonsmooth functions, namely codifferentiable ones that admit a first order approximation. Based on the necessary minimum conditions, numerical procedure is constructed; its convergence is proved.

Egorov A. V. **Comparative analysis of numerical methods of the Lyapunov matrix construction for a scalar time-delay equation**

The author proposes some methods of the Lyapunov matrix polynomial approximation. The comparison is made for case of the scalar equation with a single delay. These methods are compared with respect to the following three parameters: a degree of the polynomial approximant, an accuracy, and computation time.

Zaranik U. P. **The Adams method for the construction of asymptotic stability domain for difference-differential equations**

The article presents the analysis of a nonlinear system of difference-differential equations with a continuous initial condition. The Adams method for the approximation construction of asymptotic stability domain in a phase space is developed and illustrated with an example.

Kuznetsova A. S. **Existence of the periodic solution of the motion equation of quasi-linear mechanical system with delay**

The article analyzes the initiation of periodic motion of mechanical system with an internal force delay. It is established that a periodic solution does exist for the first approximation.

Lebedev D. M. **Modified method of support vectors**

In the article, it is considered a method of constructing the hyperplane that strictly separates two point sets in case of that intersection of convex hulls of these sets is empy. Otherwise, there exists a hyperplane that allows to compute the distance between itself and the most remote incorrectly defined points of every set. The present method is realized in MATLAB and tested.

Medvedeva I. V. **Inversion of the direct Lyapunov method in the stability analysis of systems with delay**

In the article, the constructive test conditions of the positive definiteness of the quadratic Lyapunov–Krasovskii functionals for linear time-invariant systems with delay are reduced and validated. These conditions allow using the second Lyapunov method for the analysis of exponential stability of such systems. An illustrative example of the stability analysis using the considered method is made.

Miheev V. S. **On real rational approximations of analytic function on unit disk**

The author considers the class H of analytic functions in closed unit disk that assume real values for real arguments. It is analyzed the problem of H-class function approximation via the element of W-class irreducible real rational functions, having the maximal degree of numerator and denominator that does not rank over n. The author proves theorem about the best approximant degree on condition that the function is not a rational one with the maximal degree less than n.

Morozov P. D. **Existence of periodic solution in nonlinear system with delay (central case)**

In the paper, the author considers the problem of existence of periodic solution of elliptic orbit which motion is described with a differential-difference equation with delay. Value of delay is obtained from the Loginov hypothesis. After substitution of delay value to the auxiliary system and some transformation the multiplicators for the obtained approximations can be computed.

Ponomarev A. A. **Smith predictor in nonlinear case**

The article focuses on the Smith predictor idea, which is known since the late 1950s and was originally applied in the linear systems control with time delay in feedback loop. The author uses the Smith method for the nonlinear system stabilization. It is demonstrated that the linear approximation of the given model may be used as the inner model of predictor.

Sukach M. P. **Finding of minimal distance between a point and a convex polyhedron**

The author considers the problem of finding of minimal distance between a point and a convex polyhedron in conditions that the point does not belong to it. For solving of this problem can be used several methods (geometrical, optimization one). In the paper an optimization method is applied. It is realized based on the theory of penalty functions and subdifferential calculus. By means of conditions of subdifferential function extreme, the problem is reduced to solving of the system of linear algebraic equations. It is also performed a constructive methods for its solving. The program realization is provided.

Tur N. S. **Recursive computation of the interpolation bivariate polynomial coefficients**

In the article, it is presented the theorem that allows recursively, beginning with the leading term, compute the interpolation bivariate polynomial coefficients. The proof is based on the Euler- Lagrange formula. Numerical example is made.

Firsov A. P. **Correction of moments of the Zubov approximating mixture**

In the paper, the moments correction of the Zubov mixture problem considered in respect of the mathematical expectation and dispersion. The author focuses on the possible types of initial probability distribution; variants of correction are proposed. Accuracy conditions are stated also.

Firyulina O. S. **Method for constructing maximal independent sets**

The article presents a method of construction all maximal independent sets in an undirected graph. The proposed algorithm uses a recursive scheme that is based on branch and bound method. Any branch of the enumeration tree that is built on this algorithm corresponds the maximal independent set.

Chernuetsanu E. K. **Finding a hyperplane separating two polytopes**

In the article, the problem of construction a hyperplane that separates two polytopes is considered. A numerical procedure of construction a class of such hyperplanes, which is realized via MATLAB system, is proposed. It is based on the solution of a nonlinear programming problem with a nonsmooth criterion function and an equality-type constraint. It allows to construct concerned hyperplanes for strictly separable polytopes and to find a hyperplane in case of the polytopes intersection. Results of calculations of test examples are presented.

Sharlay A. S., Alfyorov G. V. **Robots and mechatronic systems**

Some problems of robotics and mechatronics and approaches of construction of mechatronic systems are considered. Modern interpretations of conception of mechatronic are discussed.

Shakhov Ya. A. **The application of the Luenberger observer for a program motion stabilization of the quasi-linear time-invariant system**

In this paper, the problem of synthesis of the stabilizing control for quasi-linear time-invariant system in case of the incomplete feedback is considered. Sufficient conditions of existing of the Luenberger observer for this class of dynamic systems are obtained.

Shchus A. N. **Development of the adaptive track control system based on the predictive control model**

The article describes the way of union of predictive control methods and methods of parametric identification of mathematical models in the problem of the sea craft control. The author focuses on the possibility of parametric identification of nonlinear control object model during a sea voyage. It is considered a using of the present model in a contour of the control signal formation by methods of predictive control model.

Yakusheva D. B. **Boundary problem solution for nonlinear fixed controlled system of differential equations on infinite time interval with a discrete control**

The author obtains the criterion, guaranteed the discrete control function existence, that provides passing of the solution of non-linear fixed controlled system of differential equations from the initial state to a neighborhood of zero. The restrictions on control function and phase coordinates are considered.