

5. CONTROL PROBLEMS IN SOCIAL AND ECONOMICAL SYSTEMS

Abstracts

Baskov O.V. **Dual fuzzy cones**

A generalization of the concept of dual cones to the fuzzy case is considered. Three equivalent definitions and some basic statements about the properties of dual fuzzy cones are given.

Parilina E.M., Bogdanova O.K. **Markov process of the product distribution in social network**

A social network consisting of a finite number of agents which may be active or susceptible is considered. The dynamics of the spreading of a new product in the network is modeled. Advertising this product affects on the agents of the network. It is assumed that the transition of agents from the susceptible state to the active state occurs with a probability depending on the number of active players in the network and the impact of advertising. Process of transition in the course of time can be modeled with discrete Markov chains. The case of product distribution in the social network consisting of three agents is considered. The strategy maximizing the total profit of the company is found.

Bolotina O.V. **Coherent risk measures**

The work is devoted to the question of decision making under risk. Concepts such as risk, risk measure, a deterministic equivalent, an acceptable risk and coherent risk measure are introduced. The measure of risk is determined through the concept of a set of acceptable risk. It also provides the most commonly used measures: incoherent risk measure - VAR and coherent risk measure - Shortfall. Comparisons of these measures are considered on particular example.

Gurevich A.S. **Avoiding bankruptcy in a model with delayed payments**

In the paper a strategy to avoid bankruptcy in a model with delayed payments, based on Foster and Hart operational measure of riskiness, is presented.

Dubovenko A.R. **On the possibilities of managing the dynamics of demography at the macro level**

In the paper a particular problem of smoothing fluctuations of the population dynamics by entering into the system the various controls is solved.

Yeremenko O.Y. **Method of the shock for rejecting defective items**

Shock is a widely used engineering method of elimination of defective items before they are shipped to the customers or put into field operations. Items are subjected to a shock, failed during this operation items are discarded. Optimal level of the

shock minimizes quantity of defective items.

Zhigachjova A.L. **On modification of endogenous growth model of Lucas**

In the paper a modification of endogenous growth model of Lucas is presented.

Zakroyschikov S.A. **Estimation of corporation liabilities before the worker on pension insurance**

The article assesses the actual costs of liabilities of a company to its employees on additional lifelong pension insurance. The problem of actuarial evaluation of company's liabilities to a certain employee, which is based on data provided by "Russian Railways" is solved. In the article the problem is stated and an exact mathematical model to solve it is created.

Zamurayev K.A. **On an investment flow control in Saint-Petersburg economics**

In the paper the problem of management by the investments into fixed capital for reaching the certain levels of a revenues of the Saint-Petersburg organizations is considered. Process modeling is made on the real data with the assumption that investments into fixed capital and organizations revenues organize dependence and simultaneously have endogenous nature. In the model the inflationary component is considered, also a forecast of investments is constructed and compared to the real data, besides it a forecast distribution strip is modeled.

Krylatov A.Ju., Zaharov V.V. **Nash equilibrium in a game of navigation providers**

Based on the recent water-filling problem solution, an original approach to traffic flow management is developed in order to answer the challenges of flows dynamics and uncertainty. Both traffic flow assignment and management are represented as a non-zero-sum game and interpreted as a low level of decision-making. In addition, the existence and uniqueness of Nash equilibrium are proven and, moreover, explicit form of Nash equilibrium is found.

Sokolov Ju.S., Zenkevich N.A. **A game-theoretic contract model of project management**

In the paper a two-stage contract model of project management is constructed. The project is defined by a set of tasks with stochastic duration and incomplete information about costs under work performance. On the first stage the center (leader) defines payments for performers (followers) to complete the set of tasks. Two cases of payment time are investigated: when performer completes his own work or the project is completed. On the second stage performers manage work rates to complete their tasks. Nash equilibrium and expected project duration are found.

Parilina E.M., Ivanova K.A. **Weibull distribution in binary choice models**

Binary choice models (linear regression model, logit and probit models, model with Weibull distribution) are considered in the paper. Estimation of the parameters for logit model is found. Model with a Weibull distribution function is introduced. Estimation of parameters for the binary choice model where distribution function is Weibull distribution function is got. An empirical study is carried out, the sample is obtained. Estimations of parameters for logit model and for model with a Weibull distribution are found by the numerical method. Measure of fit of the constructed models is calculated for both models and conclusion about the adequacy of these models is made.

Kumacheva S.Sh., Ignateva E.P. **Forecasting bank accounts demand balance**

In the work the question of searching for the statistical method, that would help to improve the existing bank method of forecasting accounts demand balance, is considered. The importance of such question lies in the fact that well-timed and exact determination of demand balance allows to use raised funds effectively and to get significant profit.

Ipatova D.A. **Life insurance rate accounting based on linear intensity of mortality**

A model of long term life insurance for the linear intensity of mortality is builded. Based on that model the lifelong insurance contract net prize is calculated and the insurance extra charge is evaluated.

Shevkoplyas E.V., Kostjunin S.Ju. **On the choice of utility function in the problem of exhaustible resource extraction**

The optimal control problem of exhaustible resource extraction is considered. Different utility functions are proposed. Solutions of the problems with different utility functions are analyzed and compared.

Parilina E.M., Marochkina K.V. **The method of trimmed k -means in cluster analysis**

Search for the groups in the cluster analysis can be deteriorated by the appearance of outliers and other aberrations in the studied sample. Non-hierarchical method, which is able to resist the presence of a certain percentage of outliers, is considered in the paper. This is the method of trimmed k -means, which is an enhancement of the classical k -means algorithm.

Mezenin K.S. **Model of long-time contract in the supply chain**

In the paper the problem of optimization of costs and maximization of profit is considered in the supply chain at dynamic case. Optimal controls and optimal trajectory are found with help of Bellman equation. Obtained solution is verified for dynamic stability.

Mironov B.D. **Pareto-optimal solutions for multicriteria problem of maximum matching**

In the paper the problem of the discussions, that is reduced to the problem of maximum matching is formulated. The algorithms for finding the optimal solutions to the problem of the maximum matching with a single criterion are constructed. An algorithm for constructing the Pareto set for the problem of maximum matching with the two criteria is described. A way of reducing the problem of the discussions to the problem of maximum matching is stated, and a way to select an option from the Pareto set, taking into account the specifics of a particular task is given.

Pertsovsky A.K. **Usage of clusterisation algorithms for solving vehical routing problem**

Clusterisation methods for the decreasing the dimensions of vehical routing problem and geographical regions construction are described.

Parilina E.M., Petrosian O.L. **Methods of linear regression in the economic model of small demand**

The multi-agent economic-mathematical supply-demand model with unit demand is investigated. The statistical approach uses linear regression to predict the resulting price. The approach is based on the illustrative simulation tasks.

Svichshikova M.V. **One way to solve stochastic programming problems of special type**

Stochastic program with the objective function of type $c(x, \omega) \cdot x$ is considered, where x is n -dimensional vector of variables to optimize, ω is collection of r random parameters, c is n -dimensional vector-function. As a quality criteria one chooses standard deviation from optimums of nonlinear programmes generated by the stochastic program under realizations of collection ω . The straight algorithm to search an approximation to the optimum of the stochastic program according to the quality criteria is proposed.

Chentcova E.I. **The problem of estimation of actuarial liabilities of a company to its employees**

In the article the additional lifelong pension program is considered as one of the social support instruments for employees. The problem of estimation of actuarial liabilities of a company to all of its employees is solved to define eventual costs of the program. Accurate and approximate problem solutions are offered on the base of a complex mathematical model. The calculations are made based on the data provided by the public corporation "Russian railways".