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Slovokhotov Y.L.

The paper presents a state-of-art review of sociophysics: a new growing field of science where the methods of experimental and theoretical physics are used to study social phenomena. Part 1 points to the main area where physics overlaps with social sciences, and presents some examples of social dynamics analysis by physicists, taken from the literature. The topics include the modulation of historical data by climate change and solar activity, modeling of vehicular traffic and other systems of living particles, discrete states and spontaneous transitions in these systems. Next parts will present structures and dynamics of social networks, physical ideas in theoretical economy (econophysics), computational models in sociology, culturology, political science, linguistics, and mathematical history. Some academic problems as well as possible applications of sociophysics are discussed.

Keywords: interdisciplinary physics, modeling of social systems, sociophysics.

THE NEW CRITERIA OF LARGE DYNAMIC SYSTEM CONTROLABILITY AND OBSERVABILITY 21

Budargin O.M., Misrikhanov M.Sh, Ryabchenko V.N.

The problem of controllability and observability analysis of a large linear dynamic MIMO-system with inputs and outputs not less than half the dimension of the state space is considered. New necessary and sufficient conditions (criteria) of the complete controllability and observability in the form of linear matrix inequalities are proposed. Based on these conditions, estimates are given for measures of controllability and observability. The example of analyzing the controllability of the large power system is given.

Keywords: MIMO-system, state space, controllability, observability, band criteria, linear matrix inequalities, evaluation of controllability and observability, large power system.

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Zubarev V.V., Irikov V.A., Korgin N.A.

The paper describes the integrated approach to region (municipalities, industries, enterprises) innovative development control system on the basis of program-target planning and mathematical methods for solution of problems that arise during its implementation.

Keywords: program-target planning, development control, innovative development control system, integrated value, cognitive mapping, resource allocation, network programming.

AXIOMATICS FOR THE POWER INDICES IN THE WEIGHTED GAMES 33

Shvarts D.A.

A majority of the real voting rules are (or may be written as) voting with a quota (i.e. weighted game). But the axioms for the power indices defined on simple games are not directly transferred to the weighted games, because the operations used there are defined incorrectly in this case. Nevertheless, most of the axiomatics can be adapted for the weighted games. The main goal of this article is to answer the question: how to do it?

Keywords: index, power, Banzhaf, preferences, weighted games, axiom.

MULTI-PRODUCT (ITEM) STOCK CONTROL IN THE CONTEXT OF UNCERTAINTY AND NONSTATIONARITY. PART II. SAFETY STOCK CONTROL 42

Mandel A.S.

The paper discusses the problem of multi-item inventory control problem in the context of uncertainty and nonstationarity. The author proposes a multi-stage procedure as the basis for practical solution of the multi-item inventory control problem in the context of nonstationarity and lacking trustable information on statistical parameters of the demand. The main point of this procedure is that it starts with identification of the main trends covering seasonal components of the demand which are then used as a basis for the solution of the deterministic multi-item inventory control problem. At subsequent stages solutions are studied for the problem of generating additional orders for inventory replenishment (safety stock) to make up for random deviations of the demand from the identified trends.

Keywords: inventory control, conditions of uncertainty, nonstationarity, forecasting, expert-statistical approach, adaptive algorithms, Kalman filter algorithm.

A MOBILE MULTICYCLE CONTROL ACTION FOR SOLUTION OF TWO-DIMENSION PROBLEMS OF OBJECT HEATING 47

Finyagina V.I.

The concept of mobile multicycle control action for two-dimensional problems of object heating is introduced with the purpose of obtaining the static temperature distribution (temperature field) in two-dimensional plane. Exact and detailed mathematical interpretation of this problem (achievement of temperature distribution) is presented.

Keywords: system, distributed parameters, mobile multicycle control action, trajectory, concentrating action source, surface.

THE ANALYSIS AND PROCESSING OF ARCHIVAL DATA IN THE SYSTEMS OF DISPATCHING MANAGEMENT 55

Grigoriev L.I., Elov N.E., Abdullin I.V.

The paper describes the algorithm of searching alarm and emergency events templates in technological control system events archives and its realization. The work has been performed in the form of a full-fledged decision-support system. The use of other obtained data: analytical systems and computer trainer complexes for efficient personnel preparation is also proposed.

Keywords: alarms and emergencies events, automated dispatching control system, association rules, real time control, statistical analysis, decision-support system, SCADA.

SIMULATION OF COMPUTER SYSTEM WITH A FLOW ALTERNATION BETWEEN COMPONENTS 62

Promyslov V.G.

The questions of computational modeling of distributed systems are analyzed. For simulation the network calculus method derived from the mini (maxi) plus algebra is considered. The simulation focuses on an area of network systems with a variable flow of data between system components. The simulation is based on use of the extended slope (Legendre) transform to calculate the envelope of the output flow for the system. An example of modeling a computer system with summation of two flows when one flow has T-SPEC shape is presented. The second example deals with system with linear flow change and packetizing effect.

Keywords: network control system, network calculus, Legendre transform.

PATH DEFORMATION METHOD IN ROBOT MOTION PLANNING PROBLEMS IN THE PRESENCE OF OBSTACLES 70

Gilimyanov R.F., Rapoport L.B.

Path planning problem arises in many practically important fields for different robots, including wheeled and space ones. The following motion planning problem for a robot is considered. Suppose that there is a precomputed collision-free path, but, in the course of time, there may appear new obstacles (or old ones may change their positions) that prevent motion. It is required to deform the path to make it collision-free. To solve the above problem, a new method is proposed. The method is based on a component-wise method for improving path curvature and on the potential field method. The proposed method not only allows the path to avoid obstacles but also makes it smoother both in the 2D and 3D cases.

Keywords: path planning, obstacle avoidance, potential field method, path deformation, mobile robots, curvature smoothing, B-splines.

A COMPUTATIONAL PROCEDURE FOR THE OPTIMAL CONTROL OF MULTICHANNEL COMMUNICATION 80

Ismailov I.G.

An approximate construction procedure for the optimal control of multichannel communication network is presented. Alternative sets of control parameters are considered in the procedure.

Keywords: multichannel communication systems, optimal control, approximate methods.

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