

PLASMA CONTROL IN TOKAMAKS

Part 3.1. Plasma Magnetic Control Systems in ITER

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Abstract. The plasma magnetic control systems for ITER (International Thermonuclear Experimental Reactor) are presented. The systems comprise original engineering solutions for plasma position, current and shape control for the two versions of ITER: ITER-1 and ITER-2, including those designed in V. A. Trapeznikov Institute of Control Sciences of the RAS. It is noted that in ITER-1 the plasma position and shape were controlled by all PF-coils and robust H_∞ -controllers, while to decrease peaks of control power for suppressing the minor disruption the additional nonlinear circuit was used without significant changes in displacements of the gaps between the plasma separatrix and the first wall. In ITER-2 the special circuit with a fast voltage rectifier was used for plasma stabilization about zero, while for plasma current and shape control the special cascade control systems were designed with and without the control channels decoupling, with robust H_∞ -controllers and predictive model, and with adaptive stabilization of the plasma vertical position as well. To increase the plasma controllability region in vertical direction the additional horizontal field coils were introduced into the ITER-2 vacuum vessel and the capabilities of the system with the new circuits to control the plasma vertical position at the noise presence were investigated.

Keywords: tokamak, plasma, plasma magnetic control, ITER.

Funding. The work is performed with financial support of Russian Foundation of Basic Research (grant No. 17-18-00293) and Russian Science Foundation (grant No. 17-19-01022).

UPPER BOUNDS OF THE DEVIATIONS IN LINEAR DYNAMICAL SYSTEM WITH BOUNDED DISTURBANCES

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Abstract. A practically significant effect of a surge occurrences in linear dynamical systems under nonzero initial conditions is explored. The linear dynamical system subjected to unknown-but-bounded exogenous disturbances is considered. Using the apparatus of linear matrix inequalities and the invariant ellipsoids concept, the estimations of the upper bounds of the trajectories deviations are obtained, and an approach is suggested to the feedback design that minimizes the deviations. The efficacy of the approach proposed is illustrated on numerical examples.

Keywords: linear dynamical system, trajectories deviations, bounded exogenous disturbances, LMIs, invariant ellipsoids.

Funding. The work is performed with financial support of Russian Foundation of Basic Research (grant No. 18-08-00140).

EXTENDED MODEL OF THE INNOVATIVE PROJECT WITH BINARY INTERACTION OF ITS ACTIVITIES

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Abstract. The innovative project is considered, whose activities are in interaction: technological, resource, probabilistic, budgetary, and other. It is noted that the binary mutual impact of activities within the project by probability leads to a synergistic effect: the joint implementation of two or more project activities can enhance (or weaken) their resulting effect. The logistic model of cross-impact registration is constructed for the technological network of the innovative project. The problem of finding the joint probabilities values for the technical success of the project activities implementation is considered and solved, as well as the problem of the cost minimization in the extended model of the innovative project.

Keywords: innovation project, cross-impact analysis, logistic model, joint estimations, project cost, linearization method.

STRUCTURE OF RUSSIAN SCIENTIFIC ECONOMIC COMMUNITY AND ITS ATTITUDE TO RUSSIAN ECONOMIC JOURNALS. PART 1: ANALYSIS BY METHODS OF LATENT CLASSES AND SOCIAL CHOICE THEORY

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Abstract. The paper is focused on the analysis of the structure of Russian academic economic community based on a survey of participants of several Russian economic conferences, and on the analysis of the opinion of this community on some Russian scientific journals on economics and related disciplines. The first part of the work is devoted to the division of the economic community into three main groups: university professors, academic researchers and expert analysts, each of which can be conventionally split into «advanced» and «traditional» specialists. The opinion of the community and its subgroups about scientific importance, prestige and interest in some economic journals was studied and several ratings of these journals were built based on studied opinion.

Keywords: economic community, economic journals, latent classes, social choice theory.

Funding. The article was prepared within the framework of the HSE University Basic Research Program and funded by the Russian Academic Excellence Project '5-100'. The support of the Mark Aizerman Laboratory of Theory of Choice and Decision Analysis in V. A. Trapeznikov Institute of Control Sciences of Russian Academy of Sciences is appreciated by authors.

Acknowledgments. The authors express sincere gratitude to Professor Aleskerov F.T. for his valuable comments and help.

DEVELOPMENT AND TESTING OF LOGIT-MODEL TO ESTIMATE BANKRUPTCY OF INDUSTRIAL ENTERPRISES

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Abstract. It is noted that in the development of industrial enterprises there is always the probability of a crisis, so for continuous and sustainable operation it is necessary to develop the preventive tools that can predict the crisis processes in advance. The model is developed to estimate the bankruptcy on the basis of the logistic regression apparatus for sustainable development of domestic industrial enterprises. The study is conducted on the example of the pharmaceutical industry, and the method of development and testing can be applied to other industries. The model developed is able to predict the probability of bankruptcy of the pharmaceutical industry enterprises two years before its realization.

Keywords: crisis management, modeling, logistic regression, probability of bankruptcy, correlation and regression analysis, elimination method, industrial enterprises, pharmaceutical industry.

ANOMALY DETECTION FOR OPEN DATA QUALITY IMPROVEMENT

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Abstract. It is noted that an increasing number of Open Data (OD) projects are making governmental and corporate data available to public with free access and reuse. One of the barriers of getting benefits from OD is the quality of published data. This problem and its causes are analyzed, metrics and strategies of improvement of the quality of OD are considered, the general strategy using anomaly detection techniques and its' implementation for cases of time and categorical contexts are proposed.

Keywords: open data, data quality, anomaly detection.

SECURITY MODEL FOR INSTRUMENTATION AND CONTROL SYSTEMS FOR NUCLEAR POWER PLANTS

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Abstract. This paper presents a comprehensive cybersecurity model for process control systems. A formal method for classifying assets according to cybersecurity levels using the mapping system in the form of a graph and using clustering methods is proposed. A method for synthesizing the cybersecurity architecture of systems is proposed. The applicability of these methods for hierarchical systems is considered. An example of the synthesis of the security architecture for the subsystem of the NPP automated process control system is considered in accordance with the cyber security policy RG5.71. The Appendix describes the security graph in the take-grant model.

Keywords: cybersecurity, I&C, security architecture, NPP, nuclear power plant, classification, clustering, security graph, take-grant model.

FLOCKING CONTROL OF SMALL UNMANNED AERIAL VEHICLES IN OBSTACLE FIELD

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Abstract. The motion control problem of UAVs flock moving through obstacle field towards a target point in quasi-two-dimensional space is considered. An approach is suggested, according to which the grid with cells of the selected size is imposed on the mission area while the obstacle is interpolated by the set of convex polygons constructed on the nodes of this grid. The algorithm for determining the desired speed of objects in a group based on the principles of flocking robotics is proposed. The results of the simulation modeling are presented.

Keywords: flocking robotics, unmanned aerial vehicle, obstacle avoidance, simulation modeling.

XXVI INTERNATIONAL CONFERENCE «THE PROBLEMS OF COMPLEX SYSTEMS SECURITY CONTROL»

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Abstract. Scientific results of participants of the conference are presented. The thematic directions (sections) of the conference were theoretical and methodological questions of security support, problems of economic and sociopolitical security support, problems of information security support, ecological and technogenic security, methods of modelling and decision making of complex systems security control, automatic systems and instruments of complex systems security support, legal aspects of complex systems security support.

Keywords: conference, complex systems, security control.