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THEMATIC ISSUE

15th International Conference on Management on Large-Scale System Development. Opening Remarks of the Program Committee[1]

This special issue presents selected papers from the 15th International Conference on Management of Large-Scale System Development (MLSD'2022), held on September 26–28, 2022.

MLSD is an annual event organized by the Trapeznikov Institute of Control Problems, the Russian Academy of Sciences, starting from 2007. The conference program is intended for original research on the theory and practice of computer control to manage the development of production, transport, energy, financial, and social processes. Every year MLSD gathers over three hundred participants from research institutes, universities, government, and commercial organizations.

Traditionally, several high-impact conference papers are selected and placed as full-text articles in special issues of *Automation and Remote Control*. This issue of the journal includes eight best research papers presented at MLSD'2022.

Controlled thermonuclear fusion for industrial purposes is of paramount importance for the national economy. This problem is considered by Yu.V. Mitrishkin, S.L. Ivanova, and K.S. Mukhtarov in the paper "Adaptive Control Algorithm for Unstable Vertical Plasma Position in Tokamak." The authors develop and model an adaptive control algorithm for unstable vertical plasma positioning in a vertically elongated tokamak. The topic is interesting and important: at each step of automatic-mode operation, the system determines the parameters of the plant (identification) and designs a new feedback controller based on them. This system belongs to the class of robust-adaptive control systems. The parameters of the feedback controller are calculated using a given placement of the poles of the closed loop control system in the left half-plane of the complex plane. A robust system synthesized using Quantitative Feedback Theory (QFT) is used as an initial model of the control system. Note that the system was simulated on a real-time digital test bed; see https://www.ipu.ru/plasma/about.

An important area of research in various industries (energy, mechanical engineering, aviation, aerospace, and robotics) is the state monitoring of controlled objects and the controlled damping of dangerous oscillations. I.B. Yadykin and I.A. Galyaev significantly contribute to the solution of this problem in the paper "Structural Spectral Methods for Solving Continuous Lyapunov Equations." The authors develop spectral and singular decompositions for the inverse gramians of controllability and observability. As a result, invariant decompositions of energy functionals are obtained, and new stability criteria are formulated for linear systems with nonlinear mode interaction effects.

An urgent problem in developing new effective drugs and creating artificial proteins is predicting the properties of protein molecules based on their amino acid composition data. At present, molecular dynamic modeling is used to predict the properties of proteins and, in particular, their stability in the process of conformational changes. This method requires high computational and time costs. An effective approach to reduce the costs is to assess how the arrangement of amino acid residues in a protein affects its stability. In the paper "Probabilistic Assessment of a Pentapeptide Composition Influence on Its Stability" (A.I. Mikhalskii, J.A. Novoseltseva, A.A. Anashkina, and A.N. Nekrasov), this problem is solved using a cooperative game theory method. The authors

[1] The papers on pp. 1399–1467 are from the thematic issue.

calculate the Shapley value to estimate the probability of a positive or negative influence on the stability of a protein or the absence of a particular amino acid in its primary structure. The paper presents the practical implementation of the method to analyze the stability of short proteins consisting of five amino acids (pentapeptides).

The contemporary theory of managing the development of large-scale systems requires new models and methods for analyzing the attainability of goals. At present, this check is insufficiently formalized and performed mainly using the intuition and experience of decision-makers. A.D. Tsvirkun, A.F. Rezchikov, V.A. Kushnikov, O.I. Dranko, A.S. Bogomolov, and A.D. Selutin propose one approach to solving this problem; see their paper "Models and Methods for Checking the Attainability of Goals and Feasibility of Plans in Large-Scale Systems Using the Example of Goals and Plans for Elimination of the Consequences of Flood." The authors describe an algorithm for analyzing the attainability of goals and the feasibility of action plans implemented in the management of large-scale systems and consider flood management goals and plans as one example. The check is carried out in four stages; the first and second stages involve relational algebra and production models; the third stage, Markov process models and Kolmogorov–Chapman equations; the fourth stage, the system-dynamic approach and regression equations. Also, they form an algorithm for analyzing the attainability of goals and plans implemented during the development of such systems. An example is provided to illustrate the main stages of checking the attainability of goals and the feasibility of action plans.

The paper "Optimization of Group Incentive Schemes" (V.N. Burkov, I.V. Burkova, and A.R. Kashenkov) is devoted to the problem of designing a group incentive scheme to compensate for the costs of reducing the duration of project works. The theory of incentives generally considers two types of such schemes, namely, individual (a particular incentive scheme for each work) and unified (the same incentive scheme for all works). The group incentive scheme occupies an intermediate position: all works are partitioned into groups, and a particular incentive scheme is selected for each group. The problem is to partition the set of works into groups by minimizing the total incentive fund. This scheme largely offsets the disadvantages of individual and unified incentive schemes. The authors propose algorithms for solving the problem; they are based on determining shortest paths in a graph.

In the paper "Comparison of Distribution Procedures in Blended Finance," A.V. Shchepkin analyzes the following situation: the contractors of a megaproject apply to the Principal (an organization interested in this project) for funds. The Principal distributes the megaproject budget among the contractors only if they allocate their internal funds to project implementation. When distributing available funds, the Principal considers the requests for funding and the internal funds allocated by the contractors to their projects. This paper provides opportunities to improve business results.

Chair of the Program Committee
of MLSD'2022 Conference
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