11th International Conference "Distributed Computing and Grid Technologies in Science and Education" (GRID'2025)



Contribution ID: 415

Type: Sectional talk

Structural Theory of Complex Systems. Model Synthesis

Friday 11 July 2025 11:30 (15 minutes)

Based on a humanitarian analysis of the key properties of complex systems, recognized as such by a number of authoritative researchers and practitioners in this area, and assumptions about the possibility of building a mathematical computer model of a complex system-the closure hypothesis-a formal definition of a computer model of a complex system is proposed as a species of structure in the sense of N. Bourbaki-the "model" species of structure. The class of mathematical objects determined by this species of structure has the following two properties: A complex created by combining a finite number of mathematical objects of this species of structure is itself an object of this species of structure. The computational process organization is the same for all mathematical objects of this species of structure and therefore can be implemented by a single universal program. The presence of these two properties in representatives of the "model" species of structure allows us to build an end-to-end technology for describing, synthesizing, and programmatically implementing models of complex systems-Model Synthesis and Model-Oriented programming. By studying the morphisms of base sets constructed of the "model" species of structure and invariants limiting such morphisms, we get a formal mathematical language for the study of complex open systems. A new Model-Oriented programming paradigm stays within the framework of declarative programming, avoiding imperative ones, which greatly simplifies both its development, implementation, and subsequent debugging. In addition, MO-programming is focused on distributed and parallel computing.

Author: Dr BRODSKY, Yury (Federal Research Center "Computer Science and Control" of the Russian Academy of Sciences)

Presenter: Dr BRODSKY, Yury (Federal Research Center "Computer Science and Control" of the Russian Academy of Sciences)

Session Classification: Distributed Computing Systems, Grid and Cloud Technologies, Storage Systems