

Component modeling of complex dynamical systems

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Textbook Abstract

The representation of models of large systems in the form of components and connections between them is one way to cope with the increasing complexity of models. When creating a computer model, the components are naturally represented by classes and their instances. The Unified Modeling Language (UML) offers rules that allow you to create and use classes and their instances in a consistent way, apply inheritance and polymorphism mechanisms when developing new models and modifying existing ones.

Many modern modeling environments, such as the Rand Model Designer (RMD), rely on UML as the standard.

Split the source object into components and bind components to each other in different ways, using "directed" or "non-directional" links, or treating components as independent "agents" that exchange messages among themselves.

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Introduction.

Chapter 1. Object-Oriented Modeling of dynamical systems.

Active dynamical object. Inheritance of classes. Packages and Model. Computational experiments.

Chapter 2. Mathematical models of multi-component systems.

Algebraic equations. Differential equations. Algebraic-differential equations. Canonical forms. Non-linear systems of Algebraic-differential equations. Index. Index reduction.

Chapter 3. Modeling of multi-component systems. Components with inputs/outputs (causal modeling). Block decomposition of model. Package «Control systems».

Chapter 4. Modeling of multi-component systems. Components with contacts/ flows («physical» modeling). «Physical» modeling in RMD. Example of simple control system. Example of simple hydraulics system. Electrical circuits.

Chapter 5. Variable structure systems.

Simulation of queueing systems in RMD. Standard classes for queueing systems. Model of bank office.

Chapter 6. Computational experiment.

Controlling of computer experiments. Parametric dependence. Parametric optimization. Stochastic experiment.

Literature.

Target group

The book is intended for bachelors and masters of all engineering specialties related with computer modeling and simulation of complex dynamical systems.

Book imprints

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