FOR CRC-TAYLOR & FRANCIS SERIES ON SYSTEM OF SYSTEMS ENGINEERING

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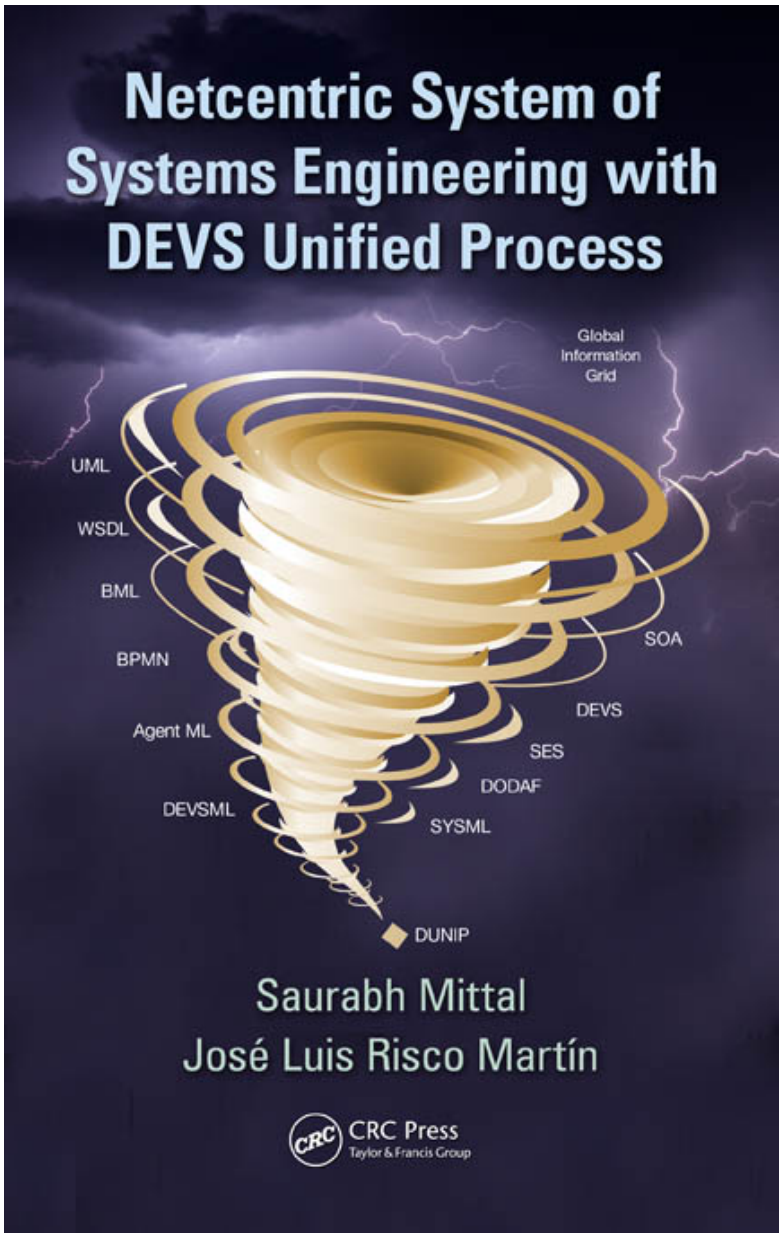

Features

- Explains the DEVS Unified Process (DUNIP), a platform-independent methodology for the modeling and simulation of netcentric systems of systems
- Details the steps needed to perform discrete event modeling and simulation (M&S) using DEVS formalism, from formal specification to software programming, to systems engineering

- Examines component-based M&S in system of systems engineering
- Uses model-driven engineering to integrate domain-specific languages into the transparent netcentric M&S framework
- Presents formal methods to build models, standards-based tools for M&S, and the possibility to create and deploy your own tools in a netcentric environment
- Describes a knowledge-based contingency-driven generative systems (KCGS) framework to specify contingency-based systems
- Analyzes the Department of Defense Architecture Framework (DoDAF) using System Entity Structure (SES) theory and DUNIP
- Assesses DUNIP with the requirements of the Open Unified Technical Framework (OpenUTF) for netcentric Test and Evaluation (T&E)
- Describes the M&S process using recent standard specifications such as UML, MDA, BPMN, and SOAP
- Includes several real-world case studies
- Offers supporting materials, partial solutions to exercises, downloadable software (distributed as Eclipse plugins or downloadable JAR files), and instructions for installing and using the software, available online at http://www.duniptechnologies.com/book/sos

Editorial Reviews

"The book is the first to expose the DEVS Unified Process (DUNIP), a methodology that employs the DEVS formalism to provide a sound modeling and simulation framework for model-driven systems engineering. Software and systems engineers at the cutting edge of intelligent system technologies will be particularly interested in the fact that the book extends DUNIP to apply to systems capable of complex adaptive and emergent behaviors."
—Bernard P. Zeigler, the father of DEVS formalism, University of Arizona, USA

"This book is among the first to coherently and concisely address the challenge to integrate modeling and simulation (M&S) as one of the emerging decision support tools of the 21st century into this netcentric environment. ... The task for integrating solutions that are implemented on heterogeneous IT systems and that were developed independently from each other, but that nonetheless shall support homogeneous presentation of required functionality to the user, is supported by netcentric system of systems. The book brings both aspects together successfully and proposes a general solution that merges successful formal approaches with state-of-the-art engineering solutions. Although the case studies are taken from the defense domain, the applicability of the recommended approach to all domains of M&S—such as business, transportation, and medical—is given implicitly, as formalism as well as engineering solutions are accepted in these domains."
—Andreas Tolk, Ph.D., Old Dominion University, USA

Formal Review in SCS July Newsletter by Dr. Bernard P. Zeigler

Summary

In areas such as military, security, aerospace, and disaster management, the need for performance optimization and interoperability among heterogeneous systems is increasingly important. Model-driven engineering, a paradigm in which the model becomes the actual software, offers a promising approach toward systems of systems (SoS) engineering. However, model-driven engineering has largely been unachieved in complex dynamical systems and netcentric SoS, partly because modeling and simulation (M&S) frameworks are stove-piped and not designed for SoS composability. Addressing this gap, **Netcentric System of Systems Engineering with DEVS Unified Process**
presents a methodology for realizing the model-driven engineering vision and netcentric SoS using DEVS Unified Process (DUNIP).

The authors draw on their experience with Discrete Event Systems Specification (DEVS) formalism, System Entity Structure (SES) theory, and applying model-driven engineering in the

context of a netcentric SoS. They describe formal model-driven engineering methods for netcentric M&S using standards-based approaches to develop and test complex dynamic models with DUNIP. The book is organized into five sections:

- **Section I** introduces undergraduate students and novices to the world of DEVS. It covers systems and SoS M&S as well as DEVS formalism, software, modeling language, and DUNIP. It also assesses DUNIP with the requirements of the Department of Defense's (DoD) Open Unified Technical Framework (OpenUTF) for netcentric Test and Evaluation (T&E).

- **Section II** delves into M&S-based systems engineering for graduate students, advanced practitioners, and industry professionals. It provides methodologies to apply M&S principles to SoS design and reviews the development of executable architectures based on a framework such as the Department of Defense Architecture Framework (DoDAF). It also describes an approach for building netcentric knowledge-based contingency-driven systems.

- **Section III** guides graduate students, advanced DEVS users, and industry professionals who are interested in building DEVS virtual machines and netcentric SoS. It discusses modeling standardization, the deployment of models and simulators in a netcentric environment, event-driven architectures, and more.
- **Section IV** explores real-world case studies that realize many of the concepts defined in the previous chapters.
- **Section V** outlines the next steps and looks at how the modeling of netcentric complex adaptive systems can be attempted using DEVS concepts. It touches on the boundaries of DEVS formalism and the future work needed to utilize advanced concepts like weak and strong emergence, self-organization, scale-free systems, run-time modularity, and event interoperability.

This groundbreaking work details how DUNIP offers a well-structured, platform-independent methodology for the modeling and simulation of netcentric system of systems.

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