Complexity Challenges in Cyber Physical Systems: Using Modeling and Simulation (M&S) to Support Intelligence, Adaptation and Autonomy

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DESCRIPTION

Offers a one-stop reference on the application of advanced modeling and simulation (M&S) in cyber physical systems (CPS) engineering

This book provides the state-of-the-art in methods and technologies that aim to elaborate on the modeling and simulation support to cyber physical systems (CPS) engineering across many sectors such as healthcare, smart grid, or smart home. It presents a compilation of simulation-based methods, technologies, and approaches that encourage the reader to incorporate simulation technologies in their CPS engineering endeavors, supporting management of complexity challenges in such endeavors.

*Complexity Challenges in Cyber Physical Systems: Using Modeling and Simulation (M&S) to Support Intelligence, Adaptation and Autonomy* is laid out in four sections. The first section provides an overview of complexities associated with the application of M&S to CPS Engineering. It discusses M&S in the context of autonomous systems involvement within the North Atlantic Treaty Organization (NATO). The second section provides a more detailed description of the challenges in applying modeling to the operation, risk and design of holistic CPS. The third section delves in details of simulation support to CPS engineering followed by the engineering practices to incorporate the cyber element to build resilient CPS sociotechnical systems. Finally, the fourth section presents a research agenda for handling complexity in application of M&S for CPS engineering. In addition, this text:

- Introduces a unifying framework for hierarchical co-simulations of cyber physical systems (CPS)
• Provides understanding of the cycle of macro-level behavior dynamically arising from spatiotemporal interactions between parts at the micro-level

• Describes a simulation platform for characterizing resilience of CPS

*Complexity Challenges in Cyber Physical Systems* has been written for researchers, practitioners, lecturers, and graduate students in computer engineering who want to learn all about M&S support to addressing complexity in CPS and its applications in today’s and tomorrow’s world.

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**ABOUT THE AUTHOR**


**ANDREAS TOLK, PhD**, is Senior Principal Computer Scientist at The MITRE Corporation and Adjunct Professor at Old Dominion University. He is a Fellow of the Society for Modeling and Simulation International. His numerous publications comprise twelve books on systems engineering and modeling and simulation, including the *Engineering Principles of Combat Modeling and Distributed Simulation* (2012), *Modeling and Simulation Support for System of Systems Engineering Applications* (2015), and *Emergent Behavior in Complex Systems Engineering: A Modeling and Simulation Approach* (2018).

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