Formal Requirements Modeling for Simulation-Based Verification: from theory to practice

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ABSTRACT

Modeling of system properties deals with formally expressing constraints and requirements that influence and determine the structure and behavior of a system. System Property Models enable the verification of system properties through real or simulated experiments so as to support their evaluation during system design and their monitoring during system operation. However, several challenges should be addressed to effectively handle systems properties, ranging from conceptual properties representation to tracing and verification. In this context, the tutorial aims at discussing these main challenges and presenting some promising solutions by focusing on those resulting from recent Systems Engineering research efforts. In particular, a proposal on how to model formal requirements in Modelica for simulation-based verification is presented. The approach is implemented in the open source Modelica_Requirements library. It requires extensions to the Modelica language that have been prototypically implemented in the Dymola and Open-Modelica software. The design of the library is based on the FOrmal Requirement Modeling Language (FORM-L) and on industrial use cases developed in the context of the ITEA3 MODRIO (Model Driven Physical Systems Operation) Project (https://itea3.org/project/modrio.html) involving 38 partners of six different European countries.

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Alfredo Garro is an Associate Professor of Computer and Systems Engineering at the Department of Informatics, Modeling, Electronics and Systems Engineering (DIMES) of the University of Calabria (Italy). He was Visiting Professor (from January to October 2016) at NASA Johnson Space Center (JSC), working with the Software, Robotics, and Simulation Division (ER). From 1999 to 2001, he was a researcher at CSELT, the Telecom Italia Group R&D Lab. From 2001 to 2003, he worked with the Institute of High Performance Computing and Networking of the Italian National Research Council (CNR). On February 2005 he received the PhD Degree in Systems and Computer Engineering from the University of Calabria. From January 2005 to December 2011, he was an Assistant Professor of Computer and Systems Engineering at the DIMES Department (formerly DEIS) of the University of Calabria. His main research interests include: Modeling and Simulation, Systems and Software Engineering, Reliability Engineering. His list of publications contains about 100 papers published in international journals, books and proceedings of international and national conferences. In 2014, he founded the Departmental Research Laboratory “System Modeling And Simulation Hub Lab (SMASH Lab)”. He is vice chair of the Space Reference Federation Object Model (SRFOM) Product Development Group (PDG) of SISO. He is the Technical Director of the “Italian Chapter” of INCOSE (International Council on Systems Engineering). He is a member of the

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