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FMI based Co-Simulation Framework to enable timing verification in Cyber-Physical Systems

Jonathan Latorre
Department of Engineering Management & Systems Engineering
George Washington University
Washington, DC
jonathanlatorre@gwu.edu

Dr. Timothy Blackburn Ph.D., P.E.
Department of Engineering Management & Systems Engineering
George Washington University
Washington, DC
timb@gwu.edu

Dr. Andreas Garstenauer Ph.D., P.E.
Department of Engineering Management & Systems Engineering
George Washington University
Washington, DC
agars001@gwu.edu

Abstract

Cyber-physical systems (CPS) are complex systems that integrate computation algorithms, communication networks and physical systems. Thus intrinsically making many of these systems heterogeneous. Using formal models of computation to model these systems is an increasing practice that enables early verification at the design phase. However, a current challenging problem is to analyze and verify timing at the initial stages, the design is still conceptual and agreements have to be made for system functionality requirements at the expense of a practical architecture that would be able to implement the functionality. To solve this problem, we present a framework that separates the architecture modeling and functions. The framework also addresses the heterogeneity aspects of CPS design. The Functional Mock-up Interface (FMI) standard is rapidly becoming an industry standard for model exchange and co-simulation. The proposed framework utilizes the FMI standard to handle the interactions between the functional model and architectural model and utilizes the SysML language to represent the systems interactions and to auto generate Functional Mock-up Units (FMUs). Three case studies on automotive systems are used to demonstrate the effectiveness of our approach.

Keywords
Cyber-Physical Systems, SysML, FMI, Systems Engineering

Biography

Jonathan Latorre is currently a PhD student in Systems Engineering from The George Washington University. He earned a B.S. in Information Systems from the University of Puerto Rico in Mayaguez and Masters in Computer Science from the Polytechnic University of Puerto Rico. Mr. Latorre has over 8 years of industry experience and currently works at the Ford Motor Company where he has completed research projects involving connected vehicles. His research interests include automotive, cyber-physical systems, IoT, connected vehicles and smart cities.

Tim Blackburn, Ph.D., P.E., is a Summa Cum Laude graduate from the William States Lee College of Engineering (UNC-Charlotte) and also holds an MBA from the Kenan-Flagler School of Business (UNC-Chapel Hill). He also received a Ph.D. in Systems Engineering from The George Washington University (GWU). He is a licensed Professional Engineer, and holds a Blackbelt in Six Sigma. Currently, he is a Professorial Lecturer in Engineering Management and Systems Engineering (EMSE) at GWU, and is the North America Lead for Technical Learning and Capability at Pfizer. His affiliations (current or previous) include Tau Alpha Pi and Phi Kappa Phi Honor Societies for academic achievement, the International Society of Pharmaceutical Engineers (ISPE), American Society for Quality (ASQ), Pharma Engineering Roundtable, International Council on Systems Engineering (INCOSE), International Foundation Process Analytical Chemistry (IFPAC), and American Indian Science and Engineering Society (AISES).

Andreas Garstenauer, Ph.D., P.E. is a Professorial Lecturer at the George Washington University in Engineering Management and Systems Engineering. Garstenauer obtained a B.S. in Mechanical Engineering, a Master of Engineering in Mechanical Engineering and a M.B.A., all from Old Dominion University. He received a Ph.D. in Systems Engineering from The George Washington University. Garstenauer is a Licensed Professional Engineer, a Certified Quality Engineer and Certified Manager of Quality/Operational Excellence. He has over 25 years of experience working for multinational organizations in engineering management, quality management, engineering and manufacturing. He is a member of the ASEM, ASQ, and SME.