OFFICE OF THE DEPUTY ASSISTANT SECRETARY OF DEFENSE
SYSTEMS ENGINEERING

System of Systems Engineering
Collaborators Information Exchange (SoSECIE)

August 8, 2017
11:00 a.m. to Noon Eastern Time

Verification and Validation of Behavior Models Using Lightweight Formal Methods

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Abstract

This presentation provides a method for exposing invalid behaviors in systems of systems (SoS) early in design, at the architecture level. The Monterey Phoenix (MP)-based method for conducting behavior model verification and validation (V&V) was developed after students ranging from high school to the graduate level began discovering unintended, invalid, and potentially high-consequence behaviors permitted by their designs. These unspecified behaviors were consistent with known requirements, but violated stakeholder intent. Examples from four models from different domains and develowped by different students are presented, then used as a basis for developing a structured set of behavior model V&V criteria that may be applied to any MP model. Finally, the criteria are put into the context of a systematic method that guides modelers in a thorough V&V of the behavior model.

The ease with which unspecified and potentially invalid behaviors were exposed by students at various levels of education suggests that this lightweight formal method for behavior model V&V is user friendly for application by practitioners who have basic skills in logic and logical thinking. Follow-on work will further test the method on other MP behavior modeling efforts, with an aim to improve and extend behavior model V&V criteria and the methods in which they are employed.

Biography

Kristin Giammarco is an Associate Professor in the Department of Systems Engineering at the Naval Postgraduate School (NPS), where she teaches courses in system architecture and design, system integration, and model-based systems engineering, and conducts research in the use and development of formal methods for systems architecture modeling. Dr. Giammarco is a member of INCOSE and of the Lifecycle Modeling Language Steering Committee. She currently serves as the Joint Executive Systems Engineering Management (SEM-PD21) Program Academic Associate.

Before her appointment at NPS, she was Chief Engineer for the Systems Engineering division of the Space and Terrestrial Communications Directorate at U.S. Army CERDEC, and Chair of the directorate's Systems Engineering Council. Before that, she led the technical execution of systems engineering analyses as a government lead engineer in partnership with other government organizations, MITRE, industry, national labs, and academic institutions. Over these years, she developed, implemented, and refined a quick-turn model-based systems engineering methodology with her team.

From NPS, Dr. Giammarco has earned a Ph.D. in Software Engineering, an M.S. in Systems Engineering Management, and a Certificate in Advanced Systems Engineering. She holds a B.E. in Electrical Engineering from Stevens Institute of Technology. She conducts research on system and software behavioral modeling and architectural patterns with students and colleagues within and outside of NPS. They are working to improve techniques for teaching architecture modeling concepts in a distributed learning environment and to students at all ages and academic levels.