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Ph.D. DISSERTATION DEFENSE

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Title:	A Graph Centered Approach to the Verification and Reuse of Digital Engineering Models
Co-Chairpersons:	Dr. Mark Blackburn, School of Systems and Enterprises, Systems Engineering Research Center Dr. Dinesh Verma, School of Systems and Enterprises, Systems Engineering Research Center
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ABSTRACT

This dissertation looks at graph-based knowledge representation in a Digital Engineering (DE) context and develops methods for using this representation to perform DE model verification and enable reuse of DE model components.

The Digital Engineering Framework for Integration and Interoperability (DEFII) is presented as a broad approach to using ontology-aligned data in a DE context. It defines three approaches to interfacing with ontology-aligned data that enable flexible access to ontology-aligned data whether the tool accessing the data is ontology aware or not.

The System of Analysis (SoA), a structured definition and description of an array of analysis models working in tandem to transform properties of a system under analysis into high-level analysis objectives, is presented.

The Semantic System Verification Layer (SSVL) is presented as a three-pronged approached to model verification using a mix of Semantic Web Technology approaches to model verification, including Description Logic reasoning and closed world constraint analysis, and more general graph-based algorithms for verification of a broad range of model requirements. The SSVL is applied to determine well-formed construction of an SoA. Scalability of the method is examined and demonstrated, and limitations are identified for future research.

The Semantic Model Component Library (SMoCLiB) is presented as an ontology-aligned component library for reuse of SoAs at multiple levels of abstraction. It is demonstrated using two separate SoAs to build a new SoA that contains elements from both SoAs. Additionally, dynamic generation of model requirements based on components reused is demonstrated to enable tailored model verification based on the actual usage of components.