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| **UTC INSTITUTE FOR ADVANCED SYSTEMS ENGINEERING**  **Seminar Series**  Monday October 1, 2018  1:00 - 2:00PM  UConn, Storrs Campus – IPB 203 [To view live webcast click here](https://na01.safelinks.protection.outlook.com/?url=https%3A%2F%2Fuconn.webex.com%2Fuconn%2Fj.php%3FMTID%3Dma907bc2747ef3388f68ef01580f303fe&data=02%7C01%7C%7C1627e90157c0494665ad08d627964dfb%7C17f1a87e2a254eaab9df9d439034b080%7C0%7C0%7C636739923827713634&sdata=jCuk1fIer4hgwpSs6V0HqwE5hYSSVFSjMGyZCLLKs50%3D&reserved=0)  **Executable Requirements for Connecting Systems Engineering with Simulation Analysis – Status and Research Needs**  Incorporating system models into the software and controls development process allows developers to receive continuous feedback on system performance throughout the design process. Included in this feedback is information about errors, both design limitations (validation) and implementation errors (verification). The benefit of this continuous feedback is more rapid convergence to the final design and less incidence of errors since errors are identified as soon as they are introduced. Frequently SysML and UML are used to describe these models through visual diagrams when concerning system software.  In this presentation we will look how we can leverage the two open standards Modelica and FMI to couple requirement monitors to executable models to evaluate the systems’ compliance to requirements continuously during development. In addition, we will demonstrate the benefits of the tried and tested paradigm of “continuous integration” outside of its home turf of software development for model-based design.  We will look at a real-world example of design iterations with integrated executable requirements, and its pros and cons. The physical system in this case is a Vehicle Thermal Management system (VTM) of a standard passenger car. As a vehicle operates, its components generate heat that must be adequately directed to the ambient environment to prevent system damage. In this example, the initial system contains a poorly designed controller that does not meet the system requirements as defined in Rhapsody and demonstrated through test cases of the Modelica model exported as FMUs.  The controller requirements are modeled as executable requirements, built from blocks of the Modelica\_Requirements library, a result from the recently concluded MODRIO EU FP7 research project. The library is based on a three-valued logic for requirements with the values “True”, “False”, and “Undecided” for the case that pre-conditions or necessary for the requirement have not been tested in a given test. The executable requirements are then included in the system model and compliance to the requirements can thus be evaluated for all test scenarios.  An improved controller system is then designed and created. Several test cases are then evaluated to demonstrate the improved controller meets the system requirements. The approach uses a newly developed Modelica Library to model executable requirements, which is under development in the European research project MODRIO. Because Modelica tools support export as FMUs, the executable requirements models can be imported into any FMI-compliant tool. The requirements compliance testing is integrated into a continuous integration tool that is specifically designed for Model Based Design. This allows for a high degree of automation in the process  Finally, we look at open issues in improving this somewhat ad-hoc way of integrating systems engineering with simulation analysis and point to open research questions.  **Hubertus Tummescheit**  **Dr. Tummescheit** is the Chief Solutions Officer of Modelon, President of Modelon Inc., and one of the founders of Modelon. Dr. Tummescheit received his MSc in Mechanical Engineering from the Technical University of Hamburg-Harburg, Germany in 1996, and his PhD in Automatic Control from the University of Lund, Sweden in 2002. He has been involved in the Design of the Modelica language from the beginning and is the developer of a number of open source and commercial Modelica Libraries in the energy and HVAC domains. In 2003 he worked as a research scientist at United Technologies Research Center and returned to Sweden in 2004 to start Modelon AB, the first company fully dedicated to tools and services based on Modelica and FMI. Dr. Tummescheit is also a member of the board of the Modelica Association, and of the FMI steering committee, and active in the future development of both standards.  Dr. Tummescheit has served as the CEO of Modelon AB from 2004 to 2012 and moved to Hartford, Connecticut in 2013 to establish Modelon as a leading force of innovation in system simulation in the US. | |  | Upcoming Distinguished Lectures  Hod Lipson, Columbia University **Curious and Creative Machines** November 5, 2018 | | |
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| Upcoming Seminars  Santosh Devasia, University of Washington,  **Synchronized Networks using Delayed Self-Reinforcement** October 22, 2018  Hamsa Balakrishnan, Massachusetts Institute of Technology  November 12, 2018 | | |
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| **Website**: [www.utc-iase.uconn.edu](http://www.utc-iase.uconn.edu)  **Email**: [utc-iase@engr.uconn.edu](mailto:utc-iase@engr.uconn.edu)  **Phone**:  860.486.3355 | | |
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