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Final Program

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Short Course 5 – Tool Support for Model Based Software Engineering in MATLAB/Simulink for Domain Experts

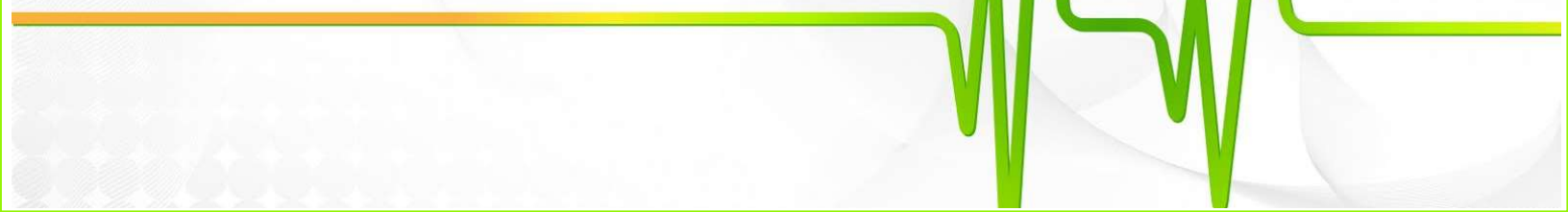Friday, June 23rd, 2017
2:00PM – 5:40PM (3:20PM-4:20PM Coffee Break in Exhibit Hall)
Venue: Room 306

Instructors:
- *Dr. Mark Lawford, Ph.D., P.Eng., Dept. of Computing and Software, McMaster University*
- *Dr. Lucian Patcas, Ph.D., Principal Research Engineer, McMaster Institute for Automotive Research and Technology (MacAUTO), McMaster University*
- *Dr. Alan Wassyng, Associate Professor, Dept. of Computing and Software McMaster University*
- *Dr. Vera Pantelic, McMaster University*
- *Monika Jaskolka, Alexander Schaap, Bennett Mackenzie, Gordon Marks, McMaster University*

Course Description: In model-based development, domain experts, such as electrical, mechanical, or control engineers, despite not having formal software engineering training, often find themselves creating models from which embedded code is generated, therefore contributing to the design and coding activities of software development. This course is aimed at improving design with Simulink from the software engineering perspective, by developing automated support for the application of some traditional software engineering principles when developing with Simulink. We present a number of open source tools which we developed at McMaster University in Canada: The Signature Tool, the Reach/Coreach Tool, the Data Store Rescope Tool, and the Auto Layout Tool. The Signature Tool extracts the interface of a Simulink subsystem, enabling developers to better understand the implicit data ow in Simulink models and use it more effectively, while also producing useful documentation and improving testing coverage. The Data Store Rescope Tool improves modularity of Simulink models by properly scoping data stores, helping to meet modeling guidelines. The Reach/Coreach Tool highlights data and control dependencies and extracts the relevant part of a Simulink model, making it easier to understand and perform dependency analysis. Also, the tool supports debugging, reverse-engineering, refactoring, and static analysis of the models. The Auto Layout Tool significantly improves the layout of Simulink models, reducing the large effort developers invest in adjusting layout to improve the readability of their models and comply with modeling guidelines. Finally, we show how these tools can be combined with Simulink Report Generator to automatically generate improved system design documentation, providing a customizable documentation template that participants can use as the basis for generating their own system design description documentation. The intended audience of this course is domain experts involved in the development of software intensive systems, but also software practitioners and managers involved in software and/or software development with Simulink.

Instructors' Short Biographies:

Mark *Lawford is a Professor in McMaster University's Department of Computing and Software and the Associate Director of the McMaster* Centre for Software Certification. He is a licensed Professional Engineer in the province of Ontario and a Senior Member of the IEEE. He received his PhD in 1997 from the Systems Control Group in Electrical and Computer Engineering at the University of Toronto and then worked at Ontario Hydro as a real-time software verification consultant on the Darlington Nuclear Generating Station Shutdown Systems Redesign project, receiving the Ontario Hydro New Technology Award for Automation of Systematic Design Verification of Safety Critical Software in 1999. He joined McMaster University's Department of Computing and Software in 1998 where he helped to develop the Software Engineering programs and Mechatronics Engineering programs. He served as the Section Chair for Computer Systems on the Computer Science Evaluation Group for the 2010 NSERC Discovery Grant Competition. From 2006 to 2007, he was a Senior Researcher in the Software Quality Research Lab at the University of Limerick, Ireland, and in August 2010, he was a visiting researcher at the Center for Devices and Radiological Health, Office of Science and Engineering Laboratories of the US FDA. His research interests include software certification, application of formal methods to safety critical real-time systems, supervisory control of discrete event systems, and cyber physical systems.

Alan Wassyng has been working on safety-critical software-intensive systems for more than 25 years, and is licensed as a Professional Engineer in Ontario. After spending 14 years as an academic, he consulted independently on critical software development for more than 15 years. He helped Ontario Hydro (OH) develop methods for safety-critical systems, and was a key member of the team that designed the methodology and built the software for the shutdown systems for the Darlington Nuclear Station. In 1995 he was awarded an OH New Technology Award for "Development of Safety-Critical Software Engineering Technology." In 2002 he returned to academia. He publishes on software certification, and the development of safe and dependable software-intensive systems, primarily in automotive, medical devices, and nuclear power. He was a co-founder of the McMaster Centre for Software Certification, and was its inaugural Director. He is a cofounder of the Software Certification Consortium (SCC), and has served as Chair of the SCC Steering Committee since its inception in 2007. He has consulted for the US Nuclear Regulatory Commission, and in July 2011, he was a visiting researcher in the Center for Devices and Radiological Health at the US Federal Drug Administration. In 2012 he was invited to give a keynote talk at Formal Methods (the premier conference in the field), and a keynote at FormaliSE 2013. In 2006 he was awarded the McMaster Students Union Award for Teaching Excellence in the Faculty of Engineering. He has served as a PI or co-PI on a number of funded projects at McMaster University.

Vera Pantelic received a B.Eng. in Electrical Engineering from the University of Belgrade, Belgrade, Serbia, in 2001, and a M.A.Sc. and a Ph.D. in Software Engineering from McMaster University, Hamilton, ON, Canada, in 2005 and 2011, respectively. She is working as a Principal Research Engineer with the McMaster Centre for Software Certification, and McMaster Institute for Automotive Research and Technology (MacAUTO), McMaster University. Her research interests include development and certification of safety-critical software systems, model-based design, and supervisory control of discrete event systems..

Lucian Patcas is a Principal Research Engineer with the McMaster Centre for Software Certification (McSCert) and McMaster Institute for Automotive Research and Technology (MacAUTO) at McMaster University in Hamilton, ON, Canada. His main research interests fall in the area of formal methods for real-time and safety-critical software. Currently, he is involved in several research projects related to the safety of automotive software, simulation and analysis of CAN networks, and model-based development of automotive software. Dr. Patcas was previously a Postdoctoral Fellow in the Department of Computing and Software at McMaster University. He received a Ph.D. in Software Engineering from McMaster University in 2014, a Master's in Computer Science from University College Dublin, Ireland in 2007, and a Bachelor's in Software Engineering from Politehnica University of Timisoara, Romania in 2004.

Monika Jaskolka is a Ph.D. student in Software Engineering at McMaster University, Hamilton, ON, Canada. She received a Master's degree in Software Engineering from McMaster University in 2014, and an Honours Bachelor of Computer Science degree in 2012 from Laurentian University, Sudbury, ON, Canada. Monika currently holds an NSERC Alexander Graham Bell Canada Graduate Scholarship - Doctoral (CGS D). Her main research interests include model-based development, safety-critical systems, and software engineering design principles.

Alexander Schaap is a Ph.D. student in Software Engineering at McMaster University in Hamilton, ON, Canada. He received his Master's in Software Engineering at McMaster in 2016, and his Bachelor's degree in Computer Science in the Netherlands in 2013. Alex's research interests include the application of generative programming techniques and functional programming languages, but also proper software engineering as a whole.

Bennett Mackenzie is a Master's student in Software Engineering at McMaster University, ON, Canada and completed his Bachelor of Engineering in Software Engineering in 2016 at McMaster. His research interests include Software Engineering principles in Model-Based Design and tool-support for Model-Based Design.

Gordon Marks completed his Bachelor of Engineering and Management in Software Engineering in April 2017 at McMaster University in Hamilton, ON, Canada, and will begin as a Master's student at McMaster in September 2017. His main research interests include model-based development, and software engineering design principles.

Mark, Alan, Vera, Lucian, Monika, Alexander, Bennett, and Gordon are part of the Automotive Partnership Canada (APC) project entitled Next Generation Affordable Electrified Powertrains with Superior Energy Efficiency and Performance -- Leadership in Automotive Powertrain (LEAP), a multi-million dollar, multidisciplinary collaboration between McMaster University and a major automotive OEM for the development of next generation hybrid-electric powertrains.