Preface to the 4th International Workshop on Multi-Paradigm Modelling for Cyber-Physical Systems (MPM4CPS)

Amrani, Moussa

Publication date:
2022

Preface to the 4th MPM4CPS (Multi-Paradigm Modeling for Cyber-Physical Systems) Workshop

Cyber-Physical Systems (CPSs) are engineered systems emerging from the networking of multi-physical (mechanical, electrical, biochemical, etc.) and computational (control, signal processing, logical inference, planning, etc.) processes, that interact with highly uncertain environments, including human actors, in a socio-economic context. Because they mix various levels of complexity, CPSs do require experts from different domains to model their reality in various formalisms, and capture explicitly the surrounding workflows. These experts need to solve challenges within their own discipline, but also have to collaborate, so that each aspect integrates flawlessly, in order to build the final product.

Multi-Paradigm Modelling (MPM) offers a foundational framework for supporting the various activities (most prominently, design and analysis, but also what-if reasoning, calibration, design space exploration, deployment, etc.) necessary for such a multi-disciplinary domain that CPS engineering is. MPM promotes the use of the most appropriate formalism(s) to capture the various aspects of a CPS, while explicitly describing the various processes at play that allow to transform, convert, but also enforce, analyze, etc. the various artefacts used along the CPS lifecycle. As such, MPM encompasses many other research topics, from language engineering, including Domain-Specific Languages and their visual and/or textual syntax and behavioral semantics, processes to support multi-view and multi-abstraction modeling, to simulation for system analysis, and deployment.

For this fourth edition of the Workshop, we had a typical call for papers that included regular and short contributions (with a 10- and 5-page limit, respectively). We also kept "*special*" tracks of last year: an *exemplars* track, whose contributions should demonstrate typical activities for CPS engineering in a real-life CPS use case; and a *lightning talk* track, in the form of an extended abstract, intended as a talk focused on an innovative approach or tool using MPM.

We received 12 contributions in total, among which we selected 9 papers for presentation during the workshop, which will be included in the Companion Proceedings of the MoDELS conference. What was especially interesting in this edition was the spectrum of application domains the papers were addressing: Internet of Things, Digital Twins, Mobile Apps, Mechatronic Systems, Autonomous Driving and Urban Traffic Management.

Since this edition (finally!) resumes with a physical meeting in Montréal, Canada, we split the papers in three sessions of paper presentations, including a keynote that will open the workshop, and set the course for a final session dedicated to open discussions on the topics the participants will help co-create with the Organizing Committee.

As a final note, we would like to warmly thank the MoDELS 2022 organizers for giving us the opportunity to host this new edition of the workshop, with a special mention to the Workshop Organizers Istvan David (University of Montréal, Canada) and Jesús Sánchez Cuadrado (University of Murcia, Spain) for their prompt responses to our inquiries during the preparation of the Workshop, but also the Proceedings Chairs Thomas Kühn (Karlsruhe Institute of Technology, Germany) and Vasco Sousa (University of Montréal, Canada), for their tremendous help in navigating the intricate guidelines and processes for producing the camera-ready versions of the accepted papers. We also thank all authors who submitted papers, and the presenters of the accepted papers. Last but not least, we warmly thank the members of the Steering Committee for their comments during the preparation of the workshop proposal, but also all the reviewers in the Program Committee, whose efforts and timely reviews during the vacation period helped us select, and organize the submissions for creating an interesting edition.

We hope you will attend, and enjoy this fourth edition of MPM4CPS!

Moussa Amrani, Dominique Blouin, Moharram Challenger, Joeri Exelmans, Robert Heinrich and Randy Paredis