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Preface to the 5th International Workshop on Multi-Paradigm Modeling for Cyber-Physical Systems (MPM4CPS)

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

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Preface

5th International Workshop on Multi-Paradigm Modeling for Cyber-Physical Systems (MPM4CPS)

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 fifth 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. Both are important to us for different reasons. Collecting exemplars is essential for providing researchers common examples simple enough to demonstrate a specific aspect of MPM4CPS, yet including enough complexity to be realistic beyond toy examples. To this date, we still have not reached a satisfactory number of exemplars to enable traditional activities (e.g., comparisons of different approaches, formalisms, etc. but also competitions for fully modelling an exemplar with various techniques and technologies, and also for grounding theoretical advances based on real cases). Lightning talks are always interesting in a workshop, not only for the audience that may become enthusiastic with a new, not completely polished topic, but also for the presenters (often Ph.D. students) who may receive feedback from the community to pursue their work.

This year, we received 9 contributions in total, among which we selected 8 papers for presentation during the workshop. Similar to the previous editions, the papers span several topics, including architectural design, system design approaches, simulation and V&V activities, for a large variety of application domains (Digital Twins, Internet of Things, Mobile Apps, Mechatronic Systems, etc.) We included an extra paper resulting from the International Hands-on Workshop on Collaborative Modeling (HoWCoM), allowing us to organise the full day around three balanced sessions. This extra paper deals with versioning, a key challenge for the various models used for CPSs.

The day starts with a keynote by Jérôme Hugues, a senior researcher at Carnegie Mellon University (CA, USA), during which he will demonstrate, showcasing results from several projects conducted by his group, how complementary MBSE and MPM are for the design of complex systems.

As a final note, we would like to warmly thank the MoDELS 2023 organizers for giving us the opportunity to host this new edition of the workshop, with a special mention to the Workshop Organizers Davide Di Ruscio (University of L'Aquila, Italy) and Leen Lambers (Brandenburg University of Technology, Cottbus-Senftenberg, Germany) for their prompt responses to our inquiries during the preparation of the Workshop, but also the Proceedings Chairs Antonio Bucchiarone (Fondazione Bruno Kessler, Trento, Italy), and Oszkár Semeráth (Budapest University of Technology and Economics, Hungary) and Javier Troya (Universidad de Málaga, Spain) for their tremendous help in navigating the intricate guidelines and processes for producing the camera-ready versions of the accepted papers (as well as this Preface!). 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 fifth edition of MPM4CPS!

Randy Paredis, *University of Antwerp*
Moussa Amrani, *University of Namur*
Joeri Exelmans, *University of Antwerp*
Dominique Blouin, *Telecom Paris, Institut Polytechnique de Paris*
Moharram Challenger, *University of Antwerp - Flanders Make*
Robert Heinrich, *Karlsruhe Institute of Technology (KIT)*
MPM4CPS 2023 Organizing Committee