

Preface

## Fundamentals of Software Engineering (extended versions of selected papers of FSEN 2019)

The increasing complexity of software and hardware systems and their ever more central role in society poses many challenges concerning their reliability, safety, correctness and robustness. Based on a variety of fundamental concepts from theoretical computer science, formal methods techniques aim at making a significant contribution to better quality systems. The development and use of formal methods aspire to mathematically sound methods and tools for system analysis and verification.

This special issue is dedicated to selected papers from the eighth IPM International Conference on Fundamentals of Software Engineering (FSEN), which was held in Tehran, Iran, on May 1-3, 2019. This biennial event is organised by the School of Computer Science at the Institute for Research in Fundamental Sciences (IPM) in Iran, in cooperation with ACM SIGSOFT and IFIP WG2.2.

The topics of interest in FSEN span over all aspects of formal methods, especially those related to advancing the application of formal methods in the software industry and promoting their integration with practical engineering techniques. The Program Committee of FSEN 2019 consists of 44 top researchers from 17 countries. For FSEN 2019 we received 47 submissions from 19 countries out of which we have accepted 14 regular papers and 3 short papers for publication in the conference post-proceedings. This special issue contains extended versions of the best papers which have undergone additional rounds of detailed anonymous peer reviews. Four papers have been selected out of this process. They address theoretical and practical results on coordination aspects in Business Process Management, the analysis of non-determinism in C programs, reinforcement learning and runtime coordination approaches. In particular:

*Compositional Workflow Modeling with Priority Constraints* by Behnaz Changizi, Natalia Kokash, Farhad Arbab and Leonid Makhnist addresses the concept of priority in Business Process Management. There it plays an important role in workflow patterns, such as the cancelable and compensable tasks within business transactions. In this paper the authors propose a constraint-based approach to formalize priority in the Reo coordination language.

*Automated Model Extraction: From Non-deterministic C Code to Active Objects* by Nathan Wasser, Asmae Heydari Tabar and Reiner Hähnle presents a novel, model-based approach to analyzing non-determinism in C programs that works by automatic extraction of a faithful model of a given C program in a concurrent active object language.

*Synthesizing Safe Policies under Probabilistic Constraints with Reinforcement Learning and Bayesian Model Checking* by Lenz Belzner and Martin Wirsing introduces a framework for the specification of requirements for reinforcement learners in constrained settings, including confidence about their results. The latter provides a useful signal for balancing optimization and safety in the learning process.

*Provably Correct Implementation of the AbC Calculus* by Rocco De Nicola, Tan Duong and Michele Loreti presents the AbC calculus with a novel communication mechanism to select in-

teracting partners based on their runtime capabilities. It addresses the implementation of the calculus, its formal operational semantics and a set of rules with which executable code can be automatically generated starting from an *AbC* specification.

The Guest Editors wish to thank all authors that contributed to this special issue for their submissions and careful revisions of their articles, and all reviewers for their detailed and constructive feedback suggesting valuable improvements. We are also grateful to the Editors-in-Chief Mohammadreza Mousavi and Andrea de Lucia, and the members of the Editorial Board for giving us the opportunity to publish this special issue and for his precious help in these complicated times. Special thanks also go to the General Chairs Farhad Arbab and Hamid Sarbazi-azad and the Steering Committee, in particular the Steering Committee Chair Marjan Sirjani, for their valuable support during all phases of the organisation of the conference and the special issue. We also thank IFIP, the IFIP Working Group 2.2 and ACM for their continuing support of the FSEN conference series in these uncertain times. We hope you will enjoy this selection of research articles and that they will be a source of inspiration for future work.

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