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Application and Theory of Petri Nets and Other Models of Concurrency: Special Issue of Selected Papers from Petri Nets 2017

Preface

This special issue is based on extended versions of the best papers presented at the 38th International Conference on Application and Theory of Petri Nets and Other Models of Concurrency (Petri Nets 2017). Petri Nets 2017 was co-located with the Application of Concurrency to System Design Conference (ACSD 2017). Both were organized by the Aragón Institute of Engineering Research of Zaragoza University. The conference took place at the School of Engineering and Architecture of Zaragoza University from June 25 to June 30, 2017.

In total, 33 papers were submitted to Petri Nets 2017 by authors from 25 different countries. Each paper was reviewed by three reviewers. The PC selected 16 papers for presentation: 9 theory papers, 4 application papers, and 3 tool papers. The best five papers were invited to submit an extended version of the conference paper for this special issue. Despite the lower number of submissions for the conference, there were several very strong contributions as was demonstrated by the unanimous support of the reviewers for a significant number of papers. Also the whole program committee unanimously supported the invitations.

After a rigorous review process, four of the five invited papers were accepted. Next to a subset of the original reviewers, we also invited additional reviewers to ensure the best feedback possible. We believe that the four accepted papers in this special issue are of high quality and represent the state-of-the-art in their respective fields.

The article "The Complexity of Diagnosability and Opacity Verification for Petri Nets" by Béatrice Bérard, Stefan Haar, Sylvain Schmitz, and Stefan Schwoon focuses on two well-studied problems in discrete-event systems: diagnosability and opacity. The authors revisit these two problems with respect to expressiveness and complexity issues. They relate different notions of diagnosability and opacity and provide a range of complexity and decidability results, e.g., opacity is ESPACE-complete for safe Petri nets and undecidable for general Petri nets.

The article "A Distributed Fixed-Point Algorithm for Extended Dependency Graphs" by Andreas E. Dalsgaard, Søren Enevoldsen, Peter Fogh, Lasse S. Jensen, Peter G. Jensen, Tobias S. Jepsen, Isabella Kaufmann, Kim G. Larsen, Søren M. Nielsen, Mads Chr. Olesen, Samuel Pastva, and Jiří Srba is based on the paper that received the best paper award at Petri Nets 2017. For computer science standards, the paper has an exceptional number of authors. Also contentwise the paper is exceptional; the authors provide a range of interesting results and also offer an implementation. The key idea

is that equivalence and model checking problems can be encoded into computing fixed points on dependency graphs. Dependency graphs model causal dependencies among the nodes of the graph by means of hyper-edges. In the article, so-called negation edges are added to extend their applicability. To address the state-space explosion problem, an on-the-fly algorithm for efficiently computing fixed points is proposed. Also a distributed version of the algorithm is given and implemented in TAPAAL. The efficiency is demonstrated using various experiments on benchmark data sets.

The article "On Deadlockability, Liveness and Reversibility in Subclasses of Weighted Petri Nets" by Thomas Hujsa and Raymond Devillers investigates well-known behavioral Petri net properties such as liveness, (non-)deadlockability and reversibility. In some cases it may be desirable that these properties are monotonic, meaning that they are preserved upon any increase of the marking. Clearly, this does not hold for arbitrary nets. Therefore, the authors explore subclasses of Petri nets and further developed the structure theory for subclasses of weighted Petri nets that are composed of join-free modules. For the homogeneous join-free nets the authors obtained polynomial-time characterizations of structural deadlockability and structural liveness.

The article "Interleaving Based Model Checking of Concurrency and Causality" by Karsten Wolf considers the spectrum of properties previously described as the 4C spectrum (from concurrency, causality, co-occurrence, conflict) in business process management literature. This paper focuses on the 2C spectrum (problems related to causality and concurrency of pairs of transitions). Ruling out obvious equivalences, the setup yields a spectrum of 20 distinct net properties. Most of these problems could be reduced to plain reachability problems such that they can be analyzed using standard interleaving-based model checkers. Of the 20 problems, only one problem remains unsolved (a few others were solved in absence of auto-concurrency).

As the above summaries illustrate, the papers provide strong theoretical contributions that help to progress the field of concurrency. Therefore, we thank the authors for extending their papers and the reviewers for their detailed reviews. We would also like to express our deepest thanks to the Organizing Committee chaired by José Manuel Colom for the time and effort invested in organizing Petri nets 2017. Finally, we would like to thank the publishing team at FUNDAMENTA INFORMATICAE for their support in preparing this special issue.

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