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# Application and Theory of Petri Nets and Other Models of Concurrency: Special Issue of Selected Papers from Petri Nets 2015

## Preface

This special issue is dedicated to papers selected from the 36th International Conference on Application and Theory of Petri Nets and Other Models of Concurrency (Petri Nets 2015), which was held June 21–26, 2015 in Brussels, Belgium.

Out of 34 submissions from 21 different countries, 14 papers were selected for presentation by a careful reviewing process. After the conference, with the help of the Program Committee members, some authors of the papers presented at the conference were invited to submit a revised and extended version of their papers, which underwent another two-round reviewing process to guarantee that the revised papers met the standards of FUNDAMENTA INFORMATICAE. Eventually, three papers were selected for publication in this special issue, which give a representative account of current issues, topics, and questions in Petri nets.

The article "Characterizing Stable and Deriving Valid Inequalities of Petri nets", by Marvin Triebel and Jan Sürmeli, characterises stable linear inequalities, which are preserved by the evolutions of a net, by means of structural properties. This allows to generalize classical results on traps, co-traps, and invariants. For a certain class of inequalities, the paper presents a polynomial time procedure to decide stability. Furthermore, it shows that stability is a local property and exploits this for the analysis of *asynchronously interacting open net structures*. Finally, it studies the summation of inequalities as means of deriving valid inequalities. This paper received the Outstanding Paper Award at Petri Nets 2015.

The article "Petri Nets with Structured Data", by Eric Badouel, Loïc Hélouët and Christophe Morvan, considers a Petri net extension (StDN) that describes open systems with data. The objective of this language is to serve as a formal basis for the analysis of systems that use data, accept inputs from their environment, and implement complex workflows. Hence, tokens are structured documents; then each transition is attached to a query, guarded by patterns (logical assertions on the contents of its preset), and transforms some tokens. From the syntax and semantics of those nets, the paper considers some classical formal properties: coverability of a marking, termination and soundness of transactions. Unrestricted StDNs are Turing complete, so coverability, termination and soundness are undecidable for them. However, using an order on documents, and putting reasonable restrictions both on the expressiveness of patterns and queries, StDNs become well-structured transition systems, for which coverability, termination and soundness are decidable. The expressive power of those nets is

exhibited on a case study, and compared to other decidable subclasses of high-level nets and other formalisms adapted to data-centric approaches or to workflow designs.

The article "On Liveness and Reversibility of Equal-Conflict Petri Nets", by Thomas Hujsa, Jean-Marc Delosme and Alix Munier-Kordon, considers Equal-Conflict Petri nets, a class of weighted Petri nets for which liveness and reversibility are not well known, contrary to subclasses like weighted Choice-Free and ordinary Free-Choice Petri nets. A first characterization of reversibility for all live Equal-Conflict Petri nets is obtained by extending a known condition that applies to the Choice-Free and Free-Choice subclasses. The monotonicity of reversibility is then derived for the live Equal-Conflict class, and polynomial sufficient conditions for liveness and reversibility are obtained for well-formed Equal-Conflict Petri nets, contrasting with previous exponential time conditions.

Once again, we would like to thank Gilles Geeraerts and his organizing team for hosting and organizing Petri Nets 2015. We would like to thank the authors of the papers for their additional effort in extending and revising their conference papers. Moreover, we would like to thank the reviewers and PC members of Petri Nets 2015 for their comments during the selection process, and the reviewers for this special issue for their careful work and their detailed reviews, which resulted in high-quality contributions. Finally, we would like to thank Damian Niwiński for giving us the opportunity to publish this special issue and the publishing team at FUNDAMENTA INFORMATICAE for their practical support.

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