Application and Theory of Petri Nets and Concurrency: Special Issue of Selected Papers from Petri Nets 2021

Preface

It is a real pleasure to present a selection from the best papers of the 42nd International Conference on Application and Theory of Petri Nets and Other Models of Concurrency (Petri Nets 2021), initially planned in Paris, June 23-25, 2021 and finally held remotely due to the coronavirus pandemic.

The Petri Net conference has a long tradition serving as the annual meeting place for researchers in the field of Petri Nets and other models of concurrency, where not only theoretical results are presented but also innovative applications. In the field of Petri nets, computer tools for modelling, analysing or enactment of Petri Nets are important to concretise the developed theories. Such tools are presented in a dedicated session or compete in the model checking contest. The conference always has a number of invited talks in which also surveys on related fields are presented. There are moreover various workshops and tutorials organised in the days before. The physical presence of researchers in such event, with all the ensuing rich interactions, has always been a main success factor for the conference and we hope that we will be able to pursue this tradition in a near future. For more information about the Petri Net conferences and related activities see: http://www.informatik.uni-hamburg.de/TGI/Petrinets/.

Petri Nets 2021 was organised by the University of Paris. There were three invited speakers, two tutorials, one workshop, a model checking contest, and a tool demonstration video. The conference received 39 submissions by authors from 16 different countries. The Program Committee accepted 20 regular papers and 2 tool papers. As in previous years also this year, the authors of the best contributions to the conference were invited to submit to a special issue of Fundamenta Informaticae. They were asked to substantially enhance their papers, which means that these submissions differ significantly from the original conference papers. Each paper was reviewed according to the standards

of the journal. The six selected papers in this special issue cover a variety of new results in theory as well as in applications.

In "Introduction to Probabilistic Concurrent Systems, Samy Abbes discusses deterministic concurrent systems. These systems are locally commutative. It is proved that irreducible and deterministic concurrent systems have a unique probabilistic dynamics and it is demonstrated that such systems are characterised by their combinatorial properties.

The paper "A Polyhedral Abstraction for Petri nets and its Application to SMT-Based Model Checking by Nicolas Amat, Bernard Berthomieu and Silvano Dal Zilio describes a method for taking advantage of net reductions in combination with an SMT-based model checker. This method relies on the new notion of polyhedral abstraction. The approach has been implemented in the tool SMPT for Bounded Model Checking and for Property Directed Reachability, and has been successfully tested.

Petri net synthesis is about deciding for a given transition system whether there exists a Petri net with a corresponding behaviour and if so to actually construct such net. In their paper "Synthesis of Pure and Impure Petri nets With Restricted Place-environments: Complexity Issues", Raymond Devillers and Ronny Tredup study the synthesis problem aiming at Petri nets with restricted place environments and a reachability graph isomorphic to the given transition system. In the case that the size of presets and postsets of places are a priori bounded, deciding whether such net exists, can be done in polynomial time. When the bounds are part of the input however, this problem is NP-complete.

The second paper by the same authors, "Some Basic Techniques allowing Petri Net Synthesis: Complexity and Algorithmic Issues", considers the problem that whatever the conditions on the correspondence, there may not always exist a Petri net with a behaviour corresponding to the given transition system. It is shown that converting an unimplementable transition system into an implementable one by removing as few states or events or edges as possible, is NP-complete.

"Computing Parameterized Invariants of Parameterized Petri Nets is a paper by Javier Esparza, Mikhail Raskin and Christoph Welzel on automated computation of invariants from the syntax of a parameterized net. They consider a technique for the parameterized verification of safety properties of systems with a ring or array architecture and present a CEGAR loop that constructs a finite set of parameterized P-components, siphons or traps, strong enough to prove safety.

The paper "Skeleton Abstraction for Universal Temporal Properties, by Sophie Wallner and Karsten Wolf, considers skeletons of uniform coloured Petri nets, obtained by turning the coloured tokens into black tokens. A simulation relation between the state spaces of the two nets can be defined and universal temporal properties are preserved. Additionally, a partition refinement algorithm for folding a place/transition net into a coloured net is proposed.

We thank all authors for contributing to this special issue and the reviewers for their hard work and constructive comments. We are grateful to the Organising Committee, chaired by Laure Petrucci,

who did a very good job on organising a virtual event in this difficult period of pandemy. Finally, we would like to thank the managing editors of Fundamenta Informaticae for their support in preparing this special issue.

Editors of this special issue

Didier Buchs
University of Geneva, Switzerland
Didier.Buchs@unige.ch

Josep Carmona
Universitat Politècnica de Catalunya, Spain
jcarmona@cs.upc.edu

Jetty Kleijn
Leiden University, The Netherlands
h.c.m.kleijn@liacs.leidenuniv.nl

June, 2022