

Founding Editors

Gerhard Goos

Karlsruhe Institute of Technology, Karlsruhe, Germany

Juris Hartmanis

Cornell University, Ithaca, NY, USA

Editorial Board Members

Elisa Bertino

Purdue University, West Lafayette, IN, USA

Wen Gao

Peking University, Beijing, China

Bernhard Steffen 

TU Dortmund University, Dortmund, Germany

Gerhard Woeginger 

RWTH Aachen, Aachen, Germany

Moti Yung

Columbia University, New York, NY, USA


More information about this series at <http://www.springer.com/series/7407>

Ryszard Janicki · Natalia Sidorova ·
Thomas Chatain (Eds.)

Application and Theory of Petri Nets and Concurrency

41st International Conference, PETRI NETS 2020
Paris, France, June 24–25, 2020
Proceedings

Editors

Ryszard Janicki 
McMaster University
Hamilton, ON, Canada

Natalia Sidorova
Eindhoven University of Technology
Eindhoven, The Netherlands

Thomas Chatain 
LSV, CNRS & ENS Paris-Saclay
Cachan, France

ISSN 0302-9743 ISSN 1611-3349 (electronic)
Lecture Notes in Computer Science
ISBN 978-3-030-51830-1 ISBN 978-3-030-51831-8 (eBook)
<https://doi.org/10.1007/978-3-030-51831-8>

LNCS Sublibrary: SL1 – Theoretical Computer Science and General Issues

© Springer Nature Switzerland AG 2020

This work is subject to copyright. All rights are reserved by the Publisher, whether the whole or part of the material is concerned, specifically the rights of translation, reprinting, reuse of illustrations, recitation, broadcasting, reproduction on microfilms or in any other physical way, and transmission or information storage and retrieval, electronic adaptation, computer software, or by similar or dissimilar methodology now known or hereafter developed.

The use of general descriptive names, registered names, trademarks, service marks, etc. in this publication does not imply, even in the absence of a specific statement, that such names are exempt from the relevant protective laws and regulations and therefore free for general use.

The publisher, the authors and the editors are safe to assume that the advice and information in this book are believed to be true and accurate at the date of publication. Neither the publisher nor the authors or the editors give a warranty, expressed or implied, with respect to the material contained herein or for any errors or omissions that may have been made. The publisher remains neutral with regard to jurisdictional claims in published maps and institutional affiliations.

This Springer imprint is published by the registered company Springer Nature Switzerland AG
The registered company address is: Gewerbestrasse 11, 6330 Cham, Switzerland

Preface

This volume constitutes the proceedings of the 41st International Conference on Application and Theory of Petri Nets and Concurrency (Petri Nets 2020). This series of conferences serves as an annual meeting place to discuss progress in the field of Petrinets and related models of concurrency. These conferences provide a forum for researchers to present and discuss both applications and theoretical developments in this area. Novel tools and substantial enhancements to existing tools can also be presented.

Petri Nets 2020 includes a section devoted to Application of Concurrency to System Design, which until this year was a separate event.

The event was organized by the LoVe (Logics and Verification) team of the computer science laboratory LIPN (Laboratoire d'Informatique de Paris Nord), University Sorbonne Paris Nord, and CNRS, jointly with members of the Paris region MeFoSy-LoMa group (Méthodes Formelles pour les Systèmes Logiciels et Matériels). The conference was supposed to take place in the chosen area of Campus Condorcet, the new international research campus in humanities and social sciences in Paris.

Unfortunately, because of the coronavirus epidemic, the event was organized as a virtual conference. We would like to express our deepest thanks to the Organizing Committee chaired by Laure Petrucci and Étienne André for the time and effort invested in the organization of this event.

This year, 56 papers were submitted to Petri Nets 2020 by authors from 21 different countries. Each paper was reviewed by three reviewers. The discussion phase and final selection process by the Program Committee (PC) were supported by the EasyChair conference system. From 44 regular papers and 12 tool papers, the PC selected 23 papers for presentation: 17 regular papers and 6 tool papers. After the conference, some of these authors were invited to submit an extended version of their contribution for consideration in a special issue of a journal.

We thank the PC members and other reviewers for their careful and timely evaluation of the submissions and the fruitful constructive discussions that resulted in the final selection of papers. The Springer LNCS team (notably Anna Kramer and Aliaksandr Birukou) provided excellent and welcome support in the preparation of this volume.

Due to a virtual format of the event the keynote presentations have been postponed to the 2021 edition of this conference. Alongside Petri Nets 2020, the following workshops and events took place: the 10th edition of the Model Checking Contest (MCC 2020), the Workshop on Algorithms and Theories for the Analysis of Event

Data (ATAED 2020), and the Workshop on Petri Nets and Software Engineering (PNSE 2020). All the above workshops and events were also delivered in virtual format.

We hope you enjoy reading the contributions in this LNCS volume.

June 2020

Ryszard Janicki
Natalia Sidorova
Thomas Chatain

Organization

Program Committee

Elvio Gilberto Amparore	Università di Torino, Italy
Paolo Baldan	Università di Padova, Italy
Benoit Barbot	Université Paris Est Créteil, France
Didier Buchs	University of Geneva, Switzerland
Josep Carmona	Universitat Politècnica de Catalunya, Spain
Thomas Chatain	ENS Paris-Saclay, France
Isabel Demongodin	LSIS - UMR CNRS, France
Jörg Desel	Fernuniversität in Hagen, Germany
Raymond Devillers	Université Libre de Bruxelles, Belgium
Susanna Donatelli	Università di Torino, Italy
Javier Esparza	Technical University of Munich, Germany
David Frutos Escrig	Universidad Complutense de Madrid, Spain
Stefan Haar	Inria Saclay, LSV, ENS Cachan, France
Xudong He	Florida International University, USA
Loic Helouet	Inria, France
Petr Jancar	Palacky University, Czech Republic
Ryszard Janicki	McMaster University, Canada
Ekkart Kindler	Technical University of Denmark, Denmark
Jetty Kleijn	Leiden University, The Netherlands
Lars Kristensen	Western Norway University of Applied Sciences, Norway
Michael Köhler-Bußmeier	University of Applied Science at Hamburg, Germany
Irina Lomazova	National Research University Higher School of Economics, Russia
Robert Lorenz	Augsburg University, Germany
Roland Meyer	TU Braunschweig, Germany
Lukasz Mikulski	Nicolaus Copernicus University, Poland
Andrew Miner	Iowa State University, USA
Andrey Mokhov	Newcastle University, UK
Claire Pagetti	ONERA, IRIT-ENSEEIH, France
Pierre-Alain Reynier	Aix-Marseille Université, France
Olivier H. Roux	École Centrale de Nantes, France
Arnaud Sangnier	Université Paris Diderot, France
Natalia Sidorova	Technische Universiteit Eindhoven, The Netherlands
Boudewijn Van Dongen	Technische Universiteit Eindhoven, The Netherlands
Karsten Wolf	Universität Rostock, Germany
Alex Yakovlev	Newcastle University, UK
Wlodek Zuberek	Memorial University, Canada

Additional Reviewers

Althoff, Matthias
Ballarini, Paolo
Bashkin, Vladimir
Basu, Samik
Baudru, Nicolas
Becker, Mike
Bergenthum, Robin
Biswal, Shruti
Boltenhagen, Mathilde
Brenner, Leonardo
Brunel, Julien
Carvalho, Rafael V.
Chini, Peter
Claviere, Arthur
Coet, Aurélien
Delahaye, Benoit
Delfieu, David
Ding, Junhua
Dong, Zhijiang
Geeraerts, Gilles
Haas, Thomas
Hoogeboom, Hendrik Jan
Jezequel, Loig
Knapik, Michał
Kot, Martin
Kurpiewski, Damian
Küpper, Sebastian
Laarman, Alfons
Leroux, Jérôme
Lime, Didier

Lukaynov, Georgy
Meggendorfer, Tobias
Metzger, Johannes
Meyer, Philipp J.
Mitsyuk, Alexey A.
Montali, Marco
Morard, Damien
Niwinski, Damian
Nowicki, Marek
Oualhadj, Youssouf
Oustrata, Jan
Padoan, Tommaso
Pekergin, Nihal
Petrak, Lisa
Przymus, Piotr
Racordon, Dimitri
Randour, Mickael
Rivkin, Andrey
Rosa-Velardo, Fernando
Roux, Pierre
Sawa, Zdeněk
Seidner, Charlotte
Sensfelder, Nathanael
Stachtari, Emmanouela
Valero, Valentin
van der Wall, Sören
Verbeek, Eric
Weil-Kennedy, Chana
Wolff, Sebastian
Yakovlev, Alex

Contents

Application of Concurrency to System Design

Automatic Decomposition of Petri Nets into Automata Networks – A Synthetic Account	3
<i>Pierre Bouvier, Hubert Garavel, and Hernán Ponce-de-León</i>	
Data Centric Workflows for Crowdsourcing	24
<i>Pierre Bourhis, Loïc Hélouët, Zoltan Miklos, and Rituraj Singh</i>	
Synthesis for Multi-weighted Games with Branching-Time Winning Conditions	46
<i>Isabella Kaufmann, Kim Guldstrand Larsen, and Jiří Srba</i>	

Languages and Synthesis

On the High Complexity of Petri Nets ω -Languages	69
<i>Olivier Finkel</i>	
A New Property of Choice-Free Petri Net Systems	89
<i>Eike Best, Raymond Devillers, and Evgeny Erofeev</i>	
On-the-Fly Synthesis for Strictly Alternating Games	109
<i>Shyam Lal Karra, Kim Guldstrand Larsen, Marco Muñiz, and Jiří Srba</i>	

Semantics

Interleaving vs True Concurrency: Some Instructive Security Examples	131
<i>Roberto Gorrieri</i>	
A Study on Team Bisimulations for BPP Nets	153
<i>Roberto Gorrieri</i>	
Circular Traffic Queues and Petri's Cycloids	176
<i>Rüdiger Valk</i>	
PSPACE-Completeness of the Soundness Problem of Safe Asymmetric-Choice Workflow Nets	196
<i>Guanjun Liu</i>	

Process Mining and Applications

Petri Nets Validation of Markovian Models of Emergency Department Arrivals	219
<i>Paolo Ballarini, Davide Duma, Andras Horváth, and Roberto Aringhieri</i>	
Repairing Event Logs with Missing Events to Support Performance Analysis of Systems with Shared Resources	239
<i>Vadim Denisov, Dirk Fahland, and Wil M. P. van der Aalst</i>	
Piecewise Affine Dynamical Models of Timed Petri Nets – Application to Emergency Call Centers.	260
<i>Xavier Allamigeon, Marin Boyet, and Stéphane Gaubert</i>	
Automated Repair of Process Models Using Non-local Constraints	280
<i>Anna Kalenkova, Josep Carmona, Artem Polyvyanyy, and Marcello La Rosa</i>	

Extensions and Model Checking

Structural Reductions Revisited.	303
<i>Yann Thierry-Mieg</i>	
Efficient Unfolding of Coloured Petri Nets Using Interval Decision Diagrams	324
<i>Martin Schwarick, Christian Rohr, Fei Liu, George Assaf, Jacek Chodak, and Monika Heiner</i>	
Dynamic Recursive Petri Nets	345
<i>Serge Haddad and Igor Khmelnitsky</i>	

Tools

Visualizing Token Flows Using Interactive Performance Spectra.	369
<i>Wil M. P. van der Aalst, Daniel Tacke Genannt Unterberg, Vadim Denisov, and Dirk Fahland</i>	
SNexpression: A Symbolic Calculator for Symmetric Net Expressions.	381
<i>Lorenzo Capra, Massimiliano De Pierro, and Giuliana Franceschinis</i>	
Cycl \bigcirc N – A Tool for Determining Stop-Transitions of Petri Nets	392
<i>Jörg Desel, Marc Finthammer, and Andrea Frank</i>	
A CTL* Model Checker for Petri Nets	403
<i>Elvio Gilberto Amparore, Susanna Donatelli, and Francesco Gallà</i>	

The Information Systems Modeling Suite. 414
Jan Martijn E. M. van der Werf and Artem Polyvyanyy

MCC: A Tool for Unfolding Colored Petri Nets in PNML Format 426
Silvano Dal Zilio

Author Index 437