Preface

This volume contains the proceedings of the 24th International Conference on Application and Theory of Petri Nets (ICATPN 2003). The aim of the Petri net conferences is to create a forum for discussing progress in the application and theory of Petri nets.

Typically, the conferences have 100-150 participants – one third of these coming from industry while the rest are from universities and research institutions. The conferences always take place in the last week of June.

The conference and a number of other activities are coordinated by a steering committee with the following members: Jonathan Billington (Australia), Giorgio De Michelis (Italy), Susanna Donatelli (Italy), Serge Haddad (France), Kurt Jensen (Denmark), Maciej Koutney (UK), Sadatoshi Kumagai (Japan), Tadao Murata (USA), Carl Adam Petri (Germany; honorary member), Wolfgang Reisig (Germany), Grzegorz Rozenberg (The Netherlands; chairman), and Manuel Silva (Spain).

The 2003 conference was organized by the Information Systems (IS) and Information & Technology (I&T) research groups of the Technische Universiteit Eindhoven (TU/e), Eindhoven, The Netherlands. We would like to thank the members of the program committee and the reviewers (see next page) for their enormous efforts in selecting 24 papers from the 74 papers submitted. We received contributions from 30 countries distributed over three categories: theory papers (35 submitted, 12 accepted), application papers (31 submitted, 8 accepted), and tool presentation papers (8 submitted, 4 accepted). This volume comprises the papers that were accepted for presentation. Invited lectures were given by M. Ajmone Marsan, E. Brinksma, J.M. Colom, C. Ellis, K. Jensen, and S. Miyano (whose papers are included in this volume). Moreover, a paper on the standardization of a Petri net exchange format is included (as suggested by the steering committee).

The conference was held in conjunction with the International Conference on Business Process Management: On the Application of Formal Methods to “Process-Aware” Information Systems (BPM 2003). BPM 2003 and ICATPN 2003 were supported by the following institutions and organizations: KNAW, NWO, Deloitte & Touche, Pallas Athena, BETA, Philips, Gemeente Eindhoven, Sodexho, OCE, FileNet, TU/e, SIGPAM, EMISA, and Atos Origin.

We gratefully acknowledge the considerable (technical) support of Eric VerbEEK and Harro Wimmel, and the help of the people in the IS and I&T research groups involved in the organization of ICATPN 2003 and BPM 2003. Finally, we would like to mention the excellent cooperation with Springer-Verlag during the preparation of this volume.

April 2003

Wil van der Aalst and Eike Best
Organizing Committee

Wil van der Aalst
Cecile Brouwer
Kees van Hee (chair)
Reinier Post
Hajo Reijers

Natalia Sidorova
Eric Verbeek
Ineke Withagen

Tool Demonstration

Eric Verbeek (chair)

Program Committee

Wil van der Aalst, The Netherlands (co-chair, applications)
Eike Best, Germany (co-chair, theory)
Didier Buchs, Switzerland
Nadia Busi, Italy
Soren Christensen, Denmark
Gianfranco Ciardo, USA
Jordi Cortadella, Spain
Giorgio De Michelis, Italy
Jörg Desel, Germany
Susanna Donatelli, Italy
Javier Esparza, UK/Germany
Serge Haddad, France

Nisse Husberg, Finland
Hanna Klaudel, France
Jetty Kleijn, The Netherlands
Sadatoshi Kumagai, Japan
Madhavan Mukund, India
Tadao Murata, USA
Wojciech Penczek, Poland
Heinz Schmidt, Australia
Manuel Silva, Spain
P.S. Thiagarajan, Singapore
Alex Yakovlev, UK
Wlodek Zuberek, Canada

Referees

Alessandro Aldini
Cosimo Anglano
Kamel Barkaoui
Marek Bednarczyk
Luca Bernardinello
Marco Bernardo
Lorenzo Bettini
Paola Bonizzoni
Andrzej Borzyszkowski
Anne Bouillard
Cécile Bui Thanh
Jon Burton

Javier Campos
Felice Cardone
Josep Carmona
Stanislav Chachkov
Robert Clariso
José-Manuel Colom
Flavio Corradini
Jean-Michel Couvreur
Deepak D'Souza
Raymond Devillers
Claude Dutheillet
Joost Engelfriet
Yann Etesse
Giuliana Franceschinis
Rossano Gaeta
Roberto Gorrieri
Marco Gribaudo
Luuk Groenewegen
Xudong He
Keijo Heljanko
Jane Hillston
Kunihiko Hiraishi
Lawrence Holloway
Hendrik Jan Hoogeboom
András Horváth
Zhaoxia Hu
Jarle Hulaas
David Hurzeler
Le Van Huu
Jean Michel Ilié
John Jeffrey
Jens Bæk Jørgensen
Gabriel Juhás
Jorge Julvez
Victor Khomenko
Fabrice Kordon
Walter Kosters
Maciej Koutny
Lars Kristensen
Narayan Kumar
Timo Latvala
Kamal Lodaya
Robert Lorenz
Thomas Mailund
Marko Mäkelä
Daniele Manini
Dan Marinescu
José Meseguer
Vesna Milijic
Andrew Miner
Toshiyuki Miyamoto
Patrice Moreaux
Rémi Morin
Isabelle Mounier
Christian Neumair
Mogens Nielsen
Atsushi Ohta
Andrea Omicini
Paritosh Pandya
Emmanuel Paviot-Adet
Elisabeth Pelz
Marco Peña
Laure Petrucci
Claudia Picardi
Michele Pinna
Denis Poitrinaud
Agata Pórla
Lucia Pomello
Franck Pommereau
Luigi Portinale
Jean-Francois Pradat-Peyre
Ram Ramanujam
Laura Recalde
Jose Rolim
Claus Schröter
Matteo Sereno
Radu Siminiceanu
Carla Simone
Pawel Sobocinski
Jeremy Sproston
Alin Stefanescu
Jason Steggles
Ichiro Suzuki
Maciej Szreter
Shigemasa Takai
Enrique Teruel
Dorothea Tippe
Shengru Tu
Toshimitsu Ushio
Kimmo Varpaniemi
Jose Luis Villarroel Salcedo
Todd Wareham
Lisa Wells
Józef Winkowski
Bozena Wozna
Haiping Xu
Shingo Yamaguchi
Hideki Yamasaki
Yi Zhou
Gianluigi Zavattaro
Du Zhang
# Table of Contents

## Invited Papers

Coloured Petri Nets: Status and Outlook ........................................ 1  
*Kurt Jensen (University of Aarhus)*

Towards Biopathway Modeling and Simulation ............................... 3  
*Hiroshi Matsuno, Sachie Fujita, Atsushi Doi (Yamaguchi University), Masao Nagasaki, Satoru Miyano (University of Tokyo)*

The Resource Allocation Problem in Flexible Manufacturing Systems .... 23  
*J.M. Colom (Universidad de Zaragoza)*

Colored GSPN Models for the QoS Design of Internet Subnets .......... 36  
*M. Ajmone Marsan (Politecnico di Torino), M. Garetto, R. Lo Cigno, M. Meo*

Compositional Theories of Qualitative and Quantitative Behaviour ...... 37  
*Ed Brinksma (University of Twente)*

Net Models Supporting Human and Humane Behaviors .................... 43  
*C.A. Ellis (University of Colorado)*

## Full Papers

Deciding Life-Cycle Inheritance on Petri Nets ............................. 44  
*H.M.W. Verbeek, T. Basten (Eindhoven University of Technology)*

Nets Enriched over Closed Monoidal Structures .......................... 64  
*Éric Badouel (Ecole Nationale Supérieure Polytechnique), Jules Chenou (Université de Douala)*

Automatic Symmetry Detection in Well-Formed Nets ...................... 82  
*Yann Thierry-Mieg, Claude Dutheillet, Isabelle Mounier (LIP6-SRC)*

A Proposal for Structuring Petri Net-Based Agent Interaction Protocols . 102  
*Lawrence Cabac, Daniel Moldt, Heiko Rölke (University of Hamburg)*

Modelling Mobility and Mobile Agents Using Nets within Nets .......... 121  
*Michael Köhler, Daniel Moldt, Heiko Rölke (University of Hamburg)*

Modular System Development with Pullbacks ................................ 140  
*Marek A. Bednarczyk (IPI PAN), Luca Bernardinello (Università degli Studi di Milano-Bicocca), Benoît Caillaud (IRISA), Wiesław Pawłowski (IPI PAN), Lucia Pomello (Università degli Studi di Milano-Bicocca)*
<table>
<thead>
<tr>
<th>Title</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Specification and Validation of the SACI-1 On-Board Computer Using</td>
<td>161</td>
</tr>
<tr>
<td>Timed-CSP-Z and Petri Nets</td>
<td></td>
</tr>
<tr>
<td>Adnan Sherif, Augusto Sampaio, Sérgio Cavalcante (Federal University</td>
<td></td>
</tr>
<tr>
<td>of Pernambuco)</td>
<td></td>
</tr>
<tr>
<td>On the Use of Petri Nets for the Computation of Completion Time</td>
<td>181</td>
</tr>
<tr>
<td>Distribution for Short TCP Transfers</td>
<td></td>
</tr>
<tr>
<td>R. Gaeta, M. Gribaudo, D. Manini, M. Sereno (Università di Torino)</td>
<td></td>
</tr>
<tr>
<td>Model Checking Safety Properties in Modular High-Level Nets</td>
<td>201</td>
</tr>
<tr>
<td>Marko Mäkelä (Helsinki University of Technology)</td>
<td></td>
</tr>
<tr>
<td>On Reachability in Autonomous Continuous Petri Net Systems</td>
<td>221</td>
</tr>
<tr>
<td>Jorge Júlvez, Laura Recalde, Manuel Silva (Universidad de Zaragoza)</td>
<td></td>
</tr>
<tr>
<td>On the Siphon-Based Characterization of Liveness in Sequential Resource Allocation Systems</td>
<td>241</td>
</tr>
<tr>
<td>Spyros A. Reveliotis (Georgia Institute of Technology)</td>
<td></td>
</tr>
<tr>
<td>Coloured Petri Nets in Development of a Pervasive Health Care System</td>
<td>256</td>
</tr>
<tr>
<td>Jens Bæk Jørgensen (University of Aarhus)</td>
<td></td>
</tr>
<tr>
<td>Logical Reasoning and Petri Nets</td>
<td>276</td>
</tr>
<tr>
<td>Kurt Lautenbach (University of Koblenz-Landau)</td>
<td></td>
</tr>
<tr>
<td>Reactive Petri Nets for Workflow Modeling</td>
<td>296</td>
</tr>
<tr>
<td>Rik Eshuis (LIASIT / CRP Henri Tudor), Juliane Dehnert (Technical University Berlin)</td>
<td></td>
</tr>
<tr>
<td>Distributed Diagnosis of Discrete-Event Systems Using Petri Nets</td>
<td>316</td>
</tr>
<tr>
<td>Sahika Genc, Stéphane Lafortune (University of Michigan)</td>
<td></td>
</tr>
<tr>
<td>Soundness and Separability of Workflow Nets in the Stepwise Refinement Approach</td>
<td>337</td>
</tr>
<tr>
<td>Kees van Hee, Natalia Sidorova, Marc Voorhoeve (Eindhoven University of Technology)</td>
<td></td>
</tr>
<tr>
<td>On Synchronicity and Concurrency in Petri Nets</td>
<td>357</td>
</tr>
<tr>
<td>Gabriel Juhás, Robert Lorenz, Tomáš Šingliar (Katholische Universität Eichstätt-Ingolstadt)</td>
<td></td>
</tr>
<tr>
<td>Analysing Properties of the Resource Reservation Protocol</td>
<td>377</td>
</tr>
<tr>
<td>María E. Villapol (University of Venezuela), Jonathan Billington (University of South Australia)</td>
<td></td>
</tr>
<tr>
<td>Hierarchical Timed High Level Nets and Their Branching Processes</td>
<td>397</td>
</tr>
<tr>
<td>Hans Fleischhack (Carl von Ossietzky Universität Oldenburg), Elisabeth Pelz (Université Paris XII)</td>
<td></td>
</tr>
</tbody>
</table>
# Table of Contents

A Heuristic Algorithm *FSDC* Based on Avoidance of Deadlock Components in Finding Legal Firing Sequences of Petri Nets ............ 417  
*Satoshi Taoka, Shinji Furusato, Toshimasa Watanabe*  
*(Hiroshima University)*

## Tool Papers

PLC Programming with Signal Interpreted Petri Nets ................. 440  
*Stéphane Klein (University of Kaiserslautern, LURPA), Georg Frey (University of Kaiserslautern), Mark Minas (University of the Federal Armed Forces, Munich)*

CPN Tools for Editing, Simulating, and Analysing Coloured Petri Nets .. 450  
*Anne Vinter Ratzer, Lisa Wells, Henry Michael Lassen, Mads Laursen, Jacob Frank Qvortrup, Martin Stig Stissing, Michael Westergaard, Søren Christensen, Kurt Jensen (University of Aarhus)*

The Model-Checking Kit ........................................... 463  
*Claus Schröter, Stefan Schwoon, Javier Esparza (Universität Stuttgart)*

Prototyping Object Oriented Specifications ......................... 473  
*Ali Al-Shabibi, Didier Buchs, Mathieu Buffo, Stanislav Chachkov, Ang Chen, David Hurzeler (Swiss Federal Institute of Technology Lausanne)*

## PNML Paper

*Jonathan Billington (University of South Australia), Søren Christensen (University of Aarhus), Kees van Hee (Technische Universität Eindhoven), Ekkart Kindler (University of Paderborn), Olaf Kummer (CoreMedia AG), Laure Petrucci (Laboratoire Spécification et Vérification), Reinier Post (Technische Universität Eindhoven), Christian Stehno (Carl von Ossietzky University Oldenburg), Michael Weber (Humboldt-Universität zu Berlin)*

## Author Index

*.......................... 507*