

# 26th International Conference on Rewriting Techniques and Applications

RTA'15, June 29 to July 1, 2015, Warsaw, Poland

Edited by

Maribel Fernández



*Editor*

Maribel Fernández  
Department of Informatics  
King's College London, UK  
Maribel.Fernandez@kcl.ac.uk

*ACM Classification 1998*

D.1 Programming Techniques, D.2 Software Engineering, D.3 Programming Languages, F.1 Computation by Abstract Devices, F.2 Analysis of Algorithms and Problem Complexity, F.3 Logics and Meanings of Programs, F.4 Mathematical Logic and Formal Languages, I.1 Symbolic and Algebraic Manipulation, I.2 Artificial Intelligence

**ISBN 978-3-939897-85-9**

*Published online and open access by*

Schloss Dagstuhl – Leibniz-Zentrum für Informatik GmbH, Dagstuhl Publishing, Saarbrücken/Wadern, Germany. Online available at <http://www.dagstuhl.de/dagpub/9978-3-939897-85-9>.

*Publication date*

June, 2015

*Bibliographic information published by the Deutsche Nationalbibliothek*

The Deutsche Nationalbibliothek lists this publication in the Deutsche Nationalbibliografie; detailed bibliographic data are available in the Internet at <http://dnb.d-nb.de>.

*License*

This work is licensed under a Creative Commons Attribution 3.0 Unported license (CC-BY 3.0): <http://creativecommons.org/licenses/by/3.0/legalcode>.



In brief, this license authorizes each and everybody to share (to copy, distribute and transmit) the work under the following conditions, without impairing or restricting the authors' moral rights:

- Attribution: The work must be attributed to its authors.

The copyright is retained by the corresponding authors.

Digital Object Identifier: 10.4230/LIPIcs.RTA.2015.i

ISBN 978-3-939897-85-9

ISSN 1868-8969

<http://www.dagstuhl.de/lipics>

## LIPICs – Leibniz International Proceedings in Informatics

LIPICs is a series of high-quality conference proceedings across all fields in informatics. LIPICs volumes are published according to the principle of Open Access, i.e., they are available online and free of charge.

### *Editorial Board*

- Susanne Albers (TU München)
- Chris Hankin (Imperial College London)
- Deepak Kapur (University of New Mexico)
- Michael Mitzenmacher (Harvard University)
- Madhavan Mukund (Chennai Mathematical Institute)
- Catuscia Palamidessi (INRIA)
- Wolfgang Thomas (*Chair*, RWTH Aachen)
- Pascal Weil (CNRS and University Bordeaux)
- Reinhard Wilhelm (Saarland University)

**ISSN 1868-8969**

**[www.dagstuhl.de/lipics](http://www.dagstuhl.de/lipics)**



## ■ Contents

Preface	
<i>Maribel Fernández</i> .....	vii

### Invited Talks

Port Graphs, Rules and Strategies for Dynamic Data Analytics – Extended Abstract	
<i>Hélène Kirchner</i> .....	1
Matching Logic – Extended Abstract	
<i>Grigore Roşu</i> .....	5
Executable Formal Models in Rewriting Logic	
<i>Carolyn Talcott</i> .....	22

### Regular Papers

Certification of Complexity Proofs Using $\mathcal{C}\bar{\epsilon}\bar{\tau}\bar{A}$	
<i>Martin Avanzini, Christian Sternagel, and René Thiemann</i> .....	23
Dismatching and Local Disunification in $\mathcal{E}\mathcal{L}$	
<i>Franz Baader, Stefan Borgwardt, and Barbara Morawska</i> .....	40
Nominal Anti-Unification	
<i>Alexander Baumgartner, Temur Kutsia, Jordi Levy, and Mateu Villaret</i> .....	57
A faithful encoding of programmable strategies into term rewriting systems	
<i>Horatiu Cirstea, Sergueï Lenglet, and Pierre-Etienne Moreau</i> .....	74
Presenting a Category Modulo a Rewriting System	
<i>Florence Clerc and Samuel Mimram</i> .....	89
Confluence of nearly orthogonal infinitary term rewriting systems	
<i>Lukasz Czapka</i> .....	106
No complete linear term rewriting system for propositional logic	
<i>Anupam Das and Lutz Straßburger</i> .....	127
A Coinductive Framework for Infinitary Rewriting and Equational Reasoning	
<i>Jörg Endrullis, Helle Hansen, Dimitri Hendriks, Andrew Polonsky, and Alessandra Silva</i> .....	143
Proving non-termination by finite automata	
<i>Jörg Endrullis and Hans Zantema</i> .....	160
Reachability Analysis of Innermost Rewriting	
<i>Thomas Genet and Yann Salmon</i> .....	177
Network Rewriting II: Bi- and Hopf Algebras	
<i>Lars Hellström</i> .....	194
Leftmost Outermost Revisited	
<i>Nao Hirokawa, Aart Middeldorp, and Georg Moser</i> .....	209

26th International Conference on Rewriting Techniques and Applications (RTA'15).  
Editor: M. Fernández



Leibniz International Proceedings in Informatics  
Schloss Dagstuhl – Leibniz-Zentrum für Informatik, Dagstuhl Publishing, Germany

Conditional Complexity <i>Cynthia Kop, Aart Middeldorp, and Thomas Sternagel</i> .....	223
Constructing Orthogonal Designs in Powers of Two: Gröbner Bases Meet Equational Unification <i>Ilias Kotsireas, Temur Kutsia, and Dimitris E. Simos</i> .....	241
Improving Automatic Confluence Analysis of Rewrite Systems by Redundant Rules <i>Julian Nagele, Bertram Felgenhauer, and Aart Middeldorp</i> .....	257
Certified Rule Labeling <i>Julian Nagele and Harald Zankl</i> .....	269
Transforming Cycle Rewriting into String Rewriting <i>David Sabel and Hans Zantema</i> .....	285
Confluence of Orthogonal Nominal Rewriting Systems Revisited <i>Takaki Suzuki, Kentaro Kikuchi, Takahito Aoto, and Yoshihito Toyama</i> .....	301
Matrix Interpretations on Polyhedral Domains <i>Johannes Waldmann</i> .....	318

## System Description Papers

Inferring Lower Bounds for Runtime Complexity <i>Florian Frohn, Jürgen Giesl, Jera Hensel, Cornelius Aschermann, and Thomas Ströder</i> .....	334
A Simple and Efficient Step Towards Type-Correct XSLT Transformations <i>Markus Lepper and Baltasar Trancón y Widemann</i> .....	350
DynSem: A DSL for Dynamic Semantics Specification <i>Vlad Vergu, Pierre Neron, and Eelco Visser</i> .....	365

## ■ Preface

This volume contains the papers presented at RTA 2015, the 26th International Conference on Rewriting Techniques and Applications, which was held from 29 June to 1 July 2015, in Warsaw, Poland. RTA 2015 was co-located with the 13th International Conference on Typed Lambda Calculi and Applications (TLCA 2015), as part of RDP 2015, the eighth edition of the International Conference on Rewriting, Deduction, and Programming. The following workshops were also part of RDP 2015: Higher-Dimensional Rewriting and Applications (HDRA), Homotopy Type Theory / Univalent Foundations (HoTT/UF), the Annual Meeting of the IFIP Working Group 1.6 on Term Rewriting, the 29th International Workshop on Unification (UNIF) and the Second International Workshop on Rewriting Techniques for Program Transformations and Evaluation (WPTE).

RTA is the major forum for the presentation of research on all aspects of rewriting. Previous RTA conferences were held in Dijon (1985), Bordeaux (1987), Chapel Hill (1989), Como (1991), Montreal (1993), Kaiserslautern (1995), New Brunswick (1996), Sitges (1997), Tsukuba (1998), Trento (1999), Norwich (2000), Utrecht (2001), Copenhagen (2002), Valencia (2003), Aachen (2004), Nara (2005), Seattle (2006), Paris (2007), Hagenberg/Linz (2008), Brasilia (2009), Edinburgh (2010), Novi Sad (2011), Nagoya (2012), Eindhoven (2013) and Vienna (2014).

RTA 2015 received 43 submissions from 16 countries. The programme committee selected 19 regular papers and 3 system description papers for presentation at the conference. Each paper was reviewed by four members of the programme committee, with the help of external reviewers. The submission and reviewing process, programme committee discussion, and author notifications were all handled seamlessly by the EasyChair conference management system.

In addition to the contributed papers, there were three invited talks at RTA 2015, by Hélène Kirchner (joint invited speaker with TLCA 2015), Grigore Roşu and Carolyn Talcott. We thank the three invited speakers for contributing to the success of the conference with their interesting talks and papers.

The programme committee gave the award for *best contribution to RTA 2015* to Jörg Endrullis, Helle Hvid Hansen, Dimitri Hendriks, Andrew Polonsky and Alessandra Silva for the paper *A Coinductive Framework for Infinitary Rewriting and Equational Reasoning*.

The proceedings of RTA 2015 are published as a volume in the LIPIcs series. We thank the LIPIcs editorial office for their help in the preparation of these proceedings.

I would like to thank the members of the organisation committee, and in particular the chair, Aleksy Schubert, for taking care of every detail to make the conference enjoyable for all the participants. It was also a pleasure to work with Thorsten Altenkirch, programme chair of TLCA 2015.

I am very grateful to all the members of the RTA 2015 programme committee and external reviewers for their careful and efficient evaluation of the papers submitted.

RTA 2015 gratefully acknowledges the financial support of the University of Warsaw and the Warsaw Center of Mathematics and Computer Science.

Maribel Fernández

London, 12 May 2015





## ■ Programme Committee

Mauricio Ayala-Rincón

Horatiu Cirstea

Stephanie Delaune

Alessandra Di Pierro

Gilles Dowek

Maribel Fernández (chair)

Jürgen Giesl

Michael Hanus

Delia Kesner

Temur Kutsia

Jordi Levy

Salvador Lucas

Christopher Lynch

Ian Mackie

Georg Moser

Detlef Plump

Femke van Raamsdonk

Kristoffer Rose

Masahiko Sakai

Andre Scedrov

Manfred Schmidt-Schauss

Carsten Schürmann

Peter Selinger

Paula Severi

Kazunori Ueda





## ■ Organisation Committee

Marcin Benke

Jacek Chrzęszcz

Łukasz Czajka

Patryk Czarnik

Krystyna Jaworska

Aleksy Schubert (RDP chair)

Pawel Urzyczyn

Daria Walukiewicz-Chrzęszcz

Maciej Zielenkiewicz



## ■ List of Subreviewers

María Alpuente	Rita Hartel
Sandra Alves	Willem Heijltjes
Takahito Aoto	Dimitri Hendriks
Kyungmin Bae	Claudio Hermida
Patrick Bahr	Peter Hibbs
Steffen van Bakel	Vincent Hugot
Demis Ballis	Munehiro Iwami
Alexander Baumgartner	Florent Jaquemard
Iovka Boneva	Artur Jez
Peter Brottveit Bock	Stefan Kahrs
Alan Cain	Yoshiharu Kojima
Łukasz Czajka	Boris Konev
Ugo Dal Lago	Serguei Lenglet
Roel De Vrijes	Flavio L. C. De Moura
Frank Drewes	Luigi Liquori
Joshua Dunfield	Carlos Lombardi
Rachid Echahed	Dorel Lucanu
Joerg Endrullis	Philippe Malbos
Santiago Escobar	António Malheiro
Francisco Ferreira	Andrew M. Marshall
Traian Florin Serbanuta	Sebastian Maneth
Florian Frohn	Alexander Maringele
Murdoch J. Gabbay	Mircea Marin
Thomas Genet	Wim Martens
Stéphane Gimenez	Edgar Martinez-Moro
Guillem Godoy	Marino Miculan
Jakob Grue Simonsen	Samuel Mimram
Yves Guiraud	Akimasa Morihata
Daniel Gustafsson	Guillaume Munch-Maccagnoni
Raúl Gutiérrez	César Muñoz
Peter Habermehl	Naoki Nishida

Mizuhito Ogawa

Ana C. R. Oliveira

Vincent Padovani

Andrei Paskevich

Andrei Popescu

Timothy Porter

Nicolas Pouillard

Thomas Powell

Silvio Ranise

Daniel R. Licata

Camilo Rocha

David Sabel

Pawel Sobocinski

Christian Sternagel

Christoph Stickse

Thomas Ströder

René Thiemann

Yoshihito Toyama

Daniel Ventura

Jamie Vicary

Herbert Wiklicky

Akihisa Yamada

Harald Zankl

Hans Zantema