Lecture Notes in Computer Science

7180

Commenced Publication in 1973
Founding and Former Series Editors:
Gerhard Goos, Juris Hartmanis, and Jan van Leeuwen

Editorial Board

David Hutchison, UK Takeo Kanade, USA Josef Kittler, UK Jon M. Kleinberg, USA

Alfred Kobsa, USA Friedemann Mattern, Switzerland

John C. Mitchell, USA Moni Naor, Israel

Oscar Nierstrasz, Switzerland C. Pandu Rangan, India Bernhard Steffen, Germany Madhu Sudan, USA Demetri Terzopoulos, USA Doug Tygar, USA

Gerhard Weikum, Germany

Advanced Research in Computing and Software Science Subline of Lectures Notes in Computer Science

Subline Series Editors

Giorgio Ausiello, *University of Rome 'La Sapienza'*, *Italy* Vladimiro Sassone, *University of Southampton, UK*

Subline Advisory Board

Susanne Albers, University of Freiburg, Germany
Benjamin C. Pierce, University of Pennsylvania, USA
Bernhard Steffen, University of Dortmund, Germany
Madhu Sudan, Microsoft Research, Cambridge, MA, USA
Deng Xiaotie, City University of Hong Kong
Jeannette M. Wing, Carnegie Mellon University, Pittsburgh, PA, USA

Nikolaj Bjørner Andrei Voronkov (Eds.)

Logic for Programming, Artificial Intelligence, and Reasoning

18th International Conference, LPAR-18 Mérida, Venezuela, March 11-15, 2012 Proceedings



Volume Editors

Nikolaj Bjørner Microsoft Research One Microsoft Way, Redmond, WA 98052-6399, USA E-mail: nbjorner@microsoft.com

Andrei Voronkov University of Manchester School of computer Science Kilburn Building, Oxford Road, Manchester, MP13 9PL, UK E-mail: andrei.voronkov@manchester.ac.uk

ISSN 0302-9743 e-ISSN 1611-3349 ISBN 978-3-642-28716-9 e-ISBN 978-3-642-28717-6 DOI 10.1007/978-3-642-28717-6 Springer Heidelberg Dordrecht London New York

Library of Congress Control Number: 2012932595

CR Subject Classification (1998): F.3, I.2, D.2, F.4.1, D.3, H.4

LNCS Sublibrary: SL 1 – Theoretical Computer Science and General Issues

© Springer-Verlag Berlin Heidelberg 2012

This work is subject to copyright. All rights are reserved, whether the whole or part of the material is concerned, specifically the rights of translation, reprinting, re-use of illustrations, recitation, broadcasting, reproduction on microfilms or in any other way, and storage in data banks. Duplication of this publication or parts thereof is permitted only under the provisions of the German Copyright Law of September 9, 1965, in its current version, and permission for use must always be obtained from Springer. Violations are liable to prosecution under the German Copyright Law.

The use of general descriptive names, registered names, trademarks, 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.

Typesetting: Camera-ready by author, data conversion by Scientific Publishing Services, Chennai, India

Printed on acid-free paper

Springer is part of Springer Science+Business Media (www.springer.com)

Preface

This volume contains the papers presented at LPAR-18: the 18th International Conference on Logic for Programming, Artificial Intelligence, and Reasoning, held on March 11–15, 2012 in Merida, Venezuela.

Following the call for papers, LPAR-18 received 85 abstracts, materializing in 74 submissions. Each submission was reviewed by at least three of the 36 Program Committee members. The committee decided to accept 25 regular papers and 6 tool descriptions and experimental papers. The program also included talks by four distinguished invited speakers: Elvira Albert (Complutense University of Madrid), Kenneth McMillan (Microsoft Research), Aart Middeldorp (University of Innsbruck), and Boris Motik (University of Oxford); covering areas ranging from constraint programming and resource analysis of programs, software verification and interpolation, rewriting and matrix interpretations, and description logics.

Two workshops were co-located with LPAR-18. The 6th International Workshop on Analytic Proof Systems, APS-6, was organized by Matthias Baaz and Christian Fermüller, both from the University of Technology, Vienna. The 9th International Workshop on the Implementation of Logics was organized by Eugenia Ternovska (Simon Fraser University, Vancouver), Konstantin Korovin (University of Manchester), and Stephan Schulz (TU München). We were fortunate in having Laura Kovacs (Vienna University of Technology) acting as the LPAR workshop chair.

LPAR has a distinct track record as a series of high-quality conferences held in places where no other reasonable conference has gone before. The 18th conference in Merida takes LPAR to new heights, roughly 3500 meters. The PC Chairs are grateful for support from EasyChair and sponsorship from Microsoft Research. It also happens to be the case that one of the chairs is from Microsoft Research, the other is the author of EasyChair. The Conference Chair, Geoff Sutcliffe, stepped in for his fourth LPAR organization and secured the domain http://lpar-18.info for the conference. Finally, we thank the local organizers Blanca Abraham and José Aguilar for their support.

January 2012

Andrei Voronkov Nikolaj Bjørner

Organization

Program Committee

José Aguilar Universidad de Los Andes, Venezuela Elvira Albert Complutense University of Madrid, Spain

Franz Baader TU Dresden, Germany

Gilles Barthe IMDEA Software Institute, France

Peter Baumgartner National ICT Australia

Armin Biere Johannes Kepler University, Austria

Nikolaj Bjørner Microsoft Research, USA Thierry Coquand Chalmers University, Sweden

Véronique Cortier Loria, France

Luca de Alfaro UCSC / Google, USA Christian Fermüller TU Vienna, Austria John Harrison Intel Corporation, USA

Manuel Hermengildo IMDEA Software Institute, France

Barbara Jobstmann CNRS/Verimag, France

Deepak Kapur University of New Mexico, Mexico

Konstantin Korovin Manchester University, UK

Laura Kovacs TU Vienna, Austria

Carsten Lutz Universität Bremen, Germany

Parthasarathy Madhusudan University of Illinois at Urbana-Champaign,

USA

Aart Middeldorp University of Innsbruck, Austria

Dale Miller INRIA Saclay - Île-de-France and LIX/

École Polytechnique, France

César Muñoz National Aeronautics and Space

Administration, USA

Albert Oliveras Technical University of Catalonia, Spain

Lawrence Paulson University of Cambridge, UK

Ruzica Piskac Max Planck Institute for Software Systems,

Germany

Francesca Rossi University of Padova, Italy

Grigore Rosu University of Illinois at Urbana-Champaign,

USA

Torsten Schaub University of Potsdam, Germany

Natarajan Shankar SRI International, USA
Wolfgang Thomas RWTH Aachen, Germany
Cesare Tinelli The University of Iowa, USA

Pascal Van Hentenryck Brown University, USA

Andrei Voronkov Toby Walsh Christoph Weidenbach Frank Wolter University of Manchester, UK NICTA and UNSW, Australia Max Planck Institute for Informatics, Germany University of Liverpool, UK

Additional Reviewers

Accattoli, Beniamino Alpuente, María Andres, Benjamin Arenas, Puri Audemard, Gilles Bana, Gergei Booth, Richard Boulmé, Sylvain Brandner, Florian Böhme, Sascha Cerny, Pavol Chaudhuri, Kaustuv Ciobaca, Stefan De Nivelle, Hans Deters, Morgan Doyen, Laurent Ellison, Chucky Everaere, Patricia García Pérez, Alvaro Garoche, Pierre-Loic Gebser, Martin Gelfond, Michael Genaim, Samir Geser, Alfons Giesl, Jürgen Giordano, Laura Goodloe, Alwyn Gutierrez, Raul Gutiérrez, Basulto Göller, Stefan Haarslev, Volker

Haemmerlé, Rémy Hagen, George Heule, Marijn Hoder, Krystof Holloway, Michael Hustadt, Ullrich Järvisalo, Matti Kristensen, Lars Kutsia, Temur König, Arne Lamotte-Schubert, Manuel Le Botlan, Didier Leucker, Martin Lopez-Garcia, Pedro Lozes, Etienne Löding, Christof Meredith, Patrick Moeller, Ralf Montenegro, Manuel Narkawicz, Anthony Narodytska, Nina Nguyen, Kim Nguyen, Linh Anh Nigham, Vivek Olivetti, Nicola Ostrowski, Max Pacholski, Leszek Parker, David Pattinson, Dirk

Popescu, Andrei

Reynolds, Andrew Riesco, Adrian Rozier, Kristin Yvonne Sabuncu, Orkunt Schneider, Thomas Serbanuta, Traian Serebrenik, Alexander Silva, Josep Smyth, Ben Stefanescu, Andrei Sticksel, Christoph Sürmeli, Jan Tang, Ching Hoo Thiemann, René Thrane, Claus Trunfio, Giuseppe A. Veanes, Margus Von Essen, Christian Vyskocil, Jiri Waldmann, Johannes Waldmann, Uwe Widmann, Florian Wies, Thomas Winkler, Sarah Wintersteiger, Christoph M. Wischnewski, Patrick Zanardini, Damiano Zankl, Harald Zeilberger, Noam Zuleger, Florian

Table of Contents

Automatic Inference of Resource Consumption Bounds	1
Matrix Interpretations for Polynomial Derivational Complexity of Rewrite Systems	12
Parameterized Complexity and Fixed-Parameter Tractability of Description Logic Reasoning	13
Enfragmo: A System for Modelling and Solving Search Problems with Logic	15
Amir Aavani, Xiongnan (Newman) Wu, Shahab Tasharrofi, Eugenia Ternovska, and David Mitchell	10
The Permutative λ -Calculus	23
Automated and Human Proofs in General Mathematics: An Initial Comparison	37
Lazy Abstraction with Interpolants for Arrays	46
Backward Trace Slicing for Conditional Rewrite Theories	62
Forgetting for Defeasible Logic	77
Querying Proofs	92
Solving Language Equations and Disequations with Applications to Disunification in Description Logics and Monadic Set Constraints Franz Baader and Alexander Okhotin	107

Dual-Priced Modal Transition Systems with Time Durations	122
Finding Finite Herbrand Models	138
Smart Testing of Functional Programs in Isabelle	153
Monitor-Based Statistical Model Checking for Weighted Metric Temporal Logic	168
Duality between Merging Operators and Social Contraction Operators	183
Automatic Generation of Invariants for Circular Derivations in SUP(LA)	197
Moral Reasoning under Uncertainty	212
Towards Algorithmic Cut-Introduction	228
Conflict Anticipation in the Search for Graph Automorphisms	243
Confluence of Non-Left-Linear TRSs via Relative Termination	258
Regular Expressions for Data Words	274
Automatic Verification of TLA+ Proof Obligations with SMT Solvers Stephan Merz and Hernán Vanzetto	289
An Asymptotically Correct Finite Path Semantics for LTL	304
On the Domain and Dimension Hierarchy of Matrix Interpretations Friedrich Neurauter and Aart Middeldorp	320
iSat: Structure Visualization for SAT Problems	335

Table of Contents	XI
Linear Constraints over Infinite Trees	343
E-Matching with Free Variables	359
Random: R-Based Analyzer for Numerical Domains	375
Solving Graded/Probabilistic Modal Logic via Linear Inequalities (System Description)	383
Labelled Superposition for PLTL Martin Suda and Christoph Weidenbach	391
The TPTP Typed First-Order Form with Arithmetic	406
Ordinals and Knuth-Bendix Orders	420
r-TuBound: Loop Bounds for WCET Analysis (Tool Paper) Jens Knoop, Laura Kovács, and Jakob Zwirchmayr	435
Author Index	445