Lecture Notes in Computer Science 3929

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

Editorial Board

David Hutchison
Lancaster University, UK

Takeo Kanade
Carnegie Mellon University, Pittsburgh, PA, USA

Josef Kittler
University of Surrey, Guildford, UK

Jon M. Kleinberg
Cornell University, Ithaca, NY, USA

Friedemann Mattern
ETH Zurich, Switzerland

John C. Mitchell
Stanford University, CA, USA

Moni Naor
Weizmann Institute of Science, Rehovot, Israel

Oscar Nierstrasz
University of Bern, Switzerland

C. Pandu Rangan
Indian Institute of Technology, Madras, India

Bernhard Steffen
University of Dortmund, Germany

Madhu Sudan
Massachusetts Institute of Technology, MA, USA

Demetri Terzopoulos
University of California, Los Angeles, CA, USA

Doug Tygar
University of California, Berkeley, CA, USA

Moshe Y. Vardi
Rice University, Houston, TX, USA

Gerhard Weikum
Max-Planck Institute of Computer Science, Saarbruecken, Germany

Wendy MacCaull Michael Winter
Ivo Düntsch (Eds.)

Relational Methods in Computer Science

8th International Seminar on Relational Methods in Computer Science
3rd International Workshop on Applications of Kleene Algebra
and Workshop of COST Action 274: TARSKI
St. Catharines, ON, Canada, February 22-26, 2005
Selected Revised Papers

Springer

Volume Editors

Wendy MacCaull
St. Francis Xavier University
Department of Mathematics, Statistics and Computer Science
P.O. Box 5000, Antigonish, Nova Scotia, Canada B2G 2W5
E-mail: wmaccaul@stfx.ca

Michael Winter
Ivo Düntsch
Brock University, Computer Science Department
St. Catharines, Ontario, Canada L2S 3A1
E-mail: {winter, duentsch}@brocku.ca

Library of Congress Control Number: 2006924115

CR Subject Classification (1998): F.4, D.2.4, F.3, I.1, I.2.3, G.2

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

ISSN 0302-9743
ISBN-10 3-540-33339-8 Springer Berlin Heidelberg New York
ISBN-13 978-3-540-33339-5 Springer Berlin Heidelberg New York

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.

Springer is a part of Springer Science+Business Media

springer.com

© Springer-Verlag Berlin Heidelberg 2006
Printed in Germany

Typesetting: Camera-ready by author, data conversion by Scientific Publishing Services, Chennai, India
Printed on acid-free paper SPIN: 11734673 06/3142 5 4 3 2 1 0

Preface

This volume is the post conference proceedings of the 8th International Seminar on Relational Methods in Computer Science (RelMiCS 8), held in conjunction with the 3rd International Workshop on Applications of Kleene Algebra and a COST Action 274 (TARSKI) Workshop. This combined meeting took place in St. Catharines, Ontario, Canada, from February 22 to February 26, 2005. The purpose of this meeting was to bring together researchers from various subdisciplines of computer science and mathematics who use the calculus of relations and/or Kleene algebra as methodological and conceptual tools in their work.

The meeting was a continuation of three different series of meetings. Previous RelMiCS meetings were held in:

- Schloß Dagstuhl, Germany, January 1994
- Parati (near Rio de Janeiro), Brazil, September 1995
- Hammamet, Tunisia, January 1997
- Stefan Banach Center, Warsaw, Poland, September 1998
- Valcartier (near Québec City), Canada, January 2000
- Osterwijk (near Tilburg), The Netherlands, October 2001
- Malente (near Kiel), Germany, May 2003

The first two workshops on applications of Kleene algebra were held Schloß Dagstuhl, Germany, February 2001 and Malente (near Kiel), Germany, May 2003. COST Workshops were held four times per year in various locations in the European Union since 2001. The substantial common interests and overlap of these communities motivated the joint meeting. Proceedings, edited by Düntsch and Winter and containing extended abstracts of the 34 accepted papers and abstracts of the 4 invited talks, were available at the conference. After the conference, a Call for Papers was issued.

This volume contains the 17 (full) papers accepted from the submissions at that time and three invited papers, "Topological Representation of Precontact Algebras" by Georgi Dimov and Dimiter Vakarelov, "Relational Semantics through Duality" by Ewa Orłowska, Ingrid Rewitzky and Ivo Düntsch and "Duality Theory for Projective Algebras" by Alasdair Urquhart. The contributed papers underwent a thorough refereeing process, in which each paper was sent to several referees. Contributed papers include such topics as static analysis of programs, representation theory, theories of programming, evolutionary algorithms, verification and quantifier elimination.

We are grateful to the members of the Program Committee and to the many people who acted as external referees and who must remain anonymous. Their efforts have ensured the high quality of the papers in this volume.

January 2006

Wendy MacCaull
Michael Winter
Ivo Düntsch

Organization

Organizing Committee

Ivo Düntsch, Brock University, Canada
Wendy MacCaull, St. Francis Xavier University, Canada
Michael Winter, Brock University, Canada

Program Committee

Roland Backhouse, University of Nottingham, UK
Rudolf Berghammer, Christian Albrechts University of Kiel, Germany
Jules Desharnais, Université Laval, Canada
Ivo Düntsch, Brock University, Canada
Marc Frappier, Université de Sherbrooke, Canada
Marcelo Frias, University of Buenos Aires, Argentina
Peter Jipsen, Chapman University, USA
Wolfram Kahl, McMaster, Canada
Yasuo Kawahara, Kyushu University, Japan
Wendy MacCaull, St. Francis Xavier University, Canada
Bernhard Möller, University of Augsburg, Germany
Ewa Orłowska, Institute of Telecommunications, Poland
Ivo Rosenberg, Université de Montréal, Canada
Gunther Schmidt, UniBw Munich, Germany
Georg Struth, University of Augsburg, Germany
Burhan Türksen, University of Toronto, Canada
Michael Winter, Brock University, Canada

Sponsoring Institutions

Financial support from the following is gratefully acknowledged:
Computer Science Department, Brock University, St. Catharines, Canada
European Union COST Action 274 (TARSKI)

Table of Contents

Invited Papers

Topological Representation of Precontact Algebras
Georgi Dimov, Dimiter Vakarelov 1

Relational Semantics Through Duality
Ewa Orłowska, Ingrid Rewitzky, Ivo Düntsch 17

Duality Theory for Projective Algebras
Alasdair Urquhart 33

Contributed Papers

Relational Approach to Boolean Logic Problems
Rudolf Berghammer, Ulf Milanese 48

Static Analysis of Programs Using Omega Algebra with Tests
Claude Bolduc, Jules Desharnais 60

Weak Contact Structures
Ivo Düntsch, Michael Winter 73

On Relational Cycles
Alexander Fronk, Jörg Pleumann 83

A Framework for Kleene Algebra with an Embedded Structure
Hitoshi Furusawa 96

Non-termination in Unifying Theories of Programming
Walter Guttmann 108

Towards an Algebra of Hybrid Systems
Peter Höfner, Bernhard Möller 121

Relational Correspondences for Lattices with Operators
Jouni Järvinen, Ewa Orłowska 134

Control-Flow Semantics for Assembly-Level Data-Flow Graphs
Wolfram Kahl, Christopher K. Anand, Jacques Carette 147

Relational Implementation of Simple Parallel Evolutionary Algorithms
Britta Kehden, Frank Neumann, Rudolf Berghammer 161

Lattice-Based Paraconsistent Logic
Wendy MacCaull, Dimiter Vakarelov 173

Verification of Pushdown Systems Using Omega Algebra with Domain
Vincent Mathieu, Jules Desharnais 188

wp Is wlp
Bernhard Möller, Georg Struth 200

Relational Representability for Algebras of Substructural Logics
Ewa Orłowska, Anna Maria Radzikowska 212

Knuth-Bendix Completion as a Data Structure
Georg Struth 225

Quantifier Elimination in Elementary Set Theory
Ewa Orłowska, Andrzej Szałas 237

Time-Dependent Contact Structures in Goguen Categories
Michael Winter 249

Author Index 263