Lecture Notes in Computer Science 1827

Edited by G. Goos, J. Hartmanis and J. van Leeuwen

Springer
Berlin
Heidelberg
New York
Barcelona
Hong Kong
London
Milan
Paris
Singapore
Tokyo

Didier Bert Christine Choppy
Peter Mosses (Eds.)

Recent Trends in Algebraic Development Techniques

14th International Workshop, WADT'99
Château de Bonas, September 15-18, 1999
Selected Papers

Springer

Series Editors

Gerhard Goos, Karlsruhe University, Germany
Juris Hartmanis, Cornell University, NY, USA
Jan van Leeuwen, Utrecht University, The Netherlands

Volume Editors

Didier Bert
CNRS, Laboratoire LSR-IMAG
681, rue de la Passerelle, BP 72
38402 Saint-Martin-d'Hères CEDEX, France
E-mail: Didier.Bert@imag.fr

Christine Choppy
LIPN, Institute Galilée - Université Paris XIII
99 Avenue Jean-Baptiste Clément
93430 Villetaneuse, France
E-mail: Christine.Choppy@lipn.univ-paris13.fr

Peter Mosses
University of Aarhus
BRICS Department of Computer Science
Ny Munkegade Building 540, 8000 Aarhus C, Denmark
E-mail: pdmosses@brics.dk

Cataloging-in-Publication Data applied for

Die Deutsche Bibliothek - CIP-Einheitsaufnahme

Recent trends in algebraic development techniques : 14th
international workshop ; selected papers / WADT '99, Châteaux de
Bonas, France, September 1999. Didier Bert ... (ed.). - Berlin ;
Heidelberg ; New York ; Barcelona ; Hong Kong ; London ; Milan ;
Paris ; Singapore ; Tokyo : Springer, 2000
(Lecture notes in computer science ; Vol. 1827)
ISBN 3-540-67898-0

CR Subject Classification (1998): D.1.1-2, D.2.4, D.2.m, D.3.1, F.3.1-2

ISSN 0302-9743
ISBN 3-540-67898-0 Springer-Verlag 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-Verlag. Violations are liable for prosecution under the German Copyright Law.

Springer-Verlag Berlin Heidelberg New York
a member of BertelsmannSpringer Science+Business Media GmbH
© Springer-Verlag Berlin Heidelberg 2000
Printed in Germany

Typesetting: Camera-ready by author, data conversion by DA-TeX Gerd Blumenstein
Printed on acid-free paper SPIN: 10721161 06/3142 5 4 3 2 1 0

Preface

The algebraic approach to system specification and development, born in the 1970s as a formal method for abstract data types, encompasses today the formal design of integrated hardware and software systems, new specification frameworks and programming paradigms (such as object-oriented, logic, and higher-order functional programming) and a wide range of application areas (including information systems, concurrent and distributed systems). Workshops on Algebraic Development Techniques, initiated in 1982 as Workshops on Abstract Data Types, have become a prominent forum to present and discuss research on this important area.

The 14th International Workshop on Algebraic Development Techniques (WADT'99) took place at the Château de Bonas, near Toulouse, September 15–18, 1999, and was organized by Didier Bert and Christine Choppy. The main topics of the workshop were:

- algebraic specification
- other approaches to formal specification
- specification languages and methods
- term rewriting and proof systems
- specification development systems (concepts, tools, etc.).

The program consisted of invited talks by Michel Bidoit, Manfred Broy, Bart Jacobs, Natarajan Shankar, and 69 presentations describing ongoing research. The parallel sessions were devoted to: algebraic specifications and other specification formalisms, test and validation, concurrent processes, applications, logics and validation, combining formalisms, subsorts and partiality, structuring, rewriting, coalgebras and sketches, refinement, institutions and categories, ASM specifications. There were also sessions reflecting ongoing research achieved in the Common Framework Initiative (CoFI, see http://www.brics.dk/Projects/CoFI/), within its different task groups: CASL (Common Algebraic Specification Language), CASL semantics, CASL tools, methodology, and reactive systems.

The program committee invited submissions of full papers for possible publication in this WADT volume on the basis of the abstracts and the presentations at WADT'99. All the submissions were subject to careful refereeing, and the selection of papers was made following further discussion by the full program committee. The authors of the 26 selected papers were asked to take account of the suggestions of the referees when preparing their final versions for inclusion in the present volume. The selected papers include three which are authored/co-authored by invited speakers at WADT'99.

We are extremely grateful to all the workshop participants, to the invited speakers, to the (other) members of the program committee, and to the external referees for their contribution to the scientific quality of the workshop and of this volume.

The workshop was organized by IFIP WG1.3 (Foundations of System Specification). It was sponsored by CoFI (Common Framework Initiative) ESPRIT Working Group 29432, and received financial support by CNRS (Centre National de la Recherche Scientifique), Ministére des Affaires Etrangéres (French Governement), IMAG Institute (Informatique et Mathématiques Appliquées de Grenoble), INPG (Institut National Polytechnique de Grenoble), UJF (Université Joseph Fourier de Grenoble), and the LSR laboratory (Logiciels, Systémes, Réseaux).

We are grateful to Springer-Verlag for their helpful collaboration and quick publication.

We would like to thank Mme Simon and M. Wozniak at Château de Bonas for hosting the workshop with dedication and care, and for greatly facilitating the innumerable local organization tasks.

Finally, we thank all workshop participants both for lively discussions and for creating a friendly and warm atmosphere!

April 2000 Didier Bert, Christine Choppy, and Peter Mosses

Organization

Program Committee

Didier Bert	(Grenoble, France)
Michel Bidoit	(Cachan, France)
Christine Choppy	(Paris, France)
Hans-Jörg Kreowski	(Bremen, Germany)
Peter Mosses, *chair*	(Aarhus, Denmark)
Fernando Orejas	(Barcelona, Spain)
Francesco Parisi-Presicce	(Rome, Italy)
Donald Sannella	(Edinburgh, Scotland)
Andrzej Tarlecki	(Warsaw, Poland)

External Referees

Stuart Anderson
David Aspinall
Paolo Baldan
Marek Bednarczyk
Saddek Bensalem
Paolo Bottoni
Bettina Buth
Andrea Corradini
Sophie Coudert
Dominique Duval
Hartmut Ehrig
Emanuela Fachini
Marie-Claude Gaudel
Martin Grosse-Rhode
Stefano Guerrini
Kathrin Hoffmann
Shi Hui
Paul Jackson
Peter Knirsch
Manuel Koch
Alexander Kurz
Sabine Kuske
Anna Labella
François Laroussinie
Kazem Lellahi
John Longley
Christoph Lueth
Till Mossakowski
Nikos Mylonakis
Catherine Oriat
Laure Petrucci
Adolfo Piperno
Detlef Plump
Bernhard Reus
Jean-Claude Reynaud
Burkhart Wolff
Elena Zucca

Sponsoring Institutions

CoFI (Common Framework Initiative), ESPRIT Working Group 29432.
Ministére des Affaires Etrangéres, French Governement.
CNRS (Centre National de la Recherche Scientifique).
IMAG Institute (Informatique et Mathématiques Appliquées de Grenoble).
INPG (Institut National Polytechnique de Grenoble).
UJF (Université Joseph Fourier de Grenoble).
Laboratoire LSR (Logiciels, Systémes, Réseaux), de Grenoble.

Table of Contents

Invited Topics

A Type-Theoretic Memory Model for Verification of Sequential Java Programs 1
Joachim van den Berg, Marieke Huisman, Bart Jacobs and Erik Poll

From States to Histories 22
Manfred Broy

Principles and Pragmatics of Subtyping in PVS 37
Natarajan Shankar and Sam Owre

CASL: Language, Methodology and Tools

Extending Casl by Late Binding 53
Davide Ancona, Maura Cerioli and Elena Zucca

Towards an Evolutionary Formal Software-Development Using CASL 73
Serge Autexier, Dieter Hutter, Heiko Mantel and Axel Schairer

Development of Parsing Tools for CASL Using Generic Language Technology 89
Mark G. J. van den Brand and Jeroen Scheerder

Using CASL to Specify the Requirements and the Design: A Problem Specific Approach 106
Christine Choppy and Gianna Reggio

Subsorted Partial Higher-Order Logic as an Extension of CASL 126
Till Mossakowski, Anne Haxthausen and Bernd Krieg-Brückner

Specifying Real Numbers in CASL 146
Markus Roggenbach, Lutz Schröder and Till Mossakowski

Foundations

Specification Refinement with System F – The Higher-Order Case 162
Jo Erskine Hannay

Guarded Algebras: Disguising Partiality so You Won't Know Whether Its There 182
Magne Haveraaen and Eric G. Wagner

A General Completeness Result in Refinement 201
Yoshiki Kinoshita and John Power

An Institution of Hybrid Systems 219
Hugo Lourenço and Amílcar Sernadas

Realization of Probabilistic Automata: Categorical Approach 237
Paulo Mateus, Amílcar Sernadas and Cristina Sernadas

Specifications in an Arbitrary Institution with Symbols 252
Till Mossakowski

A General Algebraic Framework for Studying Modular Systems 271
Fernando Orejas and Elvira Pino

Specification of Processes and Interactions

History Preserving Bisimulation for Contextual Nets 291
Paolo Baldan, Andrea Corradini and Ugo Montanari

A Model for Interaction of Agents and Environments 311
Alexander Letichevsky and David Gilbert

Algebra-Coalgebra Structures and Bialgebras 329
Ataru T. Nakagawa

A Uniform Model Theory for the Specification of Data and Process Types 348
Horst Reichel

Other Topics

Relating Abstract Datatypes and Z-Schemata 366
Hubert Baumeister

Algebraic Specification of Operator-Based Multimedia Scenarios 383
Didier Bert and Stéphane Lo Presti

Higher-Order Logic and Theorem Proving for Structured Specifications ... 401
Tomasz Borzyszkowski

Extraction of Structured Programs from Specification Proofs 419
John N. Crossley, Iman Poernomo and Martin Wirsing

Towards a Verification Logic for Rewriting Logic 438
José Luis Fiadeiro, Tom Maibaum, Narciso Martí-Oliet, Jose Meseguer and Isabel Pita

The Rôle of Normalisation in Testing from Structured Algebraic Specifications 459
Patricia D. L. Machado

Author Index 477