

Lecture Notes in Computer Science

Edited by G. Goos and J. Hartmanis

299

M. Dauchet M. Nivat (Eds.)

CAAP '88

13th Colloquium on Trees in Algebra and Programming
Nancy, France, March 21–24, 1988
Proceedings



Springer-Verlag

Berlin Heidelberg New York London Paris Tokyo

Editorial Board

D. Barstow W. Brauer P. Brinch Hansen D. Gries D. Luckham
C. Moler A. Pnueli G. Seegmüller J. Stoer N. Wirth

Editors

Max Dauchet
UFR d'IEEA, LIFL, Université de Lille I
F-59655 Villeneuve D'Ascq Cedex, France

Maurice Nivat
UFR de Mathématiques, LITP, Université de Paris VII
2, Place Jussieu, F-75221 Paris Cedex 05, France

CR Subject Classification (1987): D.2–4, F, I.1

ISBN 3-540-19021-X Springer-Verlag Berlin Heidelberg New York
ISBN 0-387-19021-X Springer-Verlag New York Berlin Heidelberg

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 other ways, and storage in data banks. Duplication of this publication or parts thereof is only permitted under the provisions of the German Copyright Law of September 9, 1965, in its version of June 24, 1985, and a copyright fee must always be paid. Violations fall under the prosecution act of the German Copyright Law.

© Springer-Verlag Berlin Heidelberg 1988
Printed in Germany

Printing and binding: Druckhaus Beltz, Hemsbach/Bergstr.
2145/3140-543210

PREFACE

This volume contains the proceedings of the 13th Colloquium on Trees in Algebra and Programming (CAAP '88), which was held on March 21-24, 1988, in Nancy.

The preceding 12 colloquia have been held in France (the first five in Lille), Italy and Germany. CAAP '85 was integrated to TAPSOFT '85, in Berlin, and CAAP '87 to TAPSOFT '87, in Pisa. As another effort to link theoretical and practical developments in Computer Science, CAAP '88 was held jointly with ESOP '88. ESOP '88 is the 2nd European Symposium on Programming. Papers presented at ESOP '88 address fundamental issues and important developments in the design, specification and implementation of programming languages and systems. ESOP '88 proceedings are published in another LNCS volume.

CAAP '88 is also a conference in the area of program development and programming concepts but, following the tradition, is devoted to theoretical aspects, and especially to Trees, which are a basic structure for Computer Science, and which are explicitly or implicitly studied in a lot of papers in this volume. But CAAP '88 covers also a wider range of topics in Theoretical Computer Science.

Word, tree or graph languages, sometimes with algorithmic or complexity studies, concern about twenty submitted papers. Abstract data types (another classical topic of CAAP) and/or term rewriting systems have been studied in ten papers. The newest fact is the large amount of papers devoted to non-standard logics and parallelism. 17 papers were selected from a total of 41, but two papers submitted to ESOP have been accepted at CAAP too. The program committee chose three sets of papers in the following areas:

- Algorithms and complexity on trees and other structures.
- Abstract data types and term rewriting.
- Logic, parallelism and concurrency.

Within these topics, very interesting papers have been selected.

The invited speakers were G.Ausiello (Rome, Italy) and E. Engeler (ETH Zurich, Switzerland).

We would like to thank the Program Committee members, who deliberated in attempt to provide a high-quality and balanced program, and the referees who reviewed several papers each under a short schedule.

We wish to express our gratitude to the members of the Local Organisation Committee, and specially to its Chairman Jean-Luc Rémy.

We gratefully thank the institutions and firms which supported the conference.

Finally, we would like to extend our thanks to the Springer Verlag, in particular to Mrs. I. Mayer for her cooperation in preparing the proceedings.

Max Dauchet
LIFL, Université de Lille I

Maurice Nivat
LITP, Université de Paris VII

Program Committee

A. Arnold, Bordeaux	P. Mosses, Aarhus
R. Casas, Barcelona	M. Nivat, Paris(Chairman)
M. Dauchet, Lille (Secretary)	P. Padawitz, Passau
H. Ehrig, Berlin	M. Protasi, l'Aquila
M. Hennessy, Brighton	J.L. Rémy, Nancy
U. Montanari, Pisa	L. Vieille, München
	W. Vogler, München

Organisation Committee

F. Bellegarde (CRIN-INRIA Lorraine)
J.P. Finance (CRIN-INRIA Lorraine)
T. Gattiser (ANL)
J. Guyard (CRIN-INRIA Lorraine)
C. Hally (INRIA Lorraine)
J.L. Rémy (CRIN-INRIA Lorraine) (Chairman)

List of Referees

L. Aceto, G. Ausiello, U.C. Baron, J. Balcazar, F. Bellegarde,
P. Bertolazzi, A.A. Bertossi, M.A. Bonuccelli, P. Boehm, E. Börger,
R. Cleaveland, F. Cocker, B. Courcelle, P. Darondeau, P. Degano, R. Denicola,
J. Diaz, V. Diekert, C. Dimitrovici, W. Fey, D. Frutos-Escrig, G. Gambosi,
M. Jantzen, C. Kirchner, H. Kirchner, A. Llamosi, G. Longo,
M. Löwe, A. Maggiolo-Schettini, B. Mahr, P. Marchand, S. Marchetti,
A. Marchetti-Spaccamela, G. Mascari, G. Mauri, B.H. Mayoh, M. Millington,
B. Möller, J.J. Navarro, N. Nielsen, F. Nickl, F. Orejas, B. Paech, L. Pagli,
F. Parisi-Presicce, E. Pelz, P. Pepper, C. Rieckhoff, M. Rodriguez-Artalejo,
Don Sannella, E.M. Schmidt, O. Schoett, H. Simonis, S. Skyum, T. Streicher,
D. Taubner, T. Tensi, A. Tsakalidis, F. Turini, P. Van Hentenryck, H. Wagner

Supporting institutions and firms

Le Conseil Régional de Lorraine
Le Conseil Général de Meurthe-et-Moselle
La Ville de Nancy
Le District de l'Agglomération Nancéenne
Le Centre National de la Recherche Scientifique
L'INRIA
L'AFCEP
L' Association Nationale de Logiciel
L' Université de Nancy I
L' Université de Nancy II
L' Institut National Polytechnique de Lorraine
The British Computer Society
Gesellschaft für Informatik
BULL SA

CONTENTS

Page

TREE ALGORITHMS

<i>J. Burghardt</i>	1
A Tree Pattern Matching Algorithm with Reasonable Space Requirements	
<i>R. Klein, D. Wood</i>	16
On the Maximum Path Length of AVL Trees	
<i>C. Lautemann</i>	28
Decomposition Trees: Structured Graph Representation and Efficient Algorithms	

COMPLEXITY

<i>J. Köbler, U. Schöning, J. Toran</i>	40
On Counting and Approximation	
<i>H. Seidl</i>	52
Parameter-Reduction of Higher Level Grammars (Extended Abstract)	
<i>J. Françon, B. Randrianarimanana, R. Schott</i>	72
Analysis of Dynamic Algorithms in D.E. Knuth's Model	

REWRITING

<i>R. Echahed</i>	89
On Completeness of Narrowing Strategies	
<i>J.R. Kennaway</i>	102
Implementing Term Rewrite Languages in Dactl	
<i>T. Nipkow</i>	117
Unification in Primal Algebras	

ALGEBRAIC SPECIFICATIONS

<i>B. Möller, A. Tarlecki, M. Wirsing</i>	132
Algebraic Specification with Built-in Domain Constructions	
<i>F. Parisi-Presicce</i>	149
Product and Iteration of Module Specifications	
<i>I. Gnaedig, C. Kirchner, H. Kirchner</i>	165
Equational Completion in Order-sorted Algebras (Extended Abstract)	

PARALLELISM AND CONCURRENCY

<i>E.P. Gribomont</i>	185
Proving Systolic Arrays	
<i>J. Widom, P. Panangaden</i>	200
Expressiveness Bounds for Completeness in Trace-Based Network Proof Systems	
<i>K.G. Larsen</i>	215
Proof Systems for Hennessy-Milner Logic with Recursion	
<i>Z. Habasinski</i>	231
Regular Automata and Model Checking	
<i>M. Michel, J-B. Stefani</i>	244
Interval Logics and Sequential Transducers	
<i>R. Gorrieri, S. Marchetti, U. Montanari</i>	258
A2CCS: A Simple Extension of CCS for Handling Atomic Actions	
<i>C. Huizing, R. Gerth, W.P. De Roever</i>	271
Modeling Statecharts Behaviour in a Fully-Abstract Way	

INVITED LECTURES

<i>G. Ausiello</i>	295
Directed Hypergraphs: Data Structures and Applications (Extended Abstract)	
<i>E. Engeler</i>	
Solving Equational Problems by Combinatory Embedding*	

AUTHOR INDEX	304
---------------------	-----

* Manuscript not received in time.