

Lecture Notes in Computer Science
Edited by G. Goos, J. Hartmanis, and J. van Leeuwen

2285

Springer

Berlin

Heidelberg

New York

Barcelona

Hong Kong

London

Milan

Paris

Tokyo

Helmut Alt Afonso Ferreira (Eds.)

STACS 2002

19th Annual Symposium
on Theoretical Aspects of Computer Science
Antibes - Juan les Pins, France, March 14-16, 2002
Proceedings



Springer

Series Editors

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

Volume Editors

Helmut Alt
Free University of Berlin, Institute for Computer Science
Takustraße 9, 14195 Berlin, Germany
E-mail: alt@inf.fu-berlin.de

Afonso Ferreira
CNRS – I3S – INRIA Sophia Antipolis
2004 Route des Lucioles, 06902 Sophia Antipolis, France
E-mail: Afonso.Ferreira@sophia.inria.fr

Cataloging-in-Publication Data applied for

Die Deutsche Bibliothek - CIP-Einheitsaufnahme

STACS <19, 2002, Antibes; Juan-les-Pins>:
Proceedings / STACS 2002 / 19th Annual Symposium on Theoretical Aspects of
Computer Science, ANTIBES - Juan les Pins, France, March 14 - 16, 2002.
Helmut Alt ; Afonso Ferreira (ed.). - Berlin ; Heidelberg ; New York ;
Barcelona ; Hong Kong ; London ; Milan ; Paris ; Tokyo : Springer, 2002
(Lecture notes in computer science ; Vol. 2285)
ISBN 3-540-43283-3

CR Subject Classification (1998): F, E.1, I.3.5, G.2

ISSN 0302-9743

ISBN 3-540-43283-3 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

<http://www.springer.de>

© Springer-Verlag Berlin Heidelberg 2002
Printed in Germany

Typesetting: Camera-ready by author, data conversion by PTP-Berlin, Stefan Sossna
Printed on acid-free paper SPIN: 10846319 06/3142 5 4 3 2 1 0

Preface

The Symposium on Theoretical Aspects of Computer Science (STACS) has become one of the most important annual meetings in Europe for the theoretical computer science community. It covers a wide range of topics in the area of foundations of computer science: algorithms and data structures, automata and formal languages, computational and structural complexity, logic, verification, and current challenges.

STACS 2002, the 19th in this series, was held in Antibes - Juan les Pins, on the French Riviera, March 14–16, 2002. Previous STACS symposia took place in Paris (1984), Saarbrücken (1985), Orsay (1986), Passau (1987), Bordeaux (1988), Paderborn (1989), Rouen (1990), Hamburg (1991), Cachan (1992), Würzburg (1993), Caen (1994), München (1995), Grenoble (1996), Lübeck (1997), Paris, (1998), Trier (1999), Lille (2000), and Dresden (2001). The proceedings of all these symposia have been published in the Lecture Notes in Computer Science series of Springer-Verlag.

STACS 2002 received 209 submissions from 30 countries, one of the highest numbers of submissions ever, for a European conference on theoretical computer science. They were dispatched to the Program Committee members, and underwent a thorough review process, where more than 900 reports were written. These reports then served as guidance to the Program Committee, which met on November 16–17, 2001, at the INRIA Sophia Antipolis (near Antibes), France, in order to select the conference program.

Fortunately, quantity yielded high scientific quality, and the task of selecting the best submissions was very difficult indeed. During the 2-day, very intense meeting of the Program Committee, less than 25% of the submissions were selected for oral presentation at the conference. The only drawback of this highly selective process was that many good, relevant papers with positive reviews could not be included in the final program. On the other hand, such a rigorous selection process was a guarantee that STACS 2002 was bound to be a scientifically rich and very fruitful forum for theoretical computer science.

We thank the three invited speakers at this symposium, Gilles Dowek (INRIA Rocquencourt), Michael O. Rabin (Harvard University), and Christian Scheidegger (Johns Hopkins University) for accepting our invitation to share their insights on new developments in their research areas.

We would like to express our sincere gratitude to all the members of the local organizing committee who invested their time and energy to organize this conference. In particular, we thank J. Durand-Lose (Local Organizing Chair), D. Coudert (web site), S. Choplin (submissions server), and E. Deriche, B. Martin, H. Rivano, B. Madeline, D. Sergeant, and M.-H. Zeitoun.

Finally, we acknowledge the various sources of financial support for STACS 2002, namely the French CNRS, ERCIM, ESSI, the INRIA Sophia Antipolis, I3S, and the French Ministries of Research and Foreign Affairs.

December 2001

Helmut Alt
Afonso Ferreira

Program Committee

H. Alt (Berlin), Co-chair
 H. Buhrman (Amsterdam)
 B. Chlebus (Warsaw)
 T. Erlebach (Zürich)
 A. Ferreira (Sophia-Antipolis), Chair
 H. Ganzinger (Saarbrücken)
 D. Lugiez (Marseille)
 Y. Métivier (Bordeaux)
 C. Moore (Albuquerque/Santa Fe)
 A. Muscholl (Paris)
 G. Pucci (Padova)
 G. Schnitger (Frankfurt)
 T. Schwentick (Jena)
 D. Trystram (Grenoble)
 B. Vöcking (Saarbrücken)

Organizing Committee

S. Choplin
 D. Coudert
 E. Deriche
 J. Durand-Lose, Chair
 S. Julia
 C. Julien
 A. Ferreira, Conference Chair
 B. Martin
 H. Rivano
 D. Sergeant
 M.-H. Zeitoun

External Referees¹

Hosam Abdo	Danielle Beauquier	Peter Brass
Luca Aceto	Bernd Becker	Stefan Brass
Dimitris Achlioptas	Richard Beigel	Jacques Briat
Micah Adler	Michael Benedikt	Stefan Burkhardt
Jochen Alber	Petra Berenbrink	Edson Caceres
Eric Allender	Anna Bernasconi	Cristian Calude
Jean-Paul Allouche	Karell Bertet	Iannis Caragiannis
Noga Alon	Jean Betrema	Olivier Carton
Ernst Althaus	Mauro Bianco	Julien Cassaigne
Andris Ambainis	Markus Blaeser	Didier Caucal
Klaus Ambos-Spies	Johannes Bloemer	Frederic Cazals
Christoph Ambühl	Hans Bodlaender	Julien Cervelle
Eric Angel	Bernard Boigelot	Samarjit Chakraborty
Dana Angluin	Mikolaj Bojanczyk	Witold Charatonik
Eugene Asarin	Paolo Boldi	Victor Chepoi
Jose Balcazar	Benedikt Bollig	Christian Choffrut
Evipidis Bampis	Ahmed Bouajjani	Marek Chrobak
David Barrington	Olivier Bournez	Andrea Clementi
Klaus Barthelmann	Patricia Bouyer	Richard Cleve
Hannah Bast	Julian Bradfield	Livio Colussi

¹ This list has been automatically compiled from the conference's database. We apologize for any omissions or inaccuracies.

VIII Committees and Referees

Robert Cori	Stephen Fenner	Vollmer Heribert
Ricardo Correa	Henning Fernau	Holger Hermanns
Stavros Cosmadakis	Paolo Ferragina	Uli Hertrampf
Solange Coupet	Alain Finkel	Mika Hirvensalo
Bruno Courcelle	Paul Fischer	John Hitchcock
Nadia Creignou	Michele Flammini	Jaap-Henk Hoepman
Pierluigi Crescenzi	Paola Flocchini	Frank Hoffmann
Maxime Crochemore	Riccardo Focardi	Hendrik Jan Hoogeboom
Tristan Crolard	Florence Forbes	Peter Hoyer
Janos Csirik	Enrico Formenti	Juraj Hromkovich
Felipe Cucker	Lance Fortnow	Guillaume Huard
Pierre-Louis Curien	Pierre Fraigniaud	Neil Immerman
Artur Czumaj	Denis Francois	Sandra Irani
Georges Da Costa	Martin Fuerer	Giuseppe Italiano
Silvano Dal Zilio	Stefan Funke	Manfred Jaeger
Vincent Danos	Maurizio Gabbrielli	Andreas Jakoby
Bhaskar DasGupta	Didier Galmiche	Peter Jancar
Jürgen Dassow	Jérôme Galtier	David Janin
Mart De Graaf	Anna Gambin	Claude Jard
Ronald De Wolf	Leszek Gasieniec	Aubin Jarry
Gianna Del Corso	Thierry Gautier	Emmanuel Jeannot
Joerg Derungs	Ricard Gavaldá	Philippe Jorrand
Josee Desharnais	Remi Gilleron	Sandrine Julia
Luc Devroye	Christian Glaßer	Yan Jurski
Pietro Di Gianantonio	Andreas Goerdt	Vanessa Kääh
Krzysztof Diks	Karol Golab	Valentine Kabanets
Jürgen Dix	Alfredo Goldman	Jarkko Kari
David Dobkin	Massimiliano Goldwurm	Juha Kärkkäinen
Yevgeniy Dodis	Erich Grädel	Marek Karpinski
Dirk Draheim	Martin Grohe	Rainer Kemp
Maksymilian Dryja	Roberto Grossi	Claire Kenyon
Bertrand Ducourthial	André Große	Lefteris Kirousis
Serge Dulucq	Josef Gruska	Daniel Kirsten
Jean-Guillaume Dumas	Isabelle Guérin Lassous	Hartmut Klauck
Arnaud Durand	Concettina Guerra	Bartek Klin
Jerome Durand-Lose	Frédéric Guinand	Adam Klivans
Pierre-Francois Dutot	Jens Gustedt	Christian Knauer
David Eppstein	Marc Gyssens	Pascal Koiran
Zoltan Esik	Peter Habermehl	Ulrich Kortenkamp
Javier Esparza	Torben Hagerup	Darek Kowalski
Kousha Etessami	Alexander Hall	Mirosław Kowaluk
Rolf Fagerberg	Eran Halperin	Marcus Kracht
Carlo Fantozzi	Joe Halpern	Matthias Krause
Sandor Fekete	Laura Heinrich-Litan	Klaus Kriegel
Stefan Felsner	Harald Hempel	Danny Krizanc

Piotr Krysta	Angelo Montanari	Giovanni Resta
Marcin Kubica	Frank Morawietz	Andrea Richa
Antonin Kucera	Malika More	Herve Rivano
Gregory Kuchеров	Rémi Morin	Amadio Roberto
Ravi Kumar	Grégory Mounie	Mike Robson
Orna Kupferman	Jean-Frederic Myoupo	Hein Roehrig
Dietrich Kuske	Markus Nebel	José Rolim
Martin Kutrib	Frank Neven	Yves Roos
Mirosław Kutylowski	Phong Nguyen	Laurent Rosaz
Gregory Lafitte	Gaia Nicosia	Francesca Rossi
Manuel Lameiras	Peter Niebert	Gianluca Rossi
Elmar Langetepe	Rolf Niedermeier	Peter Rossmanith
Denis Lapoire	Frank Niessner	Guenter Rote
Francois Laroussinie	Damian Niwinski	Michael Rusinowitch
Slawomir Lasota	Mitsunori Ogihara	Alex Russell
James Leifer	Friedrich Otto	Marcin Rychlik
Giacomo Lenzi	Martin Otto	Zenon Sadowski
Stefano Leonardi	Leszek Pacholski	Nasser Saheb
Ming Li	Linda Pagli	Anand Sai
Leonid Libkin	Aris Pagourtzis	Jacques Sakarovitch
Marek Libura	Prakash Panangaden	Alex Samorodnitsky
Andrzej Lingas	Gilles Parmentier	Peter Sanders
Giuseppe Liotta	Marco Pellegrini	Martin Sauerhoff
Markus Lohrey	Bernard Penz	Marcus Schaefer
Rita Loogen	Adriano Peron	Christian Scheideler
Antoni Lozano	Giuseppe Persiano	Christian Schindelhauer
Fabrizio Luccio	Holger Petersen	Schmidt-Schauss
Flaminia Luccio	Antoine Petit	Georg Schnitger
Jack Lutz	Andrea Pietracaprina	Philippe Schnoebelen
Mukund Madhavan	Nicholas Pippenger	Elmar Schoemer
Adam Malinowski	Wojciech Plandowski	Rainer Schuler
Vincenzo Manca	Andreas Podelski	Götz Schwandtner
Heikki Mannila	Christopher Pollett	Nicole Schweikardt
Giovanni Manzini	Christophe Prieur	Michael Seel
Alberto Marchetti-	Pavel Pudlak	Steve Seiden
Spaccamela	Alexander Rabinovich	Helmut Seidl
Luciano Margara	Rajeev Raman	Dietmar Seipel
Bruno Martin	Ramanujam	Peter Selinger
Elvira Mayordomo	Edgar Ramos	Alan Selman
Richard Mayr	Christophe Rapine	Geraud Senisergues
Jacques Mazoyer	Andre Raspaud	Jiri Sgall
Lutz Meissner	Antoine Rauzy	Jeffrey Shallit
Wolfgang Merkle	Rahul Ray	Boris Shapiro
Marino Miculan	Michel Raynal	Yaoyun Shi
Michael Mitzenmacher	Klaus Reinhardt	Mihaela Sighireanu

X Committees and Referees

Fred Sobik	Jacobo Toran	Klaus Wagner
Viorica Sofronie- Stokkermans	Leen Torenvliet	Uwe Waldmann
Christian Sohler	Csaba David Tóth	Igor Walukiewicz
Siang Song	Stavros Tripakis	John Watrous
Eric Sopena	Dieter Van Melkebeek	Klaus Weihrauch
Ewald Speckenmeyer	Marc Van Kreveld	Pascal Weil
Ludwig Staiger	Peter Van emde Boas	Maik Weinard
Jukna Stasys	Moshe Vardi	Volkmar Welker
Stamatis Stefanakos	Nikolai Vereshchagin	Carola Wenk
Angelika Steger	Yann C. Verhoeven	Matthias Westermann
Benjamin Steinberg	Robert Veroff	Sue Whitesides
Frank Stephan	Stephane Vialette	Peter Widmayer
Andrzej Szalas	Laurent Viennot	Thomas Wilke
Mario Szegedy	Sebastiano Vigna	Gerhard Woeginger
Géraud Sénizergues	Laurent Vigneron	Philipp Woelfel
Alain Terlutte	Gilles Villard	Thomas Worsch
Denis Thérien	Eelco Visser	Sergio Yovine
Jacques Theys	Paul Vitanyi	Marc Zeitoun
P.S. Thiagarajan	Joerg Vogel	Yunhong Zhou
Thomas Thierauf	Heribert Vollmer	Wieslaw Zielonka
Rick Thomas	Sergei Vorobyov	Alexandre Zvonkine
Sophie Tison	Imrich Vrto	
Ioan Todinca	Laurent Vuillon	
	Danica Vukadinovic	

Table of Contents

Invited Papers

Hyper-Encryption and Everlasting Security <i>Y.Z. Ding and M.O. Rabin</i>	1
Models and Techniques for Communication in Dynamic Networks <i>C. Scheideler</i>	27
What Is a Theory? <i>G. Dowek</i>	50

Algorithms

A Space Lower Bound for Routing in Trees <i>P. Fraigniaud and C. Gavoille</i>	65
Labeling Schemes for Dynamic Tree Networks <i>A. Korman, D. Peleg, and Y. Rodeh</i>	76
Tight Bounds for the Performance of Longest-in-System on DAGs <i>M. Adler and A. Rosén</i>	88
Approximate Strong Separation with Application in Fractional Graph Coloring and Preemptive Scheduling <i>K. Jansen</i>	100
Balanced Coloring: Equally Easy for All Numbers of Colors? <i>B. Doerr</i>	112
The Complexity of Graph Isomorphism for Colored Graphs with Color Classes of Size 2 and 3 <i>J. Köbler and J. Torán</i>	121
On the Complexity of Generating Maximal Frequent and Minimal Infrequent Sets <i>E. Boros, V. Gurvich, L. Khachiyan, and K. Makino</i>	133
On Dualization in Products of Forests <i>K.M. Elbassioni</i>	142
An Asymptotic $\mathcal{O}(\ln \rho / \ln \ln \rho)$ -Approximation Algorithm for the Scheduling Problem with Duplication on Large Communication Delay Graphs <i>R. Lepere and C. Rapine</i>	154

XII Table of Contents

Scheduling at Twilight the Easy Way <i>H. Bast</i>	166
Complexity of Multi-dimensional Loop Alignment <i>A. Darté and G. Huard</i>	179
A Probabilistic 3-SAT Algorithm Further Improved <i>T. Hofmeister, U. Schöning, R. Schuler, and O. Watanabe</i>	192
The Secret of Selective Game Tree Search, When Using Random-Error Evaluations <i>U. Lorenz and B. Monien</i>	203
Randomized Acceleration of Fundamental Matrix Computations <i>V.Y. Pan</i>	215
Approximations for ATSP with Parametrized Triangle Inequality <i>L. Sunil Chandran and L. Shankar Ram</i>	227
A New Diagram from Disks in the Plane <i>J. Giesen and M. John</i>	238
Computing the Maximum Detour and Spanning Ratio of Planar Paths, Trees, and Cycles <i>S. Langerman, P. Morin, and M. Soss</i>	250
Current Challenges	
On the Parameterized Intractability of CLOSEST SUBSTRING and Related Problems <i>M.R. Fellows, J. Gramm, and R. Niedermeier</i>	262
On the Complexity of Protein Similarity Search under mRNA Structure Constraints <i>R. Backofen, N.S. Narayanaswamy, and F. Swidan</i>	274
Pure Dominance Constraints <i>M. Bodirsky and M. Kutz</i>	287
Improved Quantum Communication Complexity Bounds for Disjointness and Equality <i>P. Høyer and R. de Wolf</i>	299
On Quantum Computation with Some Restricted Amplitudes <i>H. Nishimura</i>	311
A Quantum Goldreich-Levin Theorem with Cryptographic Applications <i>M. Adcock and R. Cleve</i>	323

On Quantum and Approximate Privacy <i>H. Klauck</i>	335
On Quantum Versions of the Yao Principle <i>M. de Graaf and R. de Wolf</i>	347
Computational and Structural Complexity	
Describing Parameterized Complexity Classes <i>J. Flum and M. Grohe</i>	359
On the Computational Power of Boolean Decision Lists <i>M. Krause</i>	372
How Many Missing Answers Can Be Tolerated by Query Learners? <i>H.U. Simon</i>	384
Games with a Uniqueness Property <i>S. Aida, M. Crasmaru, K. Regan, and O. Watanabe</i>	396
Bi-Immunity Separates Strong NP-Completeness Notions <i>A. Pavan and A.L. Selman</i>	408
Complexity of Semi-algebraic Proofs <i>D. Grigoriev, E.A. Hirsch, and D.V. Pasechnik</i>	419
A Lower Bound Technique for Restricted Branching Programs and Applications <i>P. Woelfel</i>	431
The Complexity of Constraints on Intervals and Lengths <i>A. Krokhin, P. Jeavons, and P. Jonsson</i>	443
Automata and Formal Languages	
Nesting Until and Since in Linear Temporal Logic <i>D. Thérien and T. Wilke</i>	455
Comparing Verboseness for Finite Automata and Turing Machines <i>T. Tantau</i>	465
On the Average Parallelism in Trace Monoids <i>D. Krob, J. Mairesse, and I. Michos</i>	477
A Further Step towards a Theory of Regular MSC Languages <i>D. Kuske</i>	489
Existential and Positive Theories of Equations in Graph Products <i>V. Diekert and M. Lohrey</i>	501

XIV Table of Contents

The Membership Problem for Regular Expressions with Intersection Is Complete in LOGCFL <i>H. Petersen</i>	513
Recognizable Sets of Message Sequence Charts <i>R. Morin</i>	523
Strong Bisimilarity and Regularity of Basic Parallel Processes Is PSPACE-Hard <i>J. Srba</i>	535
On the Enumerative Sequences of Regular Languages on k Symbols <i>M.-P. Béal and D. Perrin</i>	547
Logic in Computer Science	
Ground Tree Rewriting Graphs of Bounded Tree Width <i>C. Löding</i>	559
Timed Control Synthesis for External Specifications <i>D. D'Souza and P. Madhusudan</i>	571
Axiomatizing GSOS with Termination <i>J.C.M. Baeten and E.P. de Vink</i>	583
Axiomatising Tree-Interpretable Structures <i>A. Blumensath</i>	596
EXPSpace-Complete Variant of Guarded Fragment with Transitivity <i>E. Kieroński</i>	608
A Parametric Analysis of the State Explosion Problem in Model Checking <i>S. Demri, F. Laroussinie, and P. Schnoebelen</i>	620
Generalized Model-Checking over Locally Tree-Decomposable Classes <i>M. Frick</i>	632
Learnability and Definability in Trees and Similar Structures <i>M. Grohe and G. Turán</i>	645
Author Index	659