

Lecture Notes in Computer Science

Edited by G. Goos and J. Hartmanis

386

J.E. Pin (Ed.)

Formal Properties of Finite Automata and Applications

LITP Spring School on Theoretical Computer Science
Ramatuelle, France, May 23–27, 1988
Proceedings



Springer-Verlag

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CR Subject Classification (1987): F.1, F.4.3, G.2

ISBN 3-540-51631-X Springer-Verlag Berlin Heidelberg New York
ISBN 0-387-51631-X Springer-Verlag New York Berlin Heidelberg

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Printed in Germany

Printing and binding: Druckhaus Beltz, Hemsbach/Bergstr.
2145/3140-543210 – Printed on acid-free paper

Foreword

This volume contains the proceedings of the sixteenth Spring School of Theoretical Computer Science (Ecole de Printemps d'Informatique Théorique) organized jointly by the LITP (Paris), the ENSEEITH, the LSI (Toulouse) and the "Association d'Informatique Théorique", with the support of the Centre National de la Recherche Scientifique (CNRS) and of the Programme de Recherches Coordonnées (PRC) Mathématiques et Informatique.

This Spring School is a yearly meeting whose subject and location change every year. It usually consists partly of tutorial introductions and general surveys and partly of more specialized lectures. The list of the past Spring Schools is as follows (with the name of the organizers) :

1. Langages Algébriques, Bonascre, 1973, J.P. Crestin et M. Nivat.
2. Complexité des algorithmes, Ile de Berder, 1974, P. Flajolet.
3. Monoïdes syntactiques, Vic sur Cère, 1975, J.F. Perrot.
4. Sémantique des langages de programmation, Molines en Queyrac, 1976, M. Nivat.
5. Séries Formelles, Vieux-Boucau les Bains, 1977, J. Berstel.
6. Lambda Calcul, La Châtre, 1978, B. Robinet.
7. Théorie des Codes, Jougne, 1979, D. Perrin.
8. Parallélisme, Colleville, 1980, G. Roucairol.
9. Langages Algébriques, Murol, 1981, L. Boasson.
10. Compilation, Barèges, 1982, L. Nolin.
11. Algorithmique, Ile de Ré, 1983, M. Fontet.
12. Automates et Mots Infinites, Le Mont Dore, 1984, D. Perrin.
13. Logique Combinatoire et λ -calcul, Val d'Ajol, 1985, G. Cousineau et P.L. Curien.
14. Réseaux d'Automates, Argelès-sur-Mer, 1986, Ch. Choffrut.
15. Linguistique et Informatique, Ile d'Oléron, 1987, M. Gross et D. Perrin.

The proceedings of the last four Spring Schools have been published in English in this series (LNCS 192, 242, 316, 377).

The subject of the sixteenth School is the theory of finite automata and its applications. However two important parts of this theory are not treated in this volume, because they were already the subject of two earlier Spring Schools : "Automata on infinite words" (Spring School 1984) and "Automata Networks" (Spring School 1986).

The proceedings have been divided into three sections. The first section is devoted to the mathematical foundations of the theory of automata. The first paper of this section, by J. Berstel, is a survey of the theory of finite automata which contains many interesting examples. The paper by H. Straubing is an introduction to the wreath product and the decomposition techniques for finite automata. M.P. Schützenberger's paper deserves special mention. Professor Schützenberger was not able to attend the Spring School, but he was kind enough to prepare this article on rational functions, which was read by D. Perrin at the Spring School. The next two articles, by myself and J.C. Birget, concern some useful tools of the theory: relational morphisms and transductions in my article, and two-way finite automata in Birget's article. The paper by I. Simon is a survey on factorization forests, a concept that covers most of the "Ramseyan type" properties used in the theory of automata.

The second section deals with famous problems of the theory of automata. The first paper, by K. Hashiguchi, gives the main ideas of his recent algorithm for determining the star-height of a given rational language. The second paper, by J. Meakin, presents some recent advances on word problems. The paper by W. Thomas shows the connections between automata and quantifier hierarchies in logic. P. Weil gives a survey on the difficult problems connected with the concatenation product, including some very recent results. The last two papers of this section are directly related to semigroup theory. A. de Luca and S. Varricchio give some new finiteness conditions for semigroups, and J. Almeida presents a new approach on equations defining varieties of finite semigroups.

Some applications of finite automata are presented in the last section. Algorithms on strings using automata are analyzed by M. Crochemore. G. Rauzy and A. Restivo show the applications of finite automata to number theory and to the theory of codes, respectively. A. Straubing and D. Thérien present their recent work on computational complexity based on finite automata. The last two papers, by I. Guessarian and D. Vergamini, are devoted to the application of automata to the modeling of distributed systems.

Finally, I would like to thank my co-organizers Colette Ravinet and Patrick Sallé. Both spent a lot of time organizing this Spring School. Special mention is due to Colette Ravinet who

discovered the beautiful Centre Léo Lagrange in Ramatuelle. The managers and employees of the Centre deserve special mention for their kindness and for providing us with delicious "anchoyades" and perpetual sun. Finally, I would like to thank the local council of Ramatuelle for their reception.

Paris, May 1989

Jean-Eric Pin

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