

# Structural Theory of Automata, Semigroups, and Universal Algebra

Edited by

Valery B. Kudryavtsev and Ivo G. Rosenberg

**NATO Science Series** 

II. Mathematics, Physics and Chemistry - Vol. 207

#### **NATO Science Series**

A Series presenting the results of scientific meetings supported under the NATO Science Programme.

The Series is published by IOS Press, Amsterdam, and Springer (formerly Kluwer Academic Publishers) in conjunction with the NATO Public Diplomacy Division.

Sub-Series

I. Life and Behavioural Sciences

IOS Press

II. Mathematics, Physics and Chemistry

Springer (formerly Kluwer Academic Publishers)

III. Computer and Systems Science 103

IOS Press

IV. Earth and Environmental Sciences

Springer (formerly Kluwer Academic Publishers)

The NATO Science Series continues the series of books published formerly as the NATO ASI Series.

The NATO Science Programme offers support for collaboration in civil science between scientists of countries of the Euro-Atlantic Partnership Council. The types of scientific meeting generally supported are "Advanced Study Institutes" and "Advanced Research Workshops", and the NATO Science Series collects together the results of these meetings. The meetings are co-organized by scientists from NATO countries and scientists from NATO's Partner countries — countries of the CIS and Central and Eastern Europe.

Advanced Study Institutes are high-level tutorial courses offering in-depth study of latest advances in a field

Advanced Research Workshops are expert meetings aimed at critical assessment of a field, and identification of directions for future action.

As a consequence of the restructuring of the NATO Science Programme in 1999, the NATO Science Series was re-organized to the four sub-series noted above. Please consult the following web sites for information on previous volumes published in the Series.

http://www.nato.int/science http://www.springeronline.com http://www.iospress.nl



Series II: Mathematics, Physics and Chemistry - Vol. 207

# Structural Theory of Automata, Semigroups, and Universal Algebra

edited by

# Valery B. Kudryavtsev

Department of Mathematical Theory of Intelligent Systems, Faculty of Mechanics and Mathematics, M.V. Lomonosov Moscow State University, Moscow, Russia

and

# Ivo G. Rosenberg

University of Montreal, Quebec, Canada

Technical Editor:

## Martin Goldstein

Department of Mathematics and Statistics, University of Montreal, Quebec, Canada



Published in cooperation with NATO Public Diplomacy Division

### Table of Contents

Preface	vii
Key to group picture	xiii
Participants	xv
Contributors	xxi
Jorge ALMEIDA Profinite semigroups and applications	1
Joel BERMAN The structure of free algebras	47
Jürgen DASSOW Completeness of automation mappings with respect to equivalence relations	77
Teruo HIKITA, Ivo G. ROSENBERG Completeness of uniformly delayed operations	109
Paweł M. IDZIAK Classification in finite model theory: counting finite algebras	149
Marcel JACKSON Syntactic semigroups and the finite basis problem	159
Kalle KAARLI, László MÁRKI Endoprimal algebras	169
Andrei KROKHIN, Andrei BULATOV, Peter JEAVONS The complexity of constraint satisfaction: an algebraic approach	181
V. B. KUDRYAVTSEV On the automata functional systems	215
Alexander LETICHEVSKY Algebra of behavior transformations and its applications	241
Ralph MCKENZIE, John SNOW Congruence modular varieties: commutator theory and its uses	273
Lev N. SHEVRIN Epigroups	331
Magnus STEINBY Algebraic classifications of regular tree languages	381
Index	433