

CONTEMPORARY MATHEMATICS

264

Combinatorial and Computational Algebra

International Conference on Combinatorial
and Computational Algebra

May 24–29, 1999

The University of Hong Kong

Hong Kong SAR, China

Kai Yuen Chan

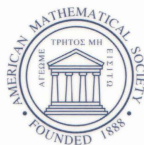
Alexander A. Mikhalev

Man-Keung Siu

Jie-Tai Yu

Efim I. Zelmanov

Editors



Selected Titles in This Series

- 264 **Kai Yuen Chan, Alexander A. Mikhalev, Man-Keung Siu, Jie-Tai Yu, and Efim I. Zelmanov, Editors**, Combinatorial and computational algebra, 2000
- 263 **Yan Guo, Editor**, Nonlinear wave equations, 2000
- 262 **Paul Igodt, Herbert Abels, Yves Félix, and Fritz Grunewald, Editors**, Crystallographic groups and their generalizations, 2000
- 261 **Gregory Budzban, Philip Feinsilver, and Arun Mukherjea, Editors**, Probability on algebraic structures, 2000
- 260 **Salvador Pérez-Esteve and Carlos Villegas-Blas, Editors**, First summer school in analysis and mathematical physics: Quantization, the Segal-Bargmann transform and semiclassical analysis, 2000
- 259 **D. V. Huynh, S. K. Jain, and S. R. López-Permouth, Editors**, Algebra and its applications, 2000
- 258 **Karsten Grove, Ib Henning Madsen, and Erik Kjær Pedersen, Editors**, Geometry and topology: Aarhus, 2000
- 257 **Peter A. Cholak, Steffen Lempp, Manuel Lerman, and Richard A. Shore, Editors**, Computability theory and its applications: Current trends and open problems, 2000
- 256 **Irwin Kra and Bernard Maskit, Editors**, In the tradition of Ahlfors and Bers: Proceedings of the first Ahlfors-Bers colloquium, 2000
- 255 **Jerry Bona, Katarzyna Saxton, and Ralph Saxton, Editors**, Nonlinear PDE's, dynamics and continuum physics, 2000
- 254 **Mourad E. H. Ismail and Dennis W. Stanton, Editors**, q -series from a contemporary perspective, 2000
- 253 **Charles N. Delzell and James J. Madden, Editors**, Real algebraic geometry and ordered structures, 2000
- 252 **Nathaniel Dean, Cassandra M. McZeal, and Pamela J. Williams, Editors**, African Americans in Mathematics II, 1999
- 251 **Eric L. Grinberg, Shiferaw Berhanu, Marvin I. Knopp, Gerardo A. Mendoza, and Eric Todd Quinto, Editors**, Analysis, geometry, number theory: The Mathematics of Leon Ehrenpreis, 2000
- 250 **Robert H. Gilman, Editor**, Groups, languages and geometry, 1999
- 249 **Myung-Hwan Kim, John S. Hsia, Yoshiyuki Kitaoka, and Rainer Schulze-Pillot, Editors**, Integral quadratic forms and lattices, 1999
- 248 **Naihuan Jing and Kailash C. Misra, Editors**, Recent developments in quantum affine algebras and related topics, 1999
- 247 **Lawrence Wasson Baggett and David Royal Larson, Editors**, The functional and harmonic analysis of wavelets and frames, 1999
- 246 **Marcy Barge and Krystyna Kuperberg, Editors**, Geometry and topology in dynamics, 1999
- 245 **Michael D. Fried, Editor**, Applications of curves over finite fields, 1999
- 244 **Leovigildo Alonso Tarrío, Ana Jeremías López, and Joseph Lipman, Editors**, Studies in duality on noetherian formal schemes and non-noetherian ordinary schemes, 1999
- 243 **Tsit Yuan Lam and Andy R. Magid, Editors**, Algebra, K -theory, groups, and education, 1999
- 242 **Bernhelm Booss-Bavnbek and Krzysztof Wojciechowski, Editors**, Geometric aspects of partial differential equations, 1999
- 241 **Piotr Pragacz, Michał Szurek, and Jarosław Wiśniewski, Editors**, Algebraic geometry: Hirzebruch 70, 1999
- 240 **Angel Carocca, Víctor González-Aguilera, and Rubí E. Rodríguez, Editors**, Complex geometry of groups, 1999

(Continued in the back of this publication)

Combinatorial and Computational Algebra

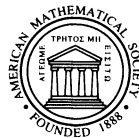
CONTEMPORARY MATHEMATICS

264

Combinatorial and Computational Algebra

International Conference on Combinatorial
and Computational Algebra
May 24–29, 1999
The University of Hong Kong
Hong Kong SAR, China

Kai Yuen Chan
Alexander A. Mikhalev
Man-Keung Siu
Jie-Tai Yu
Efim I. Zelmanov
Editors



American Mathematical Society
Providence, Rhode Island

Editorial Board

Dennis DeTurck, managing editor

Andreas Blass Andy R. Magid Michael Vogelius

2000 *Mathematics Subject Classification*. Primary 05–06, 08–06, 12–06, 13–06, 14–06,
17–06, 20–06, 26–06, 68–06, 94–06.

Library of Congress Cataloging-in-Publication Data

Combinatorial and computational algebra : a conference on combinatorial and computational algebra, May 24–29, 1999, Hong Kong / Kai Yuen Chan . . . [et al.], editors.

p. cm. — (Contemporary mathematics ISSN 0271-4132 ; 264)

International Conference on Combinatorial and Computational Algebra, held at the University of Hong Kong.

Includes bibliographical references.

ISBN 0-8218-1984-4 (alk. paper)

1. Algebra—Congresses. 2. Combinatorial analysis—Congresses. I. Chan, Kai-Yuen. II. International Conference on Combinatorial and Computational algebra (1999 : University of Hong Kong) III. Contemporary mathematics (American Mathematical Society); v. 264.

QA150.C64 2000

512—dc21

00-059345

Copying and reprinting. Material in this book may be reproduced by any means for educational and scientific purposes without fee or permission with the exception of reproduction by services that collect fees for delivery of documents and provided that the customary acknowledgment of the source is given. This consent does not extend to other kinds of copying for general distribution, for advertising or promotional purposes, or for resale. Requests for permission for commercial use of material should be addressed to the Assistant to the Publisher, American Mathematical Society, P. O. Box 6248, Providence, Rhode Island 02940-6248. Requests can also be made by e-mail to reprint-permission@ams.org.

Excluded from these provisions is material in articles for which the author holds copyright. In such cases, requests for permission to use or reprint should be addressed directly to the author(s). (Copyright ownership is indicated in the notice in the lower right-hand corner of the first page of each article.)

© 2000 by the American Mathematical Society. All rights reserved.

The American Mathematical Society retains all rights
except those granted to the United States Government.
Printed in the United States of America.

∞ The paper used in this book is acid-free and falls within the guidelines
established to ensure permanence and durability.

Visit the AMS home page at URL: <http://www.ams.org/>

10 9 8 7 6 5 4 3 2 1 05 04 03 02 01 00

Contents

Preface	ix
 Part I. Combinatorial and Computational Aspects of Group Theory	
Deformations and liftings of representations ELI ALJADDEFF AND ANDY R. MAGID	3
Embeddings of relatively free groups into finitely presented groups A. YU. OL'SHANSKII AND M. V. SAPIR	23
Fixed point ratios, character ratios, and Cayley graphs ANER SHALEV	49
 Part II. Combinatorial and Computational Aspects of Associative and Nonassociative Algebras	
Gröbner-Shirshov bases and composition lemma for associative conformal algebras: An example L. A. BOKUT, Y. FONG, AND W.-F. KE	63
Derivations in near-ring theory Y. FONG	91
Automorphic orbits of elements of free algebras with the Nielsen-Schreier property ALEXANDER A. MIKHALEV AND JIE-TAI YU	95
Universal central extensions of the matrix Lie superalgebras $\mathfrak{sl}(m, n, A)$ ALEXANDER V. MIKHALEV AND I. A. PINCHUK	111
The useful world of one-sided distributive systems GÜNTER F. PILZ	127
On the structure of conformal algebras EFIM ZELMANOV	139

Part III. Automorphisms of Polynomial Algebras and the Jacobian Conjecture

Unipotent Jacobian matrices and univalent maps L. ANDREW CAMPBELL	157
Automorphisms and coordinates of polynomial algebras VESSELIN DRENSKY AND JIE-TAI YU	179
On Bass' inverse degree approach to the Jacobian conjecture and exponential automorphisms ARNO VAN DEN ESSEN	207
A note on possible counterexamples to the Abhyankar-Sathaye conjecture constructed by Shpilrain and Yu ARNO VAN DEN ESSEN AND PETER VAN ROSSUM	215
Algorithms for polynomials in two variables WALTER D. NEUMANN AND PENELOPE G. WIGHTWICK	219
Peak reduction technique in commutative algebra: A survey VLADIMIR SHPILRAIN AND JIE-TAI YU	237
Reversion, trees, and the Jacobian conjecture DAVID WRIGHT	249

Part IV. Combinatorics and Coding Theory

Various constructions of good codes WEN-CHING WINNIE LI	271
Combinatorics and algebra: A medley of problems? A medley of techniques? MAN-KEUNG SIU	287

Preface

This volume contains the refereed proceedings of the International Conference on Combinatorial and Computational Algebra which was held at the University of Hong Kong, Hong Kong Special Administrative Region, China from May 24 to 29, 1999. The conference was a part of the Algebra Program at the Institute of Mathematical Research and the Department of Mathematics of the University of Hong Kong.

The following topics were covered during the conference:

- Combinatorial and Computational Aspects of Group Theory
- Combinatorial and Computational Aspects of Associative and Nonassociative

Algebras

- Automorphisms of Polynomial Algebras and the Jacobian Conjecture
- Combinatorics and Coding Theory.

In this volume the readers will find several excellent survey papers as well as research papers containing many significant new results on the subject. The emphasis was made on connections with other areas of mathematics. We hope that this volume will serve as an introductory guide for graduate students and as a good reference for further research in Combinatorial and Computational Algebra. We would like to thank all invited speakers for their beautifully presented motivating lectures and articles. We express our sincere gratitude to all the referees for their invaluable help. We are grateful to the American Mathematical Society for the help in the production of this volume. In particular we thank Christine M. Thivierge for her patient work in putting this volume together.

Finally, we want to express our special gratitude to the Department of Mathematics and the Institute of Mathematical Research of the University of Hong Kong for their warm hospitality, stimulating atmosphere and financial support.

Kai Yuen CHAN
Alexander A. MIKHALEV
Man-Keung SIU
Jie-Tai YU
Efim I. ZELMANOV

June 2000
New Haven – Hong Kong

Selected Titles in This Series

(Continued from the front of this publication)

- 239 **Jean-Pierre Meyer, Jack Morava, and W. Stephen Wilson, Editors**, Homotopy invariant algebraic structures, 1999
- 238 **Gui-Qiang Chen and Emmanuele DiBenedetto, Editors**, Nonlinear partial differential equations, 1999
- 237 **Thomas Branson, Editor**, Spectral problems in geometry and arithmetic, 1999
- 236 **Bruce C. Berndt and Fritz Gesztesy, Editors**, Continued fractions: From analytic number theory to constructive approximation, 1999
- 235 **Walter A. Carnielli and Itala M. L. D'Ottaviano, Editors**, Advances in contemporary logic and computer science, 1999
- 234 **Theodore P. Hill and Christian Houdré, Editors**, Advances in stochastic inequalities, 1999
- 233 **Hanna Nencka, Editor**, Low dimensional topology, 1999
- 232 **Krzysztof Jarosz, Editor**, Function spaces, 1999
- 231 **Michael Farber, Wolfgang Lück, and Shmuel Weinberger, Editors**, Tel Aviv topology conference: Rothenberg Festschrift, 1999
- 230 **Ezra Getzler and Mikhail Kapranov, Editors**, Higher category theory, 1998
- 229 **Edward L. Green and Birge Huisgen-Zimmermann, Editors**, Trends in the representation theory of finite dimensional algebras, 1998
- 228 **Liming Ge, Huaxin Lin, Zhong-Jin Ruan, Dianzhou Zhang, and Shuang Zhang, Editors**, Operator algebras and operator theory, 1999
- 227 **John McCleary, Editor**, Higher homotopy structures in topology and mathematical physics, 1999
- 226 **Luis A. Caffarelli and Mario Milman, Editors**, Monge Ampère equation: Applications to geometry and optimization, 1999
- 225 **Ronald C. Mullin and Gary L. Mullen, Editors**, Finite fields: Theory, applications, and algorithms, 1999
- 224 **Sang Geun Hahn, Hyo Chul Myung, and Efim Zelmanov, Editors**, Recent progress in algebra, 1999
- 223 **Bernard Chazelle, Jacob E. Goodman, and Richard Pollack, Editors**, Advances in discrete and computational geometry, 1999
- 222 **Kang-Tae Kim and Steven G. Krantz, Editors**, Complex geometric analysis in Pohang, 1999
- 221 **J. Robert Dorroh, Gisèle Ruiz Goldstein, Jerome A. Goldstein, and Michael Mudi Tom, Editors**, Applied analysis, 1999
- 220 **Mark Mahowald and Stewart Priddy, Editors**, Homotopy theory via algebraic geometry and group representations, 1998
- 219 **Marc Henneaux, Joseph Krasil'shchik, and Alexandre Vinogradov, Editors**, Secondary calculus and cohomological physics, 1998
- 218 **Jan Mandel, Charbel Farhat, and Xiao-Chuan Cai, Editors**, Domain decomposition methods 10, 1998
- 217 **Eric Carlen, Evans M. Harrell, and Michael Loss, Editors**, Advances in differential equations and mathematical physics, 1998
- 216 **Akram Aldroubi and EnBing Lin, Editors**, Wavelets, multiwavelets, and their applications, 1998
- 215 **M. G. Nerurkar, D. P. Dokken, and D. B. Ellis, Editors**, Topological dynamics and applications, 1998

For a complete list of titles in this series, visit the
AMS Bookstore at www.ams.org/bookstore/.

Combinatorial and Computational Algebra

Kai Yuen Chan, Alexander A. Mikhalev, Man-Keung Siu, Jie-Tai Yu, and
Efim I. Zelmanov, Editors

This volume presents articles based on the talks at the International Conference on Combinatorial and Computational Algebra held at the University of Hong Kong (China). The conference was part of the Algebra Program at the Institute of Mathematical Research and the Mathematics Department at the University of Hong Kong. Topics include recent developments in the following areas: combinatorial and computational aspects of group theory, combinatorial and computational aspects of associative and nonassociative algebras, automorphisms of polynomial algebras and the Jacobian conjecture, and combinatorics and coding theory.

This volume can serve as a solid introductory guide for advanced graduate students, as well as a rich and up-to-date reference source for contemporary researchers in the field.

ISBN 0-8218-1984-4



9 780821 819845

CONM/264

AMS on the Web
www.ams.org