Trends in Mathematics

Combinatorial and Geometric Group Theory

Dortmund and Ottawa-Montreal conferences

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Preface

We are pleased to present the book "Geometric Group Theory, Dortmund and Carleton Conferences", a selection of the best research articles from two strongly related 2007 international conferences:

- "Combinatorial and Geometric Group Theory with Applications" (GAGTA), the University of Dortmund (Germany) from August 27th to 31st;
- "Fields Workshop in Asymptotic Group Theory and Cryptography", Carleton University (Ottawa, Canada) from December 14th to 16th, followed by "Workshop on Actions on Trees, Non-Archimedian Words, and Asymptotic Cones", Saint Sauveur (Montreal) from December 17th to 21st.

The book contains a selection of refereed papers on Combinatorial and Geometric Group Theory. The breadth of topics included will assure the interest of all specialists and researchers in this area of mathematics; they will also prove to be valuable to graduate students and mathematicians in other areas who wish to explore deeper into this exciting and very active field of research.

The articles largely fall into five categories:

- equations and algebraic geometry over groups; Tarski problems,
- algorithmic problems in groups,
- groups of automorphisms of non-abelian free groups,
- groups of transformations of the unit interval and Thompson's group F,
- questions motivated by group-based cryptography.

Readers interested in the first topic may choose to look first at the excellent expository paper by O. Kharlampovich and A.G. Myasnikov. Here, the authors explain their multifaceted techniques (part of them on algebraic geometry over groups) for solving two of Tarski's famous problems on elementary theories of free groups. The paper of P. Morar and A. Shevlyakov initiates investigations of algebraic geometry over some intriquing classes of monoids.

One can also learn a lot about dynamics of automorphisms of free groups via train tracks and actions on trees, by reading the thought-provoking papers of P. Brinkmann and M. Lustig. In a similar direction, R. Weidmann shows how Makanin-Razborov diagrams and Stallings foldings can be used to solve the rank problem for virtually free groups.

The paper by O. Bogopolski and A. Vikentiev describes some particularly useful finite index subgroups of the automorphism group of a finitely generated free group. One of their uses may be to attack the problem on the Kazhdan property (T) for these groups. The paper of A. Juhasz contains a solution of the difficult membership problem in a subclass of one-relator groups.

Papers of F. Matucci, D. Savchuk and R. Zarzycki will attract the attention of those who want to know more about groups of transformations of the unit interval $[0, 1]$, in particular about the famous Thompson's group F and its limit properties.

The paper by A.J. Duncan, V. Dieckert and A.G. Myasnikov contains a very thorough survey on rewriting systems with new issues on infinite rewriting systems. The paper by L. Frenkel, A.G. Myasnikov and V.N. Remeslennikov is devoted to the problem of how to measure some subsets in free groups by using random walks. The results of this paper may be used for designing algorithms that run fast on almost all inputs. This paper as well as the paper by M. Hock and B. Tsaban are highly recommended to specialists in cryptography.

Finally, the paper by D. Goncalves and P. Wong is devoted to the twisted conjugacy in 2-dimensional crystallographic groups.

We are very grateful to the organizations that supported these two conferences:

- The conference in Dortmund was organized by O. Bogopolski, M.-T. Bochnig, G. Rosenberger, V. Shpilrain and E. Ventura. This conference was financially supported by DAAD (Deutscher Akademischer Austauschdienst), by DFG (Deutsche Forschungsgemeinschaft), and by the Universität Dortmund. The URL address for its homepage is

  `http://www.mathematik.uni-dortmund.de/~gcgta/.`

- The workshops in Canada were co-organized by I. Bumagin, O. Kharlampovich and A.G. Myasnikov. The workshops could not have been held without the generous support of the Fields Institute. The organizers also gratefully acknowledge the financial support provided by the Faculty of Science of Carleton University and by McGill University. More information about the workshops can be found at the URL

  `http://www.fields.utoronto.ca/programs/scientific/07-08/asympotic/index.html`

Finally, we wish to thank the contributors to this volume, and the anonymous referees who ensured the high quality of its contents. Our thanks also go to Thomas Hempfling at Birkhäuser for his assistance in the typsetting and preparation of this volume. Without these joint efforts, this book would never have appeared.

The editors,

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