CONTEMPORARY MATHEMATICS

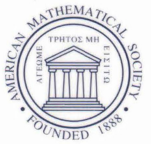
387

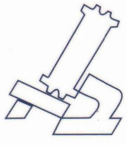
Israel Mathematical Conference Proceedings

Geometry, Spectral Theory, Groups, and Dynamics

Proceedings in Memory of Robert Brooks
December 29, 2003–January 2, 2004
January 5–9, 2004
Technion-Israel Institute of Technology
Haifa, Israel

Michael Entov
Yehuda Pinchover
Michah Sageev
Editors





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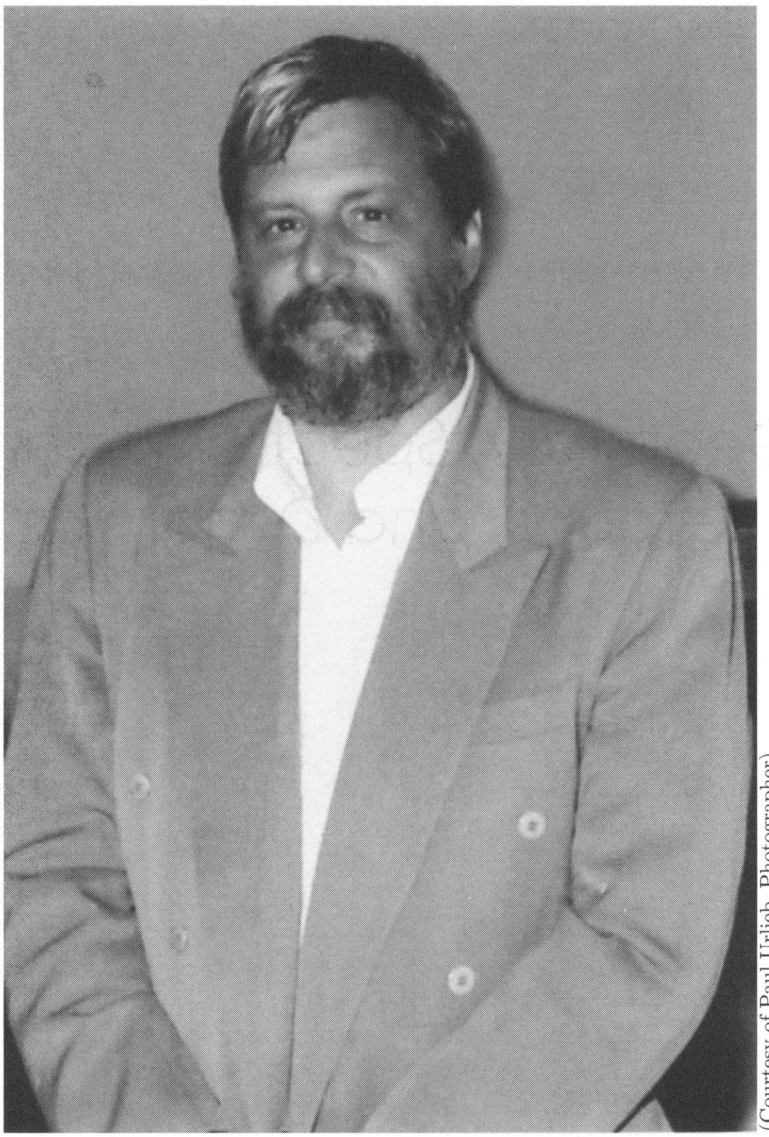
Geometry, Spectral Theory, Groups, and Dynamics



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Robert Brooks
(1952–2002)

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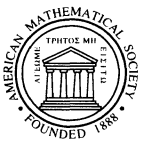

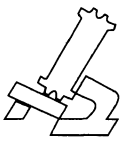

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Preface

The Robert Brooks Memorial Conference on Geometry and Spectral Theory took place at the Technion - Israel Institute of Technology, Haifa, Israel, on December 29, 2003 - January 2, 2004 and was immediately followed by the Workshop on Groups, Geometry and Dynamics, January 5-9, 2004.

The conference and the workshop were held under the auspices of the Center for Mathematical Studies (CMS) at the Technion. We thank the CMS and its director, Professor Baruch Solel, for letting us organize this program. We are grateful to the Mallat Family Fund for Research in Mathematics that supported the program and to Professors Dov Aharonov, Alexander Ioffe, Vladimir Lin, Alexander Nepomnyashchy, Allan Pinkus, Jack Sonn and Uri Srebro who provided additional financial support for the conference from their chair funds. We owe a great debt to the CMS secretary Sylvia Schur (she has passed away to our great sorrow) for her excellent job in handling all the technical matters related to the conference. We also thank Hava Harel, Galia Khanin, Ruth Markevich and the rest of the staff at the Technion Department of Mathematics, for their professional technical and logistical support. We thank the Editorial Board of the Israel Mathematics Conference Proceedings for agreeing to publish this volume. We thank Professor Lawrence Zalcman for his editorial work on the manuscripts. We thank Maxim Iorsh who carefully prepared the volume for publication. Finally, we thank all our colleagues who advised and encouraged us in the course of organizing the program and preparing this volume for publication.

***

Robert Brooks was born on September 16, 1952 and passed away on September 5, 2002. He received his PhD from Harvard in 1977 under the guidance of Raoul Bott. Having completed his postdoctoral studies at the State University of New York at Stony Brook, Robert Brooks became an assistant professor at the University of Maryland (1979-84). He went on to become an associate (1985-88) and later a full professor (1988-1997) at the University of Southern California. In 1995 Brooks immigrated to Israel and became a professor at the Technion - Israel Institute of Technology.

Known to his friends as Bob, Robert Brooks was a dear and beloved colleague. He was an outstanding mathematician whose mathematics touched a number of different fields, such as Global Analysis, Spectral Theory, the theory of Riemann Surfaces, Riemannian and Discrete Geometry, and Number Theory. A survey of Brooks' mathematical work has been kindly written for this volume by his close colleague Peter Buser. The wide range of mathematical interests represented by those who attended Brooks' memorial conference and workshop is a testament to the breadth and depth of his mathematical work: in these proceedings you will find both a work on such analytic topics as Szegő's theorem and a geometric work on isoperimetric inequalities and symmetries of manifolds.

Bob Brooks will be sorely missed by the mathematical community. His works and ideas will live on for years to come.

Israel Mathematical Conference Proceedings (IMCP)

Israel Mathematical Conference Proceedings (IMCP) is a publication, part of the Contemporary Mathematics Series, devoted to the proceedings of conferences, symposia and seminars. Collections of papers focusing on a certain subject will also be published. Prospective volumes may be submitted to any member of the editorial board. Each volume has an editor (or editors) responsible for its preparation. In order to ensure inexpensive and timely distribution, authors are requested to submit to the Editor of the volume an electronic TEX file of their manuscript in $\mathcal{A}\mathcal{M}\mathcal{S}$-LaTeX, using the Contemporary Mathematics style file which can be downloaded at `http://www.ams.org/tex/author-info.html`. For further information, contact the Managing Editor, IMCP, Department of Mathematics, Bar-Ilan University, Ramat-Gan 52900, Israel; e-mail: `rowen@macs.biu.ac.il`.

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International Conference on Geometry and Spectral Theory

29 December, 2003 - 2 January, 2004
Technion, Haifa, Israel

Program

Monday, 29 December

Morning Session

08:30-09:00 Registration

09:00-09:30 Greetings and Opening Remarks

09:30-10:20 Peter Buser (Lausanne, Switzerland)
Special lecture on the mathematical works of Robert Brooks

11:00-11:50 Ross Pinsky (Haifa, Israel)
The behavior of the principal eigenvalue in a domain with a hole - Asymptotic behavior and domain monotonicity

12:00-12:50 Shmuel Weinberger (Chicago, Illinois, USA)
Manifolds with excessive symmetry

Afternoon Session

15:00-15:50 Mikhail Sodin (Tel Aviv, Israel)
Nodal domains of Laplace-Beltrami eigenfunctions on surfaces

16:00-16:50 Eran Makover (New London, Connecticut, USA)
Jacobians of isospectral Riemann surfaces

17:00 A reception

Tuesday, 30 December

Morning session

09:00-09:50 Isaac Chavel (New York, New York, USA)
Partial survey of isoperimetric inequalities

10:00-10:50 Iosif Polterovich (Montreal, Canada)
How large can the first eigenvalue be on a Klein bottle?

11:30-12:20 Jozef Dodziuk (New York, New York, USA)
Arithmetic properties of eigenvalues of generalized Harper operators on graphs

Afternoon Session

14:30-15:20 Hershel Farkas (Jerusalem, Israel)
A variant of the 3N+1 conjecture

15:30-16:20 Motoko Kotani (Tohoku, Japan)
Magnetic transition operators on a crystal lattice

17:00-17:50 Mikhail Shubin (Boston, Massachusetts, USA)
Two-sided estimates for the bottoms of spectra and essential spectra of Schrodinger operators

Wednesday, 31 December

Morning session

09:00-09:50 Alex Lubotzky (Jerusalem, Israel)
Property "tau" and its applications in combinatorics, computer science and geometry

10:00-10:50 Alexander Gamburd (Stanford, California, USA)
Discrete and continuous variations on the expanding theme

11:30-12:20 Barry Simon (Pasadena, California, USA)
The sharp form of the strong Szegö theorem

13:00 Excursion and banquet.

Thursday, 1 January

Morning session

09:00-09:50 Toshikazu Sunada (Kawasaki, Japan)
Spectral geometry of crystal lattices

10:00-10:50 Gilbert Weinstein (Birmingham, Alabama, USA)
On a Penrose inequality with charge

11:30-12:20 Uzi Vishne (Ramat Gan, Israel)
Ramanujan complexes, and isospectral manifolds, complexes and regular graphs

Afternoon Session

14:30-15:20 Andrzej Zuk (Chicago, Illinois, USA)
The Cheeger constant of modular surfaces

15:30-16:20 Andrey Reznikov (Ramat Gan, Israel)
L_p-norms on automorphic representations

17:00-17:50 Leonid Friedlander (Tucson, Arizona, USA)
On the density of states function in quasi-gaps

Friday, 2 January

Morning session

09:00-09:50 Vadim Kaimanovich (Rennes, France)
The spectrum of the foliated Laplacian and amenability

10:00-10:50 Michael Monastyrsky (Moscow, Russia)
Hecke surfaces and monodromial representation of braid groups

11:30-12:20 Peter Buser (Lausanne, Switzerland)
Isospectrality and spectral rigidity of surfaces with small topology

International Workshop on Groups, Geometry and Dynamics

5-9 January, 2004
Technion, Haifa, Israel

PROGRAM

Monday, 5 January

Morning session

08:30-09:00 Registration

09:00-09:10 Opening remarks

09:10-10:00 David Gabai (Princeton, New Jersey, USA)
D^2 limit laminations in 3-manifolds

10:10-11:00 Joan Birman (New York, New York, USA)
Distinct transversal knots with the same topological knot type and Bennequin number

11:40-12:30 Sa'ar Hersonsky (Beer-Sheva, Israel)
The Dirichlet-Neumann boundary value problem and tiling by squares

Afternoon Session

14:30-15:20 Mark Sapir (Nashville, Tennessee, USA)
Dynamics of polynomial maps over finite fields and residually finite groups

15:30-16:20 Viktor Ginzburg (Santa Cruz, California, USA)
Almost existence of periodic orbits of Hamiltonian systems and branching Floer homology

16:30-17:20 Alexander Nabutovsky (Toronto, Canada and State College, Pennsylvania, USA)
The length of the shortest closed geodesic and related problems

17:30 A reception

Tuesday, 6 January

Morning session

09:00-09:50 Peter Shalen (Chicago, Illinois, USA)
Hyperbolic volume and the lattices of subgroup of a free group

10:00-10:50 Koji Fujiwara (Sendai, Japan)
Cat(0)-dimension of groups

11:30-12:20 Dan Mangoubi (Haifa, Israel)
Riemann surfaces and 3-regular graphs

Afternoon Session

14:30-15:20 Leonid Potyagailo (Lille, France)
On right-angled reflection groups in hyperbolic spaces

15:30-16:20 Uri Bader (Haifa, Israel)
Property (T) and unitary representation on L_p

17:00-17:50 Tsachik Gelander (New Haven, Connecticut, USA)
A topological Tits alternative

Wednesday, 7 January

Morning session

09:00-09:50 Leonid Polterovich (Tel Aviv, Israel)
Quasimorphisms in symplectic topology

10:00-10:50 Jean-Claude Sikorav (Lyon, France)
Cohomology with bounds on manifolds and groups

11:00 An excursion and banquet

Thursday, 8 January

Morning session

09:00-09:50 Andrew Casson (New Haven, Connecticut, USA)
A remark on the stable Andrews-Curtis conjecture

10:00-10:50 Paul Biran (Tel Aviv, Israel)
Linear systems, algebraic families and Lagrangian submanifolds

11:30-12:20 Mikhail Katz (Ramat Gan, Israel)
Recent progress on Gromov's filling area conjecture

Afternoon Session

14:30-15:20 Alexander Givental (Berkeley, California, USA)
Quantum Hirzebruch-Riemann-Roch

15:30-16:20 Barak Weiss (Beer-Sheva, Israel)
Bounded trajectories on parameter spaces

Friday, 9 January

Morning session

09:00-09:50 Amos Nevo (Haifa, Israel)
Spectrum theory on the boundary, and invariants of discrete groups of isometries

10:00-10:50 Wolfgang Woess (Graz, Austria)
Transition operators on co-compact G-spaces

11:30-12:20 Yair Minsky (New Haven, Connecticut, USA)
Deformation spaces of hyperbolic 3-manifolds

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This volume contains articles based on talks given at the Robert Brooks Memorial Conference on Geometry and Spectral Theory and the Workshop on Groups, Geometry and Dynamics held at Technion–the Israel Institute of Technology (Haifa).

Robert Brooks' (1952–2002) broad range of mathematical interests is represented in the volume, which is devoted to various aspects of global analysis, spectral theory, the theory of Riemann surfaces, Riemannian and discrete geometry, and number theory. A survey of Brooks' work has been written by his close colleague, Peter Buser.

Also included in the volume are articles on analytic topics, such as Szegős theorem, and on geometric topics, such as isoperimetric inequalities and symmetries of manifolds.

The book is suitable for graduate students and researchers interested in various aspects of geometry and global analysis.

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