Complex Analysis

Several Complex Variables and Connections with PDE Theory and Geometry

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Trends in Mathematics

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Birkhäuser

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Complex Analysis
Trends in Mathematics, vii–x

Preface

Norbert Hungerbühler

The idea to organize a conference in honour of Linda Rothschild emerged in 2006. This idea began to substantiate in 2007 when the Swiss Mathematical Society assigned the traditional Spring Meeting to the University of Fribourg. An organizing committee was quickly formed:

Organizing committee

Norbert Hungerbühler	University of Fribourg, Switzerland
Frank Kutzschebauch	University of Berne, Switzerland
Bernhard Lamel	University of Vienna, Austria
Francine Meylan	University of Fribourg, Switzerland
Nordine Mir	Université de Rouen, France

In order to ensure a high-quality conference program, the search for a scientific committee began. Soon after, a distinguished group was found who started working right away:

Scientific committee

Peter Ebenfelt	University of California, San Diego, USA
Franc Forstnerič	University of Ljubljana, Slovenia
Joseph J. Kohn	Princeton University, USA
Emil J. Straube	Texas A&M University, USA

Spring Meeting of the Swiss Mathematical Society
Conference on Complex Analysis 2008
Several Complex Variables and Connections with PDEs and Geometry
In honour of Linda Rothschild, Fribourg, July 7–11

Only a little while later it became clear that the subject and the top-class speakers who agreed to participate in the conference called for a proceedings volume to make the presented results available shortly after the conference. This project was carried out under the direction of the editorial board:

Focus on youth

The aim of the conference was to gather worldwide leading scientists, and to offer the occasion to PhD students and postdocs to come into contact with them. The committees explicitly encouraged young scientists, doctoral students and postdocs to initiate scientific contact and to aim at an academic career. The topic of the conference was apparently very attractive for young scientists, and the event an ideal platform to promote national and international doctoral students and postdocs. This aspect became manifest in a poster session where junior researchers presented their results.

The conference was intended to have a strong component in instruction of PhD students: Three mini courses with introductory character were held by Pengfei Guan, Mei-Chi Shaw and Ngaiming Mok. These three mini courses have been very well received by a large audience and were framed by the series of plenary lectures presenting newest results and techniques.

The participation of junior female researchers, PhD students and mathematicians from developing countries has been encouraged in addition by offering grants for traveling and accommodation.

The subject

The conference *Complex Analysis 2008* has been devoted to the subject of *Several Complex Variables and Connections with PDEs and Geometry*. These three main subject areas of the conference have shown their deep relations, and how techniques from each of these fields can influence the others. The conference has stimulated further interaction between these areas.

The conference was held in honor of Prof. Linda Rothschild who is one of the most influential contributors of the subject during the last decades. A particular aim was to encourage female students to pursue an academic career. In fact, female mathematicians have been well represented among the speakers, in the organizing committee and in the poster sessions.

Several Complex Variables is a beautiful example of a field requiring a wide range of techniques coming from diverse areas in Mathematics. In the last decades, many major breakthroughs depended in particular on methods coming from Partial Differential Equations and Differential and Algebraic Geometry. In turn, Several Complex Variables provided results and insights which have been of fundamental importance to these fields. This is in particular exemplified by the subject of Cauchy-Riemann geometry, which concerns itself both with the tangential Cauchy-Riemann equations and the unique mixture of real and complex geometry that real objects in a complex space enjoy. CR geometry blends techniques from algebraic geometry, contact geometry, complex analysis and PDEs; as a unique meeting point for some of these subjects, it shows evidence of the possible synergies of a fusion of the techniques from these fields.

The interplay between PDE and Complex Analysis has its roots in Hans Lewy's famous example of a locally non solvable PDE. More recent work on PDE has been similarly inspired by examples from CR geometry. The application of analytic techniques in algebraic geometry has a long history; especially in recent years, the analysis of the $\bar{\partial}$-operator has been a crucial tool in this field. The $\bar{\partial}$-operator remains one of the most important examples of a partial differential operator for which regularity of solutions under boundary constraints have been extensively studied. In that respect, CR geometry as well as algebraic geometry have helped to understand the subtle aspects of the problem, which is still at the heart of current research.

Summarizing, our conference has brought together leading researchers at the intersection of these fields, and offered a platform to discuss the most recent developments and to encourage further interactions between these mathematicians. It was also a unique opportunity for younger people to get acquainted with the current research problems of these areas.

Organization

The conference was at the same time the 2008 Spring Meeting of the Swiss Mathematical Society. The event has profited from the organizational structures of the SMS and the embedding in the mathematical community of Switzerland. The University of Fribourg has proven to be the appropriate place for this international event because of its tradition in Complex Analysis, the central geographic location, and its adequate infrastructure. In turn, its reputation and that of the region has benefited from this conference.

The conference has been announced internationally in the most important conference calendars and in several journals. Moreover, the event has been advertised by posters in numerous mathematics institutes worldwide, by e-mails and in the regular announcements of the Swiss Mathematical Society.

Acknowledgment

It becomes increasingly difficult to find sponsors for conferences of the given size, in particular in mathematics. We are all the more grateful to our sponsors who have generously supported the conference, and the proceedings volume in hand:

List of Sponsors

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- Department of Mathematics, University of Fribourg
- Faculty of Sciences, University of Fribourg
- Rectorate, University of Fribourg
- Swiss National Science Foundation
- Walter Haefner Stiftung
- Swiss Doctoral Program in Mathematics

In the name of the conference committees and of all participants, we would like to thank all sponsors – foundations, institutions and companies – very cordially for their contributions and the shown appreciation for our work as mathematicians: Thank you!

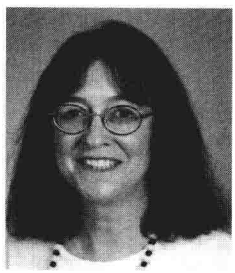
We also thank the team of Dr. Thomas Hempfling of the Birkhäuser publishing company for their help and professional expertise during the production process of these proceedings.

Finally, we would like to thank Elisabeth François and Claudia Kolly who assumed the secretariat of the conference.

Fribourg, August 2009 Norbert Hungerbühler

Complex Analysis
Trends in Mathematics, xi–xx

Extended Curriculum Vitae of Linda Preiss Rothschild



Linda Rothschild was born February 28, 1945, in Philadelphia, PA. She received her undergraduate degree, magna cum laude, from the University of Pennsylvania in 1966 and her PhD in mathematics from MIT in 1970. Her PhD thesis was "On the Adjoint Action of a Real Semisimple Lie Group". She held positions at Tufts University, Columbia University, the Institute for Advanced Study, and Princeton University before being appointed an associate professor of mathematics at the University of Wisconsin-Madison in 1976. She was promoted to full professor in 1979. Since 1983 she has been professor of mathematics at the University of California at San Diego, where she is now a Distinguished Professor.

Rothschild has worked in the areas of Lie groups, partial differential equations and harmonic analysis, and the analytic and geometric aspects of several complex variables. She has published over 80 papers in these areas. Rothschild was awarded an Alfred P. Sloan Fellowship in 1976. In 2003 she won the Stefan Bergman Prize from the American Mathematical Society (jointly with Salah Baouendi). The citation read in part:

> *"The Bergman Prize was awarded to Professors Salah Baouendi and Linda Rothschild for their joint and individual work in complex analysis. In addition to many important contributions to complex analysis they have also done first rate work in the theory of partial differential equations. Their recent work is centered on the study of CR manifolds to which they and their collaborators have made fundamental contributions.*
>
> *Rothschild, in a joint paper with E. Stein, introduced Lie group methods to prove L^p and Hölder estimates for the sum of squares operators as well as the boundary Kohn Laplacian for real hypersurfaces. In later joint work with L. Corwin and B. Helfer, she proved analytic hypoellipticity for a class of first-order systems. She also proved the existence of a family of weakly pseudoconvex hypersurfaces for which the boundary Kohn Laplacian is hypoelliptic but does not satisfy maximal L^2 estimates."*

In 2005, Rothschild was elected a Fellow of the American Academy of Arts and Sciences, and in 2006 she was an invited speaker at the International Congress of Mathematics in Madrid.

Rothschild served as President of the Association for Women in Mathematics from 1983 to 1985 and as Vice-President of the American Mathematical Society from 1985 to 1987. She served on the editorial committees of the Transactions of the AMS and Contemporary Mathematics. She is also an editorial board member of Communications in Partial Differential Equations and co-founder and co-editor-in-chief of Mathematical Research Letters. She has served on many professional committees, including several AMS committees, NSF panels, and an organization committee for the Special Year in Several Complex Variables at the Mathematical Sciences Research Institute. She presented the 1997 Emmy Noether Lecture for the AWM. Rothschild has a keen interest in encouraging young women who want to study mathematics. A few years ago she helped establish a scholarship for unusually talented junior high school girls to accelerate their mathematical training by participating in a summer program.

Educational Background

B.A.	University of Pennsylvania, 1966
Ph.D.	in mathematics, Massachusetts Institute of Technology, 1970
	Dissertation: *On the Adjoint Action of a Real Semisimple Lie Group*
	Advisor: Isadore Manual Singer

Professional Employment

1982–	Professor, University of California, San Diego
2001–05	Vice Chair for Graduate Affairs, Mathematics Dept., UCSD
1979–82	Professor, University of Wisconsin
1981–82	Member, Institute for Advanced Study
1978	Member, Institute for Advanced Study
1976–77	Associate Professor, University of Wisconsin
1975–76	Visiting Assistant Professor, Princeton University
1974–75	Member, Institute for Advanced Study
1972–74	Ritt Assistant Professor, Columbia University
1970–72	Assistant Professor, Tufts University
1970–72	Research Staff, Artificial Intelligence Laboratory, M.I.T.

Honors and Fellowships

2005	Fellow, American Academy of Arts and Sciences
2003	Stefan Bergman Prize
1976–80	Alfred P. Sloan Foundation Fellow
1966–70	National Science Foundation Graduate Fellow

Selected Invited Lectures

- Invited address, International Congress of Mathematicians, Madrid, August 2006
- "Frontiers in Mathematics" Lecturer, Texas A&M University, September 1999
- Invited hour speaker, Sectional joint meeting of American Mathematical Society and Mathematical Association of America, Claremont, October 1997
- Emmy Noether Lecturer (Association for Women in Mathematics), Annual Joint Mathematics Meetings, San Diego January 1997
- Invited hour lecturer, Annual Joint Mathematics Meetings, Orlando, January 1996
- Invited hour speaker, Annual Summer meeting of American Mathematics Society, Pittsburgh, August1981

Students

Mark Marson	University of California, San Diego,	1990
Joseph Nowak	University of California, San Diego,	1994
John Eggers	University of California, San Diego,	1995
Bernhard Lamel	University of California, San Diego,	2000
Slobodan Kojcinovic	University of California, San Diego,	2001
Robert Kowalski	University of California, San Diego,	2002

Selected National Committees and Offices

National Science Foundation, Mathematics Division

- Advisory Panel, 1984–87 and other panels 1997–99, 2004

American Mathematical Society (AMS)

- Bocher Prize Committee 2001–04
- National Program Committee 1997–2000
  Chair 1998–1999
- Nominating Committee, 1982–84, 1994–96
- Committee on Science Policy, 1979–82, 92–9
- AMS Vice President, 1985–87
- Committee on Committees, 1977–79, 1979–81
- Executive Committee, 1978–80
- Council of the AMS, 1977–80

Association for Women in Mathematics (AWM)

- Noether Lecture Committee 1988–90, 1994–1997
  Chair 1989–90
- Schafer Prize Committee 1993–94
- AWM President, 1983–85.

Mathematical Association of America

- Chauvenet Prize Committee, 1998–2000

Mathematical Sciences Research Institute

- Board of Trustees, 1996–1999
- Budget Committee 1996–1998

California Science Museum

- Jury to select California Scientist of the Year Award, 1995–1999

Institute for Pure and Applied Mathematics (IPAM)

- Board of Trustees, 2002–2005

Editorial Positions

- Co-Editor-in-Chief, Mathematical Research Letters, 1994–
- Editorial Board, Journal of Mathematical Analysis and Applications, 2001–
- Editorial Board, Communications in Partial Differential Equations, 1984–
- Editorial Board, Contemporary Mathematics, 1990–1994
- Editor for complex and harmonic analysis, Transactions of the American Mathematical Society, 1983–1986

Publication List of Linda Preiss Rothschild

[1] Peter Ebenfelt and Linda P. Rothschild. New invariants of CR manifolds and a criterion for finite mappings to be diffeomorphic. *Complex Var. Elliptic Equ.*, 54(3-4):409–423, 2009. ISSN 1747-6933.

[2] M.S. Baouendi, Peter Ebenfelt, and Linda P. Rothschild. Transversality of holomorphic mappings between real hypersurfaces in different dimensions. *Comm. Anal. Geom.*, 15(3):589–611, 2007. ISSN 1019-8385.

[3] Peter Ebenfelt and Linda P. Rothschild. Analyticity of smooth CR mappings of generic submanifolds. *Asian J. Math.*, 11(2):305–318, 2007. ISSN 1093-6106.

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