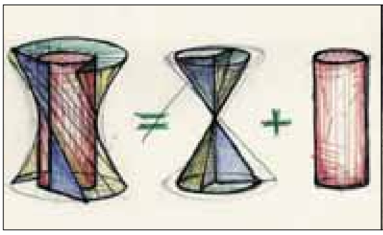
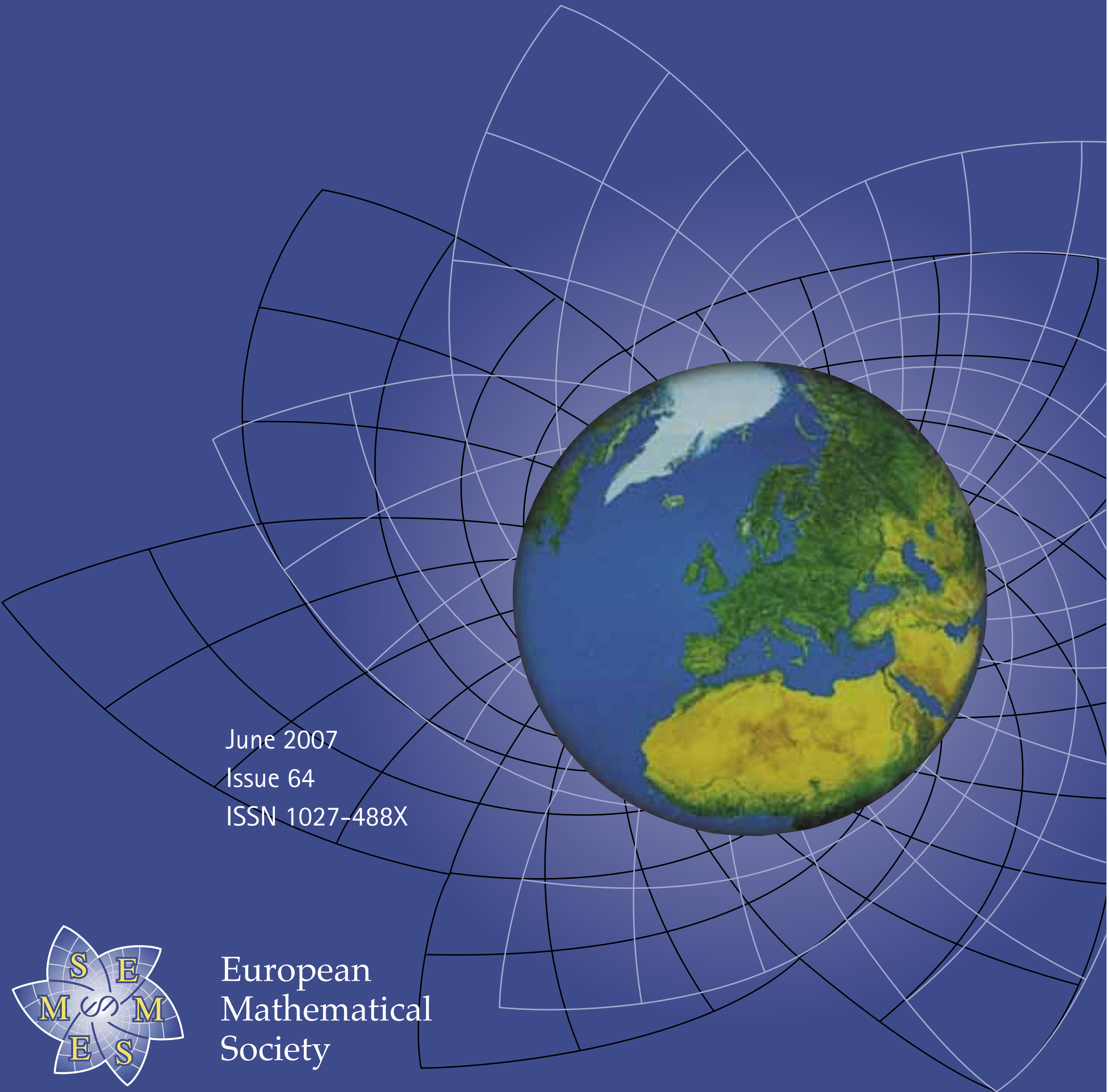
NEWSLETTER

OF THE EUROPEAN MATHEMATICAL SOCIETY





June 2007
Issue 64
ISSN 1027-488X

European
Mathematical
Society

| www.oup.com | Mathematics Books from Oxford

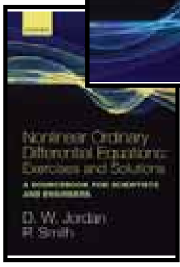
Oxford University Press is pleased to announce that all EMS members can benefit from a 20% discount on a large range of our Mathematics books.
For more information please visit: http://www.oup.co.uk/sale/science/ems

NEW EDITION

Nonlinear Ordinary Differential Equations

An Introduction for Scientists and Engineers

Fourth Edition



Dominic Jordan and Peter Smith

Review from previous edition:
'...classic book...I strongly recommend that you take a look. The presentation is exquisitely straightforward with numerous physically interesting examples, and it is carefully and well written.' **SIAM**

This is a thoroughly up-dated and expanded 4th edition of a classic text. Topics include phase plane analysis, nonlinear damping, small parameter expansions and singular perturbations, stability, Liapunov methods, Poincare sequences, homoclinic bifurcation and Liapunov exponents.

August 2007 | 560 pp | Paperback | 978-0-19-920825-8 | £30.00
Hardback | 978-0-19-920824-1 | £75.00

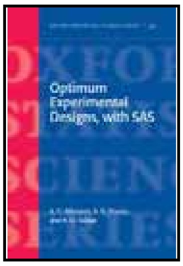
Nonlinear Ordinary Differential Equations

Problems and Solutions

A Sourcebook for Scientists and Engineers

An ideal companion to the new 4th Edition of *Nonlinear Ordinary Differential Equations*, this text contains over 500 problems and fully-worked solutions in nonlinear differential equations, many of which can be adapted for independent coursework and self-study.

August 2007 | 450 pp | Paperback | 978-0-19-921203-3 | £25.00



Optimum Experimental Designs, with SAS

Anthony Atkinson, Alexander Donev, and Randall Tobias

This text focuses on optimum experimental design using SAS, a powerful software package that provides a complete set of statistical tools including analysis of variance, regression, categorical data analysis, and multivariate analysis. SAS codes, results, plots, numerous figures and tables are provided, along with a fully supported website.

Oxford Statistical Science Series No. 34
May 2007 | 528 pp | Paperback | 978-0-19-929660-6 | £35.00
Hardback | 978-0-19-929659-0 | £75.00

Universality and Renormalization

From Stochastic Evolution to Renormalization of Quantum Fields

Ilia Binder and **Dirk Kreimer**

Explores renormalization theory in quantum field theory.
Fields Institute Communications No. 50
AMERICAN MATHEMATICAL SOCIETY
April 2007 | 404 pp | Hardback | 978-0-8218-4273-7 | £69.25

Reconstructing Evolution

New Mathematical and Computational Advances

Edited by **Olivier Gascuel** and **Mike Steel**

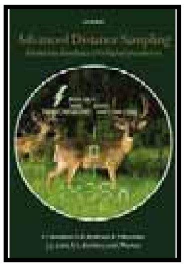
Evolution is a complex process, acting at multiple scales, from DNA sequences and proteins to populations of species. This collection of 10 chapters - based around five themes - provides a detailed overview of the key topics, from the underlying concepts to the latest results.

June 2007 | 352 pp | Hardback | 978-0-19-920822-7 | £39.50

NEW IN PAPERBACK

Advanced Distance Sampling

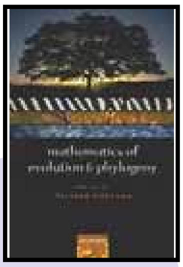
Estimating Abundance of Biological Populations



Edited by **S.T. Buckland, D.R Anderson, K.P. Burnham, J.L. Laake, D.L. Borchers, and L. Thomas**

This advanced text focuses on the uses of distance sampling to estimate the density and abundance of biological populations. It addresses new methodologies, new technologies and recent developments in statistical theory and is the follow up companion to *Introduction to Distance Sampling* (OUP, 2001).

June 2007 | 434 pp | Paperback | 978-0-19-922587-3 | £24.95



NEW IN PAPERBACK

Mathematics of Evolution and Phylogeny

Edited by **Olivier Gascuel**

`In-depth discussions make Mathematics of Evolution and Phylogeny *a key reference for those with mathematical or computational perspectives on evolution.'* **Systematic Biology**

July 2007 | 440 pp | Paperback | 978-0-19-923134-8 | £24.95

Numerical Analysis and Optimization

An Introduction to Mathematical Modelling and Numerical Simulation

Grégoire Allaire

Numerical Analysis and Optimization familiarises students with mathematical models (PDEs) and methods of numerical solution and optimization and includes numerous exercises and examples.

Numerical Mathematics and Scientific Computation
May 2007 | 427 pp | Paperback | 978-0-19-920522-6 | £30.00
Hardback | 978-0-19-920521-9 | £75.00

Dynamics of Infinite-dimensional Groups

The Ramsey-Dvoretzky-Milman Phenomenon

Vladimir Pestov

Of interest to mathematicians working in geometric functional analysis.
University Lecture Series No. 40
AMERICAN MATHEMATICAL SOCIETY
January 2007 | 192 pp | Paperback | 978-0-8218-4137-2 | £22.75

Discover New books by Email!
Subscribe to Oxford e.news and receive a monthly bulletin from OUP with information on new books in mathematics. It's easy to subscribe, just visit: www.oup.com/uk/emailnews

OXFORD
UNIVERSITY PRESS
www.oup.com

Order direct from OUP
Tel: +44 (0)1536 741727
email: bookorders.uk@oup.com
online: www.oup.com

European Mathematical Society

Newsletter No. 64, June 2007

The views expressed in this Newsletter are those of the authors and do not necessarily represent those of the EMS or the Editorial Team.

ISSN 1027-488X

Published by the
EMS Publishing House
ETH-Zentrum FLI C4
CH-8092 Zürich, Switzerland.
homepage: www.ems-ph.org

EMS Executive Committee

President

Prof. Ari Laptev
(2007–10)
Department of Mathematics
South Kensington Campus,
Imperial College London
SW7 2AZ London, UK
e-mail:a.laptev@imperial.ac.uk
and
Department of Mathematics
Royal Institute of Technology
SE-100 44 Stockholm, Sweden
e-mail: laptev@math.kth.se

Vice-Presidents

Prof. Pavel Exner
(2005–08)
Department of Theoretical
Physics, NPI
Academy of Sciences
25068 Rez – Prague
Czech Republic
e-mail: exner@ujf.cas.cz

Prof. Helge Holden
(2007–10)
Department of Mathematical
Sciences
Norwegian University of
Science and Technology
Alfred Getz vei 1
NO-7491 Trondheim, Norway
e-mail: h.holden@math.ntnu.no

Secretary

Dr. Stephen Huggett
(2007–10)
School of Mathematics
and Statistics
University of Plymouth
Plymouth PL4 8AA, UK
e-mail: s.huggett@plymouth.ac.uk

Treasurer

Prof. Jouko Väänänen
(2007–10)
Department of Mathematics
and Statistics
Gustaf Hällströmin katu 2b
FIN-00014 University of Helsinki
Finland
e-mail: jouko.vaananen@helsinki.fi
and
Institute for Logic, Language
and Computation
University of Amsterdam
Plantage Muidergracht 24
1018 TV Amsterdam
The Netherlands
e-mail: vaananen@science.uva.nl

Ordinary Members

Prof. Victor Buchstaber
(2005–08)
Steklov Mathematical Institute
Russian Academy of Sciences
Gubkina St. 8
Moscow 119991, Russia
e-mail: buchstab@mi.ras.ru and
Victor.Buchstaber@manchester.ac.uk

Prof. Olga Gil-Medrano
(2005–08)
Department de Geometria i
Topologia
Fac. Matematiques
Universitat de Valencia
Avda. Vte. Andres Estelles, 1
E-46100 Burjassot, Valencia
Spain
e-mail: Olga.Gil@uv.es

Prof. Mireille Martin-Deschamps
(2007–10)
Département de
mathématiques
45, avenue des Etats-Unis
Bâtiment Fermat
F-78030 Versailles Cedex,
France
e-mail: mmd@math.uvsq.fr

Prof. Carlo Sbordone
(2005–08)
Dipartmento de Matematica
"R. Caccioppoli"
Università di Napoli
"Federico II"
Via Cintia
80126 Napoli, Italy
e-mail: carlo.sbordone@fastwebnet.it

Prof. Klaus Schmidt
(2005–08)
Mathematics Institute
University of Vienna
Nordbergstrasse 15
A-1090 Vienna, Austria
e-mail: klaus.schmidt@univie.ac.at

EMS Secretariat

Ms. Riitta Ulmanen
Department of Mathematics
and Statistics
P.O. Box 68
(Gustaf Hällströmin katu 2b)
FI-00014 University of Helsinki
Finland
Tel: (+358)-9-1915-1426
Fax: (+358)-9-1915-1400
Telex: 124690
e-mail: riitta.ulmanen@helsinki.fi
Web site: http://www.emis.de

EMS Calendar

2007

1 June–27 July
Leonhard Euler Congress, St. Petersburg (Russia)
euler300@imi.ras.ru;
http://www.pdmi.ras.ru/EIMI/2007/Euler300/

3–10 June
EMS Conference at Będlewo (Poland)
Geometric analysis and nonlinear partial differential equations
B.Bojarski@impan.gov.plorpawelst@mimuw.edu.pl

9–10 June
EMS Executive Committee Meeting at the invitation of the Euler Society, St. Petersburg (Russia)
Stephen Huggett: s.huggett@plymouth.ac.uk

16–20 July
ICIAM 2007, Zurich (Switzerland)
www.iciam07.ch/

1 August
Deadline for submission of material for the September issue of the EMS Newsletter
Martin Raussen: raussen@math.aau.dk

27–28 October
EMS Executive Committee Meeting at the invitation of the Cyprus Mathematical Society, Cyprus
Stephen Huggett: s.huggett@plymouth.ac.uk

1 November
Deadline for submission of nominations of candidates for EMS prizes
tijdeman@math.leidenuniv.nl; http://www.5ecm.nl/ecmpc.pdf

2008

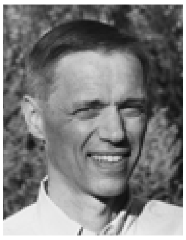
1 January
Deadline for the proposal of satellite conferences to 5ECM
top@math.rug.nl; www.5ecm.nl/satellites.html

29 February–2 March
Joint Mathematical Weekend EMS-Danish Mathematical Society, Copenhagen (Denmark)

14–18 July
5th European Mathematical Congress, Amsterdam (The Netherlands)
www.5ecm.nl

16–31 August
EMS-SMI Summer School at Cortona (Italy)
Mathematical and numerical methods for the cardiovascular system
dipartimento@matapp.unimib.it

The Abel Prize – the first five years



Helge Holden (Trondheim, Norway)

With the selection of Professor S. R. S. Varadhan of New York University as the 2007 Abel Laureate, the Abel Prize has completed its first five years and it is appropriate to take a step back and discuss the experience so far. The Prize is named after the Norwegian Niels Henrik Abel (1802–29) who has become a household name in mathematics (e.g. "abelian groups" and "abelian integrals").

The creation of the Abel Prize was announced by Prime Minister Jens Stoltenberg in 2001. A fund of NOK 200 million (equivalent to EUR 25 million or USD 34 million) was established and the interest of the fund should in particular cover the prize money of NOK 6 million (equivalent to EUR 750 thousand or USD 1 million) per year. The ambition was to create the most prestigious prize in mathematics.

The history behind the creation of the Abel Prize is interesting. Serious attempts, supported by Sophus Lie among others, to create an international Abel prize in mathematics had already started in connection with the centennial of Abel's birth. For various reasons all attempts failed. It was nearly one hundred years later that a series of improbable events involving prize-winning Abel biographer, Arild Stubhaug, and Tormod Hermansen, at that time CEO of the national phone company Telenor, which led to the creation of the prize.

The Abel Laureates so far have been:
- 2003 Jean-Pierre Serre
- 2004 Sir Michael Atiyah and Isadore Singer
- 2005 Peter D. Lax
- 2006 Lennart Carleson
- 2007 Srinivasa R. S. Varadhan

Let me first discuss some of the technicalities in connection with the prize. The nomination process is open; anyone can nominate anyone (self nominations excluded). The Abel Committee considers nominated candidates and can nominate candidates themselves before it proposes a candidate for the prize to the Board of the Norwegian Academy of Science and Letters, which then makes the formal decision.

The Prize can be awarded for lifetime achievements but can also be awarded for the solution of concrete problems. No areas of mathematics are excluded or given special preference and it is indeed the intention to award prizes over the course of time in a wide range of areas of mathematics and its applications. Normally the prize is awarded to one person but it can be shared for joint work. There are no restrictions regarding nationality, age, etc.

The Abel Committee consists of five first rank mathematicians whose names are public. Members of the Committee are proposed by the European Mathematical Society and the International Mathematical Union. The Chair, Professor Kristian Seip (Norwegian University of Science and Technology), is the only Norwegian on the Committee. Members serve for two years, except the Chair who serves for four years.

The program in connection with the prize ceremony has been given the highest priority by the officials of Norway. The Prize is awarded by the King of Norway and there is a banquet at Akershus Castle hosted by the government.

The funds from the Abel Fund have also enabled a number of additional activities. Of most interest internationally are the annual Abel Symposia, which are a series of high level conferences. The topics are decided by the Norwegian Mathematical Society and will over time cover most areas of mathematical sciences. In addition various national activities are supported: scholarships for young talents, a prize for the "best" school teacher and support for national mathematics contests.

Has Norway succeeded in creating the most important prize in mathematics? Undoubtedly all awards so far have been well deserved. The Abel Laureates all stand out as world leaders within their fields. Certainly other prominent mathematicians could have been selected but I think it is generally agreed that the selection so far has been judicious and balanced.

The leading Norwegian daily "Aftenposten" discussed in an editorial in 2004 the Abel Prize and mentioned four challenges: (i) The prize is new; (ii) it is given to experts for accomplishments that few but the experts can evaluate; (iii) it is hard or impossible to popularize their mathematics: (iv) with a new prize there is a long back-log of worthy candidates. It is easy to subscribe to this.

Considerable resources have been spent on media coverage. At the time of the announcement of the Laureate the coverage is usually restricted to a short notice in Norwegian newspapers and local newspapers in the Laureate's home country. However, during the week of the prize ceremony there has commonly been considerably more coverage. Extensive announcements in our Newsletter and the Notices of the American Mathematical Society, as well as interviews with Laureates published in Norway and America, has made the Abel Prize well-known in the mathematical community.

The creation of the Abel Prize has had considerable influence on Norwegian mathematics. Being a small country, the various activities related to the Abel Prize involve a considerable proportion of Norwegian mathematicians. For a more complete coverage of the Abel Prize, please look at www.abelprisen.no.

Helge Holden [holden@math.ntnu.no] is a professor of mathematics at the Norwegian University of Science and Technology and is the Vice-President of the EMS.

EMS Executive Committee meeting Amsterdam, 10th–11th March 2007

Vasile Berinde, EMS Publicity Officer

The EMS Executive Committee met on the afternoon of 10th March and the morning of 11th March 2007 at Tropen Hotel, Amsterdam. Those present were: Ari Laptev (*President*, in the Chair), Pavel Exner and Helge Holden (*Vice-Presidents*), Stephen Huggett (*Secretary*), Jouko Vaananen (*Treasurer*), Viktor Buchstaber, Olga Gil-Medrano, Mireille Martin-Deschamps, Carlo Sbordone, Klaus Schmidt and (by invitation) Vasile Berinde, Sir John Kingman, Luc Lemaire, Mario Primicerio, Martin Raussen and Riitta Ulmanen.

Electronic votes

The EC ratified the electronic vote setting up a credit card that will be issued to Riitta Ulmanen from the EMS Helsinki Secretariat. It was also agreed that the EC would continue with the new procedure of electronic voting and that the voting records will be presented at the forthcoming EC meeting.

Officers' reports

The president reported that, in January, at the start of his term of presidency, he had written letters to all the presidents of the national mathematical societies in Europe and that these letters were well received. Some of the societies reported that they had published the letter in their society newsletter. This clearly shows that the EMS should cooperate and build closer relationships with national mathematical societies.

He had attended the annual meeting of the AMS in New Orleans at the beginning of January and gave a brief and enthusiastic description of this "profitable conference", which had impressed him much.

He then gave a report on the very recent meeting of former EMS presidents in London, during which many interesting ideas for the future development of the EMS were expressed.

As a result of the president's initiative, Springer has expressed its willingness to award a new EMS prize. The EC accepted Springer's offer. It was agreed to ask for 10,000 euros per year and also to solicit similar offers from other companies. The EC agreed on three potential activities that should be considered for the EMS Springer prize: (i) activity in raising public awareness of mathematics; (ii) new mathematical work on interaction with other fields; (iii) rewarding paper(s) written by women. It was also agreed that the prize should not be awarded if no suitable candidates are available. Ari Laptev, Olga Gil-Medrano and Klaus Schmidt were appointed to an ad hoc committee to write down the statutes for the new Springer prize.

Amsterdam canal

Group photo: Executive Committee members and guests. New EMS president Ari Laptev in the middle of the 1st row.

A detailed report on the society's finances was then presented by Jouko Väänänen. The secretary's report was related to the question of how the EMS could be closer to the national mathematical societies in Europe. Several ideas were mentioned: (i) meeting with local societies during EC meetings; (ii) a sort of preparatory meeting of presidents before each EMS council meeting; (iii) giving young mathematicians special opportunities to speak at the ECMs (as well as encouraging them to join the EMS); (iv) appointing a "foreign minister" from the EC – an idea suggested by the former EMS president, Michael Atyah.

Finally, the publicity officer introduced the draft of the new EMS leaflet, which was welcomed by the EC. Some suggestions were made, including the insertion of a sheet with *'A dozen reasons to join the EMS'*. It was agreed that all the members of the EC would comment on the text.

Scientific meetings

The reason the EC meeting was located in Amsterdam was to offer the local organizers of 5ecm (to be held in Amsterdam in 2008) an opportunity to present to the EC a detailed report on various organizational matters. Invited for this purpose were Frank den Hollander, Andre Ran, Herman te Riele, Alexander Schrijver, Rob Tijdeman and Jan Wiegerinck.

A. Schrijver presented the work of the scientific committee, R. Tijdeman presented the work of the prize committee and J. Wiegerinck presented the actual status of the budget for 5ecm, also updating the EC on developments since the presentation he made at the previous EC meeting in Krakow. There were discussions on several issues, including satellite meetings. The EC agreed the registration fee for 5ecm and suggested refinements for early payment of the congress fee.

The next item was the registered bids for *6ecm* (to be held in 2012). It was reported that the EC had received three extremely well prepared proposals to organize 6ecm from Krakow, Prague and Vienna. A site committee, including Ari Laptev, Victor Buchstaber, Olga Gil-Medrano, Stephen Huggett and Mireille Martin-Deschamps, was set up to assess the bids in detail and report to the EC.

Martin Raussen reported about the intention of the Danish Mathematical Society to organize an EMS Mathematical Weekend in Copenhagen in 2008.

The matter of scientific meetings was closed by a discussion on the president's proposal of considering a possible joint EMS/AMS meeting. After some EC members reported their own experience of joint meetings between the AMS and national mathematical societies, it was agreed that such an event would certainly be scientifically valuable but the funding and organization arrangements could bring several difficulties because the host country's national mathematical society must also be involved.

Membership

The Turkish Mathematical Society applied to became a member of the EMS. The EC agreed to support the application but to ask for more detailed information before presenting it to the EMS Council. The EC also approved the setting up of a reciprocity agreement with the Indonesian Mathematical Society.

In response to a letter from Bernd Wegner on the payment of reduced EMS membership fees for Zentralblatt MATH (Zbl) reviewers, the EC agreed to reduce the fee for Zbl reviewers to the same level as that of reciprocity members.

Two other matters were discussed in conjunction with individual membership:

1) The president suggested that: (i) the EMS should consider, like the AMS, a system of giving research students their first year's membership free and (ii) that those attending a European Congress of Mathematics (in particular *5ecm*), and paying the full congress fee, be given one year's free EMS membership.
2) Riitta Ulmanen will set up over the next few months a system of payment of EMS membership fees online.

EMS committee

As the term of office of Luc Lemaire as chair of the Meetings Committee ended in 2006, in absence of other candidates, the president Ari Laptev has offered himself to chair the committee. His offer was gratefully accepted by the EC.

Mario Primicerio, chair of the Applied Mathematics Committee, presented his report, which related to the possible organization of periodical applied mathematics conferences in between two consecutive *ecm's*.

Tsou Sheung Tsun will take over the chair of the Developing Countries Committee from Herbert Fleischner. The president reported that he would be attending the meeting of this committee in Uppsala in April 07.

Pavel Exner, chair of the Electronic Publishing Committee, noted the importance of a good interface between the new web site and the electronic library. He then briefly described JEM (Joining Educational Mathematics), an internal course in mathematics designed for students taking a gap year.

John Kingman presented a brief report on the ERCOM Committee, while Luc Lemaire reported on the activity of the Meetings Committee, in relation to the Cortona School.

Written reports from the following EMS committees were also noted: Eastern Europe (chair, J. Kratochvil), Education (Mina Teicher) and Women in Mathematics (Sylvia Paycha), as well as the newsletter of the Raising Public Awareness Committee, edited by its chair, Robin Wilson.

The EC approved the appointment of Marcus du Sautoy (UK), Thomas Bruss (Belgium) and Nuno Crato (Portugal), proposed as members of the RPA Committee. It was also agreed that Mireille Chaleyat-Maurel should remain on the Committee 2006–2008 as an ordinary member but that the RPA Committee should start thinking about renewing its members.

The EC approved the appointment of two new members to the Women in Mathematics Committee: Veleda Baldoni and Dusanka Perisic (2008–2011), and agreed that the term of office for Catherine Hobs and Zorica Uzelac should be renewed until 2011.

Projects

The EC discussed and welcomed the idea of the Russian Summer School in Dubna for final year high school and first year university students. The president will invite presidents of national mathematical societies to nominate (and fund) a few students each.

Publishing

The new board of the European Mathematical Foundation, consisting of Ari Laptev (Chair), Rolf Jeltsch, John Kingman, Stephen Huggett and Jouko Vaananen, was noted. The EC agreed that Mădălina Păcurar from "Babes-Bolyai" University in Cluj-Napoca (Romania) should replace Vasile Berinde as conferences editor of the EMS Newsletter this summer. Martin Raussen informed the EC about planning to step down as the Editor in Chief of the EMS Newsletter.

Pavel Exner reported that the level of JEMS (Journal of European Mathematical Society) is very good. It was suggested that the president should write a letter to the Editor in Chief, Haim Brezis, to congratulate the JEMS editors.

The president will also finalize (with Bernd Wegner) the arrangements for free access to Zentralblatt for EMS members.

The EC agreed that an EC group (consisting of Ari Laptev, Pavel Exner, Helge Holden and Stephen Huggett) should proceed to set up the new EMS web site as soon as possible. Once the site is ready, a report should be given to the editor of the EMS Newsletter for publication; the new web site will be discussed at the next EC meeting.

Relations with mathematical organizations

The EC agreed to nominate Ludvig Fadeev and John Kingman to the Abel Prize Committee (the Abel Prize is awarded by the Norwegian Academy).

Closing matters

The next EC meeting will be held in St. Petersburg on the 9th of June, in conjunction with the Euler Festival (9^{th}–12^{th} June 2007), at the invitation of the Director of the St Petersburg Department of the Steklov Mathematical Institute.

The EC also agreed to accept the invitation from the Cyprus Mathematical Society to hold the following meeting in Cyprus on the 27^{th} and 28^{th} of October.

The president closed the meeting by expressing his thanks to Herman te Riele for the excellent arrangements and hospitality in Amsterdam.

New EMS president and new vice-president

At its meeting in Torino in July 2006, the EMS council elected Ari Laptev as the new president of the society and Helge Holden as one of its two vice-presidents. The society's other vice-president, Pavel Exner, had been elected at the previous council meeting in 2006. The Newsletter has asked the two new officers to present themselves:

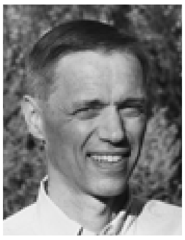
Ari Laptev received his PhD in mathematics from Leningrad University (LU) in 1978 under the supervision of Michael Solomyak. His research interest is the spectral theory of differential operators.

Over the periods 1972–77 and 1977–82 he was employed as a junior researcher and then as assistant professor at the Mathematics & Mechanics Department of LU. From 1981 to 82 he held a postdoctoral position at the University of Stockholm and in 1982 he lost his position at LU due to his marriage to a British subject. Up until his emigration to England in 1987 he was then working as a builder, constructing houses in small villages in the Novgorod district of Russia. In 1987 he was employed in Sweden, first as a lecturer at Linköping University and then from 1992 at the Royal Institute of Technology (KTH). In 1999 he became a professor at KTH and also a vice-chairman of its mathematics department. In 1992 he was granted Swedish citizenship.

He was President of the Swedish Mathematical Society from 2001 to 2003 and President of the Organising Committee of the Fourth European Congress of Mathematics in Stockholm in 2004. From January 2007 he has been employed by Imperial College London.

He has three children and has supervised twelve PhD students. One of his favourite activities apart from proving spectral inequalities is construction work. For his 50th birthday the members of the mathematics department of KTH presented him with a chain-saw as a present.

He believes that the European Mathematical Society can play a unifying role for all National Mathematical Societies in Europe in the promotion of mathematics. This is particularly important at a time when research is in grave danger due to the increasingly commercial managements of some European universities.



Helge Holden received his PhD in mathematics from the University of Oslo in 1985. After a one-year position as a postdoctoral fellow at the Courant Institute of the New York University, he obtained a position as associate professor at the University of Trondheim. Since 1991 he has been a professor at the Norwegian University of Science and Technology in Trondheim.

Holden works with partial differential equations. His early work focused on properties of the Schrödinger equation for nonrelativistic quantum mechanics. Subsequently, he started a comprehensive study of hyperbolic conservation laws and, in particular, applications to flows in porous media. He has also worked on completely integrable systems and stochastic partial differential equations. He has written several books, including: *Solvable Models in Quantum Mechanics* (2nd edition, Chelsea Publishing, American Mathematical Society, 2005) with S. Albeverio, F. Gesztesy and R. Høegh-Krohn; *Stochastic Partial Differential Equations* (Birkhäuser, 1996) with J. Ubøe, B. Øksendal and T. Zhang; *Front Tracking for Hyperbolic Conservation Laws* (2nd corr. printing, Springer, 2007) with N. H. Risebro; and *Soliton Equations and their Algebro-Geometric Solutions, Volume I: (1+1) – Dimensional Continuous Models* (Cambridge, 2003) with F. Gesztesy.

He served as President of the European Consortium for Mathematics in Industry (ECMI) for the period 2004–06 and as Secretary of the European Mathematical Society 2003–06. For the period 2007–10 he will be one of the vice-presidents of the European Mathematical Society.

Raising Public Awareness in Mathematics: the EMS–RPA Committee

Robin Wilson (Open University, UK; chair of the RPA Committee)

For World Mathematical Year 2000, the EMS set up a special committee to oversee the various activities that were going on to popularise mathematics and bring it to the attention of the general public. The Chair of this committee was Vagn Lundsgaard Hansen of Lyngby, Denmark. Under his enthusiastic and energetic leadership there were a number of activities, including

- a well-attended Round Table on Raising Public Awareness at 3ecm, the third European Congress of Mathematics in Barcelona
- Alhambra 2000: a joint mathematical European-Arabic Conference in Granada, a satellite conference of 3ecm that was promoted by the EMS
- a competition to design mathematics posters to be placed in public places during WMY2000 – the list of prize-winners and some of the entries can be seen in the EMS Newsletters for December 1999 and September 2000.

Building on the success of WMY 2000 the European Mathematical Society decided to appoint a new Committee for Raising Public Awareness in Mathematics. This was founded in late 2000 with Vagn Lundsgaard Hansen as Chair, a position that he held with distinction for six years; an article that presents his views on the popularisation of mathematics appears in EMS Newsletter 48 (June 2003).

One of Vagn's first initiatives was to propose a competition for the best popular mathematical articles that had appeared in newspapers or similar general publications. The competition was announced in early 2001, and the jury received twenty-six entries from fourteen countries. The prize-winners were announced in December 2003, and part of the winning entry on Quantum cryptography by Nuno Crato (Lisbon) appeared in the June 2004 Newsletter.

Encouraged by the quality of some of the entries, two further competitions were announced in December 2004: for an article for the educated layman that brought mathematics to an educated public, and for an article for the general public published in a newspaper or some other widely read general magazine. The first competition produced ten articles and the prize-winners were announced in the June 2006 issue; the winning entry, The art of a right decision by Thomas Bruss (Brussels), appeared in the December 2006 issue; the article A visual approach to calculus problems by Tom Apostol (Caltech) that was awarded a 2nd price appears in this issue. Unfortunately, the second competition attracted a rather small entry and the jury felt unable to recommend the award of a prize.

At the end of 2006 Vagn Lundsgaard Hansen reached the end of his term as Chair of the RPA and I was elected in his place for two years, to be succeeded by Ehrhard Behrends (Berlin) in 2009–10; Vagn will remain on the committee and his wealth of experience will be greatly valued. At the same time, Marta Sanz-Solé and Jose Francesco Rodrigues chose to retire from the committee after many years of service, and I should like to thank them for their valuable contributions.

The future

There is still a great deal to be done to increase the public's awareness of mathematics. The general public still seems to think that mathematics is the dull and boring subject that they learned at school; to them, mathematics = arithmetic or calculation, and even geometrical ideas and spacial awareness seem not to feature in their thinking when mathematics is mentioned. The idea that mathematics is a vibrant and living subject that is constantly changing and is an important part of world culture, just like music and literature, is an idea that most of the public would not understand, and the chance to rectify the situation is partly in our hands.

A good opportunity for communicating mathematical ideas to the general public arose when sudoku hit the headlines. Millions of people enjoy their daily sudoku puzzle, yet the mathematical community (apart from a few individuals) has singularly failed to get across to them that they are actually doing mathematics – the part of mathematics concerned with Latin squares and design theory. Newspapers still encourage their readers to solve the puzzles by saying that 'it's a logical puzzle and no mathematics is involved', again confusing mathematics and calculation, and we have usually allowed them to get away with it.

Another missed opportunity has arisen this year with the 300th anniversary of the birth of Leonhard Euler, the most prolific mathematician of all time on whose work so much of modern physical science is based, yet an important historical figure of whom most people have never heard. In the United States the Mathematical Association of America have grasped the nettle by mounting several special Euler meetings, organising a study tour to the three cities with which he was closely associated (Basle, St Petersburg and Berlin), and publishing five books relating to Euler. But there's far less happening in Euler's own continent of Europe. Apart from some welcome anniversary events in the three cities, Euler events in most European countries have largely been confined to a few activities organised by enthusiastic individuals.

Most of our national mathematical societies seem to have singularly failed to take advantage of the splendid opportunities that this anniversary can provide. How is it that the MAA can get themselves so well organised in the US, whereas we in Europe have produced such a miserable response? (However, there are still six months of the anniversary year to go …!)

On the general question of popularisation there are a few signs of hope. In the UK there is a series of regular radio discussions that attract audiences of up to two million, and mathematical topics appear from time to time – last year they included Archimedes, prime numbers, mathematics and music, negative numbers, and Poincaré. In December 2006 Marcus du Sautoy presented the annual Royal Institution Christmas lectures to 11 to 14-year-old schoolchildren; this was only the third time since 1826 that these lectures were on mathematics (the previous lecturers being Christopher Zeeman in 1978 and Ian Stewart in 1997 – see the Newsletter for June 1999) and they attracted TV audiences of one million during Christmas prime-time viewing. Marcus du Sautoy is currently collaborating with the Open University to record a series of four high-profile one-hour TV programmes and a book on the history of mathematics, to be broadcast in 2007–08, and these should also help to spread the word and inform the public.

There are also other events planned for the near future. Ehrhard Behrends tells me that in Germany, the nation-wide 'Wissenschaftsjahr' (year of science) will be devoted to mathematics in 2008, and there are likely to be many exciting events during that year, including a major mathematics exhibition in one of the main museums in Berlin. Mireille Chaleyat-Maurel has also told me that the travelling mathematics exhibition Experiencing mathematics (see www.mathex.org) was visited by 37000 people in Madrid last year, has been to Lebanon and Cambodia, and is about to go to Basle for the Euler2007 festival, to Poland and Spain, and then to Singapore and Latin America.

At least year's EMS Council meeting in Turin several people recounted various successful RPA events that had taken place in their countries. I am planning to write to each national member society to ask for information about events that take place in their country, with a view to sharing exciting ideas and examples of good practice. In the meantime, I should be delighted to hear from any Newsletter readers with information about events with which they are familiar, or with suggestions for activities in which the EMS–RPA committee might become involved; please send your e-mails to r.j.wilson@open.ac.uk, putting EMS–RPA in the subject heading.

Robin Wilson is a Professor of Pure Mathematics at The Open University, a Fellow of Keble College, Oxford University, and Gresham Professor of Geometry in London.

The EMS Publishing House – a crown jewel of the Society

European Mathematical Society Publishing House

The idea had already been around for a while when Rolf Jeltsch, at that time president of the EMS, announced plans for a publishing house of the EMS in his speech at the closing ceremony of ECM 2000 in Barcelona. One motivation was that mathematicians had started to suffer from the ever increasing subscription fees for journals from commercial publishers. Indeed the community was, and actually still is, confronted with an almost surreal situation: how can it be that a mathematician who not only does the research but who also produces the LaTeX files, referees articles and does editorial work for a journal does not find that very same journal with his own articles in his university's library? Because the subscription fees became unaffordable! The desire to have a publisher who really knew the needs of the mathematical community, who was a partner and whose primary interest was not to satisfy the shareholders but to make science available to the mathematical community, became manifest.

Given this situation, what could be better than a publishing house that belongs to the mathematicians to break the monopoly of commercial publishers? And this idea finally came to fruition in 2001: in order to operate its own publishing house, the EMS created the European Mathematical Foundation, which is, by definition, a not-for-profit corporation. The proceeds from the sale of the publications are used to keep the Publishing House on a sound financial footing. A positive annual account goes back to the mathematical community in compliance with the statutes of the foundation (see www.ems-ph.org/about.html). The prices of the products are set as low as is practicable in the light of the mission and market conditions. This mission of the EMS Publishing House is straightforward: it publishes high-quality peer-reviewed journals and high-quality books, on all academic levels and in all fields of pure and applied mathematics.

At a memorable meeting of the Swiss Mathematical Society in 2004, after hours of heated discussions, it was finally decided to move the two journals of the Society, the *Commentarii Mathematici Helvetici* and the *Elemente der Mathematik*, from Birkhäuser to the EMS Publishing House. This decision was dolorous since Birkhäuser had been a reliable partner with a reasonable price policy for many decades. Moreover, a very generous counteroffer of Birkhäuser stood against the potential risk that the EMS Publishing House might not flourish and prosper. However, the feeling to seize the chance to consolidate the EMS Publishing House by this move and to set a sign by doing the right thing for mathematics on a European scale was stronger than local myopic and pecuniary arguments.

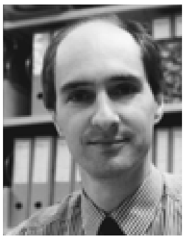
Let me emphasise that even after the move, Birkhäuser has always had an open ear and a helping hand for the Swiss mathematical community. Just to mention a few examples, Dr. Sven Fund, managing director of Birkhäuser, and Dr. Thomas Hempfling, editor for mathematics, physics and computational sciences, have supported the creation of the Swiss Digital Mathematics Library (www.math.ch/dml) and have sponsored a prize for young mathematicians in the Swiss Doctoral Program in Mathematics (www.math.ch/dp). This year's Euler-Comic has been produced by Birkhäuser at preferential conditions. Also the transition of the two journals from Birkhäuser to the EMS Publishing House was handled very professionally and went smoothly. The lists of subscribers and the back volumes changed hands quickly, and the editorial offices of both journals worked well together with the new publisher from the first moment onward.

The EMS Publishing House has been built up by Dr. Thomas Hintermann, himself a fine mathematician and a student of Herbert Amann. It is tremendous the way he has created, basically single-handedly, an efficiently running publishing house out of nothing in only a period of a few months. I have rarely seen somebody working so hard. Having this man was a stroke of fortune for the EMS. The Society owes him a lot! In 2005 Dr. Manfred Karbe joined the venture and he is responsible for the publication program of the EMS Publishing House.

Publishers Hintermann and Karbe presenting their products during ICM 2006

There are numerous factors that the Swiss Mathematical Society appreciates in its collaboration with the EMS Publishing House: the possibility to actively participate, to take part in the decision-making and to profit from Thomas Hintermann's long-lasting professional experience. The price of the journals is set by mutual agreement between the Society and the Publishing House. The accounting, as well as the management of the lists of subscribers, is completely transparent. The design of the cover was also decided jointly. The EMS Publishing House helped whenever help was needed. For example, flexible financing schemes for the transition costs or exceptional secretarial costs, implementation of a plan to serve developing countries with free copies of our journals, and realisation and maintenance of the Swiss Digital Mathematics Library.

It goes without saying that the quality of the printing and the material meets the highest professional standards. It just feels good to browse through a journal or book produced by the EMS Publishing House. Today it publishes a selection of distinguished journals, books and book series (see www.ems-ph.org). At present, scientific publishing is in motion worldwide. Quite a number of journals are changing their publisher or are considering this option. Everywhere, people are calling for a publishing house that belongs to the mathematicians. But hey, we have one: the EMS Publishing House!



Norbert Hungerbühler [norbert.hungerbuehler@unifr.ch] is Professor of Mathematics at the University of Fribourg, President of the Swiss Mathematical Society, Director of the Swiss Doctoral Program in Mathematics, and in charge of the Swiss Digital Mathematics Library. His mathematical interests are rather broad, and he is mainly working in the field of nonlinear partial differential equations.

Abel Prize and Wolf Prize 2007 awarded

Abel Prize 2007

This citation is taken from www.abelprisen.no/en/.

The Norwegian Academy of Science and Letters has decided to award the Abel Prize for 2007 to **Srinivasa S. R. Varadhan**, Courant Institute of Mathematical Sciences, New York "for his fundamental contributions to probability theory and in particular for creating a unified theory of large deviations."

Probability theory is the mathematical tool for analyzing situations governed by chance. The law of large numbers, discovered by Jacob Bernoulli in the eighteenth century, shows that the average outcome of a long sequence of coin tosses is usually close to the expected value. Yet the unexpected happens, and the question is: how? The theory of large deviations studies the occurrence of rare events. This subject has concrete applications to fields as diverse as physics, biology, economics, statistics, computer science, and engineering.

The law of large numbers states that the probability of a deviation beyond a given level goes to zero. However, for practical applications, it is crucial to know how fast it vanishes. For example, what capital reserves are needed to keep the probability of default of an insurance company below acceptable levels? In analyzing such actuarial "ruin problems", Harald Cramér discovered in 1937 that standard approximations based on the Central Limit Theorem (as visualized by the bell curve) are actually misleading. He then found the first precise estimates of large deviations for a sequence of independent random variables. It took 30 years before Varadhan discovered the underlying general principles and began to demonstrate their tremendous scope, far beyond the classical setting of independent trials.

In his landmark paper "Asymptotic probabilities and differential equations" in 1966 and his surprising solution of the polaron problem of Euclidean quantum field theory in 1969, Varadhan began to shape a general theory of large deviations that was much more than a quantitative improvement of convergence rates. It addresses a fundamental question: what is the qualitative behaviour of a stochastic system if it deviates from the ergodic behaviour predicted by some law of large numbers or if it arises as a small perturbation of a deterministic system? The key to the answer is a powerful variational principle that describes the unexpected behaviour in terms of a new probabilistic model minimizing a suitable entropy distance to the initial probability measure. In a series of joint papers with Monroe D. Donsker exploring the hierarchy of large deviations in the context of Markov processes, Varadhan demonstrated the relevance and the power of this new approach. A striking application is their solution of a conjecture of Mark Kac concerning large time asymptotics of a tubular neighbourhood of the Brownian motion path, the so-called "Wiener sausage".

Varadhan's theory of large deviations provides a unifying and efficient method for clarifying a rich variety of phenomena arising in complex stochastic systems, in fields as diverse as quantum field theory, statistical physics, population dynamics, econometrics and finance, and traffic engineering. It has also greatly expanded our ability to use computers to simulate and analyze the occurrence of rare events. Over the last four decades, the theory of large deviations has become a cornerstone of modern probability, both pure and applied.

Varadhan has made key contributions in several other areas of probability. In joint work with Daniel W. Stroock, he developed a martingale method for characterizing diffusion processes, such as solutions of stochastic differential equations. This new approach turned out to be an extremely powerful way of constructing new Markov processes, for example infinite-dimensional diffusions arising in population genetics.

Ramanujan Prize 2007

The Abdus Salam International Centre for Theoretical Physics (ICTP) is pleased to invite nominations for the 2007 Ramanujan Prize for young mathematicians from developing countries. The Prize is funded by the Niels Henrik Abel Memorial Fund. The Prize carries a $10,000 cash award and an allowance to visit ICTP for a meeting where the Prize winner will be required to deliver a lecture. The deadline for receipt of nominations is 31 July 31 2007.

The 2005 Prize was awarded to Professor Marcelo A. Viana from IMPA, Brazil. The 2006 Prize was awarded to Professor Ramdorai Sujatha, Tata Institute of Fundamental Research, Mumbai, India.

Please send nominations to director@ictp.trieste.it describing the work of the nominee in adequate detail. Two supporting letters should also be arranged.

Another major theme is the analysis of hydrodynamical limits describing the macroscopic behaviour of very large systems of interacting particles. A first breakthrough came in joint work with Maozheng Guo and George C. Papanicolaou on gradient models. Varadhan went even further by showing how to handle non-gradient models, greatly extending the scope of the theory. His ideas also had a strong influence on the analysis of random walks in a random environment. His name is now attached to the method of "viewing the environment from the travelling particle", one of the few general tools in the field.

Varadhan's work has great conceptual strength and ageless beauty. His ideas have been hugely influential and will continue to stimulate further research for a long time.

The prize amount is NOK 6,000,000 (USD 875,000, GBP 475,000, EUR 710,000) and was awarded for the first time in 2003 to Jean-Pierre Serre. Successive laureates were Sir Michael Atiyah and Isadore Singer (2004), Peter Lax (2005) and Lennart Carleson (2006).

The 2007 Wolf Foundation Prize in Mathematics

Citation from www.wolffund.org/full.asp?id=155

The Prize Committee for Mathematics has unanimously decided that the 2006/7 Wolf Prize will be jointly awarded to:

Stephen J. Smale, University of California at Berkeley, California, USA,
for his groundbreaking contributions that have played a fundamental role in shaping differential topology, dynamical systems, mathematical economics, and other subjects in mathematics, and

Harry Furstenberg, The Hebrew University of Jerusalem, Israel,
for his profound contributions to ergodic theory, probability, topological dynamics, analysis on symmetric spaces and homogenous flows.

Professor **Stephen J. Smale** contributed greatly, in the late 50s and early 60s, to the development of differential topology, a field then in its infancy. His results of immersions of spheres in Euclidean spaces still intrigue mathematicians, as witnessed by recent films and pictures on his so-called "eversion" of the sphere. His proof of the Poincaré Conjecture for dimensions bigger or equal to 5 is one of the great mathematical achievements of the 20th Century. His h-cobordism theorem has become probably the most basic tool in differential geometry.

During the 60's Smale reshaped the view of the world of dynamical systems. His theory of hyperbolic systems remains one of the main developments on the subject after Poincaré, and the mathematical foundations of the so-called "chaos-theory" are his work as well. In the early 60's, Smale's work contributed dramatically to change in the study of the topology and analysis of infinite-dimensional manifolds. This was achieved through his infinite-dimensional version of Morse's critical point theory (known today as "Palais-Smale Theory") and his infinite-dimensional version of Sard's theorem.

In the 70's Smale attention turned to mechanics and economics, to which he applied his ideas on topology and dynamics. For instance, his notion of "amended potential" in mechanics plays a key role in current developments in stability and bifurcation of relative equilibria. In economics, Smale applied an abstract theory of optimization for several functions, which he developed, to provide conditions for the existence of Pareto optima and to characterize this set of optima as a sub-manifold of diffeomorphic states to the set of Pareto equilibria. He also proved the existence of general equilibria under very weak assumptions and contributed to the development of algorithms for the computation of such equilibria.

It is this last activity that led Smale in the early 80's to the longest segment of his career, his work on the theory of computation and computational mathematics. Against mainstream research on scientific computation, which focused on immediate solutions to concrete problems, Smale developed a theory of continuous computation and complexity (akin to that developed by computer scientists for discrete computations), and designed and analyzed algorithms for a number of specific problems. Some of these analyses constitute models for the use of deep mathematics in the study of numerical algorithms.

Professor **Harry Furstenberg** is one of the great masters of probability theory, ergodic theory and topological dynamics. Among his contributions: the application of ergodic theoretic ideas to number theory and combinatorics and the application of probabilistic ideas to the theory of Lie groups and their discrete subgroups.

In probability theory he was a pioneer in studying products of random matrices and showing how their limiting behavior was intimately tied to deep structure theorems in Lie groups. This result has had a major influence on all subsequent work in this area – which has emerged as a major branch not only in probability, but also in statistical physics and other fields.

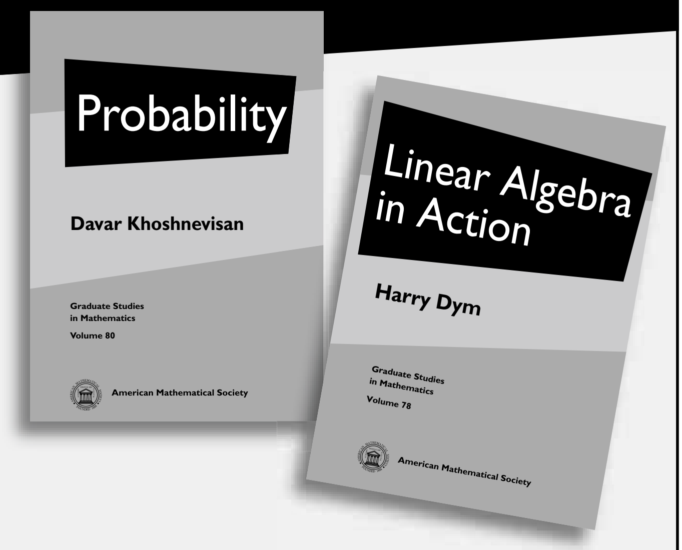
In topological dynamics, Furstenberg's proof of the structure theorem for minimal distal flows, introduced radically new techniques and revolutionized the field. His theorem that the horocycle flow on surfaces of constant negative curvature is uniquely ergodic, has become a major part of the dynamical theory of Lie group actions. In his study of stochastic processes on homogenous spaces, he introduced stationary methods whose study led him to define what is now called the Furstenberg Boundary of a group. His analysis of the asymptotic behavior of random walks on groups has had a lasting influence on subsequent work in this area, including the study of lattices in Lie groups and co-cycles of group actions.

In ergodic theory, Furstenberg developed the fundamental concept of dynamical embedding. This led him to spectacular applications in combinatorics, including a new proof of the Szemeredi Theorem on arithmetical progressions and far-reaching generalizations thereof.

AMERICAN MATHEMATICAL SOCIETY

Graduate Studies in Mathematics Series

The volumes in the GSM series are **specifically designed as graduate studies texts**, but are also suitable for recommended and/or supplemental course reading. With **appeal to both students and professors**, these texts make **ideal independent study resources**. The breadth and depth of the series' coverage make it an ideal acquisition for all academic libraries that support mathematics programs.



FROM THE GSM SERIES...

A Companion to Analysis

COURSE ADOPTION

A Second First and First Second Course in Analysis

T. W. Körner, *University of Cambridge, England*

Graduate Studies in Mathematics, Volume 62; 2004; 590 pages; Hardcover; ISBN: 978-0-8218-3447-3; List US$79; AMS members US$63; Order code GSM/62

A Geometric Approach to Free Boundary Problems

Luis Caffarelli, *University of Texas, Austin, TX* and **Sandro Salsa**, *Politecnico di Milano, Italy*

Graduate Studies in Mathematics, Volume 68; 2005; 270 pages; Hardcover; ISBN: 978-0-8218-3784-9; List US$49; AMS members US$39; Order code GSM/68

Curves and Surfaces

COURSE ADOPTION

Sebastián Montiel and **Antonio Ros**, *Universidad de Granada, Spain*

This book is jointly published by the AMS and the Real Sociedad Matemática Española (RSME).

Graduate Studies in Mathematics, Volume 69; 2005; 376 pages; Hardcover; ISBN: 978-0-8218-3815-0; List US$59; AMS members US$47; Order code GSM/69

Linear Algebra in Action

COURSE ADOPTION

Harry Dym, *Weizmann Institute of Science, Rehovot, Israel*

Graduate Studies in Mathematics, Volume 78; 2007; 541 pages; Hardcover; ISBN: 978-0-8218-3813-6; List US$79; AMS members US$63; Order code GSM/78

Probability

COURSE ADOPTION

Davar Khoshnevisan, *University of Utah, Salt Lake City, UT*

Graduate Studies in Mathematics, Volume 80; 2007; 224 pages; Hardcover; ISBN: 978-0-8218-4215-7; List US$45; AMS members US$36; Order code GSM/80

new releases | upcoming publications | Web exclusive sales | classic titles

AMS BOOKSTORE
www.ams.org/bookstore

1-800-321-4AMS (4267), in the U. S. and Canada, or 1-401-455-4000 (worldwide); fax:1-401-455-4046; email: cust-serv@ams.org. American Mathematical Society, 201 Charles Street, Providence, RI 02904-2294 USA

Visit the AMS booth at ICIAM
Zürich, Switzerland

Two mathematicians forced to resign at Uppsala University, Sweden

The European Mathematical Society is very concerned

Ulf Persson (Göteborg, Sweden) and Martin Raussen (Aalborg, Denmark)

On Thursday February 8, 2007, Oleg Viro and Burglind Juhl-Jöricke, two tenured professors at the Department of Mathematics at Uppsala University, were called in for interviews in connection with an investigation carried out by the university administration relating to work environment problems at their department. To their surprise, instead of being interviewed, they were presented with an ultimatum by Uppsala University's vice-chancellor Anders Hallberg: either to resign voluntarily and to receive damages approximately equivalent to salaries for three years or to face the due process of a dishonourable discharge. Under duress they signed the same day; their e-mail accounts were closed down almost immediately afterwards.

The measure taken and the procedure leading to it have caused wide-spread consternation among their colleagues. A few days after the forced resignations, recent Abel prize winner Lennart Carleson sent a strong letter of support to the two professors protesting against the development at Uppsala University. EMS-president Ari Laptev wrote to the vice-chancellor asking for explanations.

In his official response, given in a press statement and in his reply to the EMS-president, the vice-chancellor quotes work environment problems at the department as the reason for his action. Hallberg stresses that the affair has a purely internal character, and that public disclosure of the charges would be inappropriate in order to protect the integrity of everybody involved. He concludes: *After having been formally cautioned, the two professors tendered their resignations.*

This allegation is not in agreement with reports by the two professors that are backed up by voice recordings of the encounters taken by the two mathematicians; in Sweden, this can be done legally. These recordings have since been transcribed, they can be accessed by everybody via Oleg Viro's home page at the Russian Academy of Sciences. From these documents, it becomes clear that the two professors are not given very clear indications what they are accused of; they are not given an honest chance, appropriate time and support to defend themselves. They finally sign their resignations after the vice-chancellor's strong demand under conditions which seemingly give them no choice.

Numerous European and American mathematicians have since protested in letters to the University and to the European Mathematical Society against the treatment of Professors Viro and Juhl-Jöricke by Uppsala University. In his reply to the vice-chancellor, EMS-president Ari Laptev expresses his deep concern with respect to the procedure chosen by Uppsala University; he reports that the incident has been seen as a danger to the entire mathematical community. He asks the vice-chancellor to reconsider his decision regarding the expulsion of the two professors. The correspondence between Laptev and the vice-chancellor and other related letters and documents have since been posted on the EMS web page www.emis.de/press.html.

This is not the place to discuss the severe conflicts in the past between members of at the Department of Mathematics at Uppsala University. But it appears that the university's leadership chose the seemingly easy way to solve these work environment problems by simply dismissing two of the employees out of the hand. The measures taken make the attempts to improve the working environment at the Mathematics Department more difficult. The procedure chosen by the University's leadership to achieve their goals creates an atmosphere of fear and is unworthy of an academic institution.

Oberwolfach: Extension of the mathematical library building

On Saturday, 5th May 2007, the dedication ceremony of the enlargement of the library building took place at the Mathematisches Forschungsinstitut Oberwolfach (MFO).

The Mathematisches Forschungsinstitut Oberwolfach (MFO) is one of the most internationally renowned institutions of its kind, taking on a leading position in its field despite growing competition. Every year, it is visited by about 2,500 mathematicians from all over the world for conferences and research studies. Among researchers it is known worldwide as an institution setting standards by its internationally highly acclaimed research program.

Library extension, outside view

This is also in part due to its excellent library, which offers ideal working conditions. The library, which is one of the best of its kind, serves as the main work tool for a mathematician doing research, functioning simultaneously as "laboratory" and archive. It is therefore the quality of the library in selection and completeness that guarantees Oberwolfach a leading position among its competitors.

To ensure that the working conditions for the mathematicians do not face any limits in the future, both the Klaus Tschira Stiftung GmbH and the VolkswagenStiftung, have allocated the sum of 408,000 Euro each (in total 816,000 Euro) to the Mathematisches Forschungsinstitut Oberwolfach (MFO) for the extension of the library building. The necessary purchase of additional area around the institute has been financed by the Oberwolfach Stiftung and the Förderverein with the additional sum of 84,000 Euro, the majority of this sum coming as a donation by Ms Rosemary Lonergan in honour of the mathematician John Todd.

The library extension does not only meet the demand for more space for the print editions – those which play an important role in a research library – but, by setting up an additional server room and new computer workstatins it also improves the accessibility of research literature that is only available electronically.

from an Oberwolfach press release

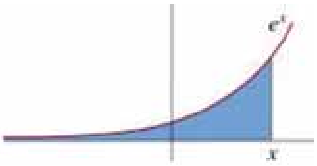
Library extension, inside view

A Visual Approach to Calculus Problems

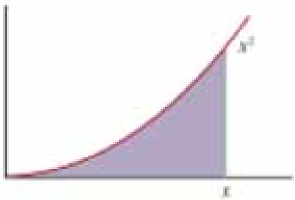
by Tom M. Apostol (Caltech, Pasadena, CA, USA)

Calculus is a beautiful subject with a host of dazzling applications. As a teacher of calculus for more than 50 years and as an author of a couple of textbooks on the subject, I was stunned to learn that many standard problems in calculus can be easily solved by an innovative visual approach that makes no use of formulas. Here's a sample of three such problems:

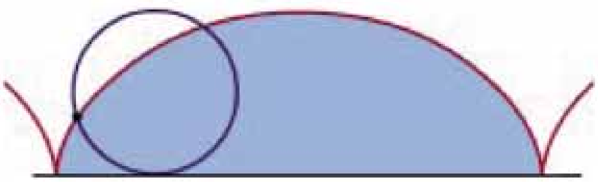
Problem 1. Find the area of the region under an exponential curve. In the graph of the exponential function $y = e^x$, below, we want the area of the blue region between the curve and the x-axis and along the interval from minus infinity up to any point x. Integral calculus reveals that the answer is e^x. And if the equation of the curve is $y = e^{x/b}$, where b is any positive constant, integration tells us the area is b times $e^{x/b}$.



Problem 2. Find the area of a parabolic segment (left) – the purple region below the graph of the parabola $y = x^2$ from 0 to x. The area of the parabolic segment was first calculated by Archimedes more than 2000 years ago by a method that laid the foundations for integral calculus. Today, every freshman calculus student can solve this problem: Integration of x^2 gives $x^3/3$.



Problem 3. Find the area of the region under one arch of a cycloid (next column). A cycloid is the path traced out by a fixed point on the boundary of a circular disk that rolls along a horizontal line, and we want the area of the region shown in blue. This problem can also be done by calculus but it is more difficult than the first two. First, you have to find an equation for the cycloid, which is not exactly trivial. Then you have to integrate this to get the required area. The answer is three times the area of the rolling circular disk.

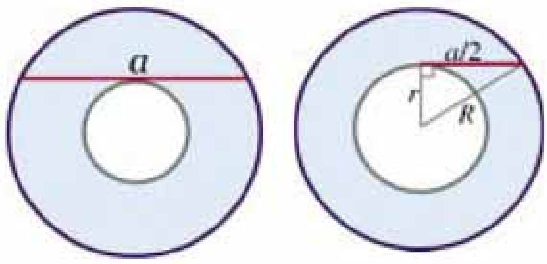


These classic problems can also be solved by a new method that relies on geometric intuition and is easily understood even by very young students. You don't need any equations. Moreover, the new method also solves some problems that can't be done *with* calculus.

The method was conceived in 1959 by Mamikon A. Mnatsakanian, then an undergraduate at Yerevan University in Armenia. When he showed his method to Soviet mathematicians they dismissed it out of hand and said, "It can't be right – you can't solve calculus problems that easily." He went on to get a PhD in physics, was appointed a professor of astrophysics at the University of Yerevan, and became an international expert in radiative transfer theory. He also continued to develop his powerful geometric methods. He eventually published a paper outlining them in 1981, but it seems to have escaped notice, probably because it appeared in Russian in an Armenian journal with limited circulation (*Proceedings of the Armenian Academy of Sciences*, vol. 73, no. 2, pages 97–102).

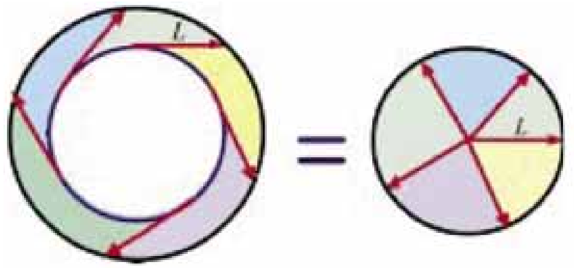
Mamikon came to California about a decade ago to work on an earthquake-preparedness program for Armenia, and when the Soviet government collapsed, he was stranded in the United States without a visa. With the help of a few mathematicians in Sacramento and at UC Davis, he was granted status as an "alien of extraordinary ability." While working for the California Department of Education and at UC Davis, he further developed his methods into a universal teaching tool using hands-on and computer activities, as well as pictures. He has taught these methods at UC Davis and in Northern California classrooms, ranging from Montessori elementary schools to inner-city public high schools, and he has demonstrated them at teacher conferences. Students and teachers alike have responded enthusiastically, because the methods are vivid and dynamic and don't require the algebraic formalism of trigonometry or calculus.

About four years ago, Mamikon showed up at *Project MATHEMATICS*! headquarters and convinced me that his methods have the potential to make a significant impact on mathematics education, especially if they are combined with visualization tools of modern technology. Since then we have published several joint papers on innovative ideas in elementary mathematics.

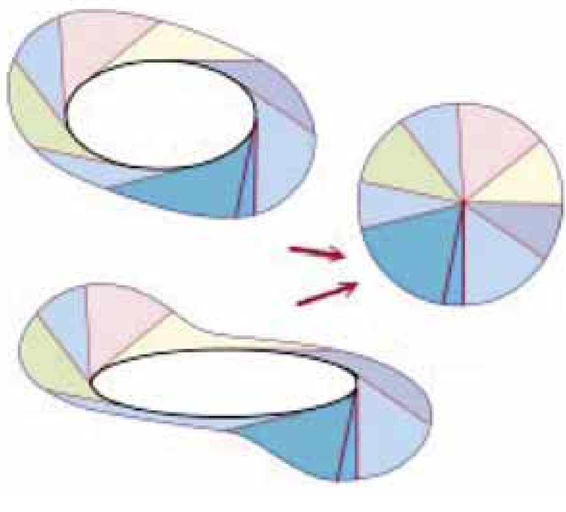


Like all great discoveries, the method is based on a simple idea. It started when young Mamikon was presented with the classical geometry problem, involving two concentric circles with a chord of the outer circle tangent to the inner one, as in the left illustration. The chord has length a, and the problem is: Find the area of the ring between the circles. As the late Paul Erdös would have said, any baby can solve this problem. Now look at the diagram below on the right. If the inner circle has radius r its area is πr^2, and if the outer circle has radius R, its area is πR^2, so the area of the ring is equal to $\pi R^2 - \pi r^2 = \pi(R^2 - r^2)$. But the two radii and the tangent form a right triangle with legs r and $a/2$ and hypotenuse R, so by the Pythagorean Theorem, $R^2 - r^2 = (a/2)^2$, hence the ring has the area $\pi a^2/4$. Note that the final answer depends only on a and not on the radii of the two circles.

If we knew in advance that the answer depends only on a, we could find it another way: Shrink the inner circle to a point, and the ring collapses to a disk of diameter a, with an area equal to $\pi a^2/4$.



Mamikon wondered if there was a way to see why the answer depends only on the length of the chord. Then he thought of formulating the problem in a dynamic way. Take half the chord and think of it as a vector of length L tangent to the inner circle. By moving this tangent vector around the inner circle, we see that it sweeps out the ring between the two circles. (But it's obvious that the area is being swept due to pure rotation.) Now, translate each tangent vector parallel to itself so that the point of tangency is brought to a common point. As the tangent vector moves around the inner circle, the translated vector rotates once around this common point and traces out a circular disk of radius L. So the tangent vectors sweep out a circular disk as though they were all centered at the same point, as illustrated below. And this disk has the same area as the ring.



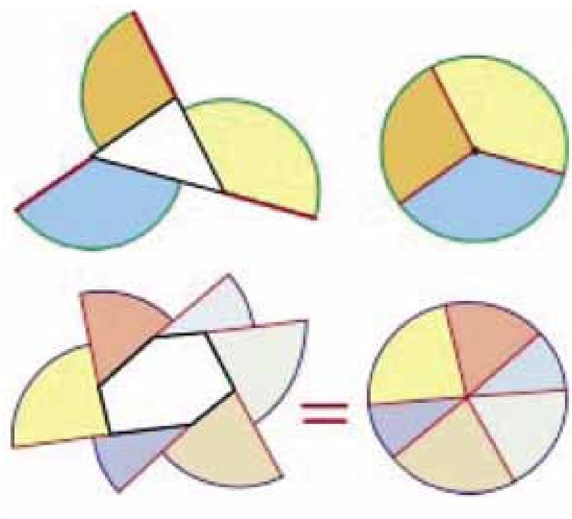
Students at the Southland Park Montessori Elementary School in Sacramento play with magnetic manipulative wedges, shaping them into a circular disk. Pushing with your finger in the center can turn it into an oval ring of any shape.

Mamikon realized that this dynamic approach would also work if the inner circle was replaced by an arbitrary oval curve. Below you can see the same idea applied to two different ellipses. As the tangent segment of constant length moves once around each ellipse, it sweeps out a more general annular shape that we call an oval ring.

Again, we can translate each tangent segment parallel to itself so that the point of tangency is brought to a common point. As the tangent moves around the oval, the translated segments trace out a circular disk whose radius is that constant length. So, the area of the oval ring should be the area of the circular disk.

The Pythagorean Theorem can't help you find the areas for these oval rings. If the inner oval is an ellipse, you can calculate the areas by integral calculus (which is not a trivial task); if you do so, you'll find that all of these oval rings have equal areas depending only on the length of the tangent segment.

Is it possible that the same is true for any convex simple closed curve? The diagram below illustrates the idea for a triangle.



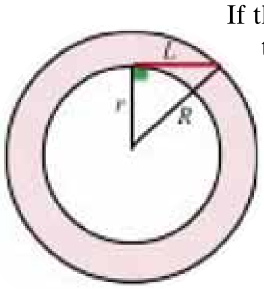
As the tangent segment moves along an edge, it doesn't change direction so it doesn't sweep out any area. As it moves around a vertex from one edge to the next, it sweeps out part of a circular sector. And as it goes around the entire triangle, it sweeps out three circular sectors that, together, fill out a circular disk, as shown to the right.

The same is true for any convex polygon, as illustrated above.

The area of the region swept out by a tangent segment of given length moving around any convex polygon is equal to the area of a circular disk whose radius is that length. Therefore the same is true for any convex curve that is a limitof convex polygons. This leads us to

Mamikon's Theorem for Oval Rings: *All oval rings swept out by a line segment of given length with one endpoint tangent to a smooth closed plane curve have equal areas, regardless of the size or shape of the inner curve. Moreover, the area depends only on the length L of the tangent segment and is equal to* πL^2*, the area of a disk of radius L, as if the tangent segment was rotated about its endpoint*.

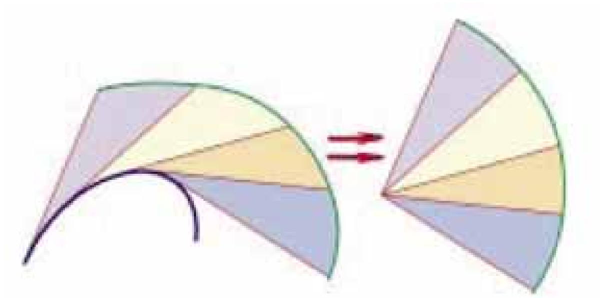
Incidentally, Mamikon's theorem for oval rings provides a new proof of the Pythagorean Theorem, as illustrated below.



If the inner curve is a circle of radius r, the outercurve will also be a circle (of radius R, say), so the area of the oval ring will be equal to the difference $\pi R^2 - \pi r^2$. But by Mamikon's theorem, the area of the oval ring is also equal to πL^2, where L is the constant length of the tangent segments. By equating areas we find $R^2 - r^2 = L^2$, from which we get $R^2 = r^2 + L^2$, the Pythagorean Theorem.

Now we can illustrate a generalized version of Mamikon's theorem. The lower curve in the diagram below is a more or less arbitrary smooth curve. The set of all tangent segments of constant length defines a region that is bounded by the lower curve and an upper curve traced out by the segment's other extremity. The exact shape of this region will depend on the lower curve and on the length of the tangent segments. We refer to this region as a *tangent sweep*.

When each segment is translated to bring the points of tangency together as before, as shown in the right-hand diagram below, the set of translated segments is called

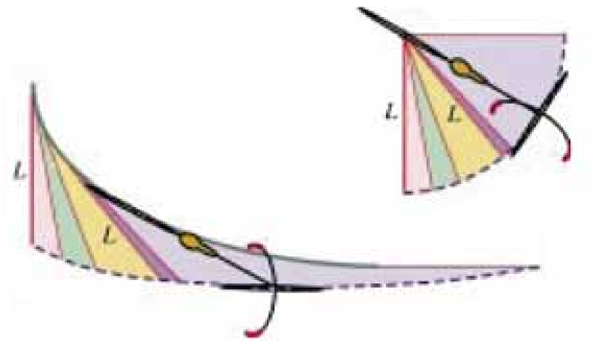


the *tangent cluster*. When the tangent segments have constant length, as in this figure, the tangent cluster is a circular sector whose radius is that constant length.

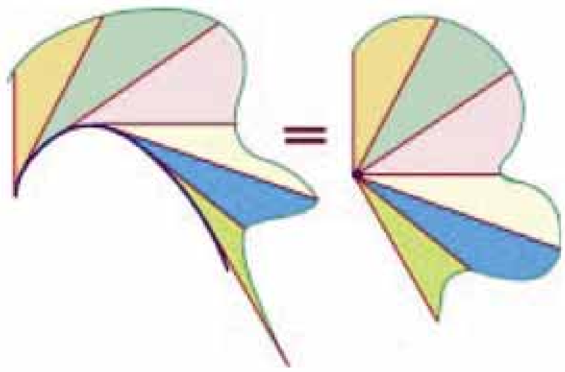
By the way, we could also translate the segments so that the *other* endpoints are brought to a common point. The resulting tangent cluster would be a symmetric version of the cluster in the right-hand figure. Now we can state

Mamikon's Theorem: *The area of a tangent sweep is equal to the area of its tangent cluster, regardless of the shape of the original curve.*

You can see this in a real-world illustration when a bicycle's front wheel traces out one curve while the rear wheel (at constant distance from the front wheel) traces out another curve, as below. To find the area of the region between the two curves with calculus, you would need equations for both curves, but we don't need any here. The area of the tangent sweep is equal to the area of a circular sector depending only on the length of the bicycle and the change in angle from its initial position to its final position, as shown in the tangent cluster to the right. The shape of the bike's path does not matter.



The next diagram illustrates the same idea in a more general setting. The only difference is that the tangent segments to the lower curve need not have constant length. We still have the tangent sweep (left) and the tangent cluster.



Mamikon's theorem, which seems intuitively obvious by now, is that the area of the tangent cluster is equal to the area of the tangent sweep. (To convince yourself, consider corresponding equal tiny triangles translated from the tangent sweep to the tangent cluster.)

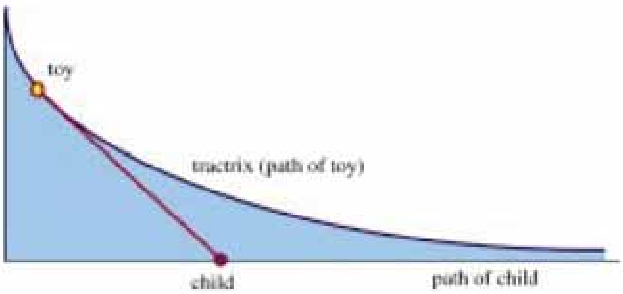
In the most general form of Mamikon's theorem the given curve need not lie in a plane. It can be any smooth

Mamikon helps children at the Montessori School trace a tractrix with a bicycle.

curve in space, and the tangent segments can vary in length. The tangent sweep will lie on a developable surface, one that can be rolled out flat onto a plane without distortion. The shape of the tangent sweep depends on how the lengths and directions of the tangent segments change along the curve; the tangent cluster lies on a conical surface whose vertex is the common point. Mamikon's general theorem equates the area of the tangent sweep with that of its tangent cluster.

General Form of Mamikon's Theorem: *The area of a tangent sweep to a space curve is equal to the area of its tangent cluster.*

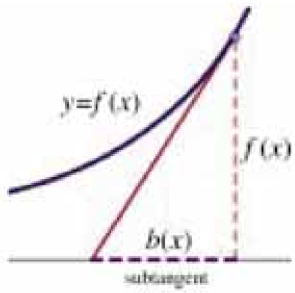
This theorem, suggested by geometric intuition, can be proved in a traditional manner – by using differential geometry, for example. My first reaction to this theorem was, "OK, that's a cool result in geometry. It must have some depth because it implies the Pythagorean Theorem. Can you use it to do anything else that's interesting?"



It turns out that you can apply this theorem in all sorts of interesting ways. As already mentioned, curves swept out by tangent segments of constant length include oval rings and the bicycle-tire tracks. Another such example is the tractrix, the trajectory of a toy on a taut string being pulled by a child walking in a straight line, as shown above. To find the area of the region between the tractrix and the x-axis using calculus, you have to find the equation of the tractrix. This in itself is rather challenging – it requires solving a differential equation. Once you have the equation of the tractrix, you have to integrate it to get the area. This also can be done, but the calculation is somewhat demanding; the final answer is simply $\pi L^2/4$, where L is the length of the string. But we can see that the tractrix is a particular case of the "bicyclix," so its swept area is given by a circular sector, and its full area is a quarter of a circular disk.

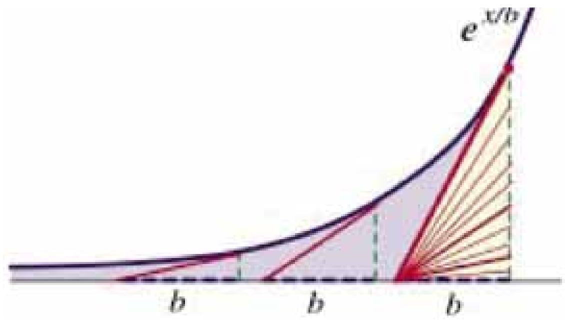
All the examples with tangents of constant length reveal the striking property that the area of the tangent cluster can be expressed in terms of the area of a circular sector without using any ofthe formal machinery of traditional calculus.

But the most striking applications are to examples in which the tangent segments are of variable length. These examples reveal the true power of Mamikon's method. This brings us to Problem 1: exponential curves. Exponential functions are ubiquitous in the applications of mathematics. They occur in problems concerning population growth, radioactive decay, heat flow, and other physical situations where the rate of growth of a quantity is proportional to the amount present. Geometrically, this means that the slope of the tangent line at each point of an exponential curve is proportional to the height of the curve at that point. An exponential curve can also be described by its subtangent, which is the projection of the tangent on the x-axis. The diagram above shows a general curve with a tangent line and the subtangent. The slope of the tangent is the height divided by the length of the subtangent. So, the slope is proportional to the height if and only if the subtangent is constant.



The next diagram, at the bottom of this column, shows the graph of an exponential curve $y = e^{x/b}$, where b is a positive constant. The only property of this curve that plays a role in this discussion is that the subtangent at any point has a constant length b. This follows easily from differential calculus, but it can also be taken as the defining property of the exponential. In fact, exponential curves were first introduced in 1684 when Leibniz posed the problem of finding all curves with constant subtangents. The solutions are the exponential curves.

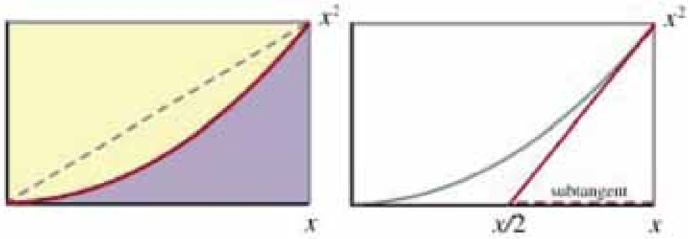
By exploiting the fact that exponential curves have constant subtangents, we can use Mamikon's theorem to find the area of the region under an exponential curve without using integral calculus. The diagram below shows the graph of the exponential curve $y = e^{x/b}$ together with its tangent sweep as the tangent segments, cut off by the



x-axis, move to the left, from x all the way to minus infinity. The corresponding tangent cluster is obtained by translating each tangent segment to the right so that the endpoint on the x-axis is brought to a common point, in this case, the lower vertex of the right triangle of base b and altitude $e^{x/b}$. The resulting tangent cluster is the triangle of base b and altitude $e^{x/b}$. Therefore the area of the blue region is equal to the area of the yellow right triangle, so the area of the region between the exponential curve and the interval (from minus infinity to x) is equal to twice the area of this right triangle, which is its base times its altitude, or $be^{x/b}$, the same result you would get by integration.

This yields the astonishing result that the area of the region under an exponential curve can be determined in an elementary geometric way without the formal machinery of integral calculus.

We turn now to our second problem, perhaps the oldest calculus problem in history – finding the area of a parabolic segment, the purple region at left, below. The parabolic segment is inscribed in a rectangle of base x and altitude x^2. The areaof the rectangle is x^3. From the figure we see that the area of the parabolic segment is less than half that of the rectangle in which it is inscribed. Archimedes made the stunning discovery that the area is exactly one-third that of the rectangle. Now we will use Mamikon's theorem to obtain the same result by a method that is not only simpler than the original treatment by Archimedes but also more powerful because it can be generalized to higher powers.



This parabola has the equation $y = x^2$, but we shall not need this formula in our analysis. We use only the fact that the tangent line above any point x cuts off a subtangent of length $x/2$, asindicated in the lower diagram. The slope of the tangent is x^2 divided by $x/2$, or $2x$.

To calculate the area of the parabolic segment we look at the next figure in which another parabola $y = (2x)^2$ has been drawn, exactly half as wide as the given parabola. It is formed by bisecting each horizontal segment between the original parabola and the y axis. The two parabolas divide the rectangle into three regions, and our strategy is to show that all three regions have equal area. If we do this, then each has an area one-third that of the circumscribing rectangle, as required.

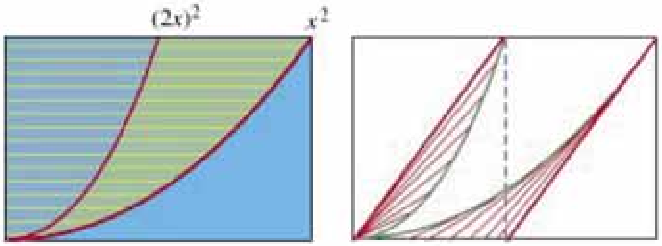
The two shaded regions formed by the bisecting parabola obviously have equal areas, so to complete the proof we need only show that the region above the bisecting parabola has the same area as the parabolic segment below the original parabola. To do this, let's look at the second diagram below. The right triangles here have equal areas (they have the same altitude and equal bases).Therefore the problem reduces to showing that the two shaded regions in this diagram have equal areas. Here's where we use Mamikon's theorem.

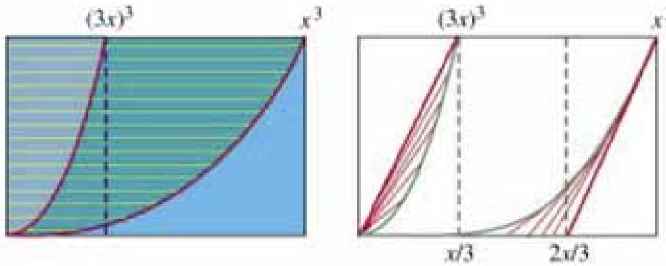
The shaded portion under the parabola $y = x^2$ is the tangent sweep obtained by drawing all the tangent lines to the parabola and cutting them off at the x-axis. And the other shaded portion is its tangent cluster, with each tangent segment translated so its point of intersection with the x axis is brought to a common point, the origin.

At a typical point (t, t^2) on the lower parabola, the tangent intersects the x-axis at $t/2$. Therefore, if the tangent segment from $(t/2, 0)$ to (t, t^2) is translated left by the amount $t/2$, the translated segment joins the origin and the point $(t/2, t^2)$ on the curve $y = (2x)^2$. So the tangent cluster of the tangent sweep is the shaded region above the curve $y = (2x)^2$, and by Mamikon's theorem the two shaded regions have equal areas, as required. So we have shown that the area of the parabolic segment is exactly one-third that of the circumscribing rectangle, the same result obtained by Archimedes.

The argument used to derive the area of a parabolic segment also extends to generalized parabolic segments, in which x^2 is replaced by higher powers. The graphs of $y = x^3$ and $y = (3x)^3$ at left divide the rectangle of area x^4 into three regions. The curve $y = (3x)^3$ *trisects* each horizontal segment in the figure, hence the area of the region above this curve is half that of the region between the two curves. In this case we will show that the area of the region above the trisecting curve is equal to that below the original curve, which means that each region has an area one-fourth that of the circumscribing rectangle.

To do this we use the fact that the subtangent is now one-third the length of the base, as shown below. One shaded region is the tangent sweep of the original curve, and the other is the corresponding tangent cluster, so they have equal areas. The right triangles are congruent, so they have equal areas. Therefore the region above the trisecting curve has the same area as the region below the curve $y = x^3$, and each is one-fourth that of the rectangle, or $x^4/4$. The argument also extends to all higher

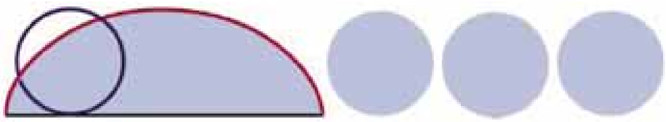




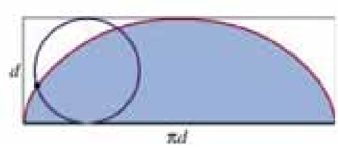
With Mamikon's help, the Montessori schoolchildren built this 60-foot-long suspension bridge. Using themselves as weight, they are illustrating how heavy loading changes the shape of the cable from a catenary (the curve normally formed by hanging a chain from both ends) to a parabola. Such a "breakdown" occurred during the 50th-anniversary celebration of the Golden Gate Bridge in 1987.

powers, a property not shared by Archimedes' treatment of the parabolic segment. For the curve $y = x^n$ we use the fact that the subtangent at x has length x/n.

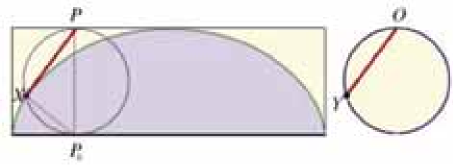
We turn next to our third standard calculus problem – the cycloid, the curve traced out by a point on the perimeter of a circular disk that rolls without slipping along a horizontal line. We want to show that the area of the region between one arch of the cycloid and the horizontal line is three times the area of the rolling disk (above), without deriving an equation for the cycloid or using integral calculus.



On top of the next column, a cycloidal arch is inscribed inside a rectangle whose altitude is the diameter d of the disk and whose base is the disk's circumference, πd. The area of the circumscribing rectangle is πd^2, which is four times the area of the disk. So it suffices to show that the unshaded region above the arch and inside the rectangle has an area equal to that of the disk. To do this, we show that the unshaded region is the tangent sweep of the cycloid, and that the corresponding tangent cluster is a circular disk of diameter d. By Mamikon's theorem, this disk has the same area as the tangent sweep. Because the area of the disk is one-fourth the area of the rectangle, the area of the region below the arch must be three-fourths that of the rectangle, or three times that of the rolling disk.



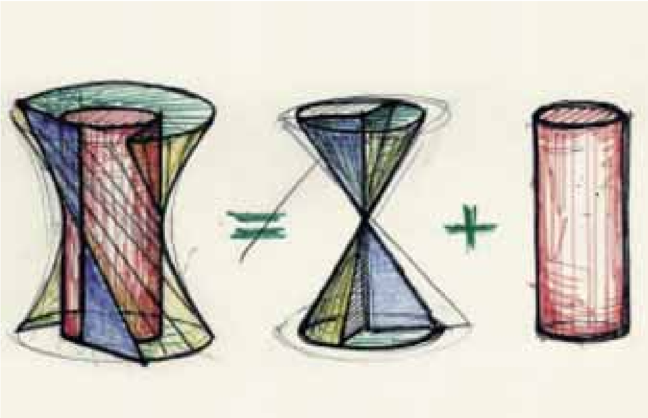
It remains to show that the tangent cluster of the unshaded region is a circular disk, as asserted. As the disk rolls along the base it is always tangent to the upper and lower boundaries of the circumscribing rectangle. If we denote the upper point of tangency by P and the lower point of tangency by P_0, as in the diagram below, the diameter PP_0 divides the rolling circle into two semicircles, and any triangle inscribed in these semicircles must be a right triangle. The disk undergoes instantaneous rotation about P_0, so the tangent to the cycloid at any point X is perpendicular to the instantaneous radius of rotation and therefore must be a vertex of a right triangle inscribed in the semicircle with diameter PP_0. Consequently, the chord XP of the rolling disk is always tangent to the cycloid.



Extend the upper boundary of the circumscribing rectangle beyond the arch and choose a fixed point O on this extended boundary. Translate each chord parallel to itself so that point P is moved horizontally to the fixed point O. Then the other extremity X moves to a point Y such that segment OY is equal in length and parallel to PX. Conse-quently, Y traces out the boundary of a circular disk of the same diameter, with OY being a chord equal in length and parallel to chord PX. Therefore the tangent cluster is a circular disk of the same diameter as the rolling disk, and Mamikon's theorem tells us that its area is equal to that of the disk.

These examples display a wide canvas of geometric ideas that can be treated with Mamikon's methods, but seeing them static on a printed page leaves something to be desired. Animation, clearly, is a better way to show how the method works. So we plan to use these examples in the first of a series of contemplated videotapes under the umbrella of *Project MATHEMATICS!* Like all videotapes produced by *Project MATHEMATICS!*, the emphasis will be on dynamic visual images presented with the use of motion, color, and special effects that employ the full power of television to convey important geometric ideas with a minimal use of formulas. The animated sequences will illustrate how tangent sweeps are generated by moving tangent segments, and how the tangent segments can be translated to form tangent clusters. They will also show how many classical curves are naturally derived from their intrinsic geometric and mechanical properties.

Mamikon's methods are also applicable to many-plane curves not mentioned above. In subsequent video-



One of Mamikon's 1959 hand sketches illustrates how the volume of a hyperboloid can be seen as disected into an inscribed cylinder and a "tangential" cone (the tangents to the cylinder).

tapes we plan to find full and partial areas of the ellipse, hyperbola, catenary, logarithm, cardioid, epicycloids, hypocycloids, involutes, evolutes, Archimedean spiral, Bernoulli lemniscate, and sines and cosines. And we can find the volumes of three-dimensional figures such as the ellipsoid, the paraboloid, three types of hyperboloids, the catenoid, the pseudosphere, the torus, and other solids of revolution.

I'll conclude with a small philosophical remark: Newton and Leibniz are generally regarded as the discoverers of integral calculus. Their great contribution was to unify work done by many other pioneers and to relate the process of integration with the process of differentiation. Mamikon's method has some of the same ingredients, because it relates moving tangent segments with the areas of the regions swept out by those tangent segments. So the relation between differentiation and integration is also embedded in Mamikon's method.

Samples of the computer animation of the problems shown in this article can be viewed at http://www.its.caltech.edu/~mamikon/calculus.html
Picture credits: Mamikon Mnatsakanian, Steven Hempel

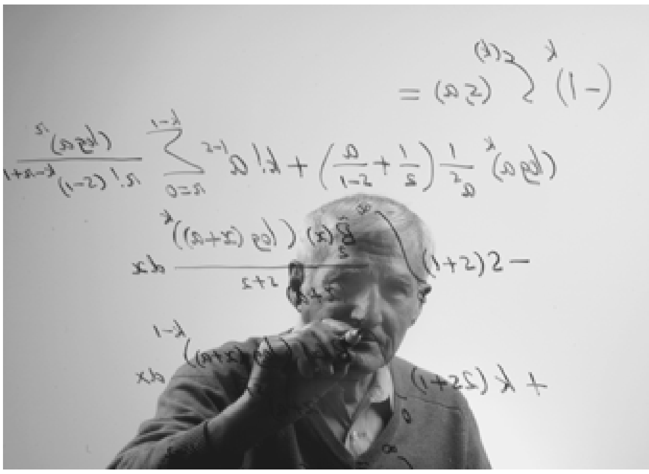
Professor of Mathematics, Emeritus, Tom Apostol [apostol@caltech.edu] joined the Caltech faculty in 1950. On October 4, 2000, a special mathematics colloquium was held in honor of his 50 years at Caltech. On that occasion he delivered the talk that's adapted here. (Mamikon Mnatsakanian was also on hand to show his computer animations.)

Apostol earned his BS in chemical engineering (1944) and MS in mathematics (1946) from the University of Washington. His PhD, with a thesis in analytic number theory, is from UC Berkeley (1948). Before beginning his 50 years at Caltech, he spent a year each at Berkeley and MIT.

Apostol should know everything there is to know about teaching calculus, even though he admits he was surprised by this new approach. For nearly four decades Caltech undergraduates (as well as a couple of generations of mathematics students all over the country) have learned calculus from his two-volume text, often referred to as "Tommy 1" and "Tommy 2."

These and his other textbooks in mathematical analysis and analytic number theory have been translated into Greek, Italian, Spanish, Portuguese, and Farsi.

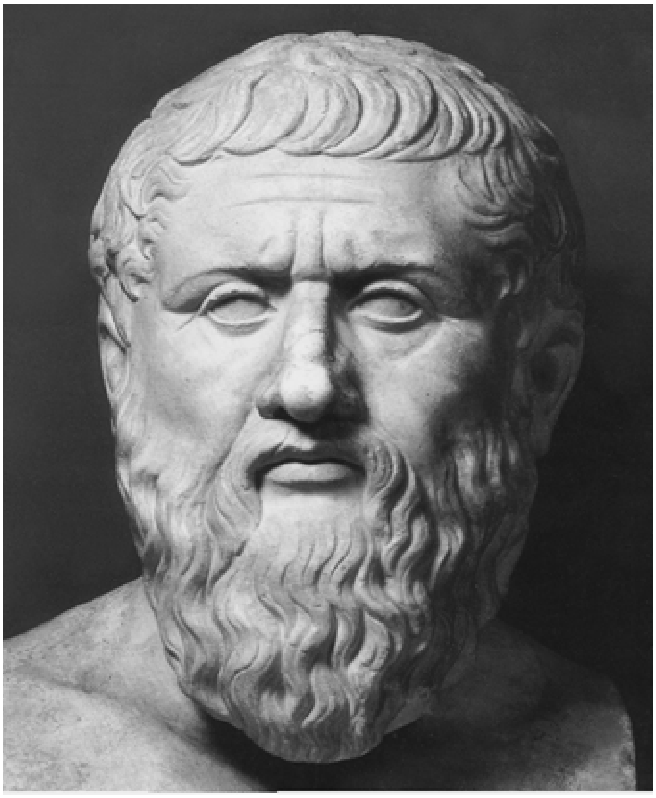
Although known nationally and internationally for his written textbooks, Apostol turned to the visual media in the 1980s as a member of the Caltech team that produced The Mechanical Universe … and Beyond*, a 52-episode telecourse in college physics. And he never looked back. He's currently creator, director, and producer of Project MATHEMATICS!, a series of award-winning, computer-animated videotapes that are used nationwide and abroad as support material in high-school and community-college classrooms.*



This article was awarded a 2nd prize in the article competition run by the EMS-Raising Public Awareness Committee in 2006; compare the article by Robin Wilson in this issue. It had originally appeared in the journal Engineering & Science *at the California Institute of Technology (no. 3, 2000, pp. 22–31). The Newsletter thanks the author and the editor for the permission to republish it. Unfortunately, the original graphic files were no longer available and had to be reconstructed from the printed article. The Newsletter apologizes for the reduced print quality.*

Let Platonism die

E. B. Davies (King's College London, UK)



Over the last few years I have noticed that a number of Fields medallists and other famous mathematicians are being asked by interviewers whether they are Platonists. Many are quite unprepared for this question and try to evade it, or give answers which indicate that they have not thought seriously about it.

Mathematical Platonism comes in many flavours, but two particular elements are usually present. One is the assertion that there exists a mathematical realm outside the confines of space and time in which ideal forms of mathematical entities exist. This should be taken literally – the realm is independent of human society and would exist even if human beings had never evolved. Theorems are statements about the properties of these mathematical entities, so their truth does not depend on whether anyone has a proof or even of whether there could be a proof (pace Gödel). If you believe that theorems are objectively true before they have been proved, but that mathematics is a creation of human beings in much the same way as music, law and chess are, then you are not a Platonist. I do not want to discuss this aspect of Platonism, about which much has been written, [1,3].

The other aspect of Platonism is that it involves a definite claim about the way the human brain functions. Platonists believe that our understanding of mathematics involves a type of perception of the Platonic realm, and that our brains therefore have the capacity to reach beyond the confines of the physical world as currently understood, albeit after a long period of intense concentration. If one does not believe this then the existence of the Platonic realm has literally no significance. This type of claim has more in common with mystical religions than with modern science. This is not surprising, because Platonism grew out of the Pythagorean mystery religion, in which mathematics played a key role.

Although he is a Platonist, Roger Penrose is almost unique in accepting that his beliefs imply that the mathematical brain cannot obey the known laws of physics. His proposals for resolving this problem involve microtubules, and are not generally accepted, [5].

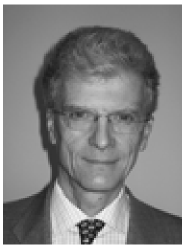
The beliefs of most Platonists are based on gut instincts – strong convictions reinforced by years of immersion in their subject. However, scientifically testable claims are not settled by taking a poll of the opinions of people who have never done any experiments to verify them, even if there is a limited entertainment value observing people reacting to unexpected questions. It seems to have escaped the notice of many Platonists that scientific investigations into the mental processes underlying mathematical understanding are now starting to be carried out. Just as the belief of Kant and many others that Euclidean geometry was the inevitable basis of human thought collapsed, intuitively based claims about how our brains allow us to do mathematics are almost certain to be wrong.

Almost everything that we have learned by scientific experiments about the way our brains operate is not only different from what had previously been thought, but pretty bizarre. One example, related to our geometrical abilities, will have to suffice. Investigation of the brain's processing of vision show that the image that impinges on our retinas is analyzed in a variety of different ways, into edges of various orientations, colours, etc. which are sent to the brain separately. It then constructs a three-dimensional 'image' of what the outside world might be like by combining these fragments with other contextual clues, including the memory of the observer. Many types of optical illusion show that this construction can easily fail to match reality. Whether or not an illusion disappears as soon as one realizes that it is one depends on the depth at which it is generated. It is worth mentioning that the investigation of optical illusions is now a subfield of experimental psychology, [4].

The study of our sense of number is in its infancy, but one of the most interesting discoveries is that reasoning about numbers is not a function of general intelligence, [2]. It depends on the successful integration of a number of different modules, or circuits, whose locations in the brain can be identified by using imaging techniques based on measuring oxygen uptake. Numbers below five are recognized using circuits, common to many other animals, that are different from those brought into play by humans for larger numbers. If these circuits are damaged in a stroke, it is quite possible for the person affected to have perfectly normal reasoning powers in all situations not involving numbers, but to be unable to see the distinction between 5 and 8. Dyscalculia is now a recognised disability, and this type has a purely physiological basis. These studies are proceeding systematically and are beginning to provide a genuine understanding of the basis of our mathematical abilities. They owe nothing to Platonism, whose main function is to contribute a feeling of security in those who are believers. Its other function has been to provide employment for hundreds of philosophers vainly trying to reconcile it with everything we know about the world. It is about time that we recognised that mathematics is not different in type from all our other, equally remarkable, mental skills and ditched the last remnant of this ancient religion.

References

1 Balaguer M.: *Platonism and Anti-Platonism in Mathematics*. Oxford Univ. Press, New York, 1998.
2 Butterworth B.: *The Mathematical Brain*. Macmillan, 1999.
3 Davies E.B.: *Science in the Looking Glass*. Oxford Univ. Press, Oxford, 2003.
4 Hoffman D.D.: *Visual Intelligence*. W W Norton, New York, 1998.
5 Penrose R.: *Shadows of the Mind*. Oxford Univ. Press, Oxford, 1994.



Brian Davies [E.Brian.Davies@kcl.ac.uk] is a professor at King's College London who has specialized in operator theory, particularly heat kernels and spectral theory for Schrödinger-type operators. Over the last ten years he has concentrated on spectral properties of non-self-adjoint operators and matrices. Details of his philosophical publications may be found at http://www.mth.kcl.ac.uk/staff/eb_davies.html. He is President Designate of the London Mathematical Society.

The Oldest Mathematical Chair in Britain

Robin Wilson

The Gresham Professorship of Geometry was founded in 1596 to provide free public lectures in the City of London, predating the mathematical chairs in both Oxford (1619) and Cambridge (1663). Here we outline its 400-year history and describe some of the distinguished people who have held this position. All those before 1740 are well documented in John Ward's Lives of the Professors of Gresham College [1]*, while others, especially during the later 18th and 19th centuries, remain obscure. Further details can be found in the College's informal account* [2].

Gresham Professors of Geometry

1597	Henry Briggs
1620	Peter Turner
1631	John Greaves
1643	Ralph Button
1648	Daniel Whistler
1657	Lawrence Rooke
1662	Isaac Barrow
1664	Arthur Dacres
1665	Robert Hooke
1704	Andrew Tooke
1729	Thomas Tomlinson
1732	George Newland
1749	William Roman
1759	Wilfred Clarke
1765	Samuel Kettleby
1808	Samuel Birch
1848	Robert Edkins
1854	Morgan Cowie
1890	Karl Pearson
1894	Henry Wagstaff
[1939	Lectures in abeyance]
1946	Louis Milne-Thompson
1956	Alan Broadbent
1969	Sir Bryan Thwaites
1972	Clive Kilmister
1988	Sir Christopher Zeeman
1994	Ian Stewart
1998	Sir Roger Penrose
2001	Harold Thimbleby
2004	Robin Wilson

The founding of Gresham College

The Gresham professorships arose from the will of Sir Thomas Gresham. Born in 1519, he was admitted to the Mercers' Company in 1543. Edward VI appointed him Royal Agent in Antwerp, one of the major commercial centres of Europe, where he amassed a vast fortune. Impressed by the Antwerp Exchange, Gresham offered to pay for a similar one in London if the City Corporation would provide the site. This Exchange – the centre of commerce in the City of London – was opened in 1566 and proclaimed *The Royal Exchange* when Queen Elizabeth I visited it around 1570.

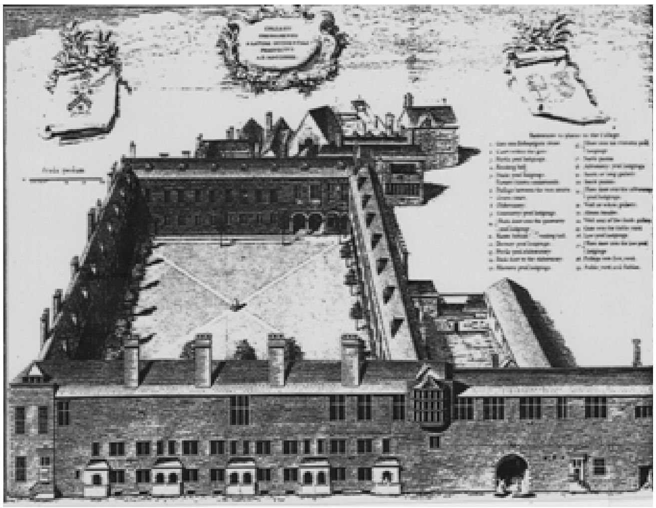
Thomas Gresham

In 1575, Sir Thomas made a will, giving half of the Royal Exchange to the Mayor and citizens of London and the other half to the Mercers' Company. These groups were to provide £50 per year for each of seven professors to give free public lectures in Geometry, Divinity, Astronomy, Music, Law, Physic and Rhetoric, within his dwelling house in Bishopsgate Street; these seven professorships exist to this day, and an eighth one, in Commerce, was added recently.

Sir Thomas Gresham died in 1579, but his wife survived him for a further 17 years. So it was not until 1596 that the Corporation and the Mercers' Company came into possession of Gresham's house, which became known as *Gresham College*. As the *Ballad of Gresham College* later described it:

If to be rich and to be learn'd
Be every Nation's cheifest glory,
How much are English men concern'd,
Gresham to celebrate thy story
Who built th'Exchange t'enrich the Citty
And a Colledge founded for the witty.

From the beginning Gresham College encouraged the practical sciences of navigation, trade, commerce, manufacturing and medicine, rather than the Aristotelian studies still pursued at the ancient universities. The professors were required to be unmarried, and a suite of apartments was provided for each one. It was laid down that the geometry lectures were to be read twice every



The original Gresham College

400 years of Gresham professors: Sir Roger Penrose with Henry Briggs

week, on Thursdays at 8 a.m. (in Latin) and 2 p.m. (in English):

> *The geometrician is to read as followeth, viz. every Trinity term arithmetique, in Michaelmas and Hilary terms theoretical geometry, in Easter term practical geometry.*

Henry Briggs

The first Gresham Professor of Geometry was **Henry Briggs**, who was installed in early 1597 and occupied his College rooms at the far right-hand of the quadrangle. There he worked on navigation and on tables for finding the height of the pole star. By 1610 he was studying eclipses, and five years later was wholly taken up with logarithms, lately discovered by John Napier of Edinburgh who, in Briggs's words:

> *set my Head and Hands a Work with his new and remarkable logarithms. I never saw a Book which pleased me better or made me more wonder.*

Unfortunately, Napier's logarithms were cumbersome – in particular, log 1 was not equal to 0, and log ab was equal to log a + log b – log 1. As Briggs continued:

> *I myself, when expounding this doctrine publicly in London to my auditors in Gresham College, remarked that it would be much more convenient that 0 should be kept for the logarithm of the whole sine.*

Briggs made two extended visits to Napier in Edinburgh to discuss such matters. The result of these deliberations was that, while still at Gresham College, he devised his new base 10 logarithms, with log 1 = 0, in which to multiply two numbers together one simply adds their logarithms. His *Arithmetica Logarithmica* of 1624, completed after he had left Gresham College to become the first Savilian Professor of Geometry in Oxford, contains his extensive hand-calculations of the logarithms of 30,000 numbers to 14 decimal places, which proved to be an invaluable aid for mariners and navigators.

Gresham College and the Royal Society

In 1657, Christopher Wren was appointed Gresham Professor of Astronomy, while Lawrence Rooke, the previous holder of that post, became Professor of Geometry. In his inaugural address, Wren praised Henry Briggs, describing the useful invention of logarithms as 'wholly a British art which at Gresham College received great additions'.

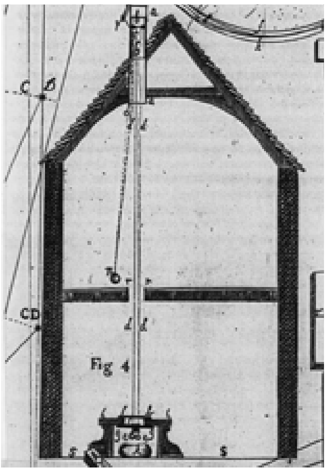
Rooke had earlier spent some years at Wadham College, Oxford, assisting Robert Boyle in his 'chymical operations' and attending meetings of 'learned and curious gentlemen' in the rooms of Dr Wilkins, Warden of Wadham. When Rooke moved to Gresham College, many of his Oxford associates – Robert Boyle, Robert Hooke, John Wallis and others – visited London to attend his lectures and discourse afterwards in his rooms. On 28 November 1660, following a Gresham lecture by Christopher Wren, the Oxford group proposed the formation of a society. This new society, later the *Royal Society*, met weekly in Rooke's rooms at Gresham College.

In 1662, Rooke died, and was succeeded by the Cambridge mathematician **Isaac Barrow**. Barrow had been one of the earliest to investigate what is now known as the fundamental theorem of calculus. He held the Gresham Geometry Chair for two years, before returning to Cambridge as the first Lucasian Professor of Mathematics, the post later held by Isaac Newton, and currently by Stephen Hawking.

Robert Hooke

The ninth Gresham professor was a remarkable person, best remembered for his work with Boyle on the air pump, for his invention of the microscope, as described in his *Micrographia* of 1665, and for 'Hooke's law' on the extension of springs. As Curator of Experiments for the Royal Society, he was required to design and present experiments to the public on a regular basis.

In his diary, Samuel Pepys wrote of 'Mr Hooke who is the most and promises the least of any man in the world that I ever saw'; Hooke had 'a meagre aspect' and there were bitter disputes with Isaac Newton and others. But he seems to have carried out his Gresham responsibilities conscientiously for over thirty-five years, making the College an important centre for scientific research and debate. The Royal Society appreciated 'the conveniency of making their experiments in the place where their curator dwells and the apparatus is at hand', and in 1674 the Gresham authorities gave Hooke £40 to erect a turret from which he could make astronomical observations.



Robert Hooke's turret at Gresham College

Shortly after Hooke's appointment, most of the City of London was destroyed in the Great Fire of 1666, including Gresham's Royal Exchange. The College narrowly escaped and became a temporary exchange, with the Lord Mayor living in the Divinity professor's lodgings, the Mercers' Company displacing the Law professor, and so on.

It was not a good time for the College. Several professors (though not Hooke) regularly failed to give their lectures, or presented them badly. The citizens of London lost interest in the lectures, which were frequently cancelled because no-one turned up. Matters came to a head in 1699. Rebuilding the Royal Exchange had been costly, and proposals were made to save money by rebuilding the College on a smaller scale. Parliament was petitioned for approval, with only Robert Hooke, now frail and the only professor resident in the College, holding out against the plans. The bill failed, but further attempts were made after Hooke's death in 1703. Isaac Newton, who became President of the Royal Society in that year, also joined in the fray, petitioning Queen Anne for land on which the Society could build. Around 1710 the Royal Society moved to Crane Court and the Gresham residence survived for a further 60 years before being demolished.

The 18th and 19th centuries

The next two centuries were largely a time of inaction when, in the words of W. W. Rouse Ball, 'an appointment at Gresham College ceases to be a mark of scientific distinction'. Few Gresham Professors from this period are now remembered, and it is remarkable that the College survived through this difficult time.

A constant problem for the Gresham authorities was the letting of rooms by the professors in order to increase their income – even the righteous Hooke had let out his stable. The salary of one Geometry Professor, **Andrew Tooke**, was withheld when he let out his lodgings for £20 per year and his coach house and stable for £7 per year; once he removed his lodgers, his salary was restored. Another Geometry professor, **George Newland**, had a different problem, arising from continued complaints by the Law professor, Mr Mace:

The Gentlemen visited the Stables belonging to Dr Newland under part of Mr Maces Appartment and are of the Opinion that the Stench arising from the Horse dung is a Nusance to those who inhabit the said Appartment.

In 1768, the Gresham College Bill finally passed through Parliament, and the College, Sir Thomas Gresham's house, was pulled down. The lectures were transferred to the Royal Exchange, where they were presented for the next 70 years.

An 18th-century view of Gresham College, shortly before its demolition

The years at the Royal Exchange proved to be another low period in the history of the Gresham lectures. Attendances continued to decline, and several of the professors were less than conscientious about their lectures, while also proving to be generally uncooperative, unwilling to change their ways and frequently causing difficulties for the Gresham committee who were trying to improve the situation.

On 10 January 1838, the Second Royal Exchange was destroyed by fire, with the total destruction of the lecture room. It was high time that a new Gresham College was built, and this opened on 2 November 1843. Built at a cost of £7000 in the enriched Roman style, with its entrance on Basinghall Street in the City of London, its lecture room was capable of holding 500 people.

Karl Pearson

Although most Geometry professors from the 19th century are largely forgotten, the 19th professor was one of the most distinguished: the applied mathematician, later statistician and biologist, **Karl Pearson**. Third Wrangler from Cambridge, he studied in Germany before returning to London, where he was called to the Inner Temple. In 1884 he abandoned law, becoming professor of applied mathematics and mechanics at University College, London, where he spent the rest of his working life. Later, he co-founded the journal *Biometrika* and was its principal editor for 36 years.

We are fortunate in knowing much about his Gresham lectures. A highly effective teacher, his lectures were beautifully presented with graphics, models and slides. From his first highly successful series of Gresham lectures, on applied mathematics, grew his popular book *The Grammar of Science* (1892) which was influential for many years.

Pearson was greatly influenced by Francis Galton's 1889 book *Natural Inheritance* and he soon turned to statistics. His second series of Gresham lectures, on the *Geometry of statistics*, was a comprehensive treatment of the graphical presentation of statistical data from the biological, physical and social sciences. His third series, *Laws of chance*, discussed probability theory and correlation, and his Gresham lecture on 31 January 1893 introduced the term 'standard deviation' to the world for the first time; the word 'histogram' also made its first appearance at a Gresham lecture.

Perason's final series was on *Normal curves, skew curves and compound curves*. With his lectures at Gresham College, the Royal Society and UCL, he firmly established statistics as a discipline in its own right – especially in its applications to problems of heredity and evolution.

The 20th century

In 1894 Pearson resigned the Gresham Chair due to ill health, and was replaced by **Henry Wagstaff**, who held the post for 45 years until the outbreak of the Second World War. He was later granted the title of Emeritus Professor of Gresham College in view of his long service, over 500 lectures.

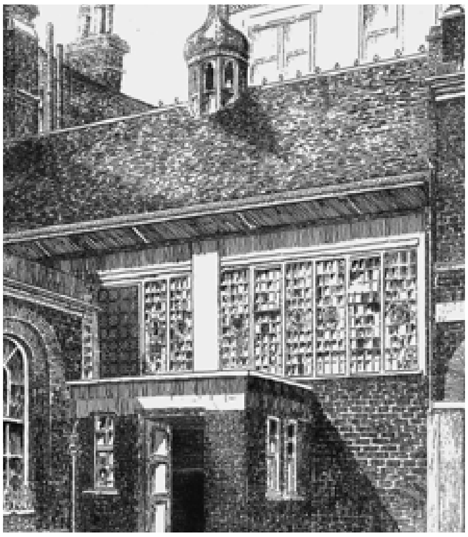
In December 1939, shortly after the outbreak of the Second World War, the lectures were suspended, resuming in Autumn 1946. The new professor was the applied mathematician **L. M. Milne-Thompson**, who was well known for his books on theoretical applied mathematics, and for his *Standard 4-figure Mathematical Tables*. At Gresham College he lectured for ten years on such topics as the geometry of configurations, and aesthetic values and their measurement. His successor, **T. A. A. (Alan) Broadbent**, had been President of the Mathematical Association and editor of the Mathematical Gazette for 25 years. He was Gresham Professor for 13 years, giving around 150 lectures on a wide range of topics.

Broadbent's successor, **Sir Bryan Thwaites**, was the Founding Director of the School Mathematics Project (SMP), and his lectures on 'Ways ahead in school mathematics' attracted audiences of over 100, mainly from the general public. Thwaites was a great enthusiast for the use of computers in applied mathematics, many years before his time, and computers featured in several of his Gresham lectures.

The next Gresham Professor was the applied mathematician and historian of mathematics **Clive Kilmister**, who held the position for 16 years. A bold experiment to link Gresham College with the new City University in London was tried, with the aim of attracting audiences from both the University and the general public. This arrangement eventually broke down, and Kilmister found himself lecturing in an unsuitable cinema in the Barbican and, more pleasantly, at the new City of London School buildings by the river. His successor, **Sir Christopher Zeeman**, also lectured at the School on a number of occasions during his six years with the College, and his lectures regularly attracted hundreds of young people.

Barnard's Inn Hall

Finally, in 1991, everything changed yet again to what is essentially the current arrangement. Gresham College moved to Barnard's Inn Hall, for 60 years the home of the Mercers' School, and since then most of the geometry lectures have been given in its fine hall.



Barnard's Inn Hall

The professors are now elected for a fixed term, usually of three or four years, and give six lectures per year. Recent Geometry professors have included well-known popularisers of mathematics: Sir Christopher Zeeman and **Ian Stewart** presented the Royal Institution Christmas series of lectures, while **Sir Roger Penrose** has written several best-selling books. His successor, **Harold Thimbleby**, focused on the role of computers in the modern world. As the current holder, my lectures concentrate mainly on topics in pure mathematics and the history of mathematics.

Audiences have recently increased, and all geometry lectures now have to be given twice in order to accommodate everyone. Each lecture can be viewed on the web [*www.gresham.ac.uk*] and transcripts can be downloaded. The number of 'hits' on the Gresham College website has increased from about 200 per month two years ago to over 20,000 per month, and many thousands of Gresham College lectures have been downloaded. It is probable that the state of the Gresham College Professorship of Geometry has never been as strong as it is has been in recent years.

References

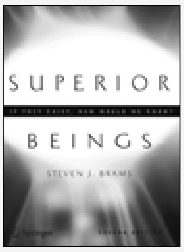
1. John Ward, *Lives of the Professors of Gresham College*, London, 1740.
2. R. Chartres and D. Vermont, A Brief History of *Gresham College, 1597–1997*, Gresham College, 1997.

Robin Wilson is Professor of Pure Mathematics at the Open University, UK, and a fellow of Keble College, Oxford University. He is the current holder of the Gresham Chair of Geometry. On the photo he is dressed as Leonhard Euler.

Springer
the language of science

springer.com

Applied Mathematics in Focus



Superior Beings. If They Exist, How Would We Know?

Game-Theoretic Implications of Omnipotence, Omniscience, Immortality, and Incomprehensibility

S. J. Brams, New York University, New York, NY, USA

Reviews from the first edition ► *Superior Beings is an extraordinary book... He [Brams] uses strikingly simple models and generally transparent logic to make some surprising inferences about superiority. His inquiry is carried out with great inventiveness and care, and his book is highly recommended to those interested in religion, philosophy, and the contribution of logical analysis.*
► **D. Marc Kilgur, American Scientist (1984)**

2nd ed. 2007. XXII, 202 p. 32 illus. Softcover
ISBN 978-0-387-48065-7 ► **€ 24,95 | £19.00**

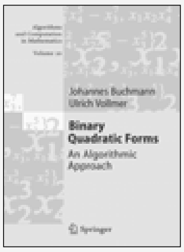
Numerical Simulation in Molecular Dynamics

Numerics, Algorithms, Parallelization, Applications

M. Griebel, University of Bonn, Germany;
S. Knapek, TWS Partners, Munich, Germany;
G. Zumbusch, University of Jena, Germany

Particle models play an important role in many applications in physics, chemistry and biology. They can be studied on the computer with the help of molecular dynamics simulations. This book presents in detail both the necessary numerical methods and techniques, including linked-cell method, SPME-method, tree codes, multipol technique. It also details the necessary theoretical background and foundations. The book illustrates the aspects modeling, discretization, algorithms and their parallel implementation with MPI on computer systems with distributed memory. In addition, it offers detailed explanations to the different steps of numerical simulation and provides code examples.

2007. XII, 470 p. 180 illus. (Texts in Computational Science and Engineering, Volume 5) Hardcover
ISBN 978-3-540-68094-9 ► **€ 39,95 | £30.50**



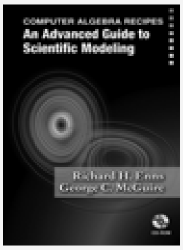
Binary Quadratic Forms

An Algorithmic Approach

J. Buchmann, **U. Vollmer**, Technical University, Darmstadt, Germany

The book deals with algorithmic problems related to binary quadratic forms. It uniquely focuses on the algorithmic aspects of the theory. The book introduces the reader to important areas of number theory such as diophantine equations, reduction theory of quadratic forms, geometry of numbers and algebraic number theory.
The book explains applications to cryptography and requires only basic mathematical knowledge. The author is a world leader in number theory.

2007. XIV, 318 p. 17 illus. (Algorithms and Computation in Mathematics, Volume 20) Hardcover
ISBN 978-3-540-46367-2 ► **€ 59,95 | £46.00**



Computer Algebra Recipes

An Advanced Guide to Scientific Modeling

R. H. Enns, Simon Fraser University, Burnaby, BC, Canada; **G. C. McGuire**, University College of the Fraser Valley, Abbotsford, BC, Canada

This book presents a large number of computer algebra worksheets or "recipes" that have been designed using MAPLE to provide tools for problem solving and to stimulate critical thinking. No prior knowledge of MAPLE is necessary. All relevant commands are introduced on a need-to-know basis and are indexed for easy reference. Each recipe features a scientific model or method and an interesting or amusing story designed to both entertain and enhance concept comprehension and retention. All recipes are included on the CD-ROM enclosed with the book.

2007. X, 374 p. With CD-ROM. Softcover
ISBN 978-0-387-25768-6 ► **€ 46,95 | £36.00**

Spectral Methods

Evolution to Complex Geometries and Applications to Fluid Dynamics

C. G. Canuto, Politecnico di Torino, Italy;
M. Y. Hussaini, Florida State University, Tallahassee, FL, USA; **A. M. Quarteroni**, EPFL, Lausanne, Switzerland and Politecnico di Milano, Italy;
T. A. Zang, NASA Langley Research Center, Hampton, VA, USA

Following up the seminal *Spectral Methods in Fluid Dynamics*, this book contains an extensive survey of the essential algorithmic and theoretical aspects of spectral methods for complex geometries. These types of spectral methods were only just emerging at the time the earlier book was published. The discussion of spectral algorithms for linear and nonlinear fluid dynamics stability analyses is greatly expanded. The chapter on spectral algorithms for incompressible flow focuses on algorithms that have proven most useful in practice, has much greater coverage of algorithms for two or more non-periodic directions, and shows how to treat outflow boundaries. Material on spectral methods for compressible flow emphasizes boundary conditions for hyperbolic systems, algorithms for simulation of homogeneous turbulence, and improved methods for shock fitting.

2007. Approx. 630 p. 183 illus. (Scientific Computation) Hardcover
ISBN 978-3-540-30727-3 ► **€ 79,95 | £61.50**

Geometry and Topology in Hamiltonian Dynamics and Statistical Mechanics

M. Pettini, Osservat. Astrofisico Arcetri, Firenze, Italy

This book covers a new explanation of the origin of Hamiltonian chaos and its quantitative characterization. The author focuses on two main areas: Riemannian formulation of Hamiltonian dynamics, providing an original viewpoint about the relationship between geodesic instability and curvature properties of the mechanical manifolds; and a topological theory of thermodynamic phase transitions, relating topology changes of microscopic configuration space with the generation of singularities of thermodynamic observables. The book contains numerous illustrations throughout and it will interest both mathematicians and physicists.

2007. Approx. 331 p. (Interdisciplinary Applied Mathematics, Volume 33) Hardcover
ISBN 978-0-387-30892-0 ► **€ 59,95 | £46.00**

Easy Ways to Order for the Americas ► **Write:** Springer Order Department, PO Box 2485, Secaucus, NJ 07096-2485, USA ► **Call: (toll free)** 1-800-SPRINGER ► **Fax:** +1(201)348-4505 ► **Email:** orders-ny@springer.com or **for outside the Americas** ► **Write:** Springer Distribution Center GmbH, Haberstrasse 7, 69126 Heidelberg, Germany ► **Call:** +49 (0) 6221-345-4301 ► **Fax :** +49 (0) 6221-345-4229 ► **Email:** SDC-bookorder@springer.com
► Prices are subject to change without notice. All prices are net prices.

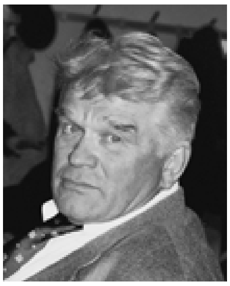
013109x

Interview with Professor L.D. Faddeev

conducted by M. Semenov-Tian-Shansky (St. Petersburg, Russia)

Introduction

Professor Ludwig Faddeev is widely known for his contributions to mathematics and theoretical physics, which have reshaped modern mathematical physics. His work on quantum field theory (QFT) has prepared the ground for the gauge field theory revolution of the 1970s. His contributions to the many body problem in quantum mechanics and to the inverse scattering problem are among the deepest achievements in this area. His pioneering work on the quantum inverse scattering method (QISM) started a wide new field of research, ranging from solvable models in quantum field theory to quantum groups.



Professor Faddeev was born in 1934 in Leningrad (now St. Petersburg) into a family of prominent Russian mathematicians. His father, Professor D.K. Faddeev, was one of the best Russian algebraists, particularly remembered for his contributions to homological algebra, Galois theory and representation theory. His university teaching has shaped several generations of Russian algebraists. His mother, Professor V.N. Faddeeva, was among the pioneers of computational methods and for many years headed the laboratory of computational methods of the Steklov Institute in Leningrad.

Himself a physicist by education, Professor Faddeev has been associated with the Steklov Mathematical Institute for more than forty years. From 1976 to 2000 he served as director of the Leningrad (later St. Petersburg) branch of the Institute and headed the Laboratory of Mathematical Problems in Physics in which he united a score of his pupils and colleagues. Although it is now dispersed over several countries and continents, the Faddeev school is still highly united and plays a prominent role in modern mathematical physics.

His work in mathematics and physics has won him wide international recognition. He was awarded the D. Heyneman Prize of the American Physical Society (1975), the Prize of the Union of Insurance Societies (Paris, 1988), the Karpinski Prize (1995), the Dirac Medal (1995), the Max Planck Medal (1996), the Euler Medal (2002) and the Henri Poincaré prize (2006). He was also awarded the USSR State Prize (1971), the Order of the Red Banner of Labour (1981), the Order of Lenin (1987), the Order of Friendship of Peoples (1994), the Russian State Prize in Science and Technology (1995), the Order of Merit of the 4th and 3rd degree (1999, 2005) and the Russian State Prize (2005). He has been elected an honorary member of the American Academy of Science and Art in Boston (1979), the Academy of Science and Literature of Finland (1988), the Royal Academy of Sweden (1989), the National Academy of the USA (1990) and the French Academy of Sciences (2000). Since 1976, he has been a full member of the Soviet (now Russian) Academy of Sciences. From 1986 to 1990 he served as President of the International Mathematical Union.

The Henri Poincaré prize

The interview with Ludwig Faddeev mentions the many prizes he has been awarded over the years. Here we say a little about one of them: the Henri Poincaré prize, which is sponsored by the *Daniel Iagolnitzer Foundation*. There is no need to introduce the man whom it was named after to readers of this newsletter.

The prize was founded ten years ago, following a proposal by the Iagolnitzer Foundation, with the aim of recognising outstanding contributions in mathematical physics and contributions that lay the groundwork for novel developments in the field. It also serves to recognise and support young people who exhibit exceptional promise. The prize is awarded every three years at the International Mathematical Physics Congress and in each case is awarded to three individuals. The laureates prior to 2006 were *Rudolf Haag, Maxim Kontsevich and Arthur Wightman* in 1997, *Joel Lebowitz, Walter Thirring and Horng-Tzer Yau* in 2000, and *Huzihiro Araki*, *Elliott H. Lieb* and *Oded Schramm* in 2003.

The 2006 prize was awarded to *Ludvig D. Faddeev*, citing his many deep and important contributions to the theory of quantum fields, the quantization of non-commutative gauge theories, scattering in quantum mechanics and quantum field theory, and the theory of integrable systems. The other two recipients at last year's IAMP congress at Rio de Janeiro were *David Ruelle* and *Edward Witten.* Laudatia to the laureates and more information about the prize can be found at http://www.iamp.org/poincare/.

Interview

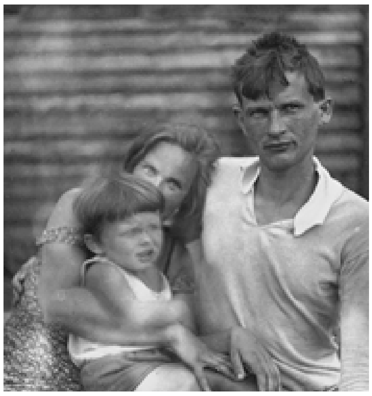
Both your father and mother were prominent mathematicians but you have chosen the Physics Department of the University.

Well, it was only natural since my father was at the time the Dean of the Mathematics Department and I wanted to make my own way. I believe that in general a reasonable share of stubbornness and non-conformism proved to be of much importance in my formation as a scholar. As a schoolboy, I did not have any particular interest in mathematics. I was a passionate reader. For instance, I learned much of English medieval history from Shakespeare's chronicles. Of course, the general intellectual atmosphere of my family had a great influence upon me. One precious thing that I owe to it is my love for music. But I cannot say that it gave me a particularly professional orientation. I remember at one point, after we had evacuated to Kazan, my father was greatly excited with his latest results. This was the time when he made important discoveries in homological algebra. I asked him how many people in the world would be able to understand his results and he replied that there might be five or six of them. I thought that this would not suit me.

You entered the University in the early 50's. This was still a rather difficult time in our country, was not it?
Yes, I should say that I had a narrow escape in 1952 when the university officials heard that I was very fond of Hamsun's novels. I was invited to the local Comsomol (Communist Youth) Committee and the secretary said to me in a grave voice, "Look, they say you are reading the writings of a certain Knuth?" Fortunately for me, Stalin died a few months later and this story did not have any sequel. But my overall impression in university was that of tremendous freedom, which contrasted to secondary school. I remember that one of the things that struck me in my first year at university was the elementary course in analytic geometry, with simple routine calculations replacing the rather refined reasoning of school geometry. I should say that ever since, I have preferred simple calculations to tricky arguments!

Your main teacher at university was Professor Ladyzhenskaya?
She was in charge of our education at the Chair of Mathematical Physics. This was, in fact, the first time ever that this Chair had enrolled students on its own account. Before that the Chair of Mathematics at the Physics Department, created by academician Smirnov in the 1930's, was mainly considered an auxiliary one. His idea, supported by academician Fock, was to dispense a special mathematical education for physicists, with emphasis on the mathematical background of quantum theory. Now, for the first time, it was given independent status and was allowed to have its own students, give special courses and supervise diploma work. Thus I was really in the very first group of students who in the following year, 1956, defended their university thesis in mathematical physics. O. A. Ladyzhenskaya was reading us a large variety of courses, starting with a basic complex variables course, which was followed by partial differential equations and operator theory and by special seminars.

And what about academician Fock? Did he lecture at the physics department at the time?
He gave us just about ten lectures on general relativity. But he has always been very attentive to me personally. He was not lecturing on quantum mechanics anymore but through my mother he passed me his personal copy of his lectures on quantum mechanics, a great bibliographical rarity at the time. Much later when I was defending my second thesis at the Steklov Institute in Moscow, he appeared at the meeting quite unexpectedly. This was a queer scene, as a matter of fact. The meeting of the Steklov Scientific Council was presided over by academician Vinogradov, seated deep in his armchair, his back to the blackboard, supervising the entire academic Areopagus placed in the back benches. I had already started my talk when the door went open and academician Fock appeared. He placed himself in the first bench in front of Vinogradov and after a while asked him loudly, in his characteristic high voice, "Ivan Matveevich, are you not interested in what Ludwig is telling? You cannot see the blackboard this way, can you?"



Ludvig Faddeev as a child with his parents

Going back to your university years, I remember you saying you had a very early interest in quantum field theory?
My first textbook in QFT was K. Friedrichs' book, "Mathematical aspects of the quantum theory of fields", which we started to study on the advice of Ladyzhenskaya in 1954/55. I was the main speaker in the seminar, which started invariably with O. A.'s question, "First of all, Ludwig, please do remind us of the definition of annihilation operators." This book has shaped my interest in mathematical problems of QFT and also encouraged a kind of aversion to the computation of Feynman diagrams that was so very popular among my fellows from the Chair of Theoretical Physics. Making an independent advance in QFT was of course too difficult a bid at that stage and my first research work was on a much easier subject: the potential scattering and spectral decomposition for the Schrödinger operators with continuous spectrum. As I was working on the subject, with the aim of combining the ideas of Friedrichs with concrete methods borrowed from the book of Levitan on singular Sturm–Liouville operators, an important paper of Povzner on the continuous spectrum expansions was published and it remained for me only to refine and to generalize his work. In the course of this I wrote my first university thesis.

Another subject that you were deeply involved in starting in the 1950's was quantum inverse scattering.
A comprehensive study of the quantum inverse problem was part of my official curriculum as a research student. Professor Ladyzhenskaya remained my scientific supervisor. When it became known that I had prepared an exhaustive exposition of the inverse scattering problem for the radial Schrödinger operator, I was invited by N. N. Bogolybov to give a plenary talk on the subject at the inaugural meeting of the Laboratory of Theoretical

Physics in Dubna, in the presence of Gelfand, Levitan, Krein, Marchenko, and other senior figures. This was a rather exceptional honour for me at the time. A written version of this talk was published the next year in Uspekhi. Simultaneously, I wrote a research paper that gave a complete solution of the inverse problem for the Schrödinger operator on the line. Much later this paper became important once again as it contained all the background of the future inverse scattering method in the theory of integrable systems.

Your main technical achievement at this time is related to multi-particle scattering.
I believed that it was important to resolve a really difficult technical problem before launching myself into the insecure waters of QFT. One such problem was the three-dimensional inverse scattering problem (without any a priory assumption of the symmetry of the potential). This problem proved to be very difficult and I only managed to solve it a few years later. And of course the quantum three-body problem was a real challenge too. The experience gained in the work on the so-called Friedrichs model was of great importance for me in this venture. Some key ideas also came from the study of a QFT model that was widely discussed at the time, the so-called Thirring model.

Later on, your work on the quantum three-body problem triggered tremendous activity.
Well, that is correct. Some of my pupils were continuing in this direction for another decade or more. As for me, I decided that it was really time to attack QFT. You know, I always believe that when you feel you are in a position to start writing serial papers, you should better change the subject…

Yes, I know it only too well. Unfortunately, it's a maxim that is rather difficult to follow. But prior to your 1967 paper on Yang–Mills theory there were also a couple of papers on automorphic functions and Selberg's theory.
My first paper on automorphic functions was written on Gelfand's command. By that time he was working on the last volume of his 'Generalized Functions' and wanted to include a special chapter on Selberg theory. He expected that the methods of scattering theory would fit in with the setting of automorphic functions and gave me just two weeks to settle the problem. This time schedule was of course rather tough but I managed to complete the task. However, Gelfand found the proof was too long to be included in his book and instead proposed for me to prepare a separate memoir, which awaited publication for another two years. A couple of years later, together with my students, A. Venkov and V. Kalinin, I gave a complete non-arithmetic proof of the Selberg trace formula. Another, very romantic, idea was to reformulate the Riemann hypothesis in terms of automorphic scattering. This was our paper with B. Pavlov written a few years later, based on Lax–Phillips theory. Unfortunately, this approach does not seem to bring us any closer to the proof of the Riemann hypothesis but it was a very interesting venture. A. Venkov has continued working in automorphic harmonic analysis ever since but he gradually returned to arithmetic methods.

I. M. Gelfand was in the jury for your second thesis. You were also rather closely associated with his famous seminar at Moscow University.
As far as I remember, I gave my first talk at Gelfand's seminar in the spring of 1958. I had been well warned about the dangers awaiting me. Gelfand would often stop the speaker and continue the report in his place or make rather acute remarks on the speaker's mistakes. I was reporting on the rather old paper of Friedrichs on perturbation theory of continuous spectrum and on the definition of the S-matrix, with my own additions, and since I was very well prepared professionally Gelfand was not able to shake me. Only V. B. Lidsky came under fire because he had once said that Friedrichs' work was not interesting.

In Gelfand's seminar I made acquaintance with F. A. Berezin and we became close scientific friends for a long time. Together with Berezin, as well as Victor Maslov, whom I met at the 1958 Odessa conference, and Bob (Robert) Minlos, we formed a small company of young experts in quantum mathematical physics. I believe our contacts were of much importance for the four of us.

Coming back to your 1967 work on Yang–Mills theory…
My starting point was not Yang–Mills theory! I did not know much on it at the time, as a matter of fact. Of course, the real thing I was concerned with was quantum gravity. At that time, many theorists were studying oversimplified models, like $\lambda\varphi^4$ as part of the so called "axiomatic approach", which was designed to overcome the difficulties of the conventional theory. But it was always intuitively clear to me that a truly good theory, one that has the chance to "exist", should have some geometric motivation and beauty. One important hint was provided by a 1963 paper of Feynman, who was also concerned with quantum gravity. Feynman noticed that the diagram expansion in general relativity is inconsistent and requires a correction to maintain unitarity. He also noticed that a similar phenomenon occurs in Yang–Mills theory, which he brought into play as a useful toy model, at the advice of M. Gell-Mann. Almost simultaneously, I bought a Russian translation of A. Lichnerowicz's book, *Théorie globale des connexions et des groupes d'holonomie*. A similarity with formulae coming from physics was striking. Soon I realized that Yang-Mills theory was as good a theory geometrically as general relativity. The book of Lichnerowicz was my first textbook in modern differential geometry. This gave me motivation to study the Yang–Mills case on its own account. Its tremendous importance in the theory of weak and strong interactions was realized only a few years later.

Doing Lagrangian QFT in this country in the 1960's was not an easy deal.
It was even worse than that! Ever since the discovery of the so-called "zero charge paradox" in quantum electrodynamics in the 1950's Landau came to the conclusion that quantum field theory is inconsistent and that the

Hamiltonian method should be considered as completely dead and may now be buried ("with all the honours it deserves"). This was the verdict he made in his last published paper, "Fundamental Problems", written shortly before the tragic car accident that put an end to his scientific career. Landau's pupils considered this maxim as their teacher's testament. So when, together with my younger colleague, V. N. Popov, we prepared a paper on the quantization of Yang–Mills theory, its complete text could neither be published in any of the Soviet physics journals nor abroad (for such a publication, one needed a positive conclusion of the Nuclear Physics Division of the Academy of Sciences). Finally, the full text was published only as a preprint of the Kiev Institute of Theoretical Physics, with hand-written formulas and a very limited circulation. We were able to publish only a short announcement in "Physics Letters". The complete version was translated into English by Fermilab only in 1973 when it finally received a wide circulation.

Victor Nikolaevich was one of the very rare experts in functional integration methods at the time.

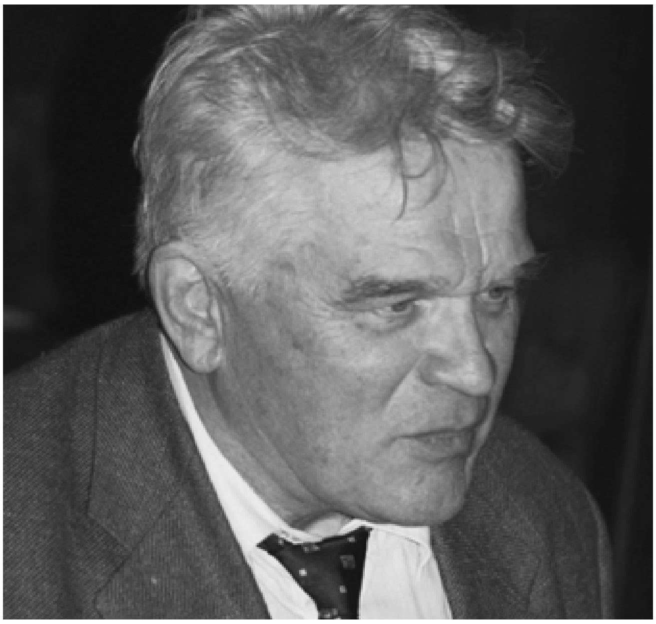
Yes, it really was a rarity in those days. Curiously enough, R. Feynman, who was at the origin of the functional integration method back in the 1940s, has never ever used it in problems of QFT, although it is certainly the most straightforward way to deduce the Feynman diagrams expansion. In Yang–Mills theory, it also allows you to resolve the problem of unitarity raised by Feynman in a very concise form. In a way, we managed to outplay Feynman in his own field.

An exposition of your new method opened the very first issue of "Theoretical and Mathematical Physics" in 1969, which I remember to be the favourite reading of young theorists (including myself) at that time.

The creation of the journal was of course very much in the spirit of the time; the necessity to establish much closer ties between fundamental physics and mathematics was really pressing. My 1969 article, which treated the quantization of Yang–Mills field via the Hamiltonian functional integral, emerged from my attempt to understand more deeply the geometric aspects of our results (derived at first by a kind of trick, the so called Faddeev–Popov trick). This brought me to the study of Dirac formalism for constrained Hamiltonian systems and of symplectic reduction (on the functional integral level). Working on this problem, I had a very fruitful interaction with V. Arnold. This gave me a big boost in my study of differential geometry. In my turn, I tried to explain to him (probably less successfully) the meaning of quantization.

Simultaneously you were also continuing your work on the inverse scattering problem.

The 1960s were exceptionally productive years. I still regard my work on three-dimensional inverse scattering as probably my best analytic result, although, for various reasons, it is much less known than many others. The key point was to tackle the problem of over-determinacy of the scattering data. The breakthrough came in 1966 when I managed to find a substitute for the "Volterra Green's functions" of the one-dimensional Sturm–Liouville equations that could be applied in the multi-dimensional setting. It took several years until all the technical details were filled in. At first I published just a short note, as I was still fully in the Yang–Mills business, and the complete exposition had to wait until 1976.



But before that there were many other exciting things to happen.

Well, that's true. At the very beginning of 1971 I went to Novosibirsk to attend an international conference on the inverse scattering problem, where I was going to report on my results on the three-dimensional inverse problem. It is there that I heard for the first time (from the talk of A. B. Shabat) about the exciting new development in the theory of non-linear PDEs. The one-dimensional inverse scattering problem has become a magic tool to solve the KdV and the non-linear Schrödinger equations. Formulae from my old PhD thesis on the inverse problem for a one-dimensional Schrödinger operator on the line were used in an entirely new context. This was sort of a bolt from the blue. During the conference we discussed the new method with V. Zakharov and soon came to its new interpretation in the spirit of the Liouville theorem in the theory of integrable Hamiltonian systems. Our joint paper, published in December 1971, started a new period in my scientific life.

By that time you were already heading a research group at the Steklov Institute in Leningrad.

Already in the 1960s I was lecturing at the Leningrad university (both in its Mathematics and Physics Departments) and quite naturally my seminar at the Steklov Institute became a point of attraction for many brilliant young students. Gradually, this handful of youngsters became a true research group I am really proud of. I should say that the new research subject, the classical inverse scattering method, which was launched in the 1970's, was perfectly adapted for a collective effort. In the university all my students had already received a very solid background in scattering theory, so now they were completely ready to join the race.

I remember that when you introduced our research group to Peter Lax during his visit in 1976 you said you reserved for yourself the role of a playing coach.

Well, you certainly agree with me that it was a really good time and a truly creative atmosphere, which prevailed in our weekly seminar and during the non-stop informal discussions that followed.

The point of view on the classical inverse scattering method that you advocated at the time was probably different from that in other research groups we competed with.

From the very beginning I was heading towards the possible applications in QFT. Of course, the KdV equation is a rather silly system to be quantized. But very quickly, together with my student Leon Takhtajan we came upon a truly exciting example: the Sine Gordon equation. Its solitons and breathers have a clear interpretation of new "relativistic particles", which emerge as kind of "collective excitations" of the original field. What's more, when the coupling constant in the original Lagrangian is small, the new particles appear to be strongly interacting, as the coupling constant passes to the denominator. When this mechanism was discovered I was of course excited and we wrote a special notice for Physics Letters. Curiously enough, this letter was lost somewhere on its way to the journal (I had passed it to R. Haag during my visit to Hamburg in 1972) so it has never been published. In the mid 70s we started a systematic work on the quantization problem for integrable models, mainly for the Sine–Gordon and for the non-linear Schrödinger equation. The first step was the study of the semi-classical expansion and of perturbation theory, which confirmed, despite the heavy opposition of the conservatives from the old Landau school, that both integrability and the non-trivial particle content of the model survive quantization. The contribution of I. Arefyeva and V. Korepin was particularly important at this stage.

Already at that time you were convinced that the role of solitons in quantum physics goes beyond the two-dimensional models.

Solitons gave the first example where the old paradigm of QFT "one particle – one field" had been broken. Of course I felt it would be great to make a similar mechanism work in realistic space-time dimension. The idea to associate stable solutions of nonlinear equations with a new kind of particle was not at all generally acceptable at the time; some of the physicists were mocking me and speaking of the revival of 'Einstein's dream' (which had a strongly pejorative meaning). In the mid-70s we frequently discussed the matter with young Moscow theorists, mainly with Polyakov, and I believe these discussions have contributed quite considerably to the discovery of the famous quasiparticle solution, the 't Hooft–Polyakov monopole and the instanton solution in Yang–Mills theory.

The semiclassical treatment of quantum integrable models was then followed by an exact solution.

This was a truly important development of the late 1970's. The new method, which was baptized the quantum inverse scattering method, brought together several ideas that were completely disjoint at the time, ranging from the old classical work of H. Bethe on lattice spin models and the more recent results of R. Baxter on quantum statistical mechanics to the inverse scattering method with its emphasis on the role of "Lax operators". The beautiful algebra behind the new method was soon crystallized in the notion of the quantum R-matrix and the quantum Yang–Baxter equation. From the very beginning, my young pupils played a key role in this development. I'd like to mention, in particular, the work of E. Sklyanin and L. Takhtajan. A couple of years later, Kulish and Reshetikhin constructed the first example of a "quantum group", which proved to be one of the most important byproducts of the new method (the term itself was coined a few years later by V. Drinfeld who was largely inspired by our work on QISM in his search for the new algebraic structures that underlie quantum integrability). For their part, Izergin and Korepin developed powerful technical tools to compute physically interesting quantities associated with integrable models like correlation functions, etc. Finally, Smirnov made a key contribution to the quantum inverse scattering problem proper, i.e. to the reconstruction of 'local' observables from spectral data. It's at this time that our research group won overall international recognition. The very landscape of mathematical physics was profoundly changed by these developments.

There were also various implications for the old classical inverse scattering method itself.

I agree, and you know it perfectly well, as you were one of the actors. The notion of the classical r-matrix (the semi-classical counterpart of the quantum R-matrix that was first introduced by Sklyanin) has played here the key role. The miracle of the Hamiltonian structures that arise in the study of integrable systems has been fully explained: the r-matrix method linked them to the Riemann–Hilbert problems, which represent a technical equivalent of the Gelfand–Levitan equations in inverse scattering. Via this notion, the classical inverse scattering method was also linked to the famous orbits method in Lie group theory, making manifest the "hidden symmetry" aspect of integrable systems. Finally, the quadratic "Sklyanin Poisson brackets", which naturally emerge in the theory, started a truly new chapter in Poisson geometry, which has developed very actively up to the present day. In the 1980's I wrote, together with L. Takhtajan, a special book on the Hamiltonian methods in the theory of integrable systems, which focused on the notion of the classical r-matrix. We hoped this first book would be followed by another one treating the quantum inverse scattering method but the big changes of the 1990s that followed did not allow us to continue.

During all these crucial years, our laboratory at the Steklov Mathematical Institute in Leningrad was a point of attraction for the entire soliton community…

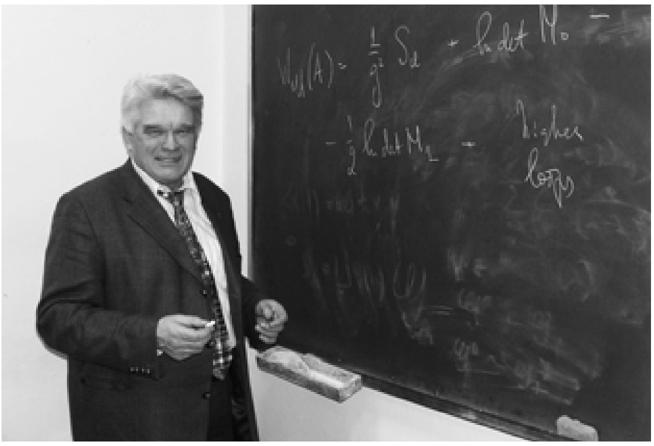
That's correct. I should mention in particular the so called Quantum Soliton Meetings that we organized. The first one in the autumn of 1979 shortly followed the breakthrough in the study of quantum integrable systems. This was a truly exciting meeting that brought together the leading lights of the previous stage of theoretical physics like academician Migdal and V.N. Gribov and the best experts in classical integrability like V. Zakharov and S.P. Novikov, as well as key people of the younger generation like Sasha Polyakov, Sasha Belavin, Sasha Zamolodchikov, Volodia Drinfeld…

The name of Drinfeld inevitably brings us to the notion of quantum groups, which you have already mentioned ...

Drinfeld took very seriously the discovery of the quantum inverse scattering method; he was a very frequent and most welcome guest of our laboratory in those days. A few years later he managed to give a very nice and appealing form to the 'algebraic half' of the QISM. In 1986, during the Mathematical Congress in Berkeley, I brought Drinfeld's address with me and asked Cartier to present it to the congress. In those late years of the Soviet Union, Drinfeld still could not get permission to go the States himself. This address immediately triggered the 'Quantum Groups Revolution' of the late 1980's, with important implications for representation theory, knot theory, geometry of low-dimensional manifolds, and more. In our research group, I'd like to single out the contribution of N. Reshetikhin to all these matters. For my part, I always preferred the original R-matrix approach to the high-brow algebraic language of Hopf algebras and tensor categories. So I was very pleased to find a simple R-matrix equivalent for the q-deformed universal enveloping algebras discovered by Drinfeld and Jimbo. This was our joint work with Reshetikhin and Takhtajan on the quantization of Lie groups and Lie algebras. I should mention that, contrary to the popular belief, the QISM is still considerably more rich than quantum group theory: its key part is certainly the algebraic Bethe Ansatz and its more refined modern versions, which still resist explanation in the context of quantum group theory (or at least any such explanation is much less elementary than our original method). Of course, much work has been done in connection to this over the past few years; the quantum separation of variables method developed by Sklyanin is probably the most important contribution I can mention.

You have mentioned q-deformations, which brings us to the realm of deformations in general…

This was a very important idea for me, which I learned in the old days, notably from the work of I. Segal. Quite a few important new physical theories, like relativity or quantum mechanics, are associated with nontrivial deformations of the underlying algebraic structures. In the late 1970's, deformation quantization formalism was systematically developed by Flato, Lichnerowicz and their colleagues. Quantum groups and the QISM provide another striking example. One more project I launched in the late 1980's was associated with the study of anomalies in QFT. Together with my student S. Shatashvili we discovered a nontrivial deformation of the three-dimensional nonabelian gauge group. This deformation, which plays some role in the Yang–Mills theory with chiral fermions, can be traced down to the characteristic classes and cohomology groups of the gauge groups. Curiously, this work has brought me very close to the discoveries my father made in homological algebra forty years earlier that I mentioned at the beginning…



The late 1980's were probably the best of times for our old research group at the Steklov Institute. In the next decade, things have changed…

By 1990 we had an incredible concentration of excellent people in almost every part of mathematics in our laboratory and in other fellow laboratories at the Leningrad Branch of the Steklov Institute. The economic crisis of the 1990's, in combination with the new freedom, has changed the scene profoundly. Many of my pupils were offered prestigious positions abroad. Those who decided to stay are travelling quite extensively as well and remain in Petersburg for only a fraction of the year. For my part, I am also travelling a lot. We also had some painful losses: V. N. Popov and A. Izergin passed away at a very early age. This new situation has prompted me to return to the rather solitary working style of my younger years, which contrasts so much with the team work of the 1970's and 1980's. Of course, now the isolation is only relative, as it is moderated by the new Internet capabilities and also by the freedom to travel. I have also established some new collaborations, notably with Anti Niemi from Helsinki University.

What were your main research topics during these years?

Rather unexpectedly for me, I have returned to Yang–Mills theory. Contacts with Niemi have revived my interest in the modified Skyrme model that I proposed in the late 1970's. Typical solitons that were studied at that time are associated with certain "topological charges" and may be described as localized solutions that resemble isolated particles. In my version of the Skyrme model (which is based on the Hopf invariant) excitations are more like strings or pipelines and are classified by various knots in R3. Unfortunately, it is practically hopeless to find explicit solutions of this model in closed analytic form. In the 1970's, when I started to study this model, there were no sufficiently good computers to deal with it numerically. In the 1990's Niemi, who mastered modern numerical methods, could already use the capacities of the supercomputer of Helsinki University. His results confirmed my expectations for the simplest configurations (the unknot); our joint publication in "Nature" attracted the attention of the true professionals in numerical methods, Sutcliff and Hietarinta, who have carried out still more refined computations. Their results convincingly show the existence of nontrivial knot-like excitations, in particular, associated with the trefoil. You remember, of course, that Escher's etching of the trefoil knot has been hanging in our seminar room since the early 1970's.

Certainly, I do! And what was the next step?

Well, we started to look around in search of interesting applications. As you know, the plausible scenario of the quark confinement in QCD is based on the following picture: the gluon field is supposed to be confined to tube-like regions, the gluon strings, which tie up quarks and assure the rapidly increasing force that keeps them together. It is natural to expect that in pure Yang–Mills theory there exist closed gluon strings (possibly knotted) that describe "glueballs". In order to trace them down, one has to look for an appropriate "change of variables" in the Yang–Mills Lagrangian, which allows you to find an effective Lagrangian describing the "collective gluonic excitations". This Lagrangian appears to be close to the Skyrme Lagrangian with the Hopf term. This program has indeed been carried through; the latest results have just been published. So far, they have not attracted too much attention ...

In the last years, quantum field theory is once again out of fashion…

Well, maybe not quite. As you know, QFT is now particularly beloved by topologists who have discovered for themselves the importance of Feynman integrals, diagram expansions, etc. But in what concerns fundamental physics, QFT is now passing indeed through a difficult period, due to the pressure of the largely speculative ideas inspired by string theory. I should confess that my attitude to fundamental physics is more conservative…

And what is your general opinion on the relation between physics and mathematics?

I am an expert in mathematical physics. This term has been given different meanings. Sometimes it is reduced merely to the set of traditional mathematical methods associated with the study of basic PDEs that arise in physical problems. On the other hand, mathematical physics was also considered as a synonym of theoretical physics (as may be seen from the name of the Lucassian Chair in Mathematics that was once occupied by Dirac and earlier by Newton). In my own opinion, both mathematical and theoretical physics are dealing with the same objects and the same ultimate reality, although they are based on different (and sometimes complementary) kinds of intuition. My own type of intuition is rather mathematical and I must confess that the simplified arguments based on the so-called "physical sense" are not too appealing to me. On the other hand, really deep physical ideas can sometimes provide a deep insight into purely mathematical problems. Over my lifetime, my science has undergone profound and unprecedented changes and I feel happy to participate in its development, which brings us ever closer to the understanding of the laws of nature.

Thank you for your story. Perhaps the readers would be interested to learn more details ...

At several occasions I have already had an opportunity to express my personal views on mathematical physics and to outline the story of my own research engagement. So I shall probably end this interview with a couple of references. One can add to this list the short story of our seminar in Steklov Institute, which you wrote a few years ago.

Thank you for this suggestion. I am very glad you liked this story and feel honoured to add this reference.

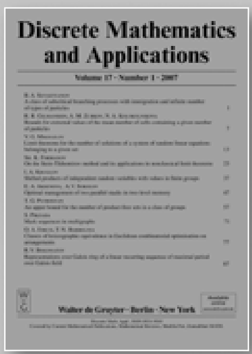
References

[1] Faddeev L.D. Modern mathematical physics: what it should be. *Mathematical physics* 2000, 1–8, Imp. Coll. Press, London, 2000.
[2] Faddeev L.D. What is modern mathematical physics? *Proc. Steklov Inst. Math*. 1999, no. 3 (226), 1–4.
[3] Faddeev, L.D. A mathematician's view of the development of physics. Les relations entre les mathématiques et la physique théorique, 73–79, Inst. Hautes Etudes Sci., Bures-sur-Yvette, 1998.
[4] Faddeev L.D. *40 years in mathematical physics*. World Scientific Series in 20th Century Mathematics, 2. World Scientific Publishing Co., Inc., River Edge, NJ, 1995. x+471 pp.
[5] Faddeev, L. Instructive history of the quantum inverse scattering method. KdV 95 (Amsterdam, 1995). *Acta Appl. Math.* 39 (1995), no. 1–3, 69–84.
[6] M. Semenov-Tian-Shansky. Some personal historic notes on our seminar. In: *L.D. Faddeev's Seminar on Mathematical Physics*. Advances in Math. Sciences, vol. 49 (M. Semenov-Tian-Shansky, editor), American Mathematical Society Translations, ser. 2, v. 201, AMS, Providence, R.I., 2000, pp. 1–8.

Michael Semenov-Tian-Shansky [semenov@u-bourgogne.fr] graduated from Leningrad (St. Petersburg) University in 1972 and received his PhD (1975) and Habilitation (1985) from the Steklov Mathematical Institute. After 1972 he worked at the Leningrad (St. Petersburg) Branch of the Steklov Mathematical Institute. In 1992 he was appointed Professor at the Université de Bourgogne, Dijon, France. His research interests include representation theory of semisimple Lie groups, integrable systems, quantum groups and Poisson geometry. His interests outside of mathematics include the history of science, music and hiking.

DE GRUYTER

Brill Journals now at de Gruyter



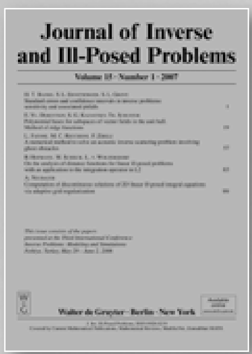
■ Discrete Mathematics and Applications

Editor-in-Chief:
V. F. Kolchin, Moscow, Russia

ISSN 0924-9265 (print)
ISSN 1569-3929 (online)

www.degruyter.com/journals/dma

Six issues per year, with approximately 100 pages per issue.
Annual subscription rate: Volume 17 (2007)
Print only or online only € 1765.00/*US$ 2241.00
Print + online € 1961.00/*US$ 2490.00



■ Journal of Inverse and Ill-Posed Problems

Editor-in-Chief: M. M. Lavrentev

ISSN 0928-0219 (print)
ISSN 1569-3945 (online)

www.degruyter.com/journals/jiip

Nine issues per year, with approximately 100 pages per issue.
Annual subscription rate: Volume 15 (2007)
Print only or online only € 1336.00/*US$ 1697.00
Print + online € 1484.00/*US$ 1885.00

■ Monte Carlo Methods and Applications

Managing Editor: K. K. Sabelfeld,
Novosibirsk, Russia

ISSN 0929-9629 (Print)
ISSN 1569-3961 (Online)

www.degruyter.com/journals/mcma

Six issues per year, with approximately 100 pages per issue.
Annual subscription rate: Volume 13 (2007)
Print only or online only € 954.00/*US$1211.00
Print + online € 1060.00/*US$ 1346.00

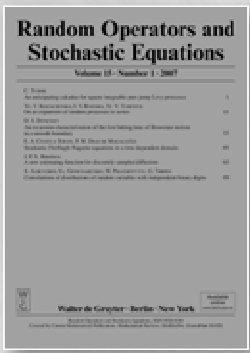
■ Journal of Numerical Mathematics

Editors-in-Chief: Ronald Hoppe,
Augsburg, Germany; Yuri Kuznetsov,
Houston, Tx, USA

ISSN 1570-2820 (Print)
ISSN 1569-3953 (Online)

www.degruyter.com/journals/jnm

Four issues per year, with approximately 100 pages per issue.
Annual subscription rate: Volume 15 (2007)
Print only or online only € 610.00/*US$ 775.00
Print + online € 678.00/*US$ 861.00



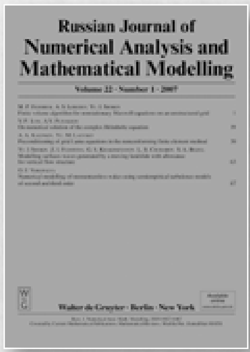
■ Random Operators and Stochastic Equations

Editors-in-Chief: V. Girko, Kiev, Ukraine;
A. Skorokhod, Michigan, USA

ISSN 0926-6364 (print)
ISSN 1569-397X (online)

www.degruyter.com/journals/rose

Four issues per year, with approximately 100 pages per issue.
Annual subscription rate: Volume 15 (2007)
Print only or online only € 808.00/*US$1026.00
Print + online € 898.00/*US$ 1140.00



■ Russian Journal of Numerical Analysis and Mathematical Modelling

Editor-in-Chief: Guri I. Marchuk, Moscow,
Russia

ISSN: 0927-6467 (Print)
ISSN: 1569-3988 (Online)

www.degruyter.com/journals/rjnamm

Six issues per year, with approximately 100 pages per issue.
Annual subscription rate: Volume 22 (2007)
Print only or online only € 1383.00/*US$1757.00
Print + online € 1537.00/*US$ 1952.00

W DE G de Gruyter
Berlin · New York

www.degruyter.de

All prices postage and handling included!

Prices are subject to change.
**For orders placed in North America*

Ma-07-017

Interview with Marius Iosifescu (Bucharest)

Interviewer: Vasile Berinde (Baia Mare, Romania)

Short Biographical note

Marius Iosifescu was born on the 12th August 1936 in Pitesti, Romania. He went to elementary school and high school in Pitesti, graduated with a mathematics degree in 1959 and obtained his PhD in probability in 1963 from the University of Bucharest. He was an assistant professor, a researcher and the Head of Department of Probability and Statistics at the Centre for Mathematical Statistics (Romanian Academy) and Director of the Institute of Mathematical Statistics and Applied Mathematics. He became a corresponding member of the Romanian Academy in 1991, a full member in 2000 and vice-president in 2002. He is the author of more than 124 research papers and 13 books on probability, stochastic processes and real analysis. He has been a visiting professor, an invited speaker and has given tens of lectures at various universities throughout Europe and in America and Australia. He is a member of the editorial board of JEMS (2004).

To start, please tell us a little about your childhood and background.

I was born on the 12th August 1936 in Pitesti, which was then a small town of some 20,000 inhabitants situated on the river Arges, about 120 km north-west of Bucharest; it is now an important industrial centre with about 200,000 inhabitants. A new university has been created there recently. During my childhood, Pitesti was a clean, unpolluted and attractive town with very good secondary schools modelled after the old French lyceés. My parents were teachers there and as a child I thought I would also become a teacher (note that mathematics was not at all involved in these actual or dreamed teaching posts). Except for the years of World War II, I can honestly say that my parents managed to give me and my younger sister a happy childhood. The terrible realities of war first manifested themselves in frequent American air raids, one of which completely destroyed our home. They were then followed by the disastrous consequences of the 1944 Soviet occupation of Romania, which, a few years later, led to a long period of communist dictatorship. My aversion to brute force, intolerance, violence and arbitrariness dates from that time.

When did you first get interested in mathematics? Did you have good teachers at school? Are there other mathematicians in your family?

I'll start by saying that there is no other mathematician in my family. My interest in mathematics was aroused when I was 14 and I started tackling problems in a Romanian journal for young people called *Revista Matematica si Fizica*. This was a temporary successor to the celebrated centennial journal *Gazeta Matematica*, which, during the period 1895–1948, served as an ideal apprenticeship magazine for the independent work of many Romanian mathematicians. I remember well how a few successful attempts gave me impetus to go on. If my interest in mathematics became a passion, this was largely due to D. Mihalascu (1908–1984), my only mathematics teacher at secondary school. I shall always revere his memory for his tactful guidance, patience and understanding. In 1953, and again in 1954, I was able to win first prize in the National Mathematical Olympiad organized by the Romanian Society for Mathematical (and Physical) Sciences (this body was also the initiator of the International Mathematical Olympiads, the first two of which were held in Romania in 1959 and 1960). These successes led me naturally to the idea of becoming a mathematician. Apart from the subjective motivation, there also existed a favourable objective context to a mathematical career, which was the existence of a mathematical research institute, namely the Bucharest Institute of Mathematics (founded in 1949) of the Romanian Academy. Mirroring the corresponding Soviet institutions of the time, this institute played an overwhelming role in the flourishing of mathematical research in Romania between 1949 and 1975, at which time it was closed down to punish the institute's staff for the careless handling of the presumed love-affair of a VIP's daughter. It was only reestablished in 1990 after the fall of the communist regime. The best mathematics students entered this institute almost automatically after completing their studies. Thus, partly for subjective and partly for objective reasons, my dream was to study mathematics and then enter the Institute of Mathematics. Of course, at the time, my idea of what mathematical research meant was quite imprecise. I spontaneously held the Halmos-like view that "problems are the heart of mathematics".

Tell us about your mathematics education. How was the academic life in your time as a student?

My university years (1954–1959) at the Faculty of Mathematics and Physics (now Mathematics and Computer Science; Physics separated in 1962) of the University of Bucharest fell in a period when all the great names of inter-war Romanian mathematics were still active. Thus, among my professors were D. Barbilian (1895–1961), A. Froda (1894–1973), A. Ghica (1902-1964), Gr. C. Moisil (1906–1973), M. Nicolescu (1903–1975), O. Onicescu

(1892–1983), N. Teodorescu (1908–2000), V. Valcovici (1895–1970), and Gh. Vranceanu (1900–1979). To these should be added C. Andreian Cazacu, T. Ganea (1922–1971), C.T. Ionescu Tulcea, S. Marcus and Gh. Marinescu (1919–1987), who made their names as mathematicians after World War II. Unfortunately, this nice picture was embedded into the Stalinist environment of the time.

Who were your (favourite) teachers?

I'll start by first mentioning my two calculus professors Ionescu Tulcea and Marcus, who taught me in my first and second university years respectively. The course given by Ionescu Tulcea was of a high level of mathematical rigour, from which I learned what mathematical proof is; it was decisive in my formation as a mathematician. From the course given by Marcus, who, following his research interests, oriented his course towards real functions, I learned how to ask (and then answer) mathematical questions. As a result I was able, in 1956, to complete my first (small) piece of original work. Professor Marcus was my first and, unfortunately, last supervisor, as will become clear later on. Next, I'll mention Barbilian, who was quite an unusual man and mathematician, as was his course on number theory. Though his lectures had been prepared well in advance, spontaneous ideas for new proofs and results flashed through his mind during the class, thus offering a live spectacle of creative mathematics. I do not doubt this happened because Barbilian is one of the four or five poets of genius in Romanian literature; as a poet he is known under the pen-name of Ion Barbu. Barbilian's double career as a scientist and as an artist offers support for Karl Weierstrass' well known opinion that a mathematician who is not also something of a poet will never be a perfect mathematician.

How did you choose your subject for research? Who did you do your PhD under? Tell us about his career and the influence on your own scientific activity.

I graduated with honours in July 1959. My diploma paper was based in part on the work done on real functions under Marcus' guidance starting from 1956. Contrary to my expectations, due to the discriminatory political criteria of the time (one had to be of a 'healthy' social origin), I was only offered a position of mathematics teacher at a lycée in Calarasi, a small harbour on the Danube. The fact that Barbilian's career had also started there did not make the offer any more attractive. I therefore declined it and began looking for other possibilities.

In the end, help came from Professor Gh. Mihoc (1906–1981), then the dean of the Faculty of Mathematics and Physics, who knew me from the Mathematical Olympiads and on whose recommendation I got a consultancy position at the Central Board of Statistics in Bucharest. My main duty there was to improve the mathematical education of the staff. Not at all an exciting job but, living in Bucharest, it was at least possible for me to keep up some contact with mathematics. This was also the beginning of a new phase in my career. On the one hand, I started studying some mathematical statistics as required by my job. On the other hand, Mihoc suggested that I should try to carry out research in probability. He proposed that I should first become acquainted with dependence with complete connections, a concept that was his own and Onicescu's joint creation in the middle of the 1930s. This was quite a timely suggestion as a book by G. Ciucu (1927–1990) and R. Theodorescu had just appeared that gathered together all that was then known in the field. My conversion from real analysis to probability was by no means difficult. The former is an indispensable basis for the latter and, moreover, I had taken a solid course in probability with Onicescu in my fourth university year. In the period 1960–1968, both independently and jointly with Theodorescu, I was able to complete some 25 papers on dependence with complete connections.

In July 1963, under Mihoc's formal supervision, I got my PhD degree (in the Soviet nomenclature of the time, this was called a "candidate of science" degree) with a thesis on chains with complete connections with an arbitrary state space. A revised and expanded version of my PhD thesis was published in Russian in the same year and was awarded a prize of the Romanian Academy in 1965. A second doctoral degree, which is roughly equivalent to the English DSc, was awarded to me in December 1969 for the whole of my mathematical work at the time. Meanwhile, in June 1963, I had at last succeeded in becoming a research worker in the Probability Division of the Institute of Mathematics of the Academy (my old dream!). When, in 1964, the Centre for Mathematical Statistics was set up as a development of that probability division, promoted by Mihoc, I moved to it and have remained there ever since.

Can you tell us about some important events in your professional life?

I should start with the publication by important publishing houses of most of my books, all of them based on my own research work. One of these books, on applications of stochastic processes in biology and medicine, won another prize of the Romanian Academy in 1968. Next, I should mention my election at the Romanian Academy, as a corresponding member in 1991 and as a full member in 2000, being then elected in 2002 as one of its four vice-presidents.

Last but not least, the fall of the communist regime opened very good prospects for collaboration with foreign mathematicians and international organizations. It should be noted that even before 1989, always under incertitude and almost insurmountable difficulties, I was able to take advantage of some of the invitations I received for conferences abroad and professorships in France and Germany as well as a six month stay at the

Statistical Laboratory of Cambridge University as an overseas fellow of Churchill College (the architect of this fellowship was Professor D.G. Kendall FRS, honorary member of the Romanian Academy, to whom the Romanian mathematical community should be grateful in many respects for his help in those difficult times).

After 1989, the situation changed for the better, so I was able to do joint work with J.-M. Deshouillers in Bordeaux and C. Kraaikamp in Delft, in both cases on probabilistic number theory. Finally, I should mention my responsibilities to the Romanian party in: (i) a Common European Project TEMPUS, "Development of Applied Mathematics in Romania", also known as "MATAROU" (1991–1994), in the framework of which 64 young Romanian mathematicians were able to study for a Masters or a PhD degree in universities of the European Union; and (ii) a convention, SAFE (which stands for Soros, Ambassade de France, ENS), from 1993 to 2000, which welcomes students of sciences or humanities from Romania and, since 1996, Bulgaria and Moldova to the French ENSs (Ecoles Normales Superieures), under which 100 people were selected in a very rigorous manner for two-year scholarships at these famous schools.

Two names are to be praised in this latter context: D. Cioranescu (of Romanian origin) from the University Paris VI for (i), and C. Duhamel from the University Paris-Orsay (on a mission at the French Embassy in Romania at the time) for both (i) and (ii). These projects set favourable conditions for a series of French-Romanian Colloquia of Applied Mathematics held every two years from 1992, alternatively in France and Romania, following a suggestion of Professor H. Brezis from the University Paris VI in his address at the Romanian Academy on his reception there as an honorary member. So, we have arrived already at the 8th colloquium in this series, which was held in Chambéry (France) at the end of August 2006. I am proud that D. Cioranescu, C. Duhamel and I are considered founders and promoters of this series, which should certainly go on through the good work of younger people from both Romania and France.

What were the main trends and results in your area of interest in the last 30-40 years and what are the present trends?

I think that Brownian motion and Ito's stochastic calculus, as well as the results associated with them, played a paramount part in stochastic process theory during the last two thirds of the 20th century. For the near future, we could also think that Malliavin's calculus will play a similar part. At the same time, we should be aware of the enormous potential interdisciplinary nature of stochastic process theory that is able to open unexpected ways to very important applications in different fields. In this respect I like very much a conclusion of D. Mumford's essay, "The dawning of the age of stochasticity", pp. 197–218, *Mathematics Frontiers and Perspectives 2000*, according to which "… stochastic methods will transform pure and applied mathematics in the beginning of the third millennium".

Which of your mathematical results are you proudest of?

It is hard to select a single item or a few items from my mathematical results over my very long career. I'll thus say that I am proud of the current state of dependence-with-complete-connections theory to which I have greatly contributed. However, to give a single result I am proud of, yet which is not far from that theory, there is the elementary solution to the celebrated 1812 Gauss' problem on continued fractions, first solved in 1928 by an intricate (and not entirely correct) method.

Are you predominantly a researcher or a teacher?

I am essentially a researcher. My teaching activities were restricted to several professorships abroad and to the supervision of many PhD students in Romania. Actually, almost all of my professional career (almost 47 years now) has been associated with only one research institute, the Centre for Mathematical Statistics (founded in 1964) that since 2002 has become the Institute of Mathematical Statistics and Applied Mathematics (ISMMA).

Who is your most admired mathematician or scientist, if any? Why?

You'll perhaps be surprised to learn that my most admired mathematician is W. Doeblin (1915–1940), who in his very short life was able to contribute a great deal to the current form of several chapters of probability theory. It has recently appeared that in a paper written in the winter of 1939, only published in December 2000 in a special issue of *C.R. Math. Acad. Sci. Paris*, anticipating contemporary one-dimensional diffusion theory, Doeblin proposed a deep, original synthesis of the two main approaches to stochastic process theory: the analytic, initiated in the 1930s, and the probabilistic, dealing with the trajectories of a process, developed during the second half of the last century. Doeblin's fate was tragic, recalling that of E. Galois. The reader might like to consult a recent paper by B. Bru and M. Yor, "Comments on the life and mathematical legacy of Wolfgang Doeblin", *Finance Stoch.* 6 (2002), 3–47.

What do you consider the most profound and influential development of the last century in your area of research?

Before answering your question, some clarification is in order. I am a probabilist who is also interested in real analysis and number theory (from a probabilistic point of view). The central topic in my original research work is dependence with complete connections, the theory of which was initiated by a note published in 1935 in *C.R. Math. Acad. Sci. Paris* by the Romanian mathematicians O. Onicescu and Gh. Mihoc, the co-founders of our Bucharest probability school. In his book, *L'évolution créatrice* (Alcan, Paris, 1907), on page 21 the famous French philosopher H. Bergson wrote, "Le moment actuel d'un corp vivant ne trouve pas sa raison d'être dans le moment immédiatement anterieur … il faut y joindre tout le passé de l'organisme, son hérédité, enfin l'ensemble d'une très longue histoire".

Intended to be a non-trivial extension of Markovian dependence, in the spirit of this Bergsonian quotation, the theory of dependence with complete connections aims to describe probabilistic evolutions where the whole past should be taken into account, unlike its celebrated Markovian predecessor where only the last moment of the past really counts. Mathematical models based on dependence with complete connections occur in mathematical learning theory, stochastic approximation, branching processes with random environments, probabilistic number theory (especially in the metric theory of different continued fraction expansions of irrational numbers), social psychology, partially observed random chains (in particular hidden Markov chains) and their control, decision theory and dynamic programming, inventory theory, and many other fields. For details one can consult my joint book with the late S. Grigorescu (1945–1997), *Dependence with Complete Connections and its Applications*, Cambridge Univ. Press, Cambridge, 1990, as well as my older joint book with Theodorescu, *Random Processes and Learning*, Springer Verlag, Berlin, 1969.

Nowadays, quite a lot of mathematicians have become interested in dependence with complete connections under the nomenclature of iterated function systems, which, among other things, are used in the construction of fractals. Coming back to your question, I'll tell you that the most important result in my subject originates from 1950. This is a general ergodic theorem for a class of non-compact linear operators that occur in a natural manner in dependence with complete connections theory. It is due to Ionescu Tulcea and Marinescu and greatly generalizes a special case of it that was considered in 1937 by Doeblin and R. Fortet (1912–1998), both important early contributors to the subject.

What are you working on right now?

Dependence with complete connections has been a topic of interest for mathematicians from France, the USA, Canada, Germany, Greece, the Netherlands, Sweden, Brazil and the former Soviet Union. Currently, most of the work on it is done abroad (see my remark above on iterated function systems). Three years ago I concluded a collaborative agreement, under Deutsche Forschungsgemeinschaft sponsoring, with a Duisburg group from the Duisburg-Essen University headed by Professor U. Herkenrath. Several papers on dependence with complete connections produced by this group have already been published. In the past, more precisely in the period 1994–2001, I did joint work with C. Kraaikamp of the Technical Delft University on a very nice and elegant application (still stemming from Doeblin) of dependence with complete connections to the metrical theory of the continued fraction expansion. This collaboration, which was sponsored by the Dutch organization for scientific research (NWO) and later (after 1999) by France's CNRS from a PICS (Projet International de Coopération Scientifique), resulted in our joint book, *Metrical Theory of Continued Fractions*, Kluwer, Dordrecht, 2002. These collaborations are still going on nowadays and my work is done within them. So, a new book on dependence with complete connections is being prepared jointly with the Duisburg group.

Let me now come to another aspect of your work. You are a full member of the Romanian Academy, belonging to its mathematics section, and you are also one of the four vice-presidents of the academy. What activities does this section run, coordinate or supervise?

Firstly, the section is responsible for the quality of the work done in its mathematical (and astronomy) institutes: 2 (+1) in Bucharest, 1 in Cluj-Napoca and 1 in Iasi. This means that each year these are evaluated by the section's members. I am happy to say that, in general, the evaluations result in good and very good marks. Secondly, the section edits the mathematical journals of the Romanian Academy: *Rev. Roumaine Math. Pures Appl.*, *Math. Rep. (Bucur.)* (formerly *Studii si Cercetari Matematice*), *Mathematica (Cluj)*, *Revue Anal. Numér. Théor. Approx.*, *Romanian Astronomical Journal*, and *Proceedings of the Romanian Academy Series A*. Next, the section coordinates meetings, the organization of which is entrusted to its institutes. For example, the Bucharest Institute of Mathematics organized the 5th Congress of Romanian Mathematicians in 2003 and it is planned to hold the 6th congress in 2007. Also, my own institute (ISMMA) always takes part in the organization of the French-Romanian Colloquia of Applied Mathematics. Finally, the section awards the annual mathematics prizes of the Romanian Academy (five in all) and elects new members when vacancies arise.

Please give a brief description of the organization and main activities of the mathematical institutes of the Romanian Academy.

Very sketchily, these institutes are divided into large teams embarked on general research projects. The members of a team then deal with pieces of such a project. A basic subsidy comes from the government but, especially in the last few years, even more money comes from research grants, both Romanian and foreign, while close contacts with applied research institutions and other bodies are encouraged. The best researchers have the possibility to be supervisors of PhD students even if they are not formally doing teaching at university, while the PhD theses are defended at the institutes (see also the answer to the preceding question). May I add that the contribution of the institutes to the total Romanian mathematics output is overwhelming.

Let's now discuss the present situation of mathematics research in Romania in both universities and research institutes. How do you see the evolution in the last 15 years and what do you predict for the near and far future?
In this respect, several things should be mentioned. First, it is clear that in the pre-1989 years there was an overproduction of (very good) mathematicians in Romania. The solution, illegal under the communist regime and utilized only moderately until 1989, whilst being legal and therefore used more commonly after 1989, was immigration to free countries, where a good mathematician is much better paid and enjoys incomparably better working conditions than in his own country. Currently, we have a shortage of well-prepared young mathematicians, which is still aggravated by both massive immigration and an unwillingness of many gifted young people to read exact sciences. Rather than mathematics, they prefer instead to read economics or law in order to get much better paid jobs than teaching or research positions. One should nevertheless note that there are currently slight signs of improvement, meaning that the brain drain might be stabilizing or even diminishing.

What can be done to attract talented young students into mathematics and, especially, to keep the best qualified mathematicians in the mathematics departments of Romanian universities?
I am sorry to tell you I think that under the current economic conditions in Romania nothing can be done in this respect. For the time being, it only remains to count on the willingness of people to decide to follow their vocation and accept poor material conditions for that. Recent steps (highly contested by the establishment) taken to recruit university professors and main research workers on the basis of strict transparent objective criteria will only produce effects in a pretty distant future.

What about your students and disciples? Are they working in Romania or abroad?
Since 1974 I have supervised some thirty PhD students who were able to complete their dissertations. Among them, there were some genuinely gifted people. Many others were unable to complete but even these took advantage of keeping in contact with recent mathematical developments. Most of my PhD students who enrolled after 1989 left the country before completing their dissertations. For some of them, joint supervising arrangements were possible. Briefly, just one of my better post-1989 PhD students is working in Romania and is still doing joint work with me.

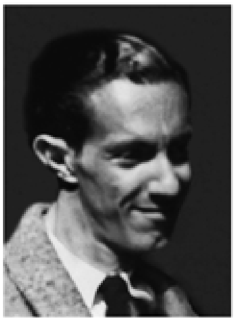
What are your opinions about the recent changes in the Romanian mathematics education system and those in the whole education system? Are they directed correctly? Is the mathematics section of the Romanian Academy involved to a certain extent in the decision process regarding mathematics education at all levels?
What should be first shown is to point out the extreme instability of these changes at all levels of our education system. As a general rule, if some steps are taken by some official, then his/her successor is often willing to cancel them in part or totally and to start practically from scratch. Even good aspects of our education system are changed for the worse under the motivation of what the European Union is asking. Needless to say, our section is never consulted about the problems of mathematics education, everything being left to more or less self-declared "experts". It becomes increasingly clear that the problems of our education system are part of a global problem of worldwide education systems, where action is needed in five major areas: (i) ensuring quality of learning for all; (ii) addressing teacher shortages; (iii) providing opportunities for adults to continue learning; (iv) financing lifelong learning; and (v) reacting to the increasing diversity of student populations. To put it in a few words, education needs to adapt to a changing world.

Do you have any particular message you would like to give to young mathematicians?
I think that, regardless of the field, whether scientific, humanistic or artistic, a gifted young person should be conscious of the fact that if they decide to accept it and pursue a career based on it, his/her gift will be a burden and a great responsibility entailing deprivation and sacrifice.

I recently noticed, watching TV during the last edition of the International Music Festival, "George Enescu", held in Bucharest, that you have a deep musical education. What about music in your life? What about music and mathematics?
I think that to maintain one's spiritual health any mathematician (pure or applied) and, more generally, any scientist should become interested in some artistic or humanistic endeavor. My *violon d' Ingres* is precisely music and the violin, to the point that had I not been a mathematician I should have wanted to be a musician. It becomes clearer and clearer for me that mathematics and music are among the very few oases of light in a world increasingly darkened by folly, intolerance and dishonesty. Actually, the connections between music and mathematics were recognized several thousand years ago and had an important revival in the 1980s. In recent years, advances in digitalization of music data as well as the availability of sophisticated mathematical tools adapted to the specific needs of music theory have made it possible to leave behind the purely qualitative or at best partially subjective approaches of the past to pursue more quantitative treatments.

Thank you very much!

The interviewer, Vasile Berinde [vberinde@ubm.ro], is the EMS publicity officer and an associate editor of the Newsletter.



fundació FERRAN SUNYER I BALAGUER
Institvt d'Estvdis Catalans

Call for the 16th edition of the
Ferran Sunyer i Balaguer Prize

The prize will be awarded for a mathematical monograph of an expository nature presenting the latest developments in an active area of research in Mathematics, in which the applicant has made important contributions.

CONDITIONS OF THE PRIZE

- The monograph must be original, written in English, and of at least 150 pages. The monograph must not be subject to any previous copyright agreement. In exceptional cases, manuscripts in other languages may be considered.
- The winning monograph will be published in Birkhäuser Verlag's series "Progress in Mathematics", subject to the usual regulations concerning copyright and author's rights.
- The prize, amounting to 12,000 euros, is provided by the Ferran Sunyer i Balaguer Foundation.
- The prize-winner will be announced in Barcelona in April, 2008.

SCIENTIFIC COMMITTEE

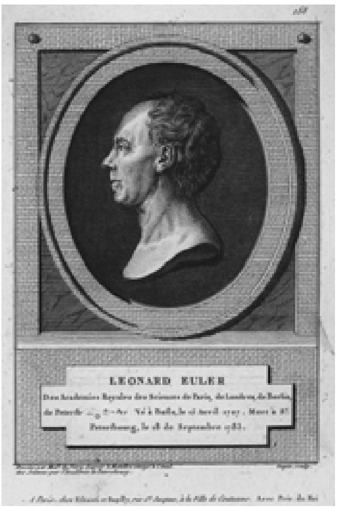
- H. Bass (University of Michigan)
- A. Córdoba (Universidad Autónoma de Madrid)
- P. Malliavin (Université de Paris VI)
- O. Serra (Universitat Politècnica de Catalunya)
- A. Weinstein (University of California at Berkeley)

DEADLINE FOR SUBMISSION*
December 3r, 2007

***For further information check the Prize's web page at:**
http://www.crm.cat/FSBPrize/ffsb.htm

ERCOM: Euler International Mathematical Institute (EIMI), St. Petersburg, Russia

Historical remarks



The decision to create the EIMI, as an institute under the auspices of the Academy of Sciences, was made in 1988 to consolidate the cooperation of Russian scientists and the international mathematical community. These were hard years due to the economic situation in Russia and the creation of the Euler Institute was made possible by the support of the Academy of Sciences and the assistance of international organizations such as UNESCO, JEC FUND, the Japanese Association for Mathematical Sciences and the Society for the Support of the Euler Institute (Berlin).

Academician Ludwig D. Faddeev has been the permanent director of the Euler Institute from the very beginning.

The scientific activity of the EIMI started in October 1990 on the premises of the St. Petersburg (at that time Leningrad) Department of the Steklov Mathematical Institute (PDMI). Since its official inauguration in September 1992 the EIMI has occupied the present, renovated building.

The decision to unite the activities of the Euler Institute and the St. Petersburg Department of the Steklov Mathematical Institute was taken in 1995 and the EIMI began operation as part of the PDMI in January 1996.

From 1990 to 2006 the EIMI organized over eighty conferences, workshops and long-term semesters. Guests from over twenty countries have visited the Euler Institute over these years.

Activity

The EIMI is financially supported by the Russian Academy of Sciences, a non-profit organisation with the aim of consolidating the mathematical research of Russian and non-Russian scientists.

The main activity of the EIMI is the organisation of international conferences on special topics in mathematics and its applications. Every year the EIMI organises about ten conferences. The Russian Foundation for Basic Research gives a grant to every conference to support the participation of Russian scientists and non-Russian organisations support participants from abroad.

The Euler institute has a tradition of the Joint Advanced Student School (JASS), which has been held in St. Petersburg every spring since 2003 for highly motivated students from Germany and Russia. The Schools are organised with the active participation of the Technische Universität München and they are supported by the Bavarian Ministry of Economics, by Siemens and others.

Besides conferences, the EIMI runs an ongoing program of scientific collaboration: "Tête-à-Tête in Russia". The aim of this program is to provide facilities for Russian (not necessarily from St. Petersburg) and non-Russian mathematicians to meet for joint work. Such a meeting of two or more colleagues could last from a couple of days to several months. In view of the present difficult economic situation, it is assumed that visitors will find the required funds from other sources. For its part, the EIMI provides offices, computer facilities with internet connection, and access to the libraries of the EIMI and the PDMI. Visitors are welcome to participate in the regular mathematical seminars of the PDMI and St. Petersburg University and in the meetings of the St. Petersburg Mathematical Society. The EIMI will issue invitations as required for obtaining Russian visas and will help in finding (reasonably inexpensive) accommodation.

Building, facilities

The EIMI occupies an historical building constructed at the beginning of 20th century on the bank of Malaya Nevka, one of the Neva's canals in the northern part of old St. Petersburg. The history of the place goes back to 1827 when the family of A. Engelgardt, who was a director of Imperial Lyceum in 1813–1827, had a wooden house here. From 1865 to 1917 the Novinsky family occupied the old building, which was replaced with a new stone one in 1913. The architect of this new building was Nikolai Lanceré (1879–1942), a member of the famous Benua family. The classical traditions of old St. Petersburg are represented in the architectural style of the building and the house is surrounded by the old Vyazemsky Park.

On the ground floor of the building, four halls facing the Nevka are situated: the Conference Hall supplied with a beamer, the Discussion Hall, the Seminar Room and the Reception Hall for coffee-breaks and receptions.

EIMI building

Blackboards in lecture room

Lecturer and audience

On the opposite side of the ground floor are the computer halls with dozen of computers with internet connection. Wi-Fi is also available. Several small offices may be used for individual work. Each of these offices has a blackboard, a computer and a telephone.

Summer is the best season; June is the peak of the White Nights in St. Petersburg. Excursions for participants are organised by the EIMI. There is a lot to see in St. Petersburg and in neighbouring towns. The current musical and artistic environment of St. Petersburg includes several world-class symphony orchestras, operas and ballet, professional choirs, modern dance, the Hermitage Museum, and the Russian State Museum. A number of concerts and exhibitions take place daily.

Tercentenary of Leonhard Euler

The EIMI is one of the organisers of the Mathematical Congress celebrating the 300th anniversary of Leonhard Euler's birth. The Congress includes the Euler Festival as a main event to be held on the 10th–12th June 2007 and a series of satellite conferences:

- L. Euler and Modern Combinatorics (A. M. Vershik, Yi Zhang) 1st–7th June 2007
- Euler Equations and Related Topics (G. A. Seregin) 7th–9th June 2007
- Arithmetic Geometry (S. V. Vostokov) 13th–19th June 2007
- Geometry Meeting (Yu. D. Burago, Yu. Reshetnyak) 18th–23rd June 2007
- Meeting on Mathematical Analysis (N. K. Nikolski, S. V. Kislyakov) 25th–30th June 2007
- Modular Forms and Moduli Spaces (V. Gritsenko, D. Orlov, P. Zograf) 2nd–7th July 2007
- Analytical Methods of Celestial Mechanics (K. Kholshevnikov, N. Vassiliev) 8th–12th July 2007
- Theoretical and Mathematical Physics (D. Diakonov, A. Mirlin) 13th–18th 2007
- Reliable Methods for Mathematical Modeling (S. Repin) 24th–27th July 2007

The meeting of the Executive Committee of the European Mathematical Society will take place on the 9th–10th June just prior to the Euler Festival.

Besides the Mathematical Congress, the following conferences will be organised in the current year:

- Annual International Seminar DIFFRACTION DAYS, 07, 29th May–1st June 2007
- Bilateral French-Russian Seminar – Asymptotic Methods in Spectral Theory and Applications, 30th June–2nd July 2007
- International conference – The Algebra and Geometry around Knots and Braids, 10th–14th September 2007
- International Algebraic Conference dedicated to the 100th anniversary of D. K. Faddeev, 24th–29th September 2007

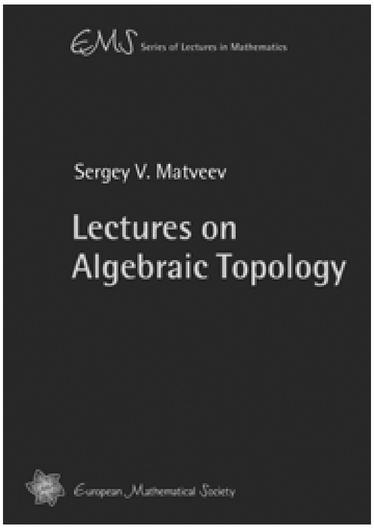
The Fifth German-Russian Joint Advanced Student School was held 25th March–4th April 2007.

Web site

For further information, please visit our web site: www.pdmi.ras.ru/EIMI/. The full list of EIMI conferences may be found there as well as the registration forms for participation in EIMI events.

Book Review

Aniceto Murillo (Málaga, Spain)



Sergey V. Matveev
Lectures on Algebraic Topology
106 pages,28 Euro
EMS Series of Lectures in Mathematics
EMS Publishing House
ISBN 978-3-03719-023-4

At a first glance, this nice, short book is comparable to other brief texts of a similar vein. Its main purpose is to introduce the reader to the basics of algebraic topology and in particular to homology theory and its applications (which is described in depth – about three-quarters of the book is devoted to it) and homotopy theory.

The book begins with homology theory, which is introduced from the geometric approach of simplicial homology. In fact, whenever it is possible within the text, results and proofs are presented through a geometric vision and intuition. Basic and classical properties of simplicial homology together with some applications are then presented. After that, the axiomatic approach to homology theory is described together with a sketch of the proof of uniqueness of homology theory on polyhedra. Then, the author introduces cellular homology and highlights the computational properties of this approach. The chapter also contains the Lefschetz fixed point theorem, a brief introduction to homology with coefficients, and a quick description of some elements of cohomology theory. This introduction to homology theory finishes with a description of Poincaré duality on manifolds.

The basics of homotopy theory are then presented in very brief terms. Starting with the definition of the fundamental group, its computation is described via the Van Kampen theorem applied in different situations. A very short introduction to higher homotopy groups and the action on them by the fundamental group is then followed by an equally extensive presentation of the long exact sequence of a fibre bundle. The chapter is completed with a compendium of the basic properties of covering spaces.

But, as mentioned above, all of this follows from a quick first look at the book under review. After a careful reading, though, this short piece reveals many insights from which different readers may benefit.

The mathematical beginner, perhaps an undergraduate, will find a very intuitive and geometrical, yet formal and rigorous, approach to homology theory. The classical combinatorial difficulties to understanding simplicial homology (a good example being the proof of the simplicial approximation theorem) are overcome with a coherent, geometrical and logical exposition.

The smooth and clear explanation at the beginning of the text of how the abstract concepts of categories and functors are going to be used later on, as well as the geometrical sketch of the proof of the uniqueness of homology theory on polyhedra and the introduction to cellular homology for computational purposes, are good examples of this attempt to bring non-trivial concepts to beginners.

For the graduate student, or the outsider to algebraic topology with some mathematical knowledge and with interests in other branches, this book is also of help. On one hand, some aspects of algebraic topology are presented in a not commonly used approach (for instance, the computation of the fundamental group of the complement of some knots). On the other hand, the use of the basics of simplicial homology theory to attain deep results on more geometrical environments are given in the same geometrical but rigorous language. Here follows an example of this:

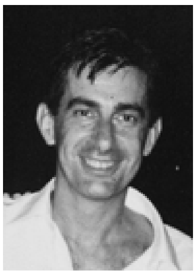
After the introduction of the degree of a self map on a manifold, and with the few tools developed at that point, the author readily presents the homotopy classification of immersions of the circle into the plane and the fundamental theorem of algebra, and shows that a vector field on the 2-sphere has a singular point.

Finally, this text could also be of use for the expert from a teaching point of view. I am sure that any experienced mathematician could find here new ways and tips, at least of an expository nature, of presenting these classical topics in the classroom.

Having said that, there are two more aspects of the text that should be remarked upon, as the author gives them special attention. That is, the exercises and computability.

In fact the whole book is scattered with many exercises of differing scales of difficulty and whose purposes vary. Some of them are provided to encourage and puzzle the independent reader as well as to make them evaluate their knowledge. Others are included to fill gaps left on purpose either to complete proofs of stated theorems or to establish results needed to make the book self-contained. In all cases hints and/or answers to the problems are presented at the end of the text.

On the other hand, concerning computability, by giving explicit and far from complicated algorithms the author points out that homology groups and fundamental groups can be explicitly calculated for many spaces found in nature.



Aniceto Murillo [aniceto@uma.es] got his PhD under the supervision of Professor Stephen Halperin of the University of Toronto. Since 1992 he has been a professor at the University of Málaga and his research interests are in algebraic topology in general and rational homotopy theory in particular.

Personal column

Please send information on mathematical awards and deaths to the editor.

Awards

Hans Föllmer (Humbolt Univ., Berlin) received the Cantor Medal of the German Mathematical Society DMV. He is recognized as the leading German probability theorist of his generation, having had a decisive influence on the development of the field of stochastics.

George Szpiro received the DMV Media Prize and **Ulf von Rauchhaupt** was awarded the DMV Journalism Prize.

The Autumn Prize of the Mathematical Society of Japan for 2006 was awarded to **Hiroshi Isozaki** (Tukuba University) for his distinguished contributions to the study of scattering theory and inverse problems.

The 2006 MSJ Geometry Prizes were awarded to **Toshiki Mabuchi** (Osaka Univ.) in recognition of his fundamental research work on the existence problem for Kähler-Einstein metrics and to **Takashi Shioya** (Tohoku Univ.) for his outstanding research work on the geometry of Alexandrov spaces.

The Analysis Prizes of MSJ in 2006 were awarded to **Narutaka Ozawa** (Univ. Tokyo), **Jun Kigami** (Kyoto Univ.) and **Nakahiro Yoshida** (Univ. Tokyo) in recognition of their outstanding contributions in analysis.

The Takebe Senior Prize was awarded to **Makoto Nakamura** (Tohoku Univ.) for his study of initial boundary value problems for nonlinear hyperbolic equations.

The Takebe Junior Prizes were awarded to **Takeshi Katsura** and **Kentaro Saji** (both from Hokkaido Univ.), **Eige Fujikawa** (Sophia Univ.), **Taro Yoshino** (Kyoto Univ.), and **Teruyuki Yorioka** (Shizuoka Univ.).

Henryk Żołądek (Warsaw) was awarded the Ważewski Great Prize of the Polish Mathematical Society for his monograph "The Monodromy Group".

Zdzisław Rychlik (Lublin) was awarded the Steinhaus Great Prize of the Polish Mathematical Society for his papers on applied mathematics.

Witold Bednorz (Warsaw) and **Piotr Oprocha** (Kraków) were awarded the Prizes of the Polish Mathematical Society for young mathematicians.

The Fundació Sunyer i Balaguer awarded the 2007 Sunyer i Balaguer Prize in its fifteenth edition to **Rosa M. Miró-Roig** for the monograph "Lectures on determinental ideals".

Deaths

We regret to announce the deaths of:

Alexander Budkin (Russia, 6.8.2006)
Gustave Choquet (France, 14.11.2006)
Tony Corner (UK, 3.9.2006)
Adrien Douady, (France, 2.11.2006)
James Eells (UK, 14.2.2007)
Ralph Henstock (UK, 6.1.2007)
Manfred Kracht (Germany, 18.1.2007)
Andrzej Lasota (Poland, 28.12.2006)
Andrzej Mąkowski (Poland, 29.1.2007)
Daniel Martin (UK, 15.9.2006)
William Parry (UK, 20.8.2006)
Victor A. Plotnikov (Ukraine, 4.9.2006)

Forthcoming conferences

compiled by Vasile Berinde (Baia Mare, Romania)

Please e-mail announcements of European conferences, workshops and mathematical meetings of interest to EMS members, to one of the following addresses ***vberinde@ubm.ro*** *or* ***vasile_berinde@yahoo.com****. Announcements should be written in a style similar to those here, and sent as Microsoft Word files or as text files (but not as TeX input files). Space permitting, each announcement will appear in detail in the next issue of the Newsletter to go to press, and thereafter will be briefly noted in each new issue until the meeting takes place, with a reference to the issue in which the detailed announcement appeared.*

June 2007

1–30: Geometric Applications of Homotopy Theory, Fields Institute, Toronto, Canada
Information: jardine@uwo.ca; http://www.fields.utoronto.ca/programs/scientific/06-07/homotopy/ index.html

3–10: Geometric Analysis and Nonlinear Partial Differential Equations, Banach Center, Będlewo, Poland
Information: http://www.impan.gov.pl/BC/

4–8: Knots, hyperplane arrangements, and Coxeter groups, CIRM Luminy, Marseille, France
Information: colloque@cirm.univ-mrs.fr, http://www.cirm.univ-mrs.fr

4–9: Algebraic Geometry in Higher Dimensions, Levico Terme (Trento), Italy
Information: aghdtn@gmail.com; http://www.science.unitn.it/~occhetta/aghd/index.html

8–13: The Ninth International Conference on Geometry, Integrability and Quantization, Sts. Constantine and Elena resort, Varna, Bulgaria
Information: mladenov@obzor.bio21.bas.bg; http://www.bio21.bas.bg/conference/

9–13: Workshop Higher Categories and their Applications, Fields Institute, Toronto, Canada
Information: jardine@uwo.ca; http://www.fields.utoronto.ca/programs/scientific/06-07/homotopy/index.html

11–14: Ergodic Theory and Limit Theorems. 9th Rencontres Mathematiques de Rouen, Rouen, France
Information: RMR2007@univ-rouen.fr;
http://www.univ-rouen.fr/LMRS/RMR07/rmr07_eng.html

11–15: Barcelona Conference on C*-Algebras and Their Invariants, Centre de Recerca Matematica, Barcelona, Spain
Information: OAlgebras @crm.es; http://www.crm.cat/ OAlgebras

11–15: Japan-France conference on Automorphic Endoscopy, CIRM Luminy, Marseille, France
Information: colloque@cirm.univ-mrs.fr, http://www.cirm.univ-mrs.fr

12–16: Complex Function Theory and Geometry, Banach Center, Będlewo, Poland
Information: http://www.impan.gov.pl/BC/

16–18: Fourth International Conference on Computability and Complexity in Analysis, Siena, Italy
Information: http://cca-net.de/cca2007/

16–22: Fifth International Workshop on Optimal Codes and Related Topics (OC 2007). Dedicated to the 60th anniversary of the Institute of Mathematics and Informatics, Hotel White Lagoon, Balchik, Bulgaria
Information: oc2007@moi.math.bas.bg; http://www.moi.math.bas.bg/oc2007/oc2007.html

17–23: Skorokhod Space Conference. 50 Years On Skorokhod Space, Kyiv, Ukraine
Information: skor_space@imath.kiev.ua; http://www.imath.kiev.ua/~skor_space/

18–22: Geometry and PDE, CIRM Luminy, Marseille, France
Information: colloque@cirm.univ-mrs.fr, http://www.cirm.univ-mrs.fr

18–23: CiE 2007 (Computability in Europe 2007 – Computation and Logic in the Real World), University of Siena, Italy
Information: http://www.amsta.leeds.ac.uk/~pmt6sbc/cie07.html

18–24: Algebraic Topology: Old and New (M. M. Postnikov Memorial Conference), Banach Center, Będlewo, Poland
Information: http://www.impan.gov.pl/BC/

19–20: Fifth Computer Algebra in Mathematics Education Symposium (CAME-5), Pecs, Hungary
Information: http://matserv.pmmf.hu/cadgme/

21–23: First Central and Eastern European Conference on Computer Algebra and Dynamic Geometry Systems in Mathematics Education, Pecs, Hungary
Information: http://matserv.pmmf.hu/cadgme/

24–29: Fifth School on Analysis and Geometry in Metric Spaces, Levico Terme (Trento), Italy
Information: michelet@science.unitn.it; http://www.science.unitn.it/cirm/MeSpa07.html

24–30: Nonlocal and Abstract Parabolic Equations and their Applications, Banach Center, Będlewo, Poland
Information: http://www.impan.gov.pl/BC/

24–30: Lyapunov Memorial Conference. International Conference on the occasion of the 150th birthday of Aleksandr Lyapunov, Kharkiv, Ukraine
Information: lmc07@ilt.kharkov.ua; http://www.ilt.kharkov.ua/lmc07/

24–30: Seventh International Conference "Symmetry in Nonlinear Mathematical Physics", Kiev, Ukraine
Information: appmath@imath.kiev.ua; http://www.imath.kiev.ua/~appmath/conf.html

25–27: 7th International Conference on Mathematical Problems in Engineering, Aerospace and Sciences, Genoa, Italy
Information: info@icnpaa.com; Seenithi@gmail.com, seenithi@aol.com
www.icnpaa.com

25–26: Mathematical Modelling in Sport, Manchester, UK
Information: http://www.ima.org.uk/Conferences/conferences.htm

25–29: Conference on Enumeration and Probabilistic Methods in Combinatorics, Centre de Recerca Matematica, Barcelona, Spain
Information: Enumeration @crm.es; http://www.crm.cat/Enumeration

25–29: Operator spaces, non-commutative Lp-spaces and Applications, CIRM Luminy, Marseille, France
Information: colloque@cirm.univ-mrs.fr, http://www.cirm.univ-mrs.fr

25–30: Topics in Geometric Group Theory, Banach Center, Będlewo, Poland
Information: http://www.impan.gov.pl/BC/

25–30: ERLOGOL–2007. Intermediate problems of Model theory and Universal algebra, Novosibirsk-Altai-Novosibirsk, Russia
Information: algebra@nstu.ru

26–29: Biennial Conferences on Numerical Analysis, Dundee, Scotland, UK

26–29: ITES2007 – Sixth Italian-Spanish Conference on General Topology and Applications, Bressanone (Bolzano), Italy
Information: topology@math.unipd.it; http://www.math.unipd.it/topology/

26–30: 3rd International Conference Computational Methods in Applied Mathematics (CMAM-3), Minsk, Belarus
Information: http://www.cmam.info/conferences

27–29: Fifth Italian Latinoamerican Conference on Industrial and Applied Mathematics, Trieste, Italy

28–July 4: 6th Congress of Romanian Mathematicians, Bucharest, Romania
Information: congmatro@imar.ro; http://www.imar.ro/~purice/announcements.html

July 2007

1: Summer Conference on Topology and its Applications 2007, Castellon, Spain
Information: http://www.sumtop07.uji.es

1–7: Groups and Their Actions, Banach Center, Będlewo, Poland
Information: http://www.impan.gov.pl/BC/

2–4: The 2007 International Conference of Applied and Engineering Mathematics, Imperial College London, London, U.K.
Information: williamyoung@iaeng.org;
http://www.iaeng.org/worldeng2007/ICAEM2007.html

2–4: Algebraic Biology 2007, RISC, Castle of Hagenberg, Austria
Information: http://www.risc.uni-linz.ac.at/about/conferences/ab2007/

2–6: 2nd European Conference for Aerospace Sciences, Brussels, Belgium
Information: http://www.vki.ac.be/eucass2007/

2–6: The 9th Conference on Orthogonal Polynomials, Special Functions and Applications, CIRM Luminy, Marseille, France
Information: colloque@cirm.univ-mrs.fr, http://www.cirm.univ-mrs.fr

4–6: Third Spain, Italy, Netherlands Meeting on Game Theory (SING3), Madrid, Spain
Information: http://www.mat.ucm.es/congresos/sing3

4–8: International Conference on Nonlinear Operators, Differential Equations and Applications (ICNODEA–2007), Cluj-Napoca, Romania
Information: nodeacj@math.ubbcluj.ro; http://www.math.ubbcluj.ro/~mserban/confan.html

8–11: EURO XXII, 22nd European Conference on Operations Research, Prague, Czech Republic
Information: http://euro2007.vse.cz/

8–13: 18th International Conference on General Relativity & Gravitation, Sydney, Australia
Information: http://www.grg18.com

9–11: MCP 2007. 5th international conference on multiple comparison procedures, Vienna, Austria
Information: http://www.mcp-conference.org

9–11: Eccomas Thematic Conference on Meshless Methods, University of Porto, Portugal
Information: http://paginas.fe.up.pt/~meshless/

9–12: International Conference on Preconditioning Technique, Toulouse, France
Information: http://www.precond07.enseeiht.fr/

9–13: The First European Set Theory Meeting, Banach Center, Będlewo, Poland
Information: http://www.impan.gov.pl/BC/

9–13: Dynamics Days Europe, Loughborough University, UK
Information: http://www.lboro.ac.uk/dynamicsdays07

9–13: SciCADE'07 International Conference on SCIentific Computation And Differential Equations, Saint-Malo, France
Information: http://scicade07.irisa.fr/

9–13: 9th International Meeting on Fully Three-Dimensional Image Reconstruction in Radiology and Nuclear Medicine, Lindau, Germany
Information: http://www.fully3d.org/2007/

9–13: First French-Spanish Congress of Mathematics (Primer Congreso Hispano-Francés de Matemáticas, Premier Congrès Franco-Espagnol de Mathématiques). Zaragoza, Spain
Information: http://www.unizar.es/ICHFM07

9–20: Summer School on Serre modularity conjecture, CIRM Luminy, Marseille, France
Information: colloque@cirm.univ-mrs.fr, http://www.cirm.univ-mrs.fr

11–13: International Conference on Approximation Methods and Numerical Modelling in Environment and Natural Resources, Granada, Spain
Information: http://www.ugr.es/local/mamern07

15–August 10: 6th Annual Summer School of the Atlantic Association for Research in the Mathematical Sciences (AARMS), Dalhousie University, Halifax, Nova Scotia, Canada
Information: keast@mathstat.dal.ca; http://www.aarms.math.ca/summer/2007

16–20: 6th International Congress on Industrial and Applied Mathematics (ICIAM 07), Zürich, Switzerland
Information: http://www.iciam07.ch

22–25: OPTIMIZATION 2007, University of Porto, Porto, Portugal
Information: opti2007@fep.up.pt; http://www.fep.up.pt/opti2007/

22–28: Topological Theory of Fixed and Periodic Points (TTFPP 2007), Banach Center, Będlewo, Poland
Information: http://www.impan.gov.pl/BC/

23–December 21: Strong Fields, Integrability and Strings, Cambridge, UK
Information: swilkinson@newton.cam.ac.uk;
http://www.newton.cam.ac.uk/programmes/SIS/index.html

23–27: 23rd IFIP TC 7 Conference on System Modelling and Optimization, Cracow, Poland
Information: http://ifip2007.agh.edu.pl/

23–27: Waves 2007. The 8th International Conference on Mathematical and Numerical Aspects of Waves, Reading, UK
Information: http://www.waves2007.org/

23–29: CIEAEM 59. For the memory of Tamás Varga, Dobogóko, Hungary
Information: http://www.tofk.elte.hu/cieaem/

23–August 31: CEMRACS 2007. Pre and post processing in scientific computing, CIRM Luminy, Marseille, France
Information: colloque@cirm.univ-mrs.fr, http://www.cirm.univ-mrs.fr

24–27: 22nd Summer Conference on Topology and Its Applications, Castellon, Spain
Information: sumtop07@uji.es; http://www.sumtop07.uji.es

August 2007

14–19: Workshops Loops '07, Prague, Czech Republic
Information: loops07@karlin.mff.cuni.cz; http://www.karlin.mff.cuni.cz/~loops07/workshops.html

15–18 International Conference on Integral Geometry, Harmonic Analysis and Representation Theory in honour of Sigurdur Helgason on the occasion of his 80th birthday, Reykjavik, Iceland
Information: http://www.raunvis.hi.is/Helgason/

19–25: Loops '07, Prague, Czech Republic
Information: loops07@karlin.mff.cuni.cz; http://www.karlin.mff.cuni.cz/~loops07

19–26: XXIInd International Workshop on Differential Geometric Methods in Theoretical Mechanics, Banach Center, Będlewo, Poland
Information: http://www.impan.gov.pl/BC/

20–24: Geometric Aspects of Analysis and Mechanics. A Conference in Honor of the 65-th Birthday of Hans Duistermaat, Utrecht, The Netherlands
Information: kolk@math.uu.nl;
http://www.math.uu.nl/people/kolk/Duistermaat65/duistermaat65.html

27–September 1: Workshop on Combinatorics and Commutative Algebra, The Aristotle University of Thessaloniki, Greece
Information: http://users.auth.gr/~hara/combcom07/webpage.htm

30–September 2: International Conference on Theory and Applications in Mathematics and Informatics (ICTAMI), Alba Iulia, Romania
Information: dbreaz@uab.ro; web site: www.uab.ro/ictami

September 2007

2–8: Linear and Non-Linear Theory of Generalized Functions and its Applications, Banach Center, Będlewo, Poland
Information: http://www.impan.gov.pl/BC/

3–7: Mathematical image processing meeting, CIRM Luminy, Marseille, France
Information: colloque@cirm.univ-mrs.fr, http://www.cirm.univ-mrs.fr

3–December 21: Phylogenetics, Cambridge, UK
Information: swilkinson@newton.cam.ac.uk;
http://www.newton.cam.ac.uk/programmes/PLG/index.html

5–10: Conference on Homological and Combinatorial Aspects in Commutative Algebra, Busteni, Romania
Information: http://www.univ-ovidius.ro/math/workshop/2007/index.htm

9–12: Grid Applications and Middleware Workshop 2007 (GAMW'2007), Gdansk, Poland; in conjunction with PPAM 2007

9–12: 7th International Conference on Parallel Processing and Applied Mathematics (PPAM 2007), Gdansk, Poland
Information: gamw@man.poznan.pl; http://ppam.pcz.pl

9–15: Measure Theory-Edward Marczewski Centennial Conference, Banach Center, Będlewo, Poland
Information: http://www.impan.gov.pl/BC/

10–14: Fifth Symposium on Nonlinear Analysis, Torun, Poland
Information: sna2007@mat.uni.torun.pl;
http://www-users.mat.uni.torun.pl/~sna2007/index.html

10–14: Aperiodic Order: new connections and old problems revisited, CIRM Luminy, Marseille, France
Information: colloque@cirm.univ-mrs.fr, http://www.cirm.univ-mrs.fr

17–21: WORDS 2007. 6th International Conference on Words, CIRM Luminy, Marseille, France
Information: colloque@cirm.univ-mrs.fr, http://www.cirm.univ-mrs.fr

18–22: Noncommutative rings and geometry. In honour of Freddy Van Oystaeyen on the occasion of his 60th birthday, Almería, Spain
Information: www.ual.es/Congresos/fred/

24–28: Conference in complex analysis and geometry, CIRM Luminy, Marseille, France
Information: colloque@cirm.univ-mrs.fr, http://www.cirm.univ-mrs.fr

24–29: 18th Congress of Unione Matematica Italiana, Bari, Italia
Information: segreteria@congressoumi2007.it
http://www.congressoumi2007.it/

October 2007

1–5: Thematic school on mathematics documentation (RNBM), CIRM Luminy, Marseille, France
Information: colloque@cirm.univ-mrs.fr, http://www.cirm.univ-mrs.fr

8–12: Diophantine approximation: curent trends, CIRM Luminy, Marseille, France
Information: colloque@cirm.univ-mrs.fr, http://www.cirm.univ-mrs.fr

11–14: "Geometric Function Theory and Nonlinear Analysis". Oon the occasion of the 60th birthday of Tadeusz Iwaniec, Hotel Continental Terme, Ischia, Naples, Italy
Information: tadeusz2007@dma.unina.it; http://www.dma.unina.it/~tadeusz2007

15–17: 2007 International Multiconference on Computer Science and Information Technology, Hotel Golebiewski, Wisla, Poland
Information: http://www.imcsit.org/

15–19: Matrix Analysis and Applications, CIRM Luminy, Marseille, France
Information: colloque@cirm.univ-mrs.fr, http://www.cirm.univ-mrs.fr

22–26: Calabi-Yau algebras and N-Koszul algebras, CIRM Luminy, Marseille, France
Information: colloque@cirm.univ-mrs.fr, http://www.cirm.univ-mrs.fr

29–November 1: Mathematical models of Traffic Flow, CIRM Luminy, Marseille, France
Information: colloque@cirm.univ-mrs.fr, http://www.cirm.univ-mrs.fr

November 2007

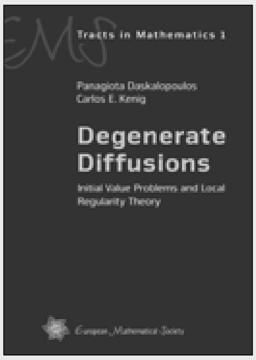
5–9: Arithmetic, Geometry, Cryptography and Coding Theory, CIRM Luminy, Marseille, France
Information: colloque@cirm.univ-mrs.fr, http://www.cirm.univ-mrs.fr

12–16: MODNET workshop on the model theory of fields, CIRM Luminy, Marseille, France
Information: colloque@cirm.univ-mrs.fr, http://www.cirm.univ-mrs.fr

19–22: Functional and Harmonic Analysis, CIRM Luminy, Marseille, France
Information: colloque@cirm.univ-mrs.fr, http://www.cirm.univ-mrs.fr

19–23: Geometrical Mechanics, CIRM Luminy, Marseille, France
Information: colloque@cirm.univ-mrs.fr, http://www.cirm.univ-mrs.fr

Books from the European Mathematical Society



Tracts in Mathematics Vol. 1

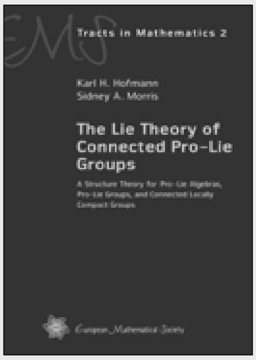
Panagiota Daskalopoulos (University of California, Irvine, USA)
Carlos E. Kenig (University of Chicago, USA)

Degenerate diffusions
Initial value problems and local regularity theory

ISBN 978-3-03719-033-3
2007. 207 pages. Hardcover. 17.0 cm x 24.0 cm
48.00 Euro

The book deals with existence, uniqueness, regularity and asymptotic behavior of solutions to the initial value problem (Cauchy problem) and the initial-Dirichlet problem for a class of degenerate diffusions modeled on the porous medium type equation $u_t = \Delta u^m$, $m \geq 0$, $u \geq 0$. Such models arise in plasma physics, diffusions through porous media, thin liquid film dynamics as well as in geometric flows such as the Ricci flow on surfaces and the Yamabe flow. The approach presented to these problems is through the use of local regularity estimates and Harnack type inequalities, which yield compactness for families of solutions. The theory is quite complete in the slow diffusion case ($m > 1$) and in the supercritical fast diffusion case ($m_c < m < 1$, $m_c = (n-2)_+/n$) while many problems remain in the range $m \leq m_c$. All of these aspects of the theory are discussed in the book.

The book is addressed to both researchers and to graduate students with a good background in analysis and some previous exposure to partial differential equations.



Tracts in Mathematics Vol. 2

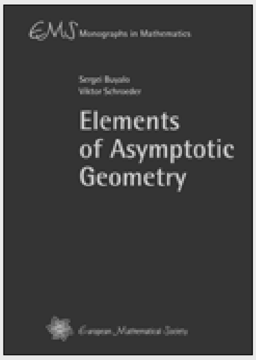
Karl H. Hofmann (Techn. Hochschule Darmstadt, Germany)
Sidney A. Morris (University of Ballarat, Australia)

The Lie Theory of Connected Pro-Lie Groups
A Structure Theory for Pro-Lie Algebras, Pro-Lie Groups, and Connected Locally Compact Groups

ISBN 978-3-03719-032-6
2007. 693 pages. Hardcover. 17.0 cm x 24.0 cm
88.00 Euro

Lie groups were introduced in 1870 by the Norwegian mathematician Sophus Lie. A century later Jean Dieudonné quipped that Lie groups had moved to the center of mathematics and that one cannot undertake anything without them.

This book exposes a Lie theory of connected locally compact groups and illuminates the manifold ways in which their structure theory reduces to that of compact groups on the one hand and of finite dimensional Lie groups on the other. It is a continuation of the authors' fundamental monograph on the structure of compact groups (1998, 2006), and is an invaluable tool for researchers in topological groups, Lie theory, harmonic analysis and representation theory. It is written to be accessible to advanced graduate students wishing to study this fascinating and important area of current research, which has so many fruitful interactions with other fields of mathematics.



EMS Monographs in Mathematics

Sergei Buyalo (Steklov Institute, St. Petersburg, Russia)
Viktor Schroeder (University of Zürich, Switzerland)

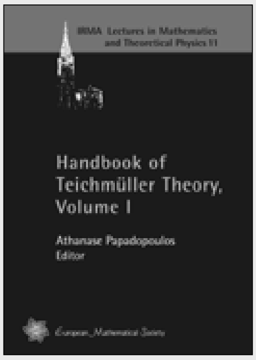
Elements of Asymptotic Geometry

ISBN 978-3-03719-036-4
2007. 209 pages. Hardcover. 16.5 cm x 23.5 cm
58.00 Euro

Asymptotic geometry is the study of metric spaces from a large scale point of view, where the local geometry does not come into play. An important class of model spaces are the hyperbolic spaces (in the sense of Gromov), for which the asymptotic geometry is nicely encoded in the boundary at infinity.

In the first part of this book, in analogy with the concepts of classical hyperbolic geometry, the authors provide a systematic account of the basic theory of Gromov hyperbolic spaces. The text leads concisely to some central aspects of the theory. Each chapter concludes with a separate section containing additional comments and historical remarks. Here the theory is also illustrated with numerous examples as well as relations to the neighboring fields of comparison geometry and geometric group theory.

The book is based on lectures the authors presented at the Steklov Institute in St. Petersburg and the University of Zurich. It is addressed to graduate students and researchers working in geometry, topology, and geometric group theory.



IRMA Lectures in Mathematics and Theoretical Physics

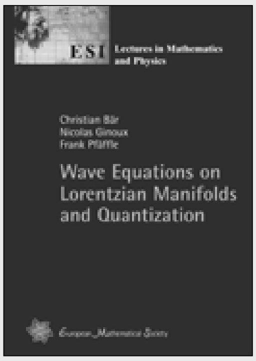
Handbook of Teichmüller Theory, Volume I

Athanase Papadopoulos (IRMA, Strasbourg, France), Editor

ISBN 978-3-03719-029-6
2007. 802 pages. Hardcover. 17 cm x 24 cm
Approx. 98.00 Euro

The Teichmüller space of a surface was introduced by O. Teichmüller in the 1930s. It is a basic tool in the study of Riemann's moduli spaces and of the mapping class groups. These objects are fundamental in several fields of mathematics including algebraic geometry, number theory, topology, geometry, and dynamics.

The purpose of this handbook is to give a panorama of some of the most important aspects of Teichmüller theory. The handbook should be useful to specialists in the field, to graduate students, and more generally to mathematicians who want to learn about the subject. All the chapters are self-contained and have a pedagogical character. They are written by leading experts in the subject.



ESI Lectures in Mathematics and Physics

Christian Bär, Nicolas Ginoux and Frank Pfäffle (University of Potsdam, Germany)

Wave Equations on Lorentzian Manifolds and Quantization

ISBN 978-3-03719-037-1
2007. 202 pages. Softcover. 17.0 cm x 24.0 cm
38.00 Euro

This book provides a detailed introduction to linear wave equations on Lorentzian manifolds (for vector-bundle valued fields). After a collection of preliminary material in the first chapter one finds in the second chapter the construction of local fundamental solutions together with their Hadamard expansion. The third chapter establishes the existence and uniqueness of global fundamental solutions on globally hyperbolic spacetimes and discusses Green's operators and well-posedness of the Cauchy problem. The last chapter is devoted to field quantization in the sense of algebraic quantum field theory. The necessary basics on C^*-algebras and CCR-representations are developed in full detail.

The text provides a self-contained introduction to these topics addressed to graduate students in mathematics and physics. At the same time it is intended as a reference for researchers in global analysis, general relativity, and quantum field theory.

European Mathematical Society Publishing House
Seminar for Applied Mathematics, ETH-Zentrum FLI C4
Fliederstrasse 23
CH-8092 Zürich, Switzerland
orders@ems-ph.org
www.ems-ph.org

26–30: Einstein manifolds and beyond, CIRM Luminy, Marseille, France
Information: colloque@cirm.univ-mrs.fr, http://www.cirm.univ-mrs.fr

December 2007

3–7: Einstein manifolds and beyond, CIRM Luminy, Marseille, France
Information: colloque@cirm.univ-mrs.fr, http://www.cirm.univ-mrs.fr

10–14: l-adic cohomology and number fields, CIRM Luminy, Marseille, France
Information: colloque@cirm.univ-mrs.fr, http://www.cirm.univ-mrs.fr

17–21: Meeting on mathematical statistics, CIRM Luminy, Marseille, France
Information: colloque@cirm.univ-mrs.fr, http://www.cirm.univ-mrs.fr

27–30: The Second International Conference on Mathematics: Trends and Developments (ICMTD07), Cairo, Egypt
Information: conf07@etms-web.org; http://www.etms-web.org/conf07/

March 2008

5–8: The First Century of the International Commission on Mathematical Instruction, Accademia dei Lincei, Rome, Italy
Information: http://www.unige.ch/math/EnsMath/Rome2008/

July 2008

14–18: Fifth European Congress of Mathematics (5ECM), Amsterdam, The Netherlands
Information: www.5ecm.nl

Recent Books

edited by Ivan Netuka and Vladimír Souček (Prague)

Books submitted for review should be sent to: Ivan Netuka, MÚUK, Sokolovská, 83, 186 75 Praha 8, Czech Republic.

***J. Awrejcewicz, V.A. Krysko: Introduction to Asymptotic Methods**, Chapman & Hall/CRC, Boca Raton, 2006, 251 pp., USD 89,95, ISBN 1-58488-677-3*
This book surveys various mathematical approaches to perturbation theory and illustrates their applicability on a number of simple, physically motivated examples and exercises expressed in terms of differential equations. These methods simplify the original formulation, still giving under certain conditions the essential characteristics of analysed processes. The topics covered include: (i) tools to study regular and singular perturbations, (ii) renormalization, characteristics and multiple scale methods for one-dimensional time-dependent nonlinear waves, (iii) the Padé approximation and its application in mechanics, (iv) oscillators with negative Duffing type stiffness, and (v) differential equations with discontinuous nonlinearities. The importance of understanding the physical concepts behind the model under consideration is emphasized throughout the book. (jmal)

***S. Benzoni-Gavage, D. Serre: Multi-dimensional Hyperbolic Partial Differential Equations – First-order Systems and Applications**, Oxford Mathematical Monographs, Oxford University Press, Oxford, 2006, 508 pp., GBP 60, ISBN 0-19-921123-X*
This carefully written and well-thought-out book presents a comprehensive view on mathematical theory concerning multi-dimensional hyperbolic partial differential equations. The main body of the book consists of four parts. The first part deals with the theory of linear Cauchy problems that involve both constant and variable coefficients, the latter illustrating the power of pseudo-differential and para-differential calculus (presented separately in the appendix). The second part is devoted to linear initial boundary value problems, proceeding from simpler to more complicated systems (symmetric, constant coefficients, variable coefficients). The third part is devoted to the theory of nonlinear problems, focusing on the notion of a smooth solution and a piecewise smooth solution suitable for analysis of shock waves (as is carefully proved). The last part investigates problems in gas dynamics and it includes a discussion of appropriate boundary conditions and shock-wave analysis. The text is completed with an extensive bibliography including classical and recent papers both in partial differential equation analysis and applications (mainly in gas dynamics). (jmal)

***N. Bergeron: Propriétés de Lefschetz automorphes pour les groupes unitaires et orthogonaux**, Mémoires de la Société Mathématique de France, no. 106, Société Mathématique de France, Paris, 2006, 125 pp., EUR 26, ISBN 978-2-85629-219-8*
The main aim of this volume of the 'Mémoires de la SMF' is to study properties of cohomology groups for an arithmetic manifold and its totally geodesic submanifolds. The classical Lefschetz hyperplane theorem states that the restriction map induced on suitable cohomology groups by a (generic) hyperplane section of a projective manifold is injective. In the book, the author discusses a (broad) analogy of the classical Lefschetz theorem for arithmetic manifolds associated to the unitary and orthogonal groups $U(p,q)$ and $O(p,q)$. There are two types of results: injectivity of the map associated with a (virtual) restriction and the one associated with 'a cup product with the class of the cycle'. The methods used are based on representation theory and a review of required results can be found in the early sections of the book. (vs)

D. Bertrand et al., Eds.: Differential Equations and Quantum Groups, *IRMA Lectures in Mathematics and Theoretical Physics, vol. 9, European Mathematical Society, Zürich, 2006, 292 pp., EUR 44.50, ISBN 978-3-03719-020-3*

This collection of papers is centred around topics of research of the late Andrei A. Bolibrukh. It starts with two short survey papers. The first one (written by Y. Ilyashenko) describes two Bolibrukh results (a sufficient condition for the solvability of the Riemann-Hilbert problem for Fuchsian systems and a discussion of the reduction to Birkhoff standard form). The second one (by C. Sabbah) contains a discussion of isomonodromic deformations and isomonodromic confluences.

Then there are ten other research contributions on various themes including a study of relations between two notions of integrability (M. Audin), formal power series solutions of the heat equation (W. Balser), master functions and the Schubert calculus on flag manifolds (P. Belkale, E. Mukhin and A. Varchenko), explicit solutions of the Riemann-Hilbert problem (P. Boalch), Galois theory for linear differential equations of a certain type (P. J. Cassidy, M. F. Singer), reductions of the Schlesinger equations (B. Dubrovin, M. Mazzocco), the Riemann-Hilbert correspondence for generalized KZ equations (V. A. Golubeva), monodromy groups of regular systems (V. P. Kostov), monodromy of Cherednik-Kohno-Veselov connections (V. P. Leksin) and finally a review of basic ideas of general differential Galois theory for ordinary differential equations (H. Umemura). The whole volume is dedicated to the memory of A. A. Bolibrukh and it gives an overview of recent results in the fields of his research interests. (vs)

R. Bhatia: Positive Definite Matrices, *Princeton Series in Applied Mathematics, Princeton University Press, Princeton, 2006, 254 pp., USD 55 ISBN 978-0-691-12918-1*

This book represents the first synthesis of the considerable body of new research in positive definite matrices. Through detailed explanations and an authoritative and inspiring writing style, R. Bhatia carefully develops general techniques that have wide applications in the study of such matrices. The book begins with a quick review of some of the basic properties of positive matrices. The author introduces several key topics in functional analysis, operator theory, harmonic analysis and differential geometry, all built around the central theme of positive definite matrices. Chapters 2 and 3 are devoted to a study of positive and completely positive maps and, in particular, on their use in proving inequalities. In chapter 4 the author discusses means of two positive definite matrices with special emphasis on the geometric mean. Among some spectacular applications of these ideas, the author includes proofs of some theorems in the field of matrix convex functions and two of the most famous theorems in the field of quantum mechanical entropy. Chapter 5 gives a quick introduction to positive definite functions on the real line. Again, special attention is given to various means of matrices. Many of these results come from recent research work. Chapter 6 presents some standard and important theorems of Riemannian geometry as seen from the perspective of matrix analysis. Notes and references are appended to each chapter.

The textbook is an informative and useful reference book for mathematicians and other researchers and practitioners. The numerous exercises and notes also make it ideal for graduate-level courses. (kn)

M. Bierlaire: Introduction a l'optimisation différentiable, *Enseignement des mathématiques, Presses polytechniques et univ. romandes, Lausanne, 2006, 532 pp., EUR 54.95, ISBN 2-88074-669-8*

Optimization theory on finite-dimensional linear spaces involving smooth (i.e. differentiable) cost functions and possibly also functional constraints is a fundamental discipline in solving various applied optimization problems with a finite number of design variables and a finite number of constraints. After introducing the general area and basic concepts in part 1, the textbook lucidly presents all major aspects of this theory. Part 2 deals with necessary and sufficient optimality conditions for problems without (or with) constraints, the Lagrange multiplier method, Karush-Kuhn-Tucker conditions, and sensibility analysis. Special attention is paid to linear and quadratic mathematical programming. Part 3 presents the Newton and quasi-Newton methods for solving systems of nonlinear equations. Part 4 then treats unconstrained optimization, starting by solving a quadratic case with the direct method or the conjugate-gradient method and continuing for a general case with the Newton method applied to optimality conditions, the descent method including line-search strategies, trust-region methods, and the quasi-Newton method with the Broyden-Fletcher-Goldfard-Shanno (BFGS) method.

Eventually, part 5 addresses constrained problems: the simplex method for linear programming, the Newton method with projected gradients, interior-point methods, the augmented-Lagrangian method and sequential quadratic programming. The textbook is equipped with many numerical examples illustrating the efficiency of the expounded methods and algorithms. It is also augmented with attractive biographical sketches and photos of mathematicians who have contributed substantially to the field. It ends with lists and appendices of definitions, theorems, examples and algorithms, and an index. All this makes it an excellent textbook for French-reading students and also for researchers interested in optimization theory. (troub)

G. Boffi, D. A. Buchsbaum: Threading Homology Through Algebra – Selected Patterns, *Oxford Mathematical Monographs, Oxford University Press, Oxford, 2006, 255 pp., GBP 60, ISBN 0-19-852499-4*

This monograph shows how homological algebra helps one to connect, understand more deeply and prove important results in commutative algebra, representation theory and combinatorics. The key tool used here is the Koszul complex and its generalizations. The book is divided into seven chapters: after a preliminary chapter 1, the second chapter deals with local ring theory and proves Serre's characterization of regular local rings and their factoriality. Chapter 3 introduces generalized Koszul complexes and presents some of their recent applications. In chapter 4 structure theorems for finite free resolutions (extending the Hilbert-Burch theorem) are proved. Chapters 5–6 and the appendix concentrate on determinantal ideals and characteristic-free representation theory. However, they also involve a good deal of combinatorics, especially when dealing with the structure of Weyl and Schur modules and their applications (via tableaux and letter place algebras). By carefully selecting the material and clearly presenting the key ideas, the authors have succeeded in writing a very nice and useful monograph both for graduate students and for experts in algebra and representation theory. (jtrl)

R. Casse: Projective Geometry – An Introduction, Oxford University Press, Oxford*, 2006, 198 pp., GBP 24,95, ISBN 0-19-929886-6*

This textbook is a very accessible introduction to projective geometry based on lectures given at the University of Adelaide. The book assumes a familiarity with linear algebra, elementary group theory, partial derivatives, finite fields and elementary coordinate geometry, hence it is suitable for students in their third or fourth year at university. The beginning of the book is devoted to Desargues' theorem, which plays a key role in projective geometry. In the following chapters, the author introduces the reader to axiomatic geometry and defines the field plane $PG(2,F)$ and its higher dimensional generalization $PG(r,F)$. The author also considers projective spaces of dimension 2 (known as non-Desarguesian planes). The last chapters deal with conics and quadrics in $PG(3,F)$. The textbook uses modern concepts of projective geometry closely related to algebra and algebraic geometry with the aim of helping the reader to understand and master proof techniques. An attractive feature of the book is a number of solved examples and more than 150 exercises. (jol)

P. J. Collins: Differential and Integral Equations*, Oxford University Press, Oxford, 2006, 372 pp., GBP 27,50, ISBN 0-19-929789-4; GBP 70, ISBN 0-19-853382-9*

This book serves as a guide to undergraduate courses in ordinary and partial differential equations. It contains the basic theory of ordinary differential equations (existence and uniqueness theorems), the variation of parameters method and the correspondence between differential and integral equations. Concerning partial differential equations, the book introduces the reader to first and second order partial differential equations, the reduction of the more general elliptic, parabolic and hyperbolic equations to the Laplace equation, the heat equation and the wave equation, together with classical results on these three basic equations. Some additional methods are then presented (including the Neumann series expansion for integral equations, the power series method, the Fourier transform method and the phase-plane analysis). There is also an introduction to the calculus of variations. The book is very well arranged. Every section is followed by many examples and exercises for better understanding of the topic. Theorems are usually not formulated in the strongest possible form, which increases the comprehensibility of the text. The book is intended not only for students of mathematics but also for students of physics, economics and other fields where differential equations play an important role. (bar)

J. Dauns, Y. Zhou: Classes of Modules*, Pure and Applied Mathematics, vol. 281, Chapman & Hall/CRC, Boca Raton, 2006, 218 pp., USD 89,95, ISBN 1-58488-660-9*

General module theory is too vast an area to provide for general structure theory, the major problem being the lack of a satisfactory decomposition theory. In this monograph, the authors propose the notions of a natural class of modules (i.e. a class closed under submodules, direct sums and essential extensions) and of a type submodule (i.e. a submodule maximal among those belonging to a natural class) to overcome this problem. They call a module M a TS-module if every type submodule of M is a direct summand. TS-modules thus generalize the notions of an extending module or a CS-module. In chapter 4, type dimension theory of a module is developed in analogy to the classical finite uniform dimension theory. Chapter 5 extends decomposition theory of CS-modules to TS-modules. It contains moreover a far reaching generalization of the Goodearl-Boyle decomposition theory of non-singular injective modules into type I, II, and III submodules (using the fact that in the appropriate generalization, type I, II, and III modules form a natural class each). Chapter 6 deals with relations between the structure of a ring R and the lattice of (pre-)natural classes of R-modules. As the authors point out, the book not only presents a new theory but it suggests a new path through general ring and module theory. (jtrf)

E. Deza, M. M. Deza: Dictionary of Distances*, Elsevier, Amsterdam, 2006, 391 pp., EUR 125, ISBN 0-444-52087-2*

This book covers in an encyclopedic way many aspects of the broad concept of 'distance'. It is divided into seven parts and 28 chapters, the majority of the text dealing with a rich variety of metrics on an equally rich class of mathematical objects. Some space is devoted to entries from outside of mathematics, including concepts as foreign to quantification as for example 'moral distance' or curiosities like 'Ironman distance' or Hollywood 'co-starring distance' (the last one to be found in chapter 22, which is called "Distances in Internet and Similar Networks"). The title correctly announces that the book is written as a dictionary, that is, the reader is given a list of entries, each of them treated in a short and succinct way. The collection originates from a personal archive of the authors. The majority of the book is written for a reader who is familiar with technical mathematical language. At the end of the book is a list of entries but there is no index of keywords (that means for example that you will not find the Euler angle metric if looking for the keyword 'angle'; it is listed only under the letter 'E'). Anybody who wants a comprehensive and reliable list of different mathematical (and some non-mathematical) concepts of distance in one place (and without using Google) will find it in this book. (shol)

F. J. E. Dillen, L. C. A. Verstraelen, Eds.: Handbook of Differential Geometry II*, Elsevier, Amsterdam, 2006, 560 pp., EUR 175, ISBN 0-444-52052-X*

This book is the second volume of a two-volume handbook reviewing many topics of contemporary differential geometry. In this volume there are eight surveys on various themes: Finsler geometry and its differential invariants (written by J. Alvarez Paiva), foliations, characteristic classes and deformation theory (by R. Barre and A. Kacimi Alaoui), symplectic manifolds, Lagrangian submanifolds and complex structures, Hamiltonian geometry and symplectic reduction (by A. Cannas da Silva), metric Riemannian geometry including Gromov-Hausdorff distance, collapsing Riemannian manifolds, Alexandrov spaces and Hausdorff convergence (by K. Fukaya), contact manifolds, particularly in dimension 3 (by H. Geiges), complex manifolds, Kahler manifolds and harmonic differential forms (by I. Mihai), Lagrange spaces, Finsler spaces and Lagrange spaces of higher order (by R. Miron), and Lorentzian manifolds and their curvature, geodesics and the Bochner techniques (by F. Palomo and A. Romero). The volume therefore covers many important fields in differential geometry. (vs)

***T. Ekedahl: One Semester of Elliptic Curves**, EMS Series of Lectures in Mathematics, European Mathematical Society, Zürich, 2006, 130 pp., EUR 32, ISBN 3-03719-015-9*

This rather short book gives an introduction to all important aspects of the theory of elliptic curves. As a consequence, many numerically or algebraically demanding calculations are left to the reader, often in the form of exercises. The book starts with a discussion of some analytic aspects of elliptic curves (including elliptic integrals, elliptic functions and projective realizations of elliptic curves). A more algebraic approach is used in a description of the standard correspondence between equivalence classes of elliptic curves and lattices, thereby leading to the j-function. By the end, the author has turned to more advanced topics like counting points on elliptic curves, curves with complex multiplication and the use of modular forms for proving the Jacobi formula for the number of representations of a positive integer as a sum of four squares. The book will be useful both for students of mathematics and computer science. (pso)

***P. Etingof: Calogero-Moser Systems and Representation Theory**, Zurich Lectures in Advanced Mathematics, European Mathematical Society, Zürich, 2007, 92 pp., EUR 28, ISBN 978-3-03719-034-0*

This small booklet contains lecture notes on the Calogero-Moser integrable system and its relation to other fields of mathematics. In one small place, the reader will find a fascinating kaleidoscope of interesting and modern topics, all interacting with the main theme of the book. The author offers a short description of each subject involved, subjects that include Poisson geometry and Hamiltonian reduction; integrable systems, action-angle variables and the classical and trigonometric Calogero-Moser system; deformation theory of associative algebras and Hochschild cohomology, together with Kontsevich quantization of Poisson structures; quantum momentum maps, quantum Hamiltonian reduction and the Levasseur-Stafford theorem; quantization of the Calogero-Moser system and the Calogero-Moser systems for finite Coxeter groups; Dunkl operators and Olshanetsky-Perelomov Hamiltonians; the rational Cherednik algebra and its relation to double affine Hecke algebras; symplectic reflection algebras and the Koszul deformation principle; the deformation approach to symplectic reflection algebras and, finally, representation theory for rational Cherednik algebras. The exposition still keeps the flavour of the corresponding lectures and it presents in a nice, condensed but understandable form the core of the theory. It really is a remarkable book. (vs)

***A. Favini, A. Lorenzi, Eds.: Differential Equations – Inverse and Direct Problems**, A Series of Lecture Notes in Pure and Applied Mathematics, vol. 251, Chapman & Hall/CRC, Boca Raton, 2006, 288 pp., USD 169,95, ISBN 1-58488-604-8*

This volume contains contributions arising from lectures and related discussions held at the meeting on 'Differential Equations: Inverse and Direct Problems', which took place at Cortona, 21st-25th June 2004. Almost all of fourteen contributions contain original results; they do not just survey and explain results already published elsewhere. They cover a wide scope of up-to-date topics from the field of differential equations. Thus there are papers dealing with abstract differential equations in Banach spaces, linear and nonlinear semigroup theory, direct and inverse problems for non-degenerate and degenerate equations, differential equations with Wentzell boundary conditions and a deep study of equations of mathematical physics (e.g. from superconductivity and phase transition problems). The book will be an interesting and stimulating read for research workers in the field. (jsta)

***A. Fletcher, V. Markovic: Quasiconformal Maps and Teichmüller Theory**, Oxford Graduate Texts in Mathematics 11, Oxford University Press, Oxford, 2006, 189 pp., GBP 45, ISBN 0-19-856926-2*

This text is based on a series of graduate lectures given by V. Markovic at the University of Warwick. The book is intended as an introduction to quasiconformal mappings in dimension 2 and Teichmüller theory. The reader is assumed to have a background in complex analysis and to be familiar with Riemann surfaces and hyperbolic geometry. The book starts with analytic and geometric definitions of quasiconformal mappings and continues with a study of their basic analytical properties. The connection with quasisymmetric maps and the Beltrami equation is explained in the following chapters, before a presentation of the definitions and basic properties of holomorphic motions and Teichmüller spaces. Extremal quasiconformal mappings are studied together with conditions that guarantee the unique extremality of a mapping. The book is well-written and illustrated with a number of examples. Some proofs are omitted but references to other sources are always given. (hencl)

***J.-F. Gerbeau, C. Le Bris, T. Lelievre: Mathematical Methods for the Magnetohydrodynamics of Liquid Metals**, Numerical Mathematics and Scientific Computation, Oxford University Press, Oxford, 2006, 305 pp., GBP 55, ISBN 0-19-856665-4*

The main topic of this book is an analysis and numerical simulation of a mathematical model consisting of magnetohydrodynamic equations describing the motion of two immiscible incompressible Newtonian fluids. The prototypical industrial application of this model is a simulation of reduction cells for the production of aluminium. However, the authors do not restrict themselves only to this specific application and cover a wide area of related topics. The book starts with a brief explanation of principles leading to the governing equations of magnetohydrodynamics. The resulting model consists of the incompressible Navier-Stokes equations with the Lorentz force on the right-hand side, a parabolic equation for the magnetic induction depending on the fluid velocity and appropriate boundary conditions. Chapters 2 and 3 are devoted to the analysis of the one-fluid problem and to its numerical solution by the finite element method. The emphasis is on the coupling between hydrodynamic and electromagnetic phenomena. The material is rather standard but very useful for readers not familiar with the respective techniques. Moreover, it allows the authors to concentrate only on key issues, with a special emphasis on nonlinear phenomena.

The next two chapters are the central chapters of the book and are mainly based on original research by the authors. These chapters deal with the mathematical analysis and numerical solution of multifluid magnetohydrodynamic problems, where the basic additional difficulty is a geometric nonlinearity due to the presence of free interfaces separating the immiscible fluids. The discretization is based on the popular arbitrary Lagrangian Eulerian method but other approaches are also briefly mentioned. The final chapter is devoted to the industrial application that motivated the preceding five chapters and it serves as an illustration of the efficiency of the approach presented in the book. The comprehensive text is well written and it contains many examples of numerical simulations and many references to relevant literature. It is intended for mathematicians, engineers and physicists and it will also be valuable for experts in mathematical and numerical analysis of magnetohydrodynamics as well as for those who want to learn the basic issues in this fascinating area. (knob)

H.-J. Glaeske, A. P. Prudnikov, K. A. Skornik: Operational Calculus and Related Topics*, Analytical Methods and Special Functions, vol. 10, Chapman & Hall/CRC, Boca Raton, 2006, 403 pp., USD 89,95, ISBN 1-58488-649-8*

This book covers a reasonable portion of topics encountered in the theory and practice of operational calculi for functions of one real variable. It is intended and can be used both as an introductory text or a reference book for mathematicians, physicists and engineers. In the first of three chapters a vast collection of integral transforms is gathered. Operational rules, convolution, some special inverse formulas and selected important properties are presented for each of the transforms. The second chapter is dedicated to Mikusiński's operational calculus. A field of so-called operators is built out of a ring of functions. Most importantly, there is an operator p in this field that represents differentiation. Many algebraic and analytical properties and operational rules are investigated. The third chapter deals with generalized functions. After a brief exposition of the 'functional approach' (i.e. distributions as functionals on the space $D(R)$), a bigger part of this section presents 'sequential approach' (pioneered again by J. Mikusiński), which defines distributions as equivalence classes of certain sequences of smooth functions.

All three chapters are packed with many examples of concrete computations of transforms of selected functions. Careful attention is given to the application of exposed calculi to the solution of differential and integral equations, summation of series and evaluation of integrals. Most of the assertions are proved and the proofs are very detailed. The reader is expected to know the basics of calculus, Lebesgue integration, complex analysis and algebra. Functional analysis is intentionally avoided. As it happens, there are some typos and grammatical mishaps. Mostly they are insignificant. Unfortunately, in some cases (e.g. "Fourier transform of L_1 function must not be L_1") the very mathematical meaning is influenced. (apr)

J. R. Goodstein: The Volterra Chronicles – The Life and Times of an Extraordinary Mathematician 1860–1940*, History of Mathematics, vol. 31, American Mathematical Society, Providence, 2007, 310 pp., USD 59, ISBN 978-0-8218-3969-0*

This book contains a wealth of information about Vito Volterra and his life. A large part of the personal history of Volterra and his family is based on the letters sent to his mother and wife; numerous excerpts presented in the book have been translated into English. The scientific career of Volterra's is traced, starting with his university studies and early professorship at Pisa, followed by a shorter period in Turin and finally his appointment at the University of Rome. Volterra was also a passionate traveller and we learn about his impressions of people and places throughout Europe and America. Volterra's scientific achievements are discussed in a reprint of E. Whittaker's obituary from 1941. The book provides a very readable account of the Italian scientific community and Italian history and politics in the 19th and 20th century. (asl)

A. Gray, E. Abbena, S. Salamon: Modern Differential Geometry of Curves and Surfaces with MATHEMATICA*, third edition, Chapman & Hall/CRC, Boca Raton, 2006, 984 pp., USD 89,95, ISBN 1-58488-448-7*

This is a nicely readable textbook on differential geometry. It offers an outstanding, comprehensive presentation of both theoretical and computational aspects. All 27 chapters are accompanied by *Mathematica* code in the form of *Mathematica* notebooks in the appendix (the code can be downloaded from the publisher's web site). This approach enables the reader to better understand how to define and compute standard geometric functions and how to construct new curves and surfaces from existing ones. Moreover, work with *Mathematica* notebooks may serve as a natural way of acquiring the basic and intermediate knowledge of *Mathematica* by example. There are hundreds of illustrations that help the reader visualize the concepts. Throughout the book the reader will find biographical information about 75 scientists, most of them with small portraits. It is a nicely written book, strongly recommended to all with an interest in differential geometry, its computational aspects and related fields. (jh)

G. S. Hall: Symmetries and Curvature Structure in General Relativity*, World Scientific Lecture Notes in Physics, vol. 46, World Scientific, New Jersey, 2004, 430 pp., USD 64, ISBN 981-02-1051-5*

This is a book describing the mathematics, and primarily the geometry, needed for the general theory of relativity. The first five chapters describe very basic notions. The exposition starts with groups, some linear algebra (including the Jordan canonical form of an endomorphism) and an introduction to the notion of Lie algebra, followed by metric and topological spaces, their various properties and finally the notion of a fundamental group and a covering space. The next part is devoted to differentiable manifolds and basic structures on them. Finally, the last section of this introductory part is devoted to Lie groups. This part, in fact, can be read by anybody who intends to learn the above mentioned topics. It should be mentioned that this introductory text is very nicely written.

The more specialized second part of the book starts with a chapter on the Lorentz group. It provides a lot of information about this group in compact form. It would hardly be possible to find all these facts together in one source elsewhere. Then the notion of a space-time (a 4-dimensional manifold endowed with a pseudo-Riemannian metric with signature + + + –) appears and the rest of the book deals with these space-time manifolds. Here, there are many results concerning this special branch of differential geometry: firstly the algebraic classification of space-time manifolds (above all the Petrov classification), than an investigation of the holonomy groups of these manifolds, an investigation of connections and the corresponding curvature tensors on these manifolds and finally symmetries. Isometries, homotheties, conformal symmetries, projective symmetries and curvature collineations are all studied. This second part, which represents the core of the book, will be attractive for physicists,

who can revise their knowledge in a more mathematical form, but also for mathematicians working in differential geometry whose field is a little aside from space-time manifolds. Because of the first introductory part, the book is to a great extent self-contained and consequently can be recommended for students, possibly even undergraduate students with enough endurance. In the bibliography there are many references for further reading and for the study of relativity theory. (jiva)

A. B. Kharazishvili: Strange Functions in Real Analysis*, second edition, Pure and Applied Mathematics, Chapman & Hall/CRC, Boca Raton, 2005, 415 pp., USD 119,95, ISBN 1-58488-582-3*
This book presents a number of important examples and constructions of pathological sets and functions as well as their properties and applications. Although the author is interested in all types of strange sets and functions, the central topic of the monograph is the question of the existence of continuous functions that are not differentiable with respect to various concepts of generalized derivatives. The book is organized as follows. After recalling basic facts from set theory, topology and measure theory, examples of Cantor and Peano type functions are constructed. The author continues with basic properties of the space of Baire-one functions and with applications to separately continuous functions. Particular subclasses of semi-continuous functions are analysed in the next chapter. The next part is devoted to a study of the differentiability properties of real functions. Monotone functions are investigated and some pathological examples of monotone functions are constructed. The next chapters deal with everywhere differentiable nowhere monotone functions and nowhere approximately differentiable functions.

A connection between category and measurability is another important part of the monograph. Blumberg's theorem and Sierpinski-Zygmund functions are followed by examples and properties of Lebesgue nonmeasurable functions and functions without the Baire property. After that, bad solutions of the Cauchy functional equation are discussed. Luzin and Sierpinski sets along with applications are presented in the next chapter. Interesting relations between absolutely nonmeasurable functions and the measure extension problem are shown, followed by examples witnessing the fail of Egorov type theorems for pathological functions. Several results connected with Sierpinski's partition of the Euclidean plane follow. Examples of bad functions defined on second category sets conclude this part of the book. The next chapter is devoted to sup-measurable and weakly sup-measurable functions and to applications in the theory of ordinary differential equations.

In the final part of the book, the family of continuous non-differentiable functions is considered from the point of view of category and measure. A short scheme for constructing the classical Wiener measure is presented along with some simple but useful statements from the theory of stochastic processes. Since the book is self-contained and the proofs are explained in detail, it should be accessible for all kinds of interested readers. All chapters are endowed with a large number of exercises that vary from elementary to difficult and provide a deeper insight into topics presented in the book. Thus the monograph is a good companion in the realm of pathological objects and counterexamples in real analysis. (jsp)

A. Kuku: Representation Theory and Higher Algebraic K-Theory*, Pure and Applied Mathematics, vol. 287, Chapman & Hall/CRC, Boca Raton, 2006, 442 pp., USD 99,95, ISBN 1-58488-603-X*
This book provides a unified treatment of a number of deep results connecting representation theory of groups in the broad sense of (continuous) homomorphisms from a group to automorphisms of objects of a category on one hand, and higher K-theory (the structure of K_n, G_n-groups) on the other hand. The book consists of three parts. The first one reviews classical algebraic K-theory (Grothendieck groups and rings, K_0, K_1, K_2, K_n, and their applications to orders and group rings). The second part presents the main results of higher K-theory and their applications to integral representations. The third part employs Mackey, Green, and Burnside functors in the development of equivariant higher algebraic K-theory and equivariant homology theory. The book culminates in a detailed discussion of the Baum-Connes conjecture and related conjectures on certain assembly maps being isomorphisms. Given the amount of results presented in the book, the author is forced in some cases to sketch proofs or refer to other sources for details. However, there are a number of detailed computations, especially of the G_n-groups in section 7. There are also two appendices. The first collects together important computational tools of K-theory, the second presents eighteen open problems. Written by a leading expert in the field, this monograph will be indispensable for anyone interested in contemporary representation theory and its K-theoretic aspects. (jtrl)

L. A. Kurdachenko, J. Otal, I. Ya. Subbotin: Artinian Modules over Group Rings*, Frontiers in Mathematics, Birkhäuser, Basel, 2006, 247 pp., EUR 42, ISBN 3-7643-7764-X*
Group rings, RG, and their modules play a central role in the structure theory of groups. The present monograph concentrates on the special case of artinian modules over the *RG*s, where *R* is a Dedekind domain and *G* is an infinite group satisfying some finiteness condition. The monograph consists of seventeen chapters. After several preliminary chapters on groups and modules, the Kovacs-Newman generalization of the Maschke theorem is presented in chapter 7 and Hartley's characterization of the V-rings of form *RG* where *R* is a field and *G* is a countable group in chapter 9. The core of the book naturally covers results on artinian modules: their Baer decompositions for *G* locally soluble *RG*-hypercentral obtained in chapter 10 and their structure for *G* abelian of finite section rank in chapter 14. In the final chapter, as an application of the tools developed, the authors present a new proof of Robinson's theorem concerning splitting of a group over its abelian generalized nilpotent radical. Equipped with a list of 313 references, the book will be useful for students and researchers both in group theory and in ring and module theory. (jtrl)

P. D. Miller: Applied Asymptotic Analysis*, Graduate Studies in Mathematics, vol. 75, American Mathematical Society, Providence, 2006, 467 pp., USD 69, ISBN 0-8218-4078-9*
This book is intended for a graduate course on asymptotic analysis in applied mathematics. The reader is assumed to have a background in differential equations, advanced calculus, complex analysis and matrix algebra at the level of introductory undergraduate courses. The text is self-contained and the exposition is well-written. The book contains chapters about various

methods of asymptotic analysis of exponential integrals, ordinary differential equations, ordinary differential equations with parameters and partial differential equations like propagation of waves. The text stresses rigorous analysis in addition to formal manipulation. Asymptotic expansions are rigorously justified and the reader is shown how to obtain solid error estimates. The book is accompanied by a considerable number of well-chosen examples and exercises that illustrate the theory. (shen)

***F. Morel: Homotopy Theory of Schemes**, SMF/AMS Texts and Monographs, vol. 12, American Mathematical Society, Providence, 2006, 104 pp., USD 39, ISBN 0-8218-3164-X*

The aim of this memoir is to define the homotopy category of (Noetherian, separated and admitting an ample family) schemes and to show that this category plays the same role for smooth (Noetherian, separated and admitting an ample family) schemes as the classical homotopy category does for differentiable (topological) varieties. For schemes of finite Krull dimension, the combinatorial definition of Morel agrees with the topological approach (based on the concept of sheaves in the Nisnevich topology) of Voevodsky. The main results of this monograph are the homotopic purity theorems, which are the foundation of localization exact sequences for any oriented cohomology theory and Poincare duality; the Thom space of closed immersions between two smooth schemes of the above type depends only on the normal bundle of the immersion. The main technical obstacle in comparison to the case of differentiable varieties is that one does not have the notion of a tubular neighbourhood. A suitable replacement of this device relies on techniques of deformations of the normal bundle. (ps)

***J. Oxley: Matroid Theory**, Oxford Graduate Texts in Mathematics 3, Oxford University Press, Oxford, 2006, 532 pp., GBP 32,50, ISBN 0-19-920250-8*

Matroid theory is a relatively young field of mathematics. Its origins are in 1935 when Whitney generalized common graph theory and linear algebra principles. This book was first published in 1992 and it is in recent times the most complete introductory monograph on matroid theory. Since the topic has grown widely one cannot give a complete survey in a single book. Hence the author has had to be selective. The first few chapters were chosen in a natural way. Chapters 1–6 provide a basic overview of matroid theory and cover the materials needed for this introductory course on the topic. The later chapters contain more details on matroid connectivity, representativity and decompositions. The theory is built stepwise and proofs are presented for almost all important statements. Hence the reader gets an overview of the results and can also observe how the proof techniques work. From this point of view, the book is essential for the researcher but can also be used as a textbook for both introductory and advanced courses on matroid theory. The advantage of the book as a study text is that it contains many examples and each section is supplemented by exercises. (pang)

***A. Polishchuk, L. Positselski: Quadratic Algebras**, University Lecture Series, vol. 37, American Mathematical Society, Providence, 2005, 159 pp., USD 35, ISBN 0-8218-3834-2*

The main topic treated by this book is a study of the generalizations of the Poincaré-Birkhoff-Witt theorem to quadratic algebras. The book starts with a review of various definitions and facts from homological algebra (including the bar construction and a quadratic duality for quadratic algebras). In chapter 2, the authors describe various definitions and properties of Koszul algebras and Koszul modules. A notion of an infinitesimal bialgebra of a Koszul algebra is introduced here. Natural operations on quadratic algebras and modules are studied in chapter 3 (including the Segre product and Veronese powers). The PBW algebras form a special subclass of Koszul algebras and their properties are studied in chapter 4. Nonhomogeneous quadratic algebras are studied in chapter 5. In particular, there is a discussion of an analogue of quadratic duality leading to the notion of curved DG-algebras. The Kozsul deformation principle and its consequences are discussed in chapter 6. The final chapter is devoted to a surprising connection to one-dependent discrete-time stochastic processes. The book offers a nice review of the field together with some new results. (vs)

***V. V. Prasolov: Elements of Combinatorial and Differential Topology**, Graduate Studies in Mathematics, vol. 74, American Mathematical Society, Providence, 2006, 331 pp., USD 59, ISBN 0-8218-3809-1*

The main topic of this book is combinatorial and differential topology. The author discusses a lot of interesting and basic facts avoiding sophisticated techniques, hence the reading of the book requires only a modest background for these topics (e.g. basic topological properties of sets in Euclidean space). After an introductory discussion of graphs, the topology of subsets in Euclidean space is considered (including the Jordan theorem for curves, the Brouwer fixed point theorem and the Sperner lemma). Simplicial complexes and CW-complexes are discussed in the next chapter, followed by a treatment of surfaces, coverings, fibrations and homotopy groups. The fifth chapter turns to differential topology (smooth manifolds, embeddings and immersions, the degree of a map, the Hopf theorem on the homotopy classification of maps to the sphere and Morse theory). The last chapter treats the fundamental groups (with many explicit examples). The book contains a lot of problems and their solutions can be found at the end of the book. (vs)

***M. Rosen, Ed.: Exposition by Emil Artin – A Selection**, History of Mathematics, vol. 30, American Mathematical Society, Providence, 2006, 72 pp., USD 59. ISBN 0-8218-4172-6*

Emil Artin was one the leading personalities of algebra and number theory from the early part of the 20th century. He was the only mathematician to solve two of the famous Hilbert problems and many important notions now bear his name: artinian rings, the Artin reciprocity law, Artin L-functions, etc. The present volume of "History of Mathematics – Sources" reprints a selection of Artin's work: his three famous short books (*The Gamma Function*, *Galois Theory* and *Theory of Algebraic Numbers*) and ten papers, mainly on algebra (on braid groups, real fields etc.), three of which appear here in English for the first time. Michael Rosen has written an introduction providing interesting comments on the reprinted work and a brief biographical sketch starting from Artin's childhood in Reichenberg (Liberec) and covering his emigration to the USA and his final return to Hamburg. (jtrlf)

W. Rossmann: Lie Groups – An Introduction Through Linear Groups*, Oxford Graduate Texts in Mathematics 5, Oxford University Press, Oxford, 2002, 265 pp., GBP 35, ISBN 0-10-859683-9*
This is the paperback edition of the book that was first published in 2002. A review of the first edition was published in the EMS Newsletter, issue 48, June 2003, p. 33.

D. H. von Seggern: CRC Standard Curves and Surfaces with Mathematica*, second edition, + CD, Chapman & Hall/CRC Applied Mathematics and Nonlinear Science Series, Chapman & Hall/CRC, Boca Raton, 2006, 556 pp., USD 79,95, ISBN 1-58488-599-8*
This is a book of mathematical pictures. It contains about 1000 illustrations of curves and surfaces of standard mathematical functions created by the computer algebra system *Mathematica*. In the introductory chapter the basic concepts concerning curves and surfaces are given. It also includes a modern classification of curves and surfaces. The structure of the following sixteen chapters is such that the formulas and/or the specific values of the parameters of the curves are on the left page while the corresponding plots are on the right page. New or reorganized sections in this edition are Green's functions, minimal surfaces, knots, links, Archimedean solids, duals of Platonic solids and stellated forms. With the exception of the introduction all the chapters are on the accompanying CD-ROM in the form of *Mathematica* notebooks. In fact, there is more material on the CD than in the book. Moreover, some omissions in the printed version are corrected in the electronic one. The reader can use the *Mathematica* notebooks to modify and play with plots of all the functions presented in the book. This book is recommended to anybody interested in the field. (jh)

S. Sheffield: Random Surfaces*, Astérisque, no. 304, Société Mathématique de France, Paris, 2005, 175 pp., EUR 26, ISBN 978-2-85629-186-3*
Random surfaces, or random height functions, are random functions defined on Z^d or R^d and taking values (heights) in Z or R. Their distributions are determined by Gibbs potentials invariant under a lattice of translations and depending only on height differences. This is a general framework that covers many particular models considered in the literature. In this setting, a variational principle is proved, namely invariant Gibbs measures of given slope are those of minimal specific free energy. Continuous models are approximated by discrete ones with increasing resolution and a large deviation principle is proved. New results concerning the uniqueness of the Gibbs state are presented. The book concludes with a list of open problems. (jrat)

R. J. Swift, S. A. Wirkus: A Course in Ordinary Differential Equations*, Chapman & Hall/CRC, Boca Raton, 2006, 667 pp., USD 89,95, ISBN 1-58488-476-2*
This voluminous book is intended as an elementary introduction aimed at undergraduate university students. Each section states (without proof) relevant theorems and then proceeds by means of simple examples and exercises. An important feature is that the exposition is richly accompanied by computer algebra code (equally distributed between *Matlab*, *Mathematica* and *Maple*). The major part of the book is devoted to classical linear theory (both for systems and higher order equations). The necessary material from linear algebra is also covered. More advanced topics include numerical methods (Euler, Runge-Kutta), stability of equilibria, bifurcations, Laplace transforms and the power series method. The elementary character of the book makes it accessible to a wide audience of students; it also serves as a simple introduction to the above mentioned computer programs. (dpr)

P. Tauvel, R. W. T. Yu: Lie Algebras and Algebraic Groups*, Springer Monographs in Mathematics, Springer, Berlin, 2005, 653 pp., EUR 69,95, ISBN 3-540-24710-1*
The main topic of this comprehensive monograph is a detailed study of Lie algebras over an algebraically closed field of zero characteristic. The first ten chapters summarize basic results from commutative algebra, topology, sheaf theory, Jordan decomposition and basic facts on groups and their representations. The following seven chapters review required facts from algebraic geometry. The next part of the book (nine chapters) contains a detailed study of the relationship between algebraic groups and corresponding Lie algebras. The next two chapters contain the theory of representations of semisimple Lie algebras and the Chevalley theorem on invariants. Then the author introduces S-triples and describes properties of nilpotent orbits in semisimple Lie algebras. The final chapters are devoted to symmetric Lie algebras, semisimple symmetric Lie algebras, sheets of Lie algebras and a study of properties of the coadjoint representation. The main advantage of the book is a systematic treatment of the field, including detailed proofs. (vs)

J. L. Vázquez: Smoothing and Decay Estimates for Nonlinear Diffusion Equations – Equations of Porous Medium Type*, Oxford Lecture Series in Mathematics and its Applications 33, Oxford University Press, Oxford, 2006, 234 pp., GBP 45, ISBN 0-19-920297-4 , ISBN 978-0-19-920297-3*
The central object of this book is the nonlinear partial differential equation, $u_t - div\ (|u|^{m-1} grad\ u)$; $x \in R^n$, $t > 0$, equipped with the initial value condition $u = u_0$; $x \in R^n$, $t = 0$. The author is concerned with the smoothing effect of the equation and the time decay of positive solutions, i.e. whether the fact that u_0 belongs to some function space X implies that the solution $u(t)$ in time $t > 0$ is a member of some "better" function space Y and if it is possible to get estimates of the form $|u(t)|_Y < C(t, X, n, m, |u_0|_X)$. Well-posedness of the problem and some other substantial results such as the comparison theorem are mentioned in the preliminary part of the book and references are given for the proofs. Smoothing is carefully studied for all $n \in N$, $m \in$ R (if $m = 1$ the classical results for the heat equation are reconstructed), X and Y being Lebesgue or weak Lebesgue spaces, which naturally appear as the correct spaces for studies of smoothing. It is very interesting that depending on m, n, X, Y, the solutions of the equation exhibit qualitatively very different properties, which are sometimes very surprising. The last chapter is devoted to the question of whether the results for the equation introduced at the beginning of the review also remain valid for the p-Laplacian equation. The book is very nicely written, well ordered and gives a rather complete overview of known results in the chosen field. At the beginning of each chapter there is a summary of the whole chapter with remarks of which sections of the chapter are essential for the following sections. The text

is equipped with historical notes, remarks and a number of exercises. These properties make the book useful as a graduate textbook or a source of information for graduate students and researchers. (kapl)

***T. A. Walls, J.L. Schafer, Eds.: Models for Intensive Longitudinal Data**, Oxford University Press, Oxford, 2006, 288 pp., GBP 38,99, ISBN 978-0-19-517344-4*

Classical longitudinal analysis is mainly focused on examples to some ten occasions. New technologies lead to longitudinal databases with a considerably higher intensity and a substantially larger volume of data, for which the new term 'intensive longitudinal data' (ILD) is used. The number of occasions in ILD may be hundreds or thousands. However, the main difference between ILD and other models pertain to the scientific motivations for collecting ILD, the nature of hypotheses about them and the complex features of the data. The main themes in ILD modeling are: (i) the complexity and variety of individual trajectories, (ii) the role of time as a covariate, (iii) effects found in the covariance structure, (iv) relationships that change over time, (v) interest in autodependence and regulatory mechanisms.

The book is a collection of eleven papers (arranged as chapters) written by different authors. The introductory chapters focus on multilevel models and on marginal modelling through generalized estimating equations. Later chapters describe methodological tools from item response theory, functional data analysis, time series, state-space modeling, stochastic differential equations, engineering control systems, and models of point processes. Theory is illustrated on real data drawn from psychology, studies of smoking and alcohol use, brain imaging and traffic engineering. Some authors have supplied programs and source code examples. They are available at a website accompanying the book. By the way, the formula on page 118, line 6, should read $s_m = c^2_{2m-1} + c^2_{2m}$. The remark on page 130 that the order p of an autoregressive process is often determined heuristically should be complemented by another remark that the order p is also often determined using AIC, BIC and similar criteria. This collection contains many interesting models and practical examples. The volume can be attractive reading for statisticians working in biostatistics and behavioural and social sciences. (ja)

***N. J. Wildberger: Divine Proportions – Rational Trigonometry to Universal Geometry**, Wild Egg, Sydney, 2005, 300 pp., USD 80, ISBN 0-9757492-0-X*

This book deals with the Euclidean geometry of plane and space, not only over the field of real numbers but over a general field, in particular over the field F_p, $p \neq 2$ and prime. The reader will become acquainted with many theorems of elementary geometry such as Menelaus' theorem, Ceva's theorem, Ptolemy's theorem and Stewart's theorem. Feurbach's nine point circle and the Euler line are presented. Conics are given by equations in linear coordinates and then parabolas, quadrolas and grammolas are defined. In three-dimensional space, Platonic solids are investigated. Besides linear coordinates the book also contains an explanation of polar and spherical coordinates, but not in the usual way (angles are not used). There is an interesting study of circles and other conics and their tangents in geometries over finite fields.

The book differs from current textbooks; it gives a new foundation for Euclidean geometry and trigonometry. The author suggests working with quadrance, i.e. using the square of distance and "spread" and "gross" instead of sine and cosine, which means the square of sine and the square of cosine in the case of real numbers. The author calls this technique "Rational Trigonometry" and adopts a purely algebraic approach, which is in his opinion a conceptually simpler framework for students. The reviewer does not share his optimistic point of view. For example, it is not clear in his modification of the cosine law which of two angles he is dealing with (acute or obtuse). The method used by the author has a lot of negative effects, nevertheless the book presents a very interesting exposition of many facts and theorems of elementary geometry. (lb)

***H. S. Wilf: Generating functionology**, third edition, A.K. Peters, Wellesley, 2006, 245 pp., USD 39, ISBN 1-56881-279-5*

There are not too many books devoted entirely to generating functions (GF). Even less of them have appeared in this century. One of them is this book. It is the third edition of a very popular book based on the author's lectures at the University of Pennsylvania. GF are an indispensable tool for discrete mathematics. Roots of the use of GF are deep. Let us recall that the Binet formula for Fibonacci numbers was discovered using a generating function method by Moivre in 1718. At the end of the eighteenth century GF were installed as a basic method of probabilistic computations by Laplace.

The book gently introduces the reader to the way that GF are used for solving problems. It also underlines another role of GF: they form a natural bridge between two seemingly distant areas of continuous and discrete mathematics. Despite the fact that the author says that he tried only to communicate some of the main ideas on the subject, the book gives the beginner a surprisingly broad view of many different uses of GF. The author presents applications of GF ranging from set partitions, the money changing problem and graph theory to relations of GF to unimodality, convexity and proofs of some congruences. For about the first seventy pages basic notions and notations are introduced and then various problems are solved. Each of the five chapters contains exercises (all solutions are provided at the end of the book). The book is very readable and it should not be missing from any university library. In particular I would like to quote that the author nicely compares a GF to a "clothesline on which we hang up a sequence of numbers to display". (jive)

Springer
the language of science

springer.com

New Mathematics Journals from Springer in 2007

Mathematics and Financial Economics

Editor-in-Chief:
Elyès Jouini, Paris, France

The primary objective of the journal is to provide a forum for work in finance which expresses economic ideas using formal mathematical reasoning. The work should have real economic content and the mathematical reasoning should be new and correct.

2007, 4 issues
ISSN 1862-9679 (print version)
ISSN 1862-9660 (electronic version)

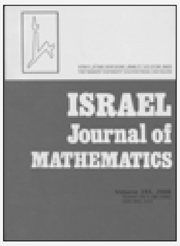
Journal d'Analyse Mathématique

Editor-in-Chief: **Lawrence Zalcman**, Barllan, Israel

Owned by the Hebrew University of Jerusalem

The **Journal d'Analyse Mathématique** publishes top-level original articles in English and French in the field of classical analysis and in related areas. The broad mathematical scope of this journal includes topics such as complex function theory, functional analysis, ergodic theory, harmonic analysis, partial differential equations, and quasi-conformal mappings.

2007, 3 issues
ISSN 0027-7670 (print version)
ISSN pending (electronic version)



Israel Journal of Mathematics

Editor-in-Chief: **A. Mann**, Jerusalem, Israel

Owned by the Hebrew University of Jerusalem

The **Israel Journal of Mathematics** is an international journal publishing high-quality original research papers in a wide spectrum of pure and applied mathematics.

2007, 6 issues
ISSN 0021-2172 (print version)
ISSN pending (electronic version)

ZDM

The International Journal on Mathematics Education

Editor-in-Chief: **Gabriele Kaiser**, Hamburg, Germany

ZDM is one of the oldest mathematics education research journals. The papers appearing in the six themed issues per year are strictly by invitation only followed by internal peer review by the issue-editors and external review by invited experts. The journal exists to survey, discuss and extend current research-based and theoretical perspectives as well as to create a forum for critical analyses of issues within mathematics education. The audience is pre-dominantly mathematics education researchers around the world interested in current developments in the field.

2007, 6 issues
ISSN 1863-9690 (print version)
ISSN 1863-9704 (electronic version)

Blätter der DGVFM

Editor-in-Chief: **Christian Hipp**, Karlsruhe, Germany

Blätter der DGVFM invites papers for publication that contribute to the area of insurance and finance. Particularly welcome are innovative research papers, survey paper, or papers of partical matter of actuarial work.

2007, 2 issues
ISSN 1864-0281 (print version)
ISSN 1864-0303 (electronic version)

Logic and Analysis

Editor-in-Chief: **N. J. Cutland**, York, UK

Logic and Analysis publishes papers of high quality involving interaction between ideas or techniques from mathematical logic and other areas of mathematics (especially - but not limited to - pure and applied analysis).

2007, 4 issues
ISSN 1863-3617 (print version)
ISSN 1863-3625 (electronic version)

Indian Academy of Sciences

Proceedings Mathematical Sciences

Main Editor: **G. Misra**, Bangalore, India

Co-publication with Indian Academy of Sciences

2007, 4 issues
ISSN 0253-4142 (print version)
ISSN pending (electronic version)

New in Springers' "Russian Library of Science"

Journal of Applied and Industrial Mathematics

2007, 4 issues

Journal of Contemporary Mathematical Analysis

2007, 6 issues

Mathematical Methods of Statistics

2007, 4 issues

Moscow University Computational Mathematics and Cybernetics

2007, 4 issues

Moscow University Mathematical Bulletin

2007, 4 issues

Regular and Chaotic Dynamics

2007, 6 issues

Russian Mathematics

2007, 12 issues

Siberian Advances in Mathematics

2007, 4 issues

Vestnik St. Petersburg University: Mathematics

2007, 4 issues

New in Springers' "Chinese Library of Science"

Applied Mathematics - A Journal of Chinese Universities

2007, 4 issues

Easy Ways to Order for the Americas ► **Write:** Springer Order Department, PO Box 2485, Secaucus, NJ 07096-2485, USA ► **Call: (toll free)** 1-800-SPRINGER ► **Fax:** +1(201)348-4505 ► **Email:** journals-ny@springer.com or **for outside the Americas** ► **Write:** Springer Distribution Center GmbH, Haberstrasse 7, 69126 Heidelberg, Germany ► **Call:** +49 (0) 6221-345-4303 ► **Fax:** +49 (0) 6221-345-4229 ► **Email:** subscriptions@springer.com

012983x