EUROPEAN MATHEMATICAL SOCIETY

NEWSLETTER No. 41

September 2001

Designed and printed by Armstrong Press Limited
Crosshouse Road, Southampton, Hampshire SO14 5GZ, UK
telephone: (+44) 23 8033 3132 fax: (+44) 23 8033 3134
Published by European Mathematical Society
ISSN 1027 - 488X

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

NOTICE FOR MATHEMATICAL SOCIETIES

Labels for the next issue will be prepared during the second half of November 2001. Please send your updated lists before then to Ms Tuulikki Mäkeläinen, Department of Mathematics, P.O. Box 4, FIN-00014 University of Helsinki, Finland; e-mail: makelain@cc.helsinki.fi

INSTITUTIONAL SUBSCRIPTIONS FOR THE EMS NEWSLETTER

Institutes and libraries can order the EMS Newsletter by mail from the EMS Secretariat, Department of Mathematics, P. O. Box 4, FI-00014 University of Helsinki, Finland, or by e-mail: (makelain@cc.helsinki.fi). Please include the name and full address (with postal code), telephone and fax number (with country code) and e-mail address. The annual subscription fee (including mailing) is 65 euros; an invoice will be sent with a sample copy of the Newsletter.

EMS Committee

EXECUTIVE COMMITTEE
PRESIDENT (1999–2002)
Prof. ROLF JELTSCH
Seminar for Applied Mathematics
ETH, CH-8092 Zürich, Switzerland
e-mail: jeltsch@sam.math.ethz.ch
VICE-PRESIDENTS
Prof. LUC LEMAIRE (1999–2002)
Department of Mathematics
Université Libre de Bruxelles
C.P. 218 – Campus Plaine
Bld du Triomphe
B-1050 Bruxelles, Belgium
e-mail: llemaire@ulb.ac.be
Prof. BODIL BRANNER (2001–2004)
Department of Mathematics
Technical University of Denmark
Building 303
DK-2800 Kgs. Lyngby, Denmark
e-mail: bbranner@mat.dtu.dk
SECRETARY (1999–2002)
Prof. DAVID BRANNAN
Department of Pure Mathematics
The Open University
Walton Hall
Milton Keynes MK7 6AA, UK
e-mail: d.a.brannan@open.ac.uk
TREASURER (1999–2002)
Prof. OLLI MARTIO
Department of Mathematics
P.O. Box 4
FIN-00014 University of Helsinki
Finland
e-mail: olli.martio@helsinki.fi
ORDINARY MEMBERS
Prof. VICTOR BUCHSTABER (2001–2004)
Department of Mathematics and Mechanics
Moscow State University
119899 Moscow, Russia
e-mail: buchstab@mendeleevo.ru
Prof. DOINA CIORANESCU (1999–2002)
Laboratoire d'Analyse Numérique
Université Paris VI
4 Place Jussieu
75252 Paris Cedex 05, France
e-mail: cioran@ann.jussieu.fr
Prof. RENZO PICCININI (1999–2002)
Dipartimento di Matematica e Applicazioni
Università di Milano-Bicocca
Via Bicocca degli Arcimboldi, 8
20126 Milano, Italy
e-mail: renzo@matapp.unimib.it
Prof. MARTA SANZ-SOLÉ (1997–2000)
Facultat de Matematiques
Universitat de Barcelona
Gran Via 585
E-08007 Barcelona, Spain
e-mail: sanz@cerber.mat.ub.es
Prof. MINA TEICHER (2001–2004)
Department of Mathematics and Computer Science
Bar-Ilan University
Ramat-Gan 52900, Israel
e-mail: teicher@macs.biu.ac.il
EMS SECRETARIAT
Ms. T. MÄKELÄINEN
Department of Mathematics
P.O. Box 4
FIN-00014 University of Helsinki
Finland
tel: (+358)-9-1912-2883
fax: (+358)-9-1912-3213
telex: 124690
e-mail: makelain@cc.helsinki.fi
website: http://www.emis.de

EMS Agenda

2001

15 November
Deadline for submission of material for the December issue of the EMS *Newsletter*
Contact: Robin Wilson, *e-mail: r.j.wilson@open.ac.uk*

19-21 November
EMS lectures at Università degli Studi, *Tor Vergata*, Rome (Italy)
Lecturer: Michèle Vergne (Ecole Polytechnique, Palaiseau, France)
Title: *Convex Polytopes*
Contact: Prof. Maria Welleda Baldoni, *e-mail:baldoni@mat.uniroma2.it*

22-23 November
Fifth Diderot Mathematical Forum
Title: *Mathematics and Telecommunications*
Venues: Eindhoven (Netherlands), Helsinki (Finland) and Lausanne (Switzerland)
Contacts: Paul Urbach at Philips, Eindhoven (*h.p.urbach@philips.com*); Olavi Nevanlinna, Helskinki University of Technology (*Olavi.Nevanlinna@hut.fi*); Gerard Ben Arous, Ecole Polytechnique Fédérale de Lausanne (*Gerard.Benarous@epfl.ch*)

2002

9-10 February
EMS Executive Committee Meeting in Brussels (Belgium), at the invitation of the Belgian Mathematical Society and the Université Libre de Bruxelles

15 February
Deadline for submission of material for the March issue of the EMS *Newsletter*
Contact: Robin Wilson, *e-mail: r.j.wilson@open.ac.uk*

24-28 February
EMS Summer School in Eilat (Israel)
Title: *Computational Algebraic Geometry and Applications*
Contact: Mina Teicher, *e-mail: teicher@macs.biu.ac.il*

1 March
Deadline for Proposals for 2003 EMS Lectures.
Contact: David Brannan, *e-mail: d.a.brannan@open.ac.uk*

31 May
EMS Executive Committee meeting in Oslo (Norway)

1-2 June
EMS Council Meeting, Oslo

3-8 June
Abel Bicentennial Conference, Oslo

2004

25-27 June
EMS Council Meeting, Stockholm (Sweden)

27 June-2 July
4th European Congress of Mathematicians, Stockholm

Editorial

Carles Casacuberta (Barcelona)

(EMS Publications Officer, Chair of the Publications Committee)

Since the foundation of the EMS in 1990, the Society's publications strategy has been a source of lengthy debates, often with divided views and energetic standpoints. Yet, a lull has arrived when most of the former subjects of discussion have become realities, while exciting new ventures are about to start. The recently appointed Managing Director of the EMS Publishing House, Thomas Hintermann, starts his term of office in September 2001. Before looking into the future, however, let me shortly review the past.

The first steps

The EMS Publications Committee started at the same meeting that the Society was founded. Stewart Robertson was elected as Chair. His first task was to launch the *Newsletter*, which has appeared regularly every three months since September 1991. It was initially edited by David Singerman (Southampton) and Ivan Netuka (Prague). An editorial team from the Glasgow Caledonian University, represented by Roy Bradley and Martin Speller, undertook the production in 1996, still in connection with the Prague team. In early 1999, Robin Wilson accepted the role of Editor-in-Chief and built up the current editorial team. The inner format was designed by Jan Kosniowski, from Armstrong Press (Southampton), while the cover design stems from Marie-Claude Vergne of IHÉS (Paris). It is unanimously recognised that, after the efforts and expertise of all the people involved, the EMS *Newsletter* has reached maturity in its content and layout.

The birth of *JEMS*

The desire to produce a learned journal was also as old as the Society itself, in spite of much controversy about the manner in which it should materialise. A letter of intent was signed by EMS President Friedrich Hirzebruch and representatives of Springer-Verlag in December 1994. At that stage, the negotiations were conducted by Stewart Robertson and David Wallace. The journal was to have a distinct European flavour and carry articles in as wide a variety of fields as possible. Nevertheless, still a long way was needed until a contract was signed and the first issue of JEMS appeared in January 1999, after the impulse given by EMS President Jean Pierre Bourguignon. Thanks are due to Springer for the friendly collaboration and joint promotion of the journal. The board of editors of *JEMS* consists of Jürgen Jost (Editor-in-Chief), Luigi Ambrosio, Gérard Ben Arous, John Coates, Helmut Hofer, Alexander Merkurjev, and twenty-five associate editors. As the Editor-in-Chief wrote in his 1998 *Newsletter* editorial, '*JEMS* aims at preserving the unity of mathematical thinking by presenting profound and important advances in both pure and applied mathematics'.

Electronic versus traditional

Articles published in *JEMS* become available on EMIS, the Society's website, two years after the printed version. By the middle of the past decade, debates about the impact and management of electronic publications were ubiquitous. Peter Michor, former EMS Secretary, was strongly supportive of the new means of storage and diffusion. He created EMIS in 1995, in collaboration with FIZ Karlsruhe. The website was implemented by Michael Jost and Bernd Wegner; it contains general information about EMS, currently compiled by Volker Mehrmann, and a large Electronic Library giving free access to journals, monographs and preprints. Bernd Wegner has dedicated an enormous amount of time and ability to this and other initiatives involving EMS, such as the Mathematical Preprints Server System, the EULER project, and the EMS Publishing House. Most notably, the EMS is an active partner of Zentralblatt MATH since 1997. The process to make Zentralblatt a large European-based infrastructure started with a French-German cooperation in 1995, highlighted by the creation of the Cellule MathDoc in Grenoble. It is currently being cofunded by the European Commission under the LIMES project, which is coordinated by FIZ Karlsruhe and in which EMS is a major partner. The EMS has a Database Committee, chaired by Laurent Guillopé, after John Coates, who chaired it from its creation in 1995 until 2000 and an Electronic Publishing Committee, which has successively been chaired by Peter Michor (since 1995) and Bernd Wegner (since 2001).

Other EMS publications

Originally, the text of EMS Lectures was to be published in *JEMS*. This idea was later discarded and a project came out, under the presidency of Jean-Pierre Bourguignon, to produce a series of volumes with material from the EMS Lectures, EMS Summer Schools and Diderot Mathematical Forum events. This initiative led to a letter of agreement with Springer in 1998, in which an EMS subseries of *Springer Lecture Notes in Mathematics* was originated. Two scientific advisers were elected for this new series: Fabrizio Catanese and Ragnar Winther, and the first volume of the series, authored by Nigel Cutland, appeared as *LNM* **1751** during 2000. At present, two more volumes have been submitted, and four are in preparation.

The Publications Committee

Stewart Robertson retired and ended his term of office as Chairman of the Publications Committee in April 1997. Marta Sanz-Solé was elected Chair *pro tempore* and held this position until the end of that year. In October 1997, terms of reference for the Publications Committee were formally approved; among other things, it was stated that 'The Publications Committee has as its main task to formulate a strategy of publications of the Society, to suggest and discuss ideas for its implementation, and to supervise the development of EMS publications'. The current Chair was appointed in 1998 and has been re-elected for 2001 and 2002. The other committee members are the Publicity Officer (David Salinger), the Editor-in-Chief of JEMS (Jürgen Jost), the Newsletter Editor (Robin Wilson), the Chair of the Electronic Publishing Committee (Bernd Wegner), and the Managing Director of the EMSph (Thomas Hintermann). This updated list of members was agreed by the Executive Committee in March 2001, in accordance with the terms of reference. The most immediate goal of the committee is to define its way of action for the years to come, obviously in coordination with the activities of the EMS Publishing House.

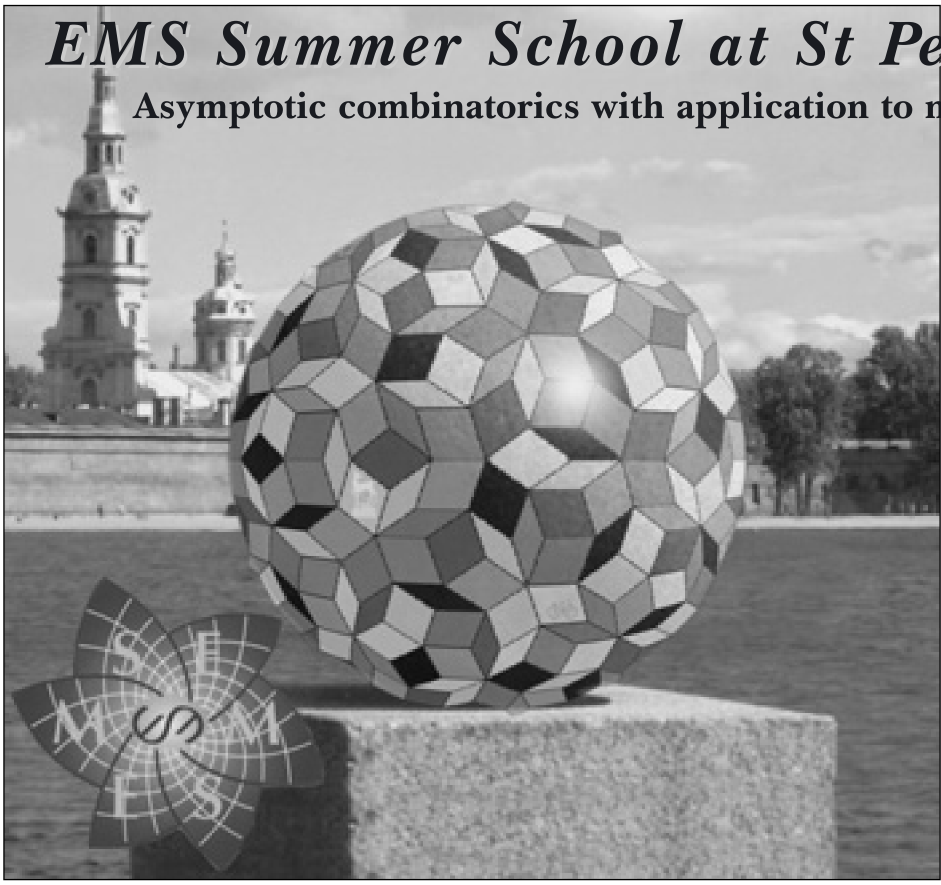
The EMS Publishing House

The old dream of making EMS a publishing force went through its decisive step soon after Rolf Jeltsch began his presidency in 1999. The creation of the EMS Publishing House (EMSph) was approved by the Executive Committee in November 2000, after a detailed proposal of an *ad hoc* committee. The EMSph is not financially dependent on the EMS, but it belongs to a newly created European Mathematical Foundation. This is a non-profit organisation, subsidiary of EMS, with seat in Zurich; its statutes have recently been registered under Swiss law. According to these, the tasks of the Foundation include the establishment and supervision of the EMSph, the furtherance of the activities of the EMS, and support of activities of corporate member societies of the EMS.

The EMSph aims to provide a framework where member societies can join efforts in printing and distributing mathematical journals. Two prospective meetings with editors of learned journals were held in August 1998 (Berlin) and July 2000 (Barcelona), resulting in clearly positive reactions and several preliminary intents of partnership. The EMS wishes however to preserve the current diversity of mathematical literature in Europe and does not want to damage any existing cooperation schemes. As a non-profit body, the EMSph will fight to keep prices as low as possible; on the other hand, the EMSph has to prove itself financially viable, and in the long run it should enable further initiatives towards enhancing the visibility, strength and influence of the EMS.

EMS Summer School at St Petersburg 2001

Asymptotic combinatorics with application to mathematical physics



The EMS Summer School 2001 and NATO Advanced Study Institute at St Petersburg, *Asymptotic combinatorics with application to mathematical physics*, attracted the leading world-wide specialists in the theory of integrable systems, random matrix theory, the Riemann-Hilbert problem and asymptotic combinatorics. Many young mathematicians took part in the summer school and the school was especially important for them. One important features of the school was the presence of mathematicians and physicists simultaneously as lecturers and students. The school was successful and fruitful, and many new contacts between participants were established. More than half the participants were less than age 35.

The preparation was started in the autumn of 1999 after EMS Executive Committee meeting in Zurich. An application was sent to the NATO Scientific Affairs Division in July 2000, and a grant was obtained in January 2001. A grant from the Russian Fund of Basic Researches was obtained in April 2001. Information about the school was published in the AMS *Notices*, the EMS *Newsletter*, the INTERNET sites of NATO, the AMS Mathematics Calendar, the International Euler Mathematical Institute and the St Petersburg Mathematical Society. A poster was prepared by the EMS and sent to many Universities.

The opening session was at the Steklov Institute of Mathematics in St Petersburg, and all the lectures and seminars were held at the Euler International Mathematical Institute (part of the Steklov Institute) and were supported by staff from the Euler and Steklov Institutes.

The deadline for the registration was 1 April, but there were a lot of applications after the deadline. However, many who had registered in time did not take part, for different reasons, including some main lecturers. The support of the EMS allowed us to include more participants from East Europe than was announced in the application.

The scientific Committee was A. Vershik (Chair), L. Faddeev, E. Brezin, P. Deift, V. Malyshev and O. Bohigos.

Scientific report

Asymptotic combinatorics with applications to mathematical physics was devoted to some areas of mathematics and mathematical physics that have been studied very intensively in recent years. The idea was to get specialists in integrable systems, asymptotic combinatorics, representation theory, random matrix theory and quantum field theory to give short courses of lectures on the subject and attract young students to those areas. The list of lecturers included specialists of the highest level (P. Deift, E. Brezin, L. Faddeev, etc.). The school well confirmed the organisers' initial idea on the fruitfulness of the interrelations between asymptotic combinatorics and mathematical physics. Methods from the theory of integrable systems and matrix problems, as well as the theory of the Riemann-Hilbert problem together with asymptotic combinatorics and representation theory, give very powerful tools for the solution of many old problems (fluctuations of the eigenvalues of random matrices, counting the number of coverings of algebraic curves, universality of distribution of spacing and other statistics characteristics of Young diagrams, etc.). We emphasise some of the lectures on spectacular new results in mathematical physics (P. Deift), combinatorics (A. Borodin and R. Kenyon) and algebraic geometry (A. Okounkov).

The impressions of the participants were very positive and most of them considered the lectures to be very useful. The programme was over-full, with additional talks. A round table on current problems was organised, and the younger participants took part in short discussions about their studies. The lectures and some additional matter will be published in the special volumes of the proceedings of the school, to be edited by V. Malyshev and A. Vershik; Volume 1 will be published by Springer-Verlag, and Volume 2 by the Kluver Publishing House, in 2002.

Main lectures

P. Biane, Asymptotics of representations of symmetric groups, random matrices and free cumulants

A. Borodin, Asymptotic representation theory and Riemann-Hilbert problem

M. Bozejko, Positive definite functions on Coxeter groups and second quantization of Yang-Baxter type

E. Brezin, An introduction to matrix models

P. Deift, Random matrix theory and combinatorics: a Riemann-Hilbert approach

L. Faddeev, 3-dimensional solitons and knots

J. L. Jacobsen, Enumerating coloured tangles

V. Kazakov, Matrix quantum mechanics and statistical physics on planar graphs

R. Kenyon, Hyperbolic geometry and the low-temperature expansion of the Wulff shape in the 3D Ising model

V. Korepin, Quantum spin chains and Riemann zeta function with odd arguments

I. Krichever, τ-functions of conformal maps

V. Liskovets, Some asymptotic distribution patterns for planar maps

V. Malyshev, Combinatorics and probability for maps on two-dimensional surfaces

M. Nazarov, On the Frobenius rank of a skew Young diagram

S. Novikov, On the weakly nonlocal Poisson and symplectic structures

A. Okounkov, Combinatorics and moduli spaces of curves

G. Ol'shanski, Harmonic analysis on big groups, and determinantal point processes

L. Pastur, Eigenvalue distribution of unitary invariant ensembles of random matrices of large order

S. Smirnov, Critical percolation is conformally invariant

R. Speicher, Free probability and random matrices

A. Vershik, Introduction to asymptotic theory of representations

EAGER - ENI - EMS Summer School

Computational Algebraic Geometry and Applications

Eilat, Israel 24-28 February 2002

First announcement

The school is an introduction on how to use computer algebra systems such as SINGULAR and MACAULAY2 and packages such as SCHUBERT (intersection theory) for research in algebraic geometry and its applications. The programme consists of lectures and practical exercise sessions with a computer.

The topics to be considered include: computer algebra systems, Gröbner bases and syzygies, ideal and radical membership, manipulating ideals and modules, Hilbert polynomials and Hilbert functions, elimination, computations in local rings and Milnor numbers, homological algebra (constructive module theory, Ext and Tor, sheaf cohomology, Beilinson monads), primary decomposition, normalisation, rings of invariants, parametrisation, deformations, intersection theory, applications to special varieties, computer vision and coding theory.

The course will be directed by Prof. Wolfram Decker (Saarbrucken, Germany). There will be additional guest lectures by Dr Jeremy Kaminski (Bar-Ilan, Israel).

Computers
Please bring your laptop with you. Two students can use one computer, so if you coordinate with a fellow student you need bring just one computer between you. Before coming you should download some software from the Internet – this will be made precise in January 2002.

Accommodation
The site of the Conference, Eilat, is the southernmost point of Israel, a resort city hugging the shores of the Red Sea, surrounded by the magnificent Edom Mountain Range and characterised by its crystal clear waters and year-round sunshine. Its unique undersea vista, flora and fauna can be admired by boat, from a breathtaking underwater observatory, or by snorkelling or diving. The inland desert landscapes are no less fascinating. Eilat is well known for its mild winter climate. The weather in Eilat during February is warm during the day and cooler at night; temperatures range from 12C to 25C, and it seldom rains. Participants who extend their stay may like to join interesting day-trips from Eilat, inside Israel or over the border to Jordan or Egypt (Moon Valley, Akaba, Petra, Wadi Rum, Nuweiba, Colored Canyon and Santa-Catarina). (Reservations can be made on the spot through the hotel concierge.)

The Summer School will take place in Hotel Meridian. The hotel special conference rates are $90 a day per person (FB) in a double occupancy; the registration fee is $80.

More details will appear in the second announcement.

Arrival
You can get to Eilat by bus from the central bus station in Tel Aviv (about 4.30 hours); this is very economical and is the way we recommend.

The standard way to arrive by air is to take a connecting flight to Eilat city airport from Ben-Gurion international airport. There are also some direct flights from Europe to Eilat: you may check this possibility with your own travel agency. Occasionally there are charter flights from Europe to Ovda Airport (40 minutes from Eilat: no regular bus services, but taxis or transportation provided by the charter company).

From Eilat airport or from the Eilat central bus station, take a taxi to the hotel, or walk.

Registration
The number of places in the school is limited. If you are interested in coming, fax the form below **by 15 September** to (972-3)-5353325, att. Boris Kunyavski, indicating arrival/departure data and credit card number.

Financial support for local expenses
If you belong to EAGER you can apply to your node coordinator for support.

Otherwise, please contact Boris Kunyavski at the Emmy Noether Institute: *eni@macs.biu.ac.il* indicating age, academic degree and institution where awarded, PhD thesis title, name of advisor, nationality, place of residence and affiliation.

If you are getting financial support from any of the above sources, please send your hotel receipts to the responsible party after the conference for reimbursement.

Organisation
Profs. Mina Teicher and Boris Kunyavski of the Emmy Noether Institute
(Conference Secretary: Ms Chen Fireman)

Sponsors
EMS (European Mathematical Society), EAGER (European Algebraic Geometry Education and Research) and ENI (Emmy Noether Research Institute for Mathematics at Bar-Ilan University and the Minerva Foundation)

To be sent by fax to (972-3)-5353325, att. Boris Kunyavski
Hotel registration form
EMS/EAGER Summer School
Computational Algebraic Geometry
Eilat, Hotel Meridian, 25-28 February 2002

Surname:

First (and other) name(s):

Affiliation:

Tel.:

Fax:

e-mail:

Credit card number:

Arrival data (date and time):

Departure date:

Accompanying persons (with names, sex, ages, if under 16):

Accommodation: single room

double room with ...

Remarks:

JEMS

Journal of the European Mathematical Society

Volume 3, number 3 of *JEMS* contains:
L. Birgé and P. Massart: *Gaussian model selection*
R. Meyer: *Excision in Entire Cyclic Cohomology*

Volume 3, number 4 of *JEMS* contains:
A. de Carvalho and T. Hall: *Pruning theory and Thurston's classification of surface homeomorphisms*
O. Biquard and M. Jardim: *Asymptotic behaviour and the moduli space of doubly-periodic instantons*

Meeting of the EMS Council

Oslo: 1-2 June 2002

First Announcement

The EMS Council meets every second year. The next meeting will be held in Oslo, Norway, on 1-2 June 2002, before the Abel Centennial Meeting in Oslo which begins on 3 June. The first session of the Council meeting will start at 10 a.m. on 1 June, and will run all day with a break for lunch. The second session will probably start at 9 or 10 a.m. on 2 June, and may last most or all of the day with a break for lunch, depending on the volume and complexity of the business on the agenda.

Invitation to suggest business for the Council

The Executive Committee is responsible for preparing the matters to be discussed at Council meetings. Items for the agenda of this Council meeting should be sent (preferably by e-mail) as soon as possible, and no later than 1 February 2002, to the EMS Secretariat in Helsinki. The Executive Committee will meet on 9-10 February 2002 to put together the Council agenda.

Delegates to the Council will be elected by the various categories of members, as per the Statutes.

Election to Council of representatives of 'individual EMS members'

A person becomes an individual member of EMS either through a corporate member, by paying an extra fee, or by direct membership. On 14 July 2001, there were some 2247 individual members, and, according to our Statutes, these members will be represented on Council by 23 delegates. Nomination papers for these elections appear in this *Newsletter*.

15 delegates were elected for the term 2000-03, so they will continue unless they inform the Secretariat to the contrary by 31 December 2001. They are Giuseppe Anichini (Firenze, Italy), Vasile Berinde (Baia Mare, Romania), Giorgio Bolondi (Milano, Italy), Alberta Conte (Torino, Italy), Chris Dodson (Manchester, UK), Jean-Pierre Françoise (Paris, France), Salvador Gomis (Alicante, Spain), Laurent Guillopé (Nantes, France), Willi Jägger (Heidelberg, Germany), Klaus Habetha (Aachen, Germany), Tapani Kuusalo (Jyväskylä, Finland), Laslo Marki (Budapest, Hungary), Andrzej Pelczar (Krakow, Poland), Zeev Rudnick (Tel Aviv, Israel) and Gerard Tronel (Paris, France).

The mandates of 5 of the present 20 delegates end on 31 December 2001, and so elections must be held for their positions. They are Manuel Castellet (Barcelona, Spain), George Jaiani (Tbilisi, Georgia), Marina Marchisio (Boves, Italy), Vitali Milman (Tel Aviv, Israel) and Jan Slovak (Brno, Czech Republic). *All of these can be re-elected, since they have served in this capacity for only 4 years.*

Election to Council of delegates of other categories of EMS members

Full EMS Members are national mathematical societies, which elect 1, 2 or 3 delegates according to their size and resources. Each society is responsible for the election of its delegates. Each society should notify the EMS Secretariat in Helsinki of the names and addresses of its delegate(s) no later than 1 February 2002. As of 1 July 2001, there were about 47 such societies, which could designate a maximum of about 69 delegates.

There is one associate EMS member: the Gesellschaft für Mathematische Forschung. According to the Statutes: "delegates representing associate members shall be elected by a ballot organized by the Executive Committee from a list of candidates who have been nominated and seconded, and have agreed to serve."

There are three institutional EMS members: Institut Non-Linéaire de Nice, the Moldovian Academy of Sciences and the Mathematical Institute of the Serbian Academy of Sciences and Arts. According to the Statutes: "delegates representing institutional members shall be elected by a ballot organized by the Executive Committee from a list of candidates who have been nominated and seconded, and have agreed to serve."

The EMS Secretariat will contact the society members in these three categories directly in connection with their delegates.

Membership of the EMS Executive Committee

The Council is responsible for electing the President, Vice-Presidents, Secretary, Treasurer and other members of the Executive Committee. The present membership of the Executive Committee, together with their individual terms of office, is as follows.

President
Professor
  Rolf Jeltsch (1999-2002)
Vice-Presidents
  Professor Luc Lemaire (1999-2002)
  Professor Bodil Branner (2001-04)
Secretary
  Professor David Brannan (1999-2002)
Treasurer
  Professor Olli Martio (1999-2002)
Members
  Professor Victor Buchstaber (2001-04)
  Professor Doina Cioranescu (1999-2002)
  Professor Renzo Piccinini (1999-2002)
  Professor Marta Sanz-Solé (2001-04)
  Professor Mina Teicher (2001-04)

The President may serve only one term of office, so Rolf Jeltsch cannot be re-elected as President. David Brannan and Renzo Piccinini have indicated that they do not currently wish to be re-elected.

Under Article 7 of the Statutes, members of the Executive Committee shall be elected for a period of 4 years. Committee members may be re-elected, provided that consecutive service shall not exceed 8 years. No current member has served on the Executive Committee for 8 years, so all existing Committee members are in principle available for re-election.

It would be convenient if potential nominations for office in the Executive Committee, duly signed and seconded, could reach the Secretariat by 1 February 2002. It is strongly recommended that a statement of intention or policy is enclosed with each nomination.

The Council may, at its meeting in Oslo, add to the nominations received and set up a Nominations Committee, disjoint from the Executive Committee, to consider all candidates. After hearing the report by the Chair of the Nominations Committee (if one has been set up), the Council will proceed to the elections to the Executive Committee posts.

If a nomination comes from the floor during the Council meeting, there must be a written declaration of the willingness of the person to serve, or his/her oral statement must be secured by the chair of the Nominating Committee (if there is such) or by the President. It is recommended that a statement of policy of the candidates nominated from the floor should be available.

Accommodation arrangements

Delegates to the Council meeting, who are planning to attend the Abel Centennial Meeting, are advised that their accommodation arrangements should be made through the normal Abel Centennial Meeting organisation arrangements. For delegates to the Council who are not attending the Abel Centennial Meeting, an address for accommodation arrangements will be provided later.

Secretariat: Ms. Tuulikki Mäkeläinen
Department of Mathematics
P. O. Box 4
FIN-00014 University of Helsinki
Finland
e-mail: makelain@cc.helsinki.fi

David Brannan
Secretary of the EMS
e-mail: d.a.brannan@open.ac.uk

Timetable for the Council Meeting

September 2001

Information on the Council meeting is printed in the EMS *Newsletter*. A nomination form for delegates of the individual members to Council is given. Suggestions for Council business and for Executive Committee membership are invited.

Letters are sent to full, associate and institutional members, as well as continuing delegates, giving information on the Council meeting. (Delegates are kindly requested to keep the Secretariat informed of their correct and up-to-date addresses.) Specifically, points for the agenda and suggestions for future members of the Executive Committee are invited.

2 November
Deadline for nominations for delegates to Council of individual members.

December
A ballot paper for delegates of individual members to Council is sent to individual members in the EMS *Newsletter*. The venue and meeting times of the Council meeting are announced.

1 February 2002
Close of voting for delegates to Council of individual members.

February
Members elected as delegates to Council of individual members are contacted by the EMS Secretariat to inform them of their election, and to let them know the venue, meeting times and agenda of the Council meeting.

March
The results of the elections for delegates to Council of individual members are announced in the EMS *Newsletter*. The venue, the meeting times, and the agenda of the Council meeting are given.
A letter is sent to each delegate to Council, containing the venue, meeting times and agenda of the Council meeting.

April
Final material for the Council meeting is sent to the delegates.

1-2 June 2002
Council meeting in Oslo.

Election of Council Delegates

representing the Individual members of the Society

Nominations are required for Council delegates representing individual members of the Society. On 14 July 2001, there were some 2247 individual members and, according to our Statutes, these members will be represented on Council by 23 delegates.

15 delegates were elected for the term 2000-03, so they will continue unless they inform the Secretariat to the contrary by 31 December 2001. These delegates are:

Giuseppe Anichini (Firenze, Italy)
Vasile Berinde (Baia Mare, Romania)
Giorgio Bolondi (Milano, Italy)
Alberta Conte (Torino, Italy)
Chris Dodson (Manchester, UK)
Jean-Pierre Françoise (Paris, France)
Salvador Gomis (Alicante, Spain)
Laurent Guillopé (Nantes, France)
Willi Jägger (Heidelberg, Germany)
Klaus Habetha (Aachen, Germany)
Tapani Kuusalo (Jyväskylä, Finland)
Laslo Marki (Budapest, Hungary)
Andrzej Pelczar (Krakow, Poland)
Zeev Rudnick (Tel Aviv, Israel)
Gerard Tronel (Paris, France)

The mandates of 5 of the present 20 delegates end on 31 December 2001, and so elections must be held for their positions. They are:

Manuel Castellet (Barcelona, Spain)
George Jaiani (Tbilisi, Georgia)
Marina Marchisio (Boves, Italy)
Vitali Milman (Tel Aviv, Israel)
Jan Slovak (Brno, Czech Republic)

All of these can be re-elected, since they have served in this capacity for only 4 years.

Nominations are therefore now sought for 8 delegates to serve for the years 2002-05. With this notice in the *Newsletter* is a nomination form. Completed nomination forms must arrive at the Society's office in Helsinki by 2 November 2001. (*A photocopy of the nomination form is acceptable.*) If there are more nominations than the allowed number of delegates, a postal election will be held. Members will receive ballot forms in the December 2001 *Newsletter*, which must be returned by 1 February 2002.

Nominated individuals must be individual members of the Society, and they must be proposed and seconded by individual members. The Society will pay subsistence costs for them to attend the Council meetings, if necessary, but it is not able to cover travel costs except perhaps in cases of particular hardship.

Candidates for election are invited to submit with their nomination form a short biography (not more than 200 words), together with a statement of not more than 100 words in support of their candidature. These will be circulated to the Society members with the ballot forms. A copy of the biography and statement can be sent as a text file by e-mail to the Secretariat at the following e-mail address: *makelain@cc.helsinki.fi*

David Brannan
EMS Secretary

NOMINATION FORM FOR COUNCIL DELEGATE

[*A photocopy of this nomination form is acceptable.*]

NAME OF CANDIDATE:..TITLE OF CANDIDATE: ....
(please print)
ADDRESS OF CANDIDATE: ....
(please print)
....

E-MAIL ADDRESS OF CANDIDATE: ....
(please print)

NAME OF PROPOSER:.. SIGNATURE OF PROPOSER: ....
(please print)

NAME OF SECONDER: .... SIGNATURE OF SECONDER: ....
(please print)

I certify that I am an individual member of the EMS and that I am willing to stand for election as a delegate of individual members to the Council.

SIGNATURE OF CANDIDATE: .... DATE: ....

Completed forms should be sent to: Ms T. Mäkeläinen, EMS Secretariat, Department of Mathematics, P.O. Box 4, FIN-00014 University of Helsinki, Finland to arrive by 2 November 2001.

Note: While it is highly desirable that the Biography and Statement of candidates be received by e-mail (as text files), it is necessary that nomination forms are received in hard copy format to ensure the genuineness of signatures.

EMS Lecturer 2002 : Gianni Dal Maso

The EMS Lecturer for 2002 will be Professor Gianni Dal Maso of the International School for Advanced Studies (SISSA) in Trieste, Italy.

It is planned that he will visit two different locations in Europe to give the same series of lectures to different audiences, affording as many interested mathematicians as possible the opportunity to attend and discuss the topics with him. EMS members interested in organising such a visit are invited to contact Professor Dal Maso directly (*e-mail: dalmaso@sissa.it*) by mid-October, copying their e-mail to Professor David Brannan (*e-mail: d.a.brannan@open.ac.uk*).

Brief biography

Professor Dal Maso was born in Vicenza, Italy, in 1954; in 1955 his family moved to Trieste, where he received his basic education. He was a student of the Scuola Normale of Pisa from 1973 to 1977, and graduated in mathematics from the University of Pisa in 1977, with Ennio De Giorgi as his advisor. He was then a graduate student of the Scuola Normale di Pisa from 1978 to 1981, working with Ennio De Giorgi on many problems connected with the theory of gamma-convergence that was developed in those years.

After serving as Assistant Professor of Mathematical Analysis in the Faculty of Engineering of the University of Udine from 1982 to 1985, he moved to the International School for Advanced Studies in Trieste. He worked there as Associate Professor of Mathematical Analysis from 1985 to 1987, and has been Full Professor of Calculus of Variations since 1987. He was awarded the Caccioppoli Prize in 1991 and the 'Medaglia dei XL per la Matematica' of the Accademia Nazionale delle Scienze detta dei XL in 1996.

At SISSA he has developed his research interests on gamma-convergence, homogenisation theory and free discontinuity problems, and has supervised 19 PhD students working on these subjects. He is currently Head of the Sector of Functional Analysis and Applications of SISSA.

Research interests

Professor Dal Maso started his research work in Pisa while Ennio De Giorgi was developing the new notion of gamma-convergence to deal systematically with the following phenomena: the solutions of variational problems depending on a parameter may converge to the solution of a limit problem even if the integrands of the functionals to be minimised do not converge in any reasonable sense, or converge to a limit integrand which is different from the integrand of the functional minimised by the limit of the solutions. Gamma-convergence is a very efficient tool to tackle this kind of problems.

In his work in Pisa and Udine he studied several problems related to gamma-convergence. In particular he developed, together with Giuseppe Buttazzo, several techniques to prove under different hypotheses that the gamma-limits of integral functionals are still integral functionals, and he used gamma-convergence techniques to study the asymptotic behaviour of solutions to minimum problems with strongly oscillating obstacles. Using the notion of capacity, he also gave a complete characterisation of the sequences of obstacle problems whose variational limit is still an obstacle problem.

He later used these techniques to study, with Umberto Mosco, the asymptotic behaviour of the solutions of Dirichlet problems for the Laplace equation in perforated domains, and to determine the general form of their variational limits, as well as the fine properties of the solutions of these limit problems. These results have been extended, with different collaborators, to the case of other linear and nonlinear equations and systems.

At present his main research interests are in free discontinuity problems. These are variational problems where the functional to be minimised depends on a function and on its discontinuity set, whose shape and location are not prescribed. In many cases the discontinuity set can be considered as the main unknown of the problem. Examples are given by the minimisation of the Mumford-Shah functional in image segmentation, and by the minimum problems which appear in many variational models for fracture mechanics, where the unknown crack is represented as the discontinuity set of the displacement vector, and the functional to be minimised is the sum of the elastic energy and of an integral on the discontinuity set, which represents the work done to produce the crack.

Selected list of publications

An Introduction to Gamma-Convergence, Birkhäuser, Boston, 1993.

Asymptotic behaviour of minimum problems with bilateral obstacles, *Ann. Mat. Pura Appl. (4)* **129** (1981), 327-366.

Some necessary and sufficient conditions for the convergence of sequences of unilateral convex sets, *J. Funct. Anal.* **62** (1985), 119-159.

(with U. Mosco) Wiener criteria and energy decay for relaxed Dirichlet problems, *Arch. Rational Mech. Anal.* **95** (1986), 345-387.

(with G. Buttazzo) Shape optimization for Dirichlet problems: relaxed formulation and optimality conditions, *Appl. Math. Optim.* **23** (1991), 17-49.

(with J. M. Morel and S. Solimini) A variational method in image segmentation: existence and approximation results, *Acta Math.* **168** (1992), 89-151.

(with A. Garroni) New results on the asymptotic behaviour of Dirichlet problems in perforated domains, *Math. Mod. Meth. Appl. Sci.* **3** (1994), 373-407.

(with I. Ambrosio and A. Coscia) Fine properties of functions with bounded deformation, *Arch. Rational Mech. Anal.* **139** (1997), 201-238.

(with F. Murat) Asymptotic behaviour and correctors for Dirichlet problems in perforated domains with homogeneous monotone operators, *Ann. Scuola Norm. Sup. Pisa Cl. Sci. (4)* **24** (1997), 239-290.

(with A. Braides) Non-local approximation of the Mumford-Shah functional, *Calc. Var. Partial Differential Equations* **5** (1997), 293-322.

(with F. Murat, L. Orsina and A. Prignet) Renormalized solutions of elliptic equations with general measure data, *Ann. Scuola Norm. Sup. Pisa Cl. Sci. (4)* **28** (1999), 741-808.

(with G. Alberti and G. Bouchitte) The calibration method for the Mumford-Shah functional, *C.R. Acad. Sci. Paris I Math.* **329** (1999), 249-254.

(with R. Toader) A model for the quasi-static growth of brittle fractures: existence and approximation results, *Arch. Rational Mech. Anal.*, to appear.

Bringing mathematicians into biology

The *Human Frontier Science Program* is an international funding agency, supported by the G7 governments, the European Union and Switzerland. The HFSP supports interdisciplinary international collaborations in the life sciences, with an increasing focus on bringing scientists from various fields such as physics, mathematics, chemistry, computer science and engineering, together with biologists, to open up new approaches to understanding complex biological systems.

The HFSP promotes international collaboration through collaborative research grants and post-doctoral fellowships. Long-term and short-term fellowships are available for scientists early in their research careers. *Long-term fellowships* provide three years of support to obtain research training in another country in a new research area; the third year can be used in the home country and under this condition can be delayed for up to two years. The application deadline is September each year. *Short-term fellowships* provide travel and subsistence support to visits from 2 weeks to 3 months to acquire new techniques or establish new collaborations; there is no deadline for this programme. *Research grants* support international collaborative projects. Teams of scientists wishing to apply for a grant must submit a letter of intent via the HFSP web site. The next deadline for applications for letters of intent to submit research grants is 30 March 2002. Further information can be obtained from the HFSP web site at *http://www.hfsp.org*

Interview with Marek Kordos

(Editor-in-Chief of the Polish monthly *Delta*)

interviewers: Krzysztof Ciesielski and Zdzis³aw Pogoda

'Delta' is a popular mathematical, physical and astronomical monthly publication by the Polish Mathematical Society, Polish Physics Society and Polish Astronomical Society. The first issue was published in January 1974. Since then, Professor Marek Kordos from the Mathematics Institute of Warsaw University has been the journal's Editor-in-Chief.

In Poland, most mathematicians know 'Delta', but it is less well known abroad. What is its purpose?

The main purpose of *Delta* is to present mathematics, physics and astronomy by people who work on these sciences. We believe that such scientists can present their subjects in a clear way, and do not believe in the picture of science that is presented by the professional journalists. The true picture we obtain is the main advantage of our point of view. However, many scientists do not believe that they can speak and write about their results for a general audience: this is the main disadvantage.

How was 'Delta' created?

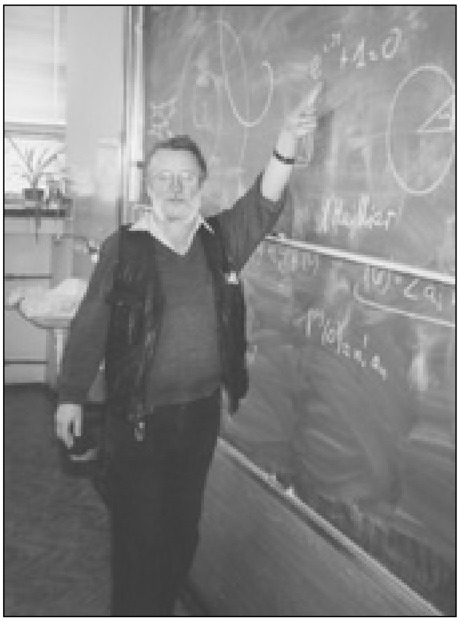
The godfather of *Delta* was Professor Leon Jesmanowicz, who convinced Professor Roman Sikorski, President of the Polish Mathematical Society, of the idea. The efforts of Sikorski and Tadeusz Iwianski, Secretary of the Society, who was very clever at fighting administrative formalities, brought *Delta* into existence. If somebody wanted to discredit *Delta* he could say that the event happened during the Gierek decade, so *Delta*, together with small 'Fiat 126p' cars, Central Railway Stations, Lazienki Roads, etc., form the same company. From the very beginning of *Delta*, the idea of presenting only mathematics in the journal was given up, because the authorities decided that mathematics alone is not interesting enough to fill the whole journal. In fact, I am very surprised at such a point of view, but I think it is much better that *Delta* is not only a mathematical journal.

Where did the title come from?

It was Jesmanowicz who invented the title. The idea was to put something mathematical in the title and $\Delta = b^2 - 4ac$ is supposedly the best-known mathematical term.

How did you become Editor-in-Chief?

The editor had to be somebody who was involved in journalism in some way. At that time there was precisely one man in Poland who fulfilled the required condition – a mathematician, who presented quizzes and logical puzzles on TV. However, this candidate was rejected when he presented his idea of the journal – let me not speak about the details, it is

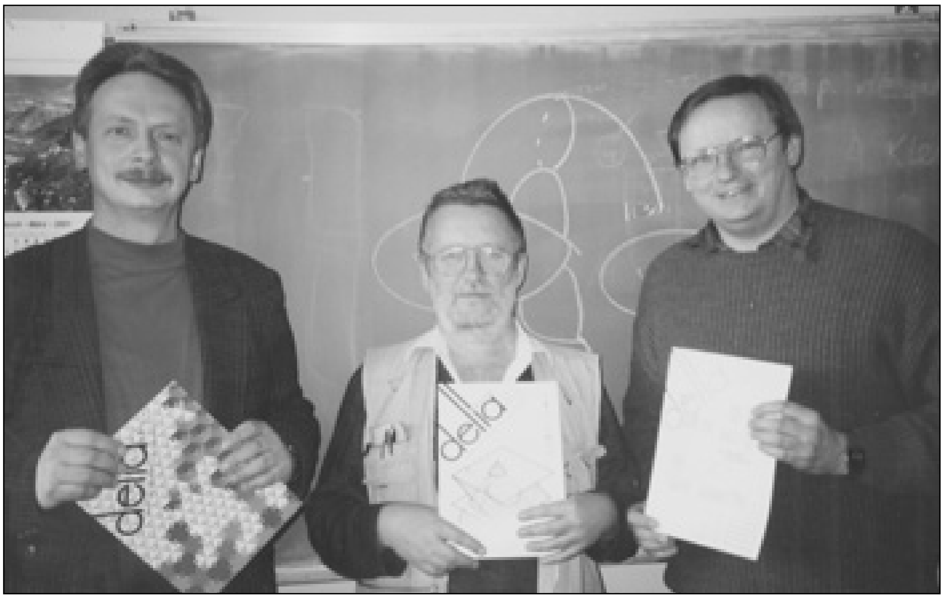


Marek Kordos

enough to say that the authorities of the Polish Mathematical Society did not like it.

Then they were terrified, they did not know what to do and desperately looked for an editor. Eventually, my candidature was put forward by Andrzej Makowski, who thought that my previous work on the journal *Wiedza i Zycie* (Knowledge and Life) was a sufficient recommendation. They were short of time and nobody worried about any precise investigation. Sikorski phoned me and asked if I could visit him – immediately, if possible. Of course, I came to him at once and then I was offered the job of Editor-in-Chief of *Delta*. I asked for some time to think the proposal over. Sikorski said: 'Certainly. How much time do you want?'. I answered: 'One week'. Then Sikorski told me: 'Of course, you have one week, but tomorrow you must take part in a special meeting with physicists and, as Editor-in-Chief, select the associate editor. So, in fact I never agreed to be the Editor-in-Chief, but I probably didn't have to, it was not necessary.

I do not know how everything connected with *Delta* would have gone on if I hadn't found Tomasz Hofmokl. He was a wonderful man, a very good scientist and a very good manager (this is rather rare), and an excellent partner. Tomasz was capable of everything I couldn't do and of doing some things I could do and this was really fine. My meeting with Sikorski took place on 3 June 1973 and on 8 December 1973 another meeting with the Boards of the Mathematical and Physical Societies was planned. During this meeting we were to present our plans concerning *Delta*. However, we did not present the plans, we presented the first issue just printed. This was a great surprise and perhaps for that reason the Boards liked it very much. In practice, the official acceptance of the shape of *Delta* took place in September 1974 in Torun, during the General Assembly of the Polish Mathematical Society, where there was a row. This row was provoked by the godfather of *Delta*, Leon Jesmanowicz himself, who said that *Delta* was too effective as its covers were too colourful: perhaps because of that, some fools might buy *Delta*. He regarded such a situation as bad. Such an opinion may seem strange now, but in the 1970s *Delta* was the most colourful journal sold in Poland, I think. *Delta* was defended by

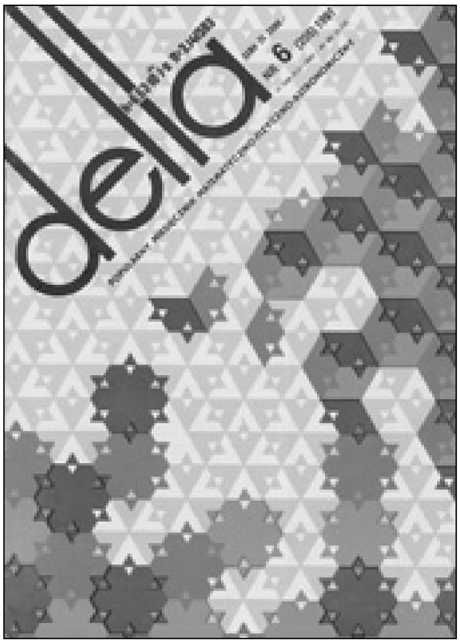


Marek Kordos (centre) with Krzysztof Ciesielski (right) and Zdzislaw Pogoda (left)

Professor Zofia Krygowska with the words: 'Mathematics is colourful'. Such was the beginning of *Delta*.

Who is Delta aimed at?

We were given some suggestions about the kind of readers. At the beginning, most outstanding Polish mathematicians had an ambition to have an article published in *Delta*. On the basis of what they wrote, it is difficult to point out the readers. Nevertheless, I do not think that the readers of *Delta* should be precisely characterised.



I always explain why I do not want to popularise science professionally. Somebody who does it professionally tries to take science in, to digest it and to show the final result to the audience. It is disgusting, isn't it? I was always against such a method of popularising science. The 'speaking science' is my ideal. I mean scientists should be able to speak about their work in the way understandable for others. In my opinion, this is the only method if we want science to be accepted. Scientists should inform others what they do and what for. If the subject is interesting for them, they should know how to interest others in it. This is the reason why *Delta* was always interested in particular authors, not in particular readers.

Some time ago, *Delta* went through a bad period. After some years, elderly mathematicians stopped writing for it (usually for the reasons such as illness or death) and so-called 'young doctors' became the majority of our authors. These people (not all of them, of course) are probably the worst kind of authors: they want to write as quickly as possible about everything they've managed to learn. They do not want anyone thinking: 'Ah, they didn't mention martingales? That means they do not know what martingales are!' Then, *Delta* became really too difficult.

We still have discussions during editorial committee meetings. Some members of the committee want to reject the articles which seem too easy and trivial. I always strongly recommend such articles, frequently somebody agrees with me, so we fight to accept the articles regarded as trivial by others. However, one must be very careful here. In any article (easy or difficult – it does not matter), there should be enough information. In my opinion, the most difficult task in our editorial job is to find articles that can be read easily read – say, as a newspaper – not studied.

After the period of the authors from the Polish Mathematical School came another generation came – a rather strange one. They regarded mathematical techniques as most important. They would prefer gathering different techniques (and perhaps never apply them) to something converse, that is to fighting with problems without suitable techniques being learnt. This generation (not all of them, of course) saw no reason to inform a general audience about their work. Fortunately, the next generation turned out to be more normal, and young mathematicians are now very interested in their connections with the 'non-mathematical world'.

Somebody writes an article for 'Delta' and submits it. It is read, judged...

... and frequently accepted. In such a way we get many articles by scientists from different countries, and all continents! – from India, New Zealand and Vietnam, as well as the USA, Great Britain and Germany. But it sometimes happens that the Editorial Board does not want to publish a submitted article.

Sometimes you suggest corrections, don't you?

Ah, yes, of course, but I think that we always do it in a reasonable way. Only once did I shorten an article, written by a professor of physics. It originally had eleven pages and after my rewriting had 2 pages. The author was very grateful to me, he liked it very much. I think it was the only article that was really changed. In fact, we interfere only in articles we want to publish, and the author has always the right to appeal.

Comparing the first Editorial Board with the present board, one can see that only you have remained. Of the present Committee, only Andrzej Maakowski was in the first Scientific Committee…

Delta cannot be the main point in somebody's CV. People come to *Delta* and later they go away. Professor Hofmokl, for instance, was the Assistant Editor of *Delta*, later he was Chairman of the Department of Experimental Physics at Warsaw University, and at the end of his life was the Head of Polish Internet. Besides scientific and academic careers, people leaving *Delta* often organise their own printing business. Why I didn't I give up? I wanted to several times, but there was never any fool who agreed to take over the job. On the other hand, it would be a pity to give it up. It seems that Sikorski sentenced me to life imprisonment.

Delta had a stall during the 1983 International Congress of Mathematicians in Warsaw

Yes, it attracted people mainly because of our many colourful covers. Every participant of the Congress received a special issue of *Delta* in English, containing selected articles from its first ten years. Some articles into English can now be found on the internet (*www.mimuw.edu.pl/delta/*). Also, a selection of our articles will be published in Catalonian, which will probably be the beginning of an analogous journal there. Articles from *Delta* are also frequently published in the Russian 'Empire of Mathematics'.

Delta's sold together with newspapers. How does this work?

Ah, this is very interesting. At first, we published 30000 copies of the journal and everything was sold. Later we jumped to 50000! However, ten years ago economic changes came, and several new journals and newspapers started. We believed that many of our readers bought *Delta* because they could not get *Penthouse* or *Daily Rag*. Now, we publish 4500 copies, which seems to be reasonable and is probably about the number of fans of mathematics and physics in Poland. On the other hand, such numbers of copies are not easy to distribute and sell through a large number of newsstands.

A caricature of Marek Kordos drawn by Leon Jesmanowicz

Has Delta ever published original research papers?

One summer day in 1980 Professor Karol Borsuk called me and gave me a manuscript. In his article he wrote about his now well-known theorem that there exists an intrinsic isometry mapping n-dimensional Euclidean space E^n onto a subset of the space E^{n+1} with arbitrarily small diameter. The article was written in a style suitable for *Delta*. Borsuk wanted this theorem to be first published in *Delta*, because it acted for imagination: in fact, if an alien from Aldebaran could move in the Euclidean space of higher dimension, then the distance from his feet to his nose might be the same as the distance from his feet to the Earth. Thus *Delta* was the first journal which published this result.

You haven't published only this journal, have you?

Delta has only 17 pages, so we had to publish something else, as our writers wanted to write much more. We used to publish three series of books: *Delta's library*, *Delta presents* and *Read! Perhaps you will understand*: in this last series we published 26 volumes. But first we published a book for schoolchildren *Can you wonder?* which sold 200,000 copies! This is double the number of copies of any most popular crime book in Poland. We continued with a second book *See it in another way*, which was also a best-seller.

These two books were based on *Little Delta*. For some years, each issue of *Delta* included a special column for younger readers, called *Little Delta*. In 1981 we gave up this column and start publishing an independent journal *Little Delta*. After two years, its title changed to *A glass and an eye*, the editors changed, and the journal was edited by the group from Bialystok. 99 issues were published, and *A glass and an eye* existed for about ten years. Now we have a *Little Delta* column again. We also produced special TV programmes and even some theatre and circus performances.

What about other columns in Delta?

The oldest is *Club 44*, and is a challenge to the readers. In each issue some mathematical and physical problems are published and the readers are invited to send in solutions. These are marked, and a competitor who gains 44 points joins the club. Marcin Kuczma, who edits and organises the competition, was presented with the David Hilbert Award by the World Federation of National Mathematical Competitions for this column.

For many years we had a column called *Laboratory at home*. Edited by Jan Gaj, this was very popular with the readers and slightly less so with their schoolteachers, who sometimes did not know how to explain the physics of the experiments. In 1979 the astronomers joined *Delta*, and we started a new column *Look at the sky*.

We work in Warsaw, but have columns edited by colleagues from other cities. In 1991-97 we had a column named *Epsilon*. It appeared in 77 issues and was edited by our Krakow colleagues. They presented mathematics in 'a light way', with a special sense of humour. Now we have *Gammalimatias* written by a Wroclaw mathematician.

In 1986, the International Mathematical Olympiad took place in Warsaw...

Yes, it was really quite interesting. A group selected from the members of Club 44 took part in the competition unofficially, but with the acceptance of the Jury. The result of our group was similar to that obtained by the official Polish team.

Each year you organise a competition for a mathematical paper by a secondary school student...

Yes, we do this together with the Polish Mathematical Society, and consider only original results obtained by young people. The first competition took place in 1978. The winners are awarded Gold, Silver and Bronze Medals and small amounts of money, but the main prize is that the winners present their papers to the General Assembly of the Polish Mathematical Society. Also, the winning papers are published in *Delta*.

The level of that competition is really high. Some papers presented here are later published in good professional mathematical journals. The winner of the 1980 Competition is now a professor of mathematics, while some others are on the way to professorships. Since 1995, Poland has participated in the European Competition for Young Scientists, organised by the European Community. There, papers are presented by young students and schoolchildren, aged 20 or less. All the mathematical papers from Poland in that competition won in our Competition first, and gained one Silver Medal, two Bronze Medals and one special distinction in the European Competition. These were all the prizes gained by mathematicians in the European Competition.

What about the future of Delta?

Our situation is complicated. It is similar to Bialowieza National Park in Poland. Two rare species live in this National Park: large ones, European bisons and small ones, Laxmann's shrews. Bisons are at least representative, but what are shrews are? The existence of *Delta* depends on Warsaw University. As long as the University regards *Delta* as useful, or at least good, *Delta* will exist. This may be called 'ecology outside biology'. In fact, there is not much trouble with *Delta*.

Any problems with censorship?

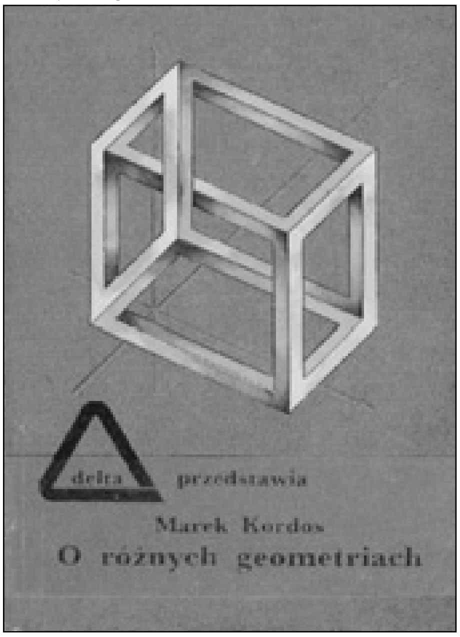
Oh, yes, there were some problems at the very beginning. In the first issue an article about the Department of Nuclear Physics was going to be published. Professor Hrynkiewicz, a Krakow physicist, talked about that Department and photographs were included. In the article it was noted how large an area is taken by the Department. This piece of information turned out to be top secret information and we were strictly forbidden to publish it. It was so silly, that when we were ordered to cancel a sentence about this, we laughed about it very much. I believe that we laughed too much, because as a result we forgot to cancel this piece of information. So, the issue was printed in 30000 copies and this issue had no right to be distributed. What to do? The copy editor of *Delta* visited the Main Censorship Office, then he fainted and fell into the arms of the censor-ladies in the office. When the ladies brought him back to consciousness he whispered tragically about the extremely large amount of money he would have to pay as the one who accepted the issue for publication.

Then the ladies told him: 'Ah, it's nothing, really'. When, additionally, it turned out that the copy editor brought with him two copies of the best-seller *Cezars' lives* and wanted to leave these books in the office, everything cleared up very soon.

Speaking of censorship, they also cancelled a lot in the issue about ecology.

Look back at 27 years of Delta. What do you admire mostly? Any articles...

It is difficult to say which articles were the best: I cannot judge it in any sensible way. I would rather mention whole issues. I especially liked three of them: the issues on ecology and the 17th century, and a mini-monograph on complex numbers. Another valuable thing was a map of the sky. In 1985, we printed part of such a map on the back cover of each issue: twelve parts put together formed a large umbrella with the sky pictured. I have never heard of anything similar to that.

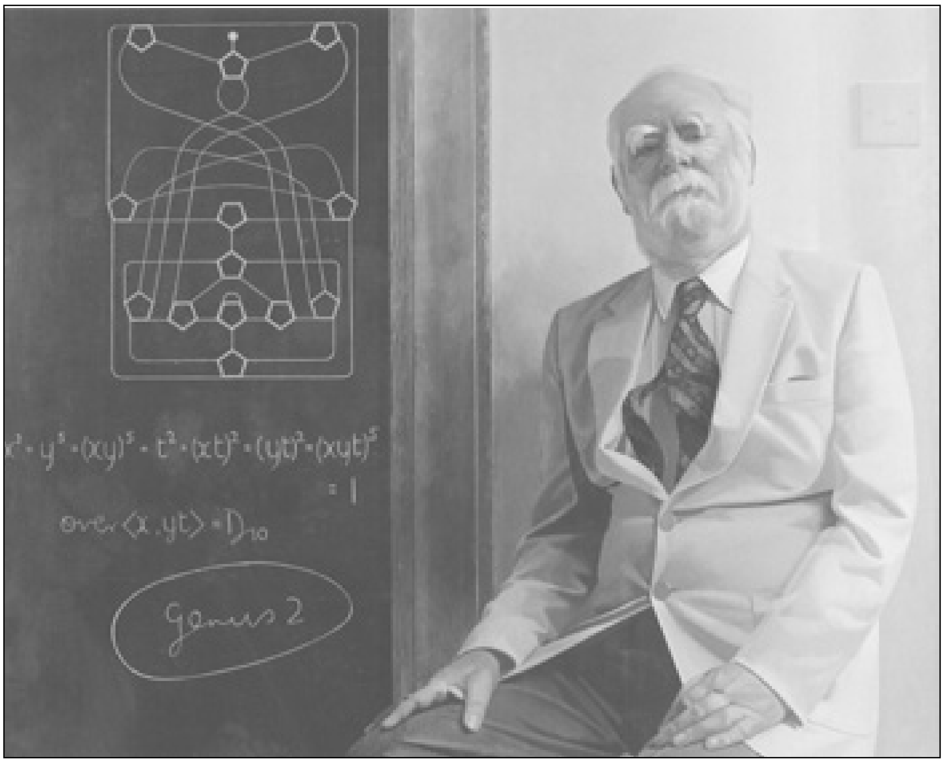


The cover of the book ***On different geometries****, written by Marek Kordos and published in the series* ***Delta presents***

Also, we made special glasses for stereographic pictures, which was a swindle ... ah, you wanted a funny story about *Delta*, so now you have one. In 1984 we wanted to print special stereographic pictures. These pictures have to be printed in two colours, but when you look at them through special colour glasses you see three-dimensional pictures. The glasses should have been enclosed with the issue of *Delta*. We had to produce glasses and we needed special colour transparents. We needed money for that – where from? No chance to get money. So, we started looking for somebody who would give us such transparents. In particular, we asked several institutions engaged in international trade. In one such agency, we were told: 'It is possible'. They wrote to the foreign producer of such transparents saying that they were considering buying transparents, and asked for sample copies. These sample copies were used for producing our glasses and the agency did not buy anything!

Looking back: Graham Higman

interviewers: ADRIAN RICE and ROBIN WILSON



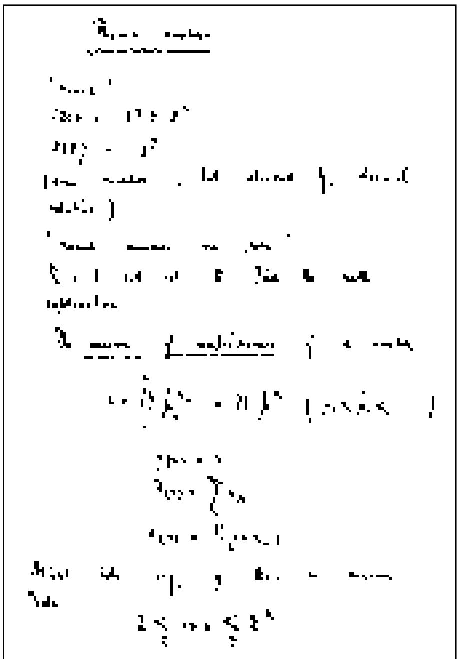
Graham Higman was Waynflete Professor of Mathematics at Oxford University from 1960 to 1984, following a period at the University of Manchester. His contributions to pure mathematics have been mainly in group theory and mathematical logic.

How did you become interested in mathematics?
The chief reason was that my elder brother did chemistry! When I went to Oxford I came up on a natural science scholarship – but since he'd read chemistry, I thought I'd better read mathematics. My brother had already gone to Balliol College, so I went there too.

What sort of mathematics did you enjoy at Oxford?
I was a born pure mathematician – I had no respect for applied mathematics – but I had to study it all the same to a certain extent.

Was there any pure mathematician who particularly inspired you?
Well, Henry Whitehead, who was my tutor, of course…a very good tutor. I didn't realise how great he was – undergraduates don't. He certainly wasn't intimidating. But he had a sense of humour that was rather different from mine, and his non-mathematical attitudes were also different. But apart from that, we got on very well. However, I don't think he took me seriously for the first couple of terms, because I'd opted to do mathematics on a natural science scholarship, and he had no idea whether I was any good.

While you were an undergraduate, you helped to found the Invariant Society – the undergraduate mathematical society?
Yes, that was Whitehead's idea – it was the first Oxford society for mathematics undergraduates. I remember G.H. Hardy giving the opening address in 1936 – on round numbers.



G.H. Hardy's notes on round numbers

To what extent was algebra taught at Oxford in the 1930s in the undergraduate syllabus?
Well, there was a good deal of old-fashioned traditional algebra – determinants, matrices, and that sort of thing. But there was no group theory – except that you could do it as a special subject. In fact, you could take one or two special subjects – I took two: the theory of groups and differential geometry.

What happened after that?
I did a D.Phil. – straightaway; Whitehead was my supervisor. I suppose I was already interested in an academic career. My topic, *Units in group rings*, was designed to make me into an algebraist. But I was also interested in combinatorial topology at that time, as Whitehead was. He was a topologist – but he still had an interest in algebra of various kinds – more in linear algebra, I think, than in group theory. From his point of view, the point of studying units of group rings was because of their applications to K-theory.

When did you first get to know Philip Hall?
I spent a year in Cambridge at the end of my D.Phil. course, and that's when I met him. However, Cambridge was a shocking place to be at that time – the beginning of the War. It was too near the East Coast! I also got to know Max Newman a little – but more so later, when I went to Manchester. He was interested in group theory and also in logic. He contributed greatly to my becoming partly a logician and partly an algebraist.

What did you do during the War?
I signed up as a conscientious objector, and then drifted in to the meteorological office – partly because of that, I suppose. I began in Lincolnshire, and spent part of the time in Northern Ireland, and also in Gibraltar for a while. I didn't do any mathematics – I was just a straightforward forecaster.

Did you enjoy your work there?
Yes, as much as anyone enjoyed anything in those days – more than I would have done in other jobs. It exercised the mind.

What happened after the War?
Well, I can tell you why I became a mathematician after the War. By then, I was totally disillusioned by my experiences in the real world, and I decided that since I knew nothing else I'd better stay in the Met Office. I was interviewed there, and at the end the interviewer asked me: 'If it hadn't been for the War, what would you have done?' And I said, 'I suppose I would have tried to climb the academic ladder.' And he said, 'Well, with qualifications like yours, you still could.' And I thought, 'Well, a nod's as good as a wink to a blind horse, so I left.' They offered me a job, but it wasn't a particularly good one, so I decided to apply for academic jobs.

Were academic jobs difficult to get at that time?
No, they were actively looking for people – anybody with the right qualifications could get one. In fact, I was offered a job at Durham. I was interviewed at Durham and Manchester in the same week – Durham first – and they offered me a job. Since I knew that Max Newman was now at Manchester, I asked Durham if I could delay my decision until I'd heard from Manchester. But they said 'no', so I turned Durham down and went to Manchester.

Who else was in Manchester at that time?
Jack Good and David Rees – Bernhard Neumann and Walter Ledermann came later.

Was Alan Turing still around?
He must have been around when I got there, but I didn't meet him until I became interested in his stuff. I think he was in the department of experimental physics, since he had to have a laboratory. He was rather a kind man, but rather 'up in the air', 'loose', one might say. He didn't give the impression of being very organised. I worked a little with him, when he solved the word problem – or nearly solved it.

Were there any other colleagues at Manchester with whom you worked, or were you a solitary figure?
No, I was never very solitary. David Rees, as I said, and Trevor Evans – and Bernhard Neumann when he arrived. Bernhard Neumann settled me down a great deal, though it was Max Newman who I chiefly remember with gratitude. In the first place, he took me at a time when I'd not done any serious mathematics for several years and I was rather doubtful of my capacity to do so – he encouraged me a good deal. And the other thing about Max Newman was that he was interested in various things – he gave a course of lectures which I remember very well, on logic and word problems. My interest in that aspect of group theory springs very much from him.

The two prominent figures in your career, Whitehead and Newman, were primarily topologists.
They were topologists *primarily*, but they were both *mathematicians* with a wide range – I hope people would describe me the same way. They were interested in the fundamental group as a topological tool, and this led immediately to algebraic questions, of course.

Have you noticed an increasing tendency towards specialisation in recent years?
Well, I think that analysts have always specialised – it's in their nature – they're self-sufficient, aren't they, whereas nobody else can afford to be self-sufficient. The D.Phil., as an almost universal gateway to the profession, wasn't there in my day. But after the War, it became obvious that we needed something like that.

With such a stimulating environment in Manchester, why did you return to Oxford in 1955?
In the first place I was very ambitious – I started applying for professorships that I was perhaps not qualified for, and also for other jobs – which rather unsettled me. But I think Henry Whitehead was partly responsible for my returning to Oxford, because he thought I would be wasted in certain places that shall remain nameless. He arranged a lectureship, which became a readership pretty quickly.

Then Whitehead died suddenly, in 1960.
Yes, it was a shock for everybody. He died in America – a long way away – at a meeting in Princeton. He was at a tragically young age.

Henry Whitehead and friend

Whitehead had been the Waynflete Professor of Pure Mathematics at Oxford. Were you the heir apparent – the natural successor?
I thought so, but whether anybody else did, I don't know! I applied, and I thought that I had a reasonable chance – and I was in fact appointed.

During your time as Waynflete Professor from 1960-84, you built up a formidable research school in algebra in Oxford.
Well, that is what I was there for, really. Perhaps the topologists had had it all their own way for too long!

Your time in Oxford coincided with all the exciting work on the classification of finite simple groups.
Yes, but I was always on the periphery. I was more interested in infinite groups than finite groups, and I was never a very good conjecturer – I always thought there would be far more simple groups than there turned out to be. I tried to construct them rather to characterise them. In fact, I missed a great opportunity to discover the Conway groups. I should have known better than to go on footling along with finite groups, but unfortunately I was really obstinate about it.

During the 1960s you became President of the London Mathematical Society. Had you always been involved with the LMS?
I'd been a member since just after the War. I was on the Council for many years and was assistant editor on the *LMS Proceedings* to John Todd. When I was on the Council I attended all the meetings they had in London – except on one occasion when such a fog descended that I arrived just as the meeting was due to finish, and there didn't seem much point in going.

In those days the outgoing president looked for a new one. I succeeded A. G. Walker. On the whole I think I was a rather conservative president. You have to remember that the London Mathematical Society is a very much larger institution than ever before, and most of that increase took place after I was president. It was already beginning when I was president – it was clear that it had to come, but I was a bit frightened of it.

Since you retired, have you kept up your interest in mathematics?
I'm interested in the kinds of mathematics that people do. I'm interested in algebra. I'm interested in logic. And I'm particularly interested in seeing a greater number of people working on the borderline between algebra and logic. I'm interested, for instance, in model theory, and the work I've done on almost free groups; this leads you to consider the language in which you can talk about these things. But above all, I'm interested in going on doing mathematics, even if it isn't very good mathematics, because there's nothing else that keeps me sane – relatively sane, at least.

Do you still keep abreast of current mathematical developments?
No, I don't claim to keep abreast of current developments – I never did. I was never a good person for knowing the literature – it wasn't my strong point. Others are far more widely read than I am. What I do is fiddle around with problems that are probably of no interest to anybody else. On the whole I've been interested in things that other people haven't been interested in. I've never felt that my lines were popular.

Is there a piece of your own work of which you are particularly proud?
Oh yes – there's no doubt whatever! The one thing that I hope to be remembered for is the theorem on the necessary and sufficient condition on a finitely generated group for it to be embeddable into a finitely generated group with finite presentation. In the first place, that is solely mine – nobody even so much as conjectured it before. And in the second place it opens up vistas; for instance, an obvious corollary is that there are universal finitely presented groups – that is, finitely presented groups which contain every finitely presented group as a subgroup. As far as I know, there's no proof of this which doesn't use my theorem. There are other things that I'm proud of – but that's the thing I think is really important.

Is there any mathematician from the past who you wish you had met?
I suppose, Kurt Gödel. I have an immense admiration for his work.

And finally, how would you like to be remembered?
As a great mathematician, of course – what else is there?

We thank the Mathematical Institute and Prof A Kosinski for supplying the photographs in this article

The Methodology of Mathematics *part 2*

Ronald Brown and Timothy Porter

The first part of this article appeared in the June 2001 issue.

We return to the last three questions at the beginning of Part 1 of this article:

4. What is the methodology of mathematics, and what is the way it goes about its job?

5. Is there research going on in mathematics? If so, how much? What are its broad aims or main aims? What are its most important achievements? How does one go about doing mathematical research?

6. What is good mathematics? Is there a future for mathematics?

We re-emphasise that the tone of this article is that of an address to students. We hope that its publication will encourage debate about how, as Dantzig [1] put it, to present mathematics 'with its cultural content' and not as 'a bare skeleton of technicalities', with the danger of repelling 'many a fine mind'. Serious and difficult questions remain on the balance between this kind of teaching and the usual material, and on assessment: students are rightly inclined to believe that matters not assessed are thought to be unimportant. If matters related to professionalism are not discussed, then there is a danger that naive attitudes will prevail – such as that 'good mathematics is precisely the mathematics done by top mathematicians'.

What is the methodology of mathematics?

Here again is a subject that is rarely and not widely studied. There is the comment of Paul Erdõs [4] that mathematics is a means of turning coffee into theorems; perhaps, though, this does not help the beginner too much. So let us look at some of the issues discussed in the books by P. Davis and R. Hersh, *The mathematical experience* [2] and *Descartes' dream* [3], particularly the section of the first book on 'Inner issues'. This deals with a number of themes.

Symbols

The use of symbols and symbolic notations is one of the characteristics of mathematics, and one that puts off the general public. People will say they were able to do mathematics till it got onto x and y.

The manipulation of symbols according to rules is still an important part of the craft of mathematics. We find we have to teach people who wish to master (say) economics, but who are unable to deduce from $x + 2 = 4$ that $x = 2$. This makes it very difficult to understand the concepts of economics.

Very complicated relations can be expressed symbolically in a way that can hardly be conveyed in words. This economy which symbols allow is improving continually, as symbols are used in the denotation of advanced concepts and the rules of symbol manipulation are used to model the rules for the concepts.

It has been said, in an exaggerated way, that the history of mathematics is the history of improved notation. This reflects the finite nature of intelligence, which requires props and metaphors to help and guide it.

Some symbols are in themselves metaphors: examples are $/$, $<$, $\rightarrow$, $\int$. Others have acquired strong associations, so that we can use them as metaphors. Symbols are able to express 'with economy and precision', to use words of A.N. Whitehead. The use of particular symbols is something that changes with time, as mathematicians become accustomed to, and appropriate, a new notation.

In some cases, a notation, brought about by the laziness of mathematicians, leads to a new theory. For example, expressions of the type $(a_{11}x_1 + \ldots + a_{1n}x_n; \ldots ; a_{m1}x_1 + \ldots + a_{mn}x_n)$ get abbreviated over time to $\mathbf{Ax}$, and to allow for the correct manipulation of this abbreviation the rules for matrices are worked out.

To give an example close to the heart of some of our research, the first author has been concerned for many years as to whether the linear notation for mathematics is a necessity or a historical result, based on the needs of printing.

The analysis of this linguistic point has led to a new kind of 'higher-dimensional algebra', in which symbols are related not just to those to the left and to the right, but also up and down or out of the page. This algebra then becomes closer to, and more able to model, some geometric situations, and this leads to the formulation and proofs of new theorems, and to new calculations and insights.

Abstraction

This is an essential part of mathematics, and again is one part of what makes mathematics incomprehensible to the general public.

Mathematical structures are abstract. They are defined by the relations within them. They are thought of as non-sensual. The advantages of abstraction are at least three-fold:

* An abstract theory codifies our knowledge about a number of examples, and so makes it easier to learn their common features. Only one theory is needed, to replace a multiplicity. This codification exploits analogies, not between things themselves, but between the behaviour and relations of things. Finding these analogies, the abstract theory that replaces a multiplicity, is an important method in mathematics.

* Once the theory is available, it may be found to apply to new examples. This leads to the excitement and joy of: 'That reminds me of ...!'. For this new example, a body of established theory is available at the turn of a page.

* An abstract theory allows for simpler proofs. This is a surprise, but is commonly found to be true. The abstract theory allows for the distillation of essentials. It is of interest to know if a theorem or fact is true in the general situation or only in the particular example. The abstract theory allows for the removal of possibly irrelevant aspects.

Generalisation and extension

This has some features in common with abstraction, but usually applies differently. Thus a generalisation of the (3, 4, 5) right-angled triangle is Pythagoras' theorem, while an extension is Fermat's last theorem, that the equation $x^n + y^n = z^n$ has no solutions for positive integers x, y, z, if $n > 2$. This has now been famously proved by Andrew Wiles [7].

Proof

The rigorousness of the notion of proof is a particular feature of mathematics. It is why mathematics is essential in engineering, safety, physics, and so on.

The notion of proof, of validity, in mathematics, is an aspect of the general question: what is the notion of validity in an area of study? Each area, from social sciences, economics, chemistry, biology, education, law, literature, and so on, has its notion of validity, and the contrast and uses of this notion are of particular interest.

The question of what is acceptable as a valid argument in mathematics is still subject to argument and discussion, particularly with the existence of very long proofs (for example, 15000 pages [5]), and with the use of computers for visualisation, experimentation and calculation.

Existence of mathematical objects

A great mathematician has urged that the major problem of mathematical education is to teach the reality of mathematical objects. What is this reality? In what way do these objects exist? For example, *Eternity*, by John Robinson, is a symbolic

Eternity, by John Robinson

sculpture, but is also the construction of a fibre bundle! (see [6]).

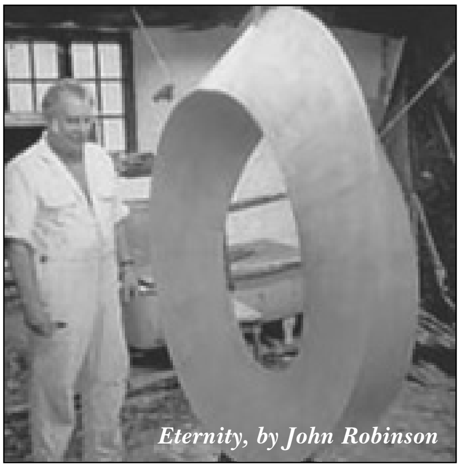
These questions have been a matter of major interest to many philosophers of mathematics, but their interest is perhaps in the process of being downgraded. Mathematics is often about processes. The question of existence of a mathematical structure is maybe like asking whether the game of chess exists. Clearly it does not exist in the way that tables and chairs exist, but nonetheless it influences many lives and, to put it crudely, passes the cash test. (Does it earn money? The answer is clearly: yes, for some – for example, world champions and makers of chess equipment.)

The relation of mathematical concepts and methods to processes is indicated by the way that memory of muscular action and rhythm are important aspects of mathematical work. A lot of mathematics is concerned with the realisation and understanding of the effect of repetitive processes and methods.

Mathematicians are good at understanding and imagining moving things around, such as from one side of an equation to another, or changing a pattern in space. They use movements of their hands and arms to convey what is happening. The objects and ideas of which mathematicians talk are sometimes a kind of concatenation of a variety of such remembered processes. By contrast the representation of these ideas in writing is often bare and sparse, and this is part of the difficulty of learning the use and application of these objects and ideas. On the other hand, it also allows for each person to make the interpretation and internalisation most appropriate to themselves.

Infinity

The taming of the infinite, or the enlargement of the imagination to include infinite operations, is one of the joys of mathematics, and also one of its scandals. Are these infinite objects real? The surprise is that these infinite, possibly unreal, objects can be used to prove finite real things, and this again is an aspect of the mystery of the subject. Suppose for example that these infinite objects are used to prove the safety of a nuclear installation, or of an aircraft landing system? What credence should be placed on such a proof? These are real issues.



Eternity, by John Robinson

Is there research going on in mathematics?

Those who wish a practical test should look at the change in *Mathematical Reviews* since it started in 1940. This monthly journal contains abstracts of mathematical papers. Roughly speaking, a few paragraphs are enough for a five-page paper. The growth in numbers of pages over these years is about eleven-fold: each month now about 400 large pages of abstracts of mathematical papers are published. This is indeed the golden age of mathematics, both in quantity and quality.

The aims of this research are at various levels. One is the advancement in knowledge about particular types of structures, that are already well defined. Another is the introduction of the study of new structures, as they have appeared and been shown to be relevant. There are new relations between structures. There is the urge to simplification, to find structures that explain and help us to understand the way particular structures behave in themselves relative to other structures.

What is difficult for the newcomer in the field, and for the general public, to understand is how one goes about doing mathematical research. Here we give some pointers, by suggesting four ways of going about the job. There are certainly many more, and individual researchers must in the end devise their own strategy for success. It is also difficult to know how much one must know before starting on mathematical research: a famous answer to this particular question was: 'Everything, or nothing.'

Method 1: Apply a standard method to a standard type of problem

This method is probably a part of every successful research project, and has every guarantee of success, provided that one is sufficiently skilful in the standard method. Indeed, a common method of mathematical research is to reduce a problem to one already considered. If the original problem is too difficult, then a standard strategy is to simplify the problem so that it becomes of standard type, before adding the complications that make it a new problem. The general presumption might be that one can do only easy things. So the method is to reduce a problem to a type that can be seen to be easy. If in doubt, do the obvious thing first.

Those who become skilful at applying standard methods may someday find that their skills apply to a problem no one else has considered, and that this leads to new and important results. Much of the education of a mathematician is concerned with acquiring the skills and knowledge appropriate to work in a chosen area.

Method 2: Attack a famous problem at the frontiers of knowledge

This is the strategy of going for a famous problem at a peak of knowledge. The advantage is that if you succeed, then you will become famous. It is more difficult to assess your chances of success: you will probably need some new ideas.

This seems to be the most ambitious method for a young person. However, S. Ulam, in conversation with the first author in 1964, suggested that while this method might appeal to young ambitious persons, concentration on this might also not allow them to develop the kind of mathematics most personal and characteristic to themselves, because they are solving other people's problems.

Usually, though, one attacks smaller problems at the frontiers of knowledge, problems to which less effort has been devoted, and so where there is a greater likelihood of success. You will almost certainly have to study to find what has been done, what techniques are available, and which you need to master.

It is helpful to have problems whose criteria for success are clear: the answer is *yes* or *no* to some question. On the other hand, failure to provide a solution is then also clear cut, as is finding the problem too easy. Mathematicians need to build into their strategy plans for dealing with both too little and too much success on the problem at hand.

Method 3: Relate different areas of knowledge

In this method you learn about the beginnings of different areas, and find relations between them – so you fill in the gaps between the peaks, while often the 'top people' are occupied with building up the peaks. The advantages of this method are that you learn something of different areas, and in a useful way, since you have to work to do the translations between the two areas. This is a good method for PhD theses, since a supervisor can often see the relation without having worked out the details; it also advances the general unity of mathematics. Another advantage is that it gets you used to the idea of proving small but useful results which help to fill in the gaps and create the picture of what is going on.

Method 4: Blue sky research

Here you have some idea of a mathematics that ought to exist, and of its characteristics. You also have a few hints as to the kind of materials from which the mathematics ought to be made. The problem is that proper mathematics requires definitions, examples, propositions, theorems, proofs, calculations, and in the beginning none of these exist – so they have to be assembled over a period of time. In what order should this be done, and how important will the work be? This can hardly be judged until the theory is worked out, and such a theory does not emerge, like *Venus Anadyamene*, fully formed from the sea. A theory accumulates in a journey over a period of years, and a gut feeling of the importance of a line of investigation is necessary to motivate travel on a long road.

For decades we have both been working on this kind of research, as well as on other kinds. In the mid-1960s the first author formulated the theme of 'higher-dimensional algebra', as mentioned earlier. The aim was that of an algebra more closely related to the geometry, and allowing a more general type of composition. The expectation was that this algebra would yield some formulations and proofs of new theorems, which would automatically lead to new methods of calculation.

This in the end has proved correct, with many people joining in the project. For a long time (five years), though, all that could be said was that it was possible to draw pictures that suggested that the ideas would have to work. The problem was a lack of framework to express the algebra corresponding to the pictures, and to the geometry. This framework was built up gradually, and it became ever more amazing to see how natural and fitting a way it was, once the ideas were thought about in the 'correct' manner. Thus, as suggested by Wigner in the quotation given earlier, the aesthetic criteria for a proper theory were nicely satisfied, and the theory became better than the vision that had prompted it.

It has to be said that, paradoxically, the secret of success in research is the successful management of failure. For if you never fail, then it is likely that the tasks you have set yourself are simply too easy. Interesting research must have an element of risk. You need strategies for dealing with situations when things go wrong: the problem may have proved too hard, or too easy. What comes next? Analysing the reasons for failure, and comparing these reasons with the reasons for wanting to do this problem in the first place, becomes instructive for future work.

What is good mathematics?

We would not like to attempt any final answer to this, but all of us should try and formulate some of the aspects we are looking for. Indeed, as editors of journals, we have to make judgements on this question on a daily basis. For a new mathematical paper we ask the questions: are the results new? how far ahead of current literature do they go? is the paper clear and well written? are the authors familiar with current work in the field and aware the relation of their results to the field? how surprising are the results? how elegant are the methods, and are any new methods introduced?

Some of 'the best' mathematics is that which introduces new ideas and concepts that make the previously difficult easy. This contradicts an impression you may have that mathematics is meant to be hard, and is good for you partly for that reason, like a cold bath. On the contrary, good mathematics can (perhaps, should) be easy. It is just that often we do not know how to do this. The combination of apparently simple arguments with a surprising conclusion, perhaps with a surprising twist, is what we like best of all.

What is worrying is that many young mathematicians go through their education without the notion of 'good mathematics' even being debated. Yet for any human activity, there is always the question of its value, both for society and personally. There is an argument that the teaching of a subject should reflect something of the values of the professionals in it; for example, for a professional, it is not enough just to produce an answer, but it is important also to produce (if possible) a satisfying explanation.

Thus we would argue for the advantages of introducing pupils and students to the notion of good exposition, and even to ask them to compete, not in problem solving, but in producing expositions and exhibitions of mathematical principles and applications. We have found the work on producing a mathematical exhibition enormously instructive [8, 9].

Is there a future for mathematics?

There is a view that there is no more basic mathematics to be found. This view is comparable to the view of those who have said that physics was ended, the basic problems having been solved. We feel, to the contrary, that mathematics is undergoing a revolution – a quiet one, but a revolution nonetheless. This is occurring on two fronts.

There is first the *computational revolution*. For computation with numbers, or for graphics presentation, this revolution is well known. Less well known publicly is the computer software that can manipulate symbols and axioms, and other software that can carry out automated reasoning. In principle, these should give mathematicians power to calculate and reason a million-fold more than they can at present, and to deal with the complexities of systems thought previously to be intractable. The prospective effect of these on the teaching of mathematics has yet to be properly understood and assessed, although a lot of work is in progress. The effect on research has already been considerable and is likely to grow in its influence.

A more subtle revolution is the *conceptual revolution*. The emphasis on mathematics as the study of structures is finding its mathematicisation in category theory, the mathematical and algebraic study of structures. Category theory has revealed new approaches to the basic concepts of mathematics, such as logic and set theory, and indeed has made respectable the idea that the practice of mathematics needs not one foundation, as traditionally sought, but alternative environments and a framework for their comparison. These ideas are also important for the progress of computer science, as (for example) in showing new approaches to data structures.

Some dangers ahead

One of the pleasures of mathematics is the way it operates on various levels, which then interact. So the algebraic study of mathematical structures has itself led to new mathematical structures. Some of these structures have had notable applications in mathematics and in physics.

Nevertheless, there are still many current dangers for mathematics. There is a general lack of appreciation of what mathematicians have accomplished, and of the importance of mathematics. Some of this has come about through mathematicians themselves failing to define and explain their subject in a global sense to their students, to the public, and to government and industry. It is possible for a student to get a good degree in mathematics without any awareness that research is going on in the subject.

Another danger is the growing reliance on computers as a black box to give the answer, without any understanding of the processes involved, or of the concepts that are intended to be manipulated. So both the scope and the limitations of the computer fail to be understood, the mathematical basis is neglected and perhaps fails to be developed, and the computer may be used in ways that are inappropriate, or simply limited by the software design. It is said that some engineering firms are dispensing with their mathematical research departments in favour of engineers manipulating software packages. Will this ensure the safety or reliability of the product, and will it allow the use of the most advanced mathematical concepts?

If these dangers are to be averted, then an increased understanding and appreciation of the questions with which we started are essential. There may be ways of speeding up the process of transfer from the conceptual foresight of the mathematician to the realisation in a scientific or technological application. To find them, we need in society a real understanding of the work of mathematicians, and of the way mathematics has played a role in the society in which we live. It is our responsibility to the subject we love to find ways of developing this understanding.

Acknowledgements Many of the questions raised in this article were discussed with students of the final-year *Maths in Context* course we ran together at Bangor, and also with first-year honours mathematics students taking the course *Ideas in Maths*. The contributions of these students through discussions and essays have strongly influenced our thinking. We also wish to thank Roger Bowers and Brian Denton who have run a course on *Mathematics in Society* at Liverpool University.

References

1 T. Dantzig, *Number: the language of science*, 1930, 2nd ed. 1954, Macmillan.
2. P. Davis and R. Hersh, *The mathematical experience*, Penguin, 1981.
3. P. Davis and R. Hersh, *Descartes' Dream*, Penguin, 1988.
4. *http://www-history.mcs.st-and.acuk/history/Mathematicians/Erdos.html*
5. S. Gorenstein, The longest proof, *Scientific American*.
6. John Robinson sculpture: for a discussion of this, see *http://www.cpm.informatics.bangor.ac.uk/sculmath/wake.htm*
7. *http://www-history.mcs.st-and.ac.uk/history/Mathematicians/Wiles.html*
8. Bangor Maths exhibition group, *Mathematics and knots*, Exhibition for the PopMaths RoadShow, 1989 (16 A2 boards); also a brochure, published by *Mathematics and Knots*, 1989, and the website: *http://www.cpm.informatics.bangor.ac.uk/*
9. R. Brown and T. Porter, Why we made a mathematical exhibition, *The Popularisation of Mathematics* (ed. G. Howson and P. Kahane), Cambridge, 1992.

School of Informatics, University of Wales, Dean St., Bangor, Gwynedd LL57 1UT, UK

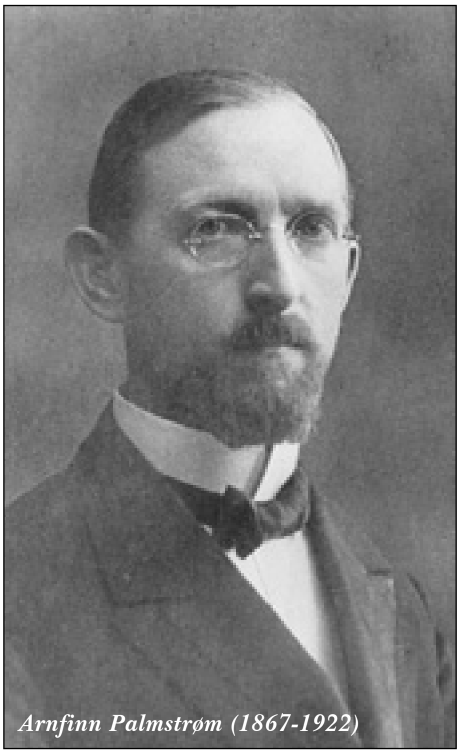
Societies Corner

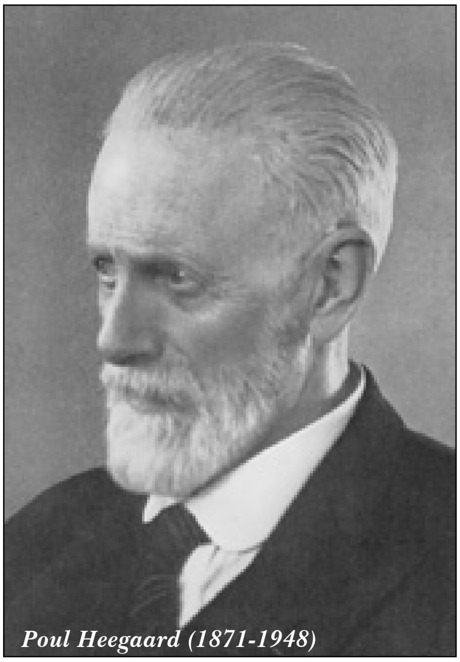
The Norwegian Mathematical Society

Bent Birkeland

The first attempt to create a mathematical society in Norway was made in 1885 by Sophus Lie, who was at that time professor in Oslo. This was a time when similar initiatives took place in many European countries. The Moscow Mathematical Society was founded in 1864, London in 1865, and the Finnish, French and Danish ones in 1868, 1872 and 1873, respectively. In Norway, however, the mathematical community at that time was too small, and the venture broke down when Lie moved to Leipzig in the following year. But a series of reforms in the high schools and at the university in the second half of the 1800s (less Latin and Greek, more modern languages, science and mathematics) led to a marked expansion of that community, and a formal organisation became necessary. In particular, the need for a Norwegian mathematical journal was felt. The difficulty was to find financial support for it, and to find persons able and willing to take on the editorial work.

In 1918 the time had come, and preliminary discussions took place in the early autumn. Arnfinn Palmstrøm, who at that time worked as an actuary and who from 1919 until his untimely death in 1922 was Norway's first professor of insurance mathematics, secured financial support from the major insurance companies. Government sources also responded positively, and the Danish mathematician Poul Heegaard, who had just been appointed professor of geometry in Oslo, was willing to edit the journal. He had valuable experience from editing the *Danish Mathematical Journal* for a couple of years. Finally, on 2 November 1918 (incidentally, Heegaard's birthday), the Norwegian Mathematical Society was born. Its purpose was stated broadly as 'connecting mathematically interested persons from all over the country', and the first more specific task was to start a national mathematical journal. Professor Carl Störmer was elected the Society's first president, while Palmstrøm became its secretary and the more arduous task of editing the journal was taken on by Heegaard for the mathematical side and Anton Alexander for the didactic one.


Arnfinn Palmstrøm (1867-1922)


Poul Heegaard (1871-1948)

The 'founding fathers' were university mathematicians, leading schoolteachers, actuaries, officers (mainly from the geodetic service) and students. At least two of them came to be closely involved with the Society for more than sixty years: the number-theorist Viggo Brun (1885-1978) became a university professor, while Fredrik Lange Nielsen (1891-1980) became a leader in the insurance world in Norway.

The activities taken on were what one might expect: meetings, publications, and some lobbying for good mathematical causes. A few of these are described below.

Publications

The first issue of the *Norsk Matematisk Tidsskrift* (Norwegian Mathematical Journal) appeared in 1919, opening, sadly, with the obituary of Ludvig Sylow, written by Thoralf Skolem. The first volume also contained contributions by the young and promising number-theorists Viggo Brun and Trygve Nagel.

The journal was intended to serve two not-quite-compatible purposes: to provide interesting reading for the general mathematically interested public, and to give young and aspiring mathematicians a chance to have their work printed. That problem found a temporary solution when Heegaard succeeded in obtaining funds for a series of pamphlets, *Norsk Matematisk Forenings Skrifter* (Publications of the NMF), where younger Norwegian mathematicians, including Øystein Ore, Thoralf Skolem, Trygve Nagel and Ragnar Frisch (Nobel laureate in Economics, 1969) had some of their early work published. Regrettably, this enterprise was discontinued in the 1930s for financial reasons.

The journal continued for 34 years. Finally, in 1952, it was amalgamated with the corresponding journals in the other Scandinavian countries to form two new periodicals, the *Mathematica Scandinavica* for professional mathematics, and the *Nordisk Matematisk Tidskrift* (*Normat*, for short), which aims at a broader audience and mainly prints work in the Scandinavian languages. Both of these are still active, under the joint auspices of the five Nordic mathematical societies (Danish, Icelandic, Finnish, Swedish and Norwegian).

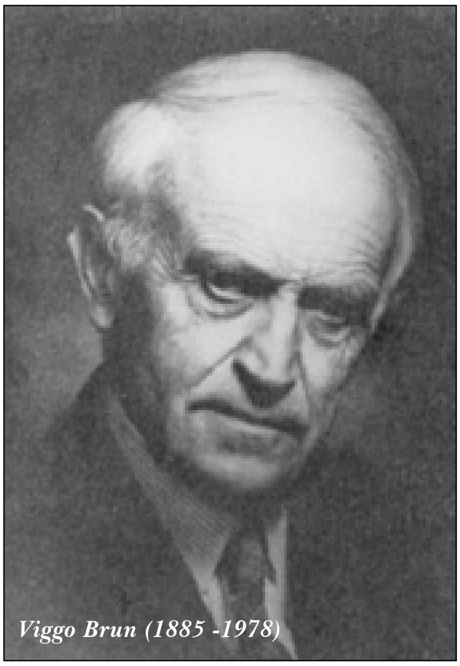
Another publishing venture of the Society was Sophus Lie's collected works. The editors, Friederich Engel and Poul Heegaard, published the first volume in 1922, but for financial and other reasons the seventh and last volume did not appear until 1960.

The NMF also published a series of small popular booklets in the early 1990s, aimed mainly at college students, on themes varying from 'number systems' to 'Norwegian mathematicians'.

Present activities

Mathematics competitions for college stu-


Carl Störmer (1874-1957)



Viggo Brun (1885 -1978)

dents have been part of the Society's activities nearly constantly from the beginning. For many years, starting in 1922, Crown Prince Olav awarded a prize for the best solutions to a series of problems posed in the *Journal*. Later on, other sponsors took over. For many years the Norwegian telecommunications company Telenor has sponsored a mass contest in three stages, called the Abel Competition. The first stage involves several thousand students, and successive eliminations bring it down to about twenty participants in the final round. Of these, the best six are selected to take part in the International Mathematical Olympiad. (A note on this competition appeared in EMS *Newsletter* **32** in June 1999.)

Another activity is the winter seminar 'Ski and Mathematics', early in January. This tradition was initiated in the 1960s by Professor Karl Egil Aubert. The seminar was arranged regularly for half a dozen years, then more intermittently, until it was resumed on a regular basis in 1997. It takes place at a hotel in the mountains, the programme being divided between outdoor activities before lunch and mathematics in the afternoon. (There is not much daylight after 3 p.m. at that time of the year.)

World Mathematical Year 2000

The international mathematical year was celebrated by the NMF and by others, with activities at the universities, in the schools and in the streets. Mathematically, the main event was a conference in Trondheim in January. Later in the year a large number of events were aimed at the schools and the general public. On one occasion the first 5000 digits of ð were written along the main street of Oslo!

The Abel Bicentennial Conference

Niels Henrik Abel was born on 6 August 1802. His bicentennial will be the occasion for much celebration, aiming both at mathematicians from home and abroad and at society in general. The main event will be the *Abel Bicentennial Conference 2002*, which takes place in Oslo from 3-8 June. The conference is arranged jointly by the Norwegian Mathematical Society, the Norwegian Academy of Science and Letters and the Norwegian Mathematical Council, with support from the International Mathematical Union and the European Mathematical Society. The conference will present an overview of the mathematical heritage of Niels Henrik Abel and, based on this heritage, will identify new mathematical trends for the 21st century. There will be sessions on the history of mathematics, algebraic geometry, complex analysis, differential equations and non-commutative geometry. On this occasion the remaining unsold copies of Abel's works (edited by Sylow and Lie in 1881) will be on sale, nicely bound in leather. This should be of interest to both mathematicians and bibliophiles.

75 Years of the Estonian Mathematical Society

Mati Abel

The Academic Mathematical Society, predecessor of the Estonian Mathematical Society, was founded in Tartu 75 years ago. The statutes of the Society were registered by the Council of the University of Tartu on 23 February 1926, although the opening meeting of the Society with 68 founding members present – mostly teachers and students from the University's mathematics department – took place in the Festive Hall of the University on 21 March 1926. A lecture on 'Archimedean and Euclidean Sentences' was delivered by Professor Jaan Sarv. Professor Gerhard Rägo became the first President of the Society, and his successors as President were Jüri Nuut (1927-32), Edgar Krahn (1932-36) and Hermann Jaakson (1936-40). In addition to mathematicians from Tartu, several members of the Society came from other towns in Estonia.

The Academic Mathematical Society played an essential role in the mathematical life of pre-war Estonia. Interesting current results in the field of exact sciences, reports on research by members of the Society, issues connected with the teaching of mathematics, and topics from the history of mathematics were discussed at meetings of the Society.

After the annexation of Estonia by the Soviet Union in 1940, the activities of scientific societies were banned, and the last meeting of the Academic Mathematical Society took place in November 1940. In June 1941 the new puppet Soviet government in Tallinn ordered the University of Tartu to reorganise the activities of eighteen functioning academic societies at the University (the Academic Mathematical Society included). In reply to this regulation, Professor Hans Kruus, Rector of the University, made a proposal to the government that the Academic Mathematical Society be closed. The activities of other societies were reorganised in accordance with the requirements presented to organisations in the Soviet society. Because of the German invasion of Estonia in July 1941, the Soviet administration in Tallinn could not deal with the Rector's proposal: the Academic Mathematical Society was not closed down, but its activities were stopped. During the war Hermann Jaakson, the most recent President of the Society, repeatedly tried to obtain permission to continue the Society's activities, but the new occupation system in Estonia placed demands on the statutes of academic societies, with the result that the Academic Mathematical Society changed its statutes several times during the war. After the war the activities of all former academic societies were forbidden by the Soviet regime in Estonia.

The idea of re-establishing the Mathematical Society circulated among Estonian mathematicians in the 1970s, but the timing was not favourable. The first attempt to re-establish the activities of the Society in 1983 failed: the Estonian Communist Party leadership did not give permission to re-open it. In spite of this refusal, Estonian mathematicians continued to seek ways to continue the Society's activities.

The re-opening conference of the Academic Mathematical Society, under the

Mati Abel and Imre Csiszar

Anniversary meeting of the society on 17 February 2001

new name of the Estonian Mathematical Society, took place with 118 founding participants and 52 guests on 17 September 1987, once again in the Festive Hall of the University. Professor Ülo Lumiste, the main initiator of the re-establishment of the Society, opened the conference. The participants elected the Board of the Society, the President of the Society (Ülo Lumiste) and the Honorary President (Academician Arnold Humal). Ülo Lumiste led the activities of the Society for two three-year terms until 1993. Mati Abel has occupied the Presidency since 1994.

Immediately after its re-establishment, the Society started its activities with the restored pre-war structure. The section on school mathematics (from which the Union of School Mathematics was formed in 1989), and several working groups (on computer science, mathematical terminology, history of mathematics, etc.) began to work. It was decided to publish the yearbooks of the Society, to establish annual prizes for high-school final-grade students (for the best results in the Olympiads in mathematics) and for undergraduate students (for outstanding results in research). On a proposal from the heirs of Academician Arnold Humal, the Arnold Humal Annual Prize for a young mathematician was established. In 1995 the Association of School Teachers of Mathematics Teaching in Russian joined the Estonian Mathematical Society and started functioning as a section of the Society.

Every other year the Estonian Mathematical Society organises 'Days of Mathematics' in Estonia, and the Union of School Mathematics holds the annual Summer and Winter Days of the Union which are very popular with teachers of mathematics. In addition to workshops and report meetings, the Society helps to organise international and local conferences in mathematics, to publish mathematical books and a journal, to compose reference books and dictionaries in mathematics, to organise open competitions and Olympiads in mathematics for high school students, and to train them for international competitions in mathematics. An International Workshop on Topological Algebras and an essay competition 'The beauty, magic and pain of mathematics' were held by the Society to celebrate World Mathematical Year 2000 in Estonia.

With over 400 members, the Estonian Mathematical Society was a founding member of the European Mathematical Society, and since 2000 has been a member of the International Mathematical Union as an associated organisation.

On 17 February 2001, the Estonian Mathematical Society celebrated its 75th anniversary with a conference in Tartu. Among the participants were Imre Csiszar (President of the Hungarian Mathematical Society), Aleksanders Šostaks (President of the Latvian Mathematical Society), Ulf Perrson (President of the Swedish Mathematical Society), Wies³aw Zelazko (President of the Polish Mathematical Society in 1984-86 and a foreign member of the Estonian Mathematical Society), and Hans-Olav Johannes Tylli (a member of the Finnish Mathematical Society). Jonas Kubilius (President of the Lithuanian Mathematical Society) and Anatoly Vershik (President of the St Petersburg Mathematical Society) sent anniversary congratulations.

We cherish friendly ties and cooperation with mathematicians from other countries and are determined to expand our international contacts.

Problem Corner

Contests from Romania, part 4

Paul Jainta (Schwabach, Germany)

The solution of problems … is the ladder by which the mind ascends into the higher fields of original research and investigation. Many dormant minds have been aroused into activity through the mastery of a single problem.

Benjamin Finkel and John Colaw, American Math. Monthly, 1894, Vol. 1, no. 1, page 1

At the beginning of the twenty-first century, elementary mathematics is undergoing two major changes. The first is in teaching, where one moves away from routine exercises and memorised algorithms towards creative solutions to unconventional problems. The second consists in spreading the culture of problem solving - especially in Eastern Europe. Romanian mathematicians have influenced both trends strongly, breaking new ground in establishing competitions for youngsters. Following Paul Halmos, who said, 'problems are the heart of mathematics', they emphasised them in the classroom, in seminars, and in many publications of all kinds written to train their students to be better problem-solvers and problem-posers.

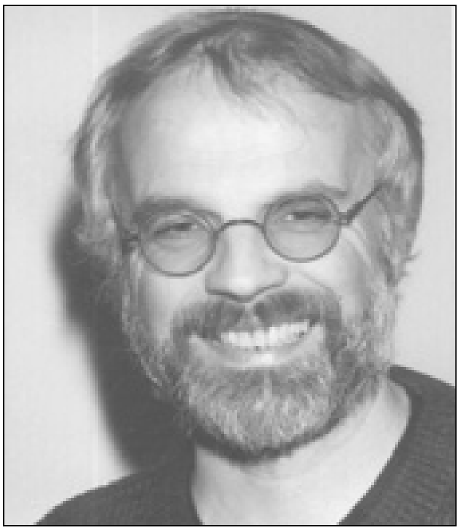
It has been claimed that mathematics in East Europe flourished under Communism because it is less susceptible to political interference than other intellectual pursuits, and consequently attracted many talented minds to its study. With ungrudging admiration we observe that Romania has produced more than its fair share of top-quality mathematicians. What makes Romania unusual compared with other Western countries is the large proportion of its distinguished mathematical experts who have devoted time and energy to the younger generation of promising scientists, through via their problem-solving competitions and associated training units. These Academicians know the necessity for challenging the cleverest students with difficult problems and teaching them the mathematical skills required for their solution. This involvement by many mathematical experts has also led to the creation of remarkably artful problems aimed at differing levels of students. The variety of the questions, their suitability for a range of age groups and the nature of the challenge has been of a consistently high standard since the first competition in 1895.

The Gazeta Matematica Competition

In January 1910 the renowned mathematical journal *Gazeta Matematica* rose to the fore by promoting mathematics competitions and created a separate maths event nationwide. As a result the questions were circulated to the remotest corners of the country overnight. In this way a competition was launched that embraced the whole Romanian area for the first time.

The Annual *Gazeta Matematica* Contest had a life-span of about 40 years, and was finally replaced by the National Mathematics Olympiad in 1950. However, the competition that was run by a mathematics journal had its eyes on particular benchmarks. Priority was given to those participants who had corresponded well to the problems published in the journal over a given period (perhaps a year). The columns of *Gazeta Matematica* represent a hotbed of demanding questions that cannot be solved in a short time, and thus this periodical was an excellent vehicle for identifying highly talented young persons.

At the start of the global economical race in the 1980s, Romanian authorities again became aware of the significance of *Gazeta Matematica* in drafting new mathematical blood. The old 'tool' has been revived, and the *Gazeta Matematica* Competition now runs annually in summer. The competitors can choose between problems for the *Gazeta*'s contest and tricky questions designed to prepare young people for mathematics competitions. Both types of problems are published in Romanian and English. In 1998 about 2100 teasers of the first type were amassed, while in the second some 280 problems were devised for junior contestants and roughly 900 challenging questions for senior contributors. A useful barometer of the increase in mathematical



ability is the number of submitted solutions to the problems.

Another selection rule for candidates wishing to become one of Romanian top young mathematicians invokes the results achieved in national or international events during the previous year. But they have to get over two other hurdles to reach the summit, the 'reasoning' round and a stage that examines problem-solving strategies and a mastery of mathematical techniques. In August 1998, forty-eight students attended the final round, held in Pitesti, undergoing two 4-hour papers. The top scorers are awarded prize money, books, medals or diplomas. In 2000, the editorial department of *Gazeta Matematica* conducted its twentieth annual contest. In the Western hemisphere no other publication does as good a job as the Romanian periodical, and in general the assortment of mathematics events in Romania exceeds by far the range of contests elsewhere.

I wish to thank **Professor Vasile Berinde**, of the Department of Mathematics and Computer Science in the North University of Baia Mare, for providing me with information for use in this corner.

This leads to the next set of questions, from the *Gazeta Matematica* Contest in September 1997.

128 Given 21 distinct natural numbers selected from the set $\{1, 2, \ldots , 2046\}$, show that there exist three chosen numbers a, b, c such that $bc < 2a^2 < 4bc$.

129 Let ABC be an equilateral triangle. A straight line divides this triangle into two parts with the same perimeter but different areas A_1 and A_2. Prove that $7/9 \le A_1/A_2 \le 9/7$.

130 Find non-negative integers n such that $\sqrt{(x-1)} + \sqrt{(x-2)} + \ldots + \sqrt{(x-n)} < x$ is valid for all $x \ge n$.

131 Consider the polynomial $p(x) = ax^3 + bx^2 + cx + d$ with rational coefficients a, b, c, d and roots x_1, x_2, x_3. Show that if x_1/x_2 is a rational number different from 0 or 1, then all roots of $p(x)$ must be rational.

132 Let $f : \mathbf{R} \to \mathbf{R}\backslash\{3\}$ be a function with the property that there exists $k > 0$ such that $f(x + k) = (f(x) - 5) / (f(x) - 3)$, for all x in $\mathbf{R}$. Prove that f is periodic.

133 Find all numbers of the form $m(m + 1)/3$ that are perfect squares.

Solutions to some earlier problems

116 Let x be a natural number. Prove that x is a perfect square if and only if for every natural number y there is a natural number z such that $x + yz$ is also a perfect square.

***Solution** by Pierre **Bornsztein**, Courdimanche (France); also solved by Niels Bejlegaard, Copenhagen (Denmark), Pietro Fanciulli, Porto Stefano (Italy), Erich Gulliver, Schwäbisch Hall (Germany), Gerald Heuer, Moorhead (USA), J. N. Lillington, Dorchester (UK) and Dr Z Reut, London (UK)*

If $x = 0$, choose $z = y$.
So let $x = a^2$ be a non-zero natural number, let y be a natural number and let $z = y + 2a$.
Then $x + yz = a^2 + y^2 + 2ay = (a + y)^2$ is a perfect square.
Conversely, suppose that for each number y there is a number z such that $x + yz$ is a perfect square.
Then for $y = x^2$ there exist z and b such that $x + x^2z = b^2$.
But $x + x^2z = x(1 + xz)$ and x and $1 + xz$ are coprime, so x and $1 + xz$ are perfect squares.

117 Let x, y and z be positive numbers satisfying $xyz = 1$. Show that

$$(x^9 + y^9)/(x^6 + x^3y^3 + y^6) + (y^9 + z^9)/(y^6 + y^3z^3 + z^6) + (z^9 + x^9)/(z^6 + z^3x^3 + x^6) \geq 2.$$

Solution by J. N. Lillington, Dorchester (UK); also solved by Niels Bejlegaard, Pierre Bornsztein, Erich Gulliver and Dr Z Reut.

Let $E(x, y) = (x^9 + y^9) / (x^6 + x^3y^3 + y^6) = (x^3 + y^3)(x^6 - x^3y^3 + y^6) / (x^6 + x^3y^3 + y^6)$.
But $x^6 + y^6 \geq 2x^3y^3$, by the arithmetic-geometric mean inequality.
This leads to the following estimation:

$$E(x, y) \geq (x^3 + y^3)(1/2)E(x^6 + y^6) / (3/2)E(x^6 + y^6) = (1/3)E(x^3+y^3).$$

Denote $E(y, z)$ and $E(x, z)$ likewise.
Thus $E(x, y) + E(y, z) + E(x, z) \geq (2/3)E(x^3 + y^3 + z^3) \geq (2/3)3xyz = 2$,
again by the arithmetic-geometric mean inequality.

118 Which five integers have the following property: if we add in different ways four of these numbers we obtain 21, 25, 28 and 30 ?

Solution by Oren Kolman, London (UK); also solved by Niels Bejlegaard, Erich Gulliver, Gerald Heuer, J. N. Lillington and Dr Z Reut.

Suppose that $x < y < z < u < v$ are the five integers in question.
Then $a = x + y + z + u < b = x + y + z + v < c = x + y + u + v < d = x + z + u + v < e = y + z + u + v$,
and $\{21, 25, 28, 30\}$ is a subset of $\{x, y, z, u, v\}$.
We distinguish five cases:
Case 1: If a is not 21, then $b = 21$, $c = 25$, $d = 28$, $e = 30$.
Then $y = x + 2$ (since $e - d = 2 = y - x$) and $z = x + 5$ (since $e - c = 5 = z - x$).
So $v = 21 - x - (x + 2) - (x + 5) = 14 - 3x$,
and since $c - b = 4 = u - z$, we get $u = 4 + z = x + 9$, and hence $a = 4x + 16 < 21$, so $x < 2$;
thus, the integer solution set is $\{(x, x + 2, x + 5, x + 9, 14 - 3x): x < 2\}$.
Case 2: If $a = 21$, then b is not 25, $c = 25$, $d = 28$, $e = 30$.
So $y = x + 2$, $z = x + 5$, $v = x + 9$, and $22 \leq b = 4x + 16 \leq 24$.
This yields $x = 2$, $u = 8$, and the solution is $(x, y, z, u, v) = (2, 4, 7, 8, 11)$.
Cases 3 and 4: $a = 21$, $b = 25$, $d = 28$, $e = 30$ and $a = 21$, $b = 25$, $c = 28$, $e = 30$ have no integer solutions.
Case 5: $a = 21$, $b = 25$, $c = 28$, $d = 30$, $30 < e$.
This is similar to Case 1, giving the solution set $\{(14 - 3y, y, y + 2, y + 5, y + 9): y > 3\}$.

119 A rectangular sheet of dimensions 12 × 10 is cut into two pieces of equal area. What is the minimum length of the line of intersection ?

Solution by Dr Z Reut; also solved by Niels Bejlegaard, Erich Gulliver, and J. N. Lillington.

Any straight line drawn through the centre of symmetry divides the rectangular sheet into two parts of equal area, because of the equality of parts between the line and the axis of symmetry parallel to either the shorter or longer sides. The minimum length of intersection is equal to the length of the shorter side (10 cm) when the line is parallel to the shorter side and perpendicular to the longer side. Any curved line through the centre of symmetry that divides the rectangular sheet into two parts of equal area has greater length than the straight line intersection, because a straight line is the shortest path between any two points.

120 For real numbers a, b, c, d, consider the two sets

$$A = \{x: x^2 + a\,|x| + b = 0\} \text{ and } B = \{x: [x]^2 + c[x] + d = 0\},$$

where $[x]$ denotes the integer part of x.
Prove that if the intersection of A and B has exactly three elements, then a cannot be an integer.

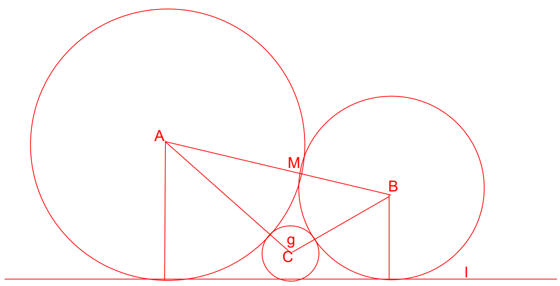
Solution by Pierre Bronsztein; also solved by Niels Bejlegaard, J.N. Lillington and Dr Z Reut.

First note that if a number x is in A, then so is $-x$ and $x^2 + ax + b = 0$ or $x^2 - ax + b = 0$.
Since both equations are quadratic, we deduce that card $(A) \leq 4$.
Suppose that card $(A \cap B) = 3$; then card $(A) = 3$ or card $(A) = 4$.
Case 1: card $(A) = 3$. From the above, we have $A = \{-p, 0, p\}$, where $p > 0$.
Since 0 is in A, $b = 0$; it follows that $p^2 + ap = 0$, and thus $a = -p$.
Since card $(A) = 3 =$ card $(A \cap B)$ and $A \cap B \subset A$, we have $A \cap B = A$ and so $A \subset B$.
So $[-p]$, 0, $[p]$ are three solutions of the quadratic equation $x^2 + cx + d = 0$.
Since $p > 0$ (which excludes $[-p] = 0$ and $[-p] = [p]$), we have $[p] = 0$.
So p is in (0, 1) and a is in (–1, 0), and so a cannot be an integer.
Case 2: card $(A) = 4$. Then $A = \{-p, -q, p, q\}$ where $p, q > 0$.
Since p, q are roots of $x^2 - ax + b = 0$, we deduce that $a = -(p + q)$. (1)
Without loss of generality, since $A \cap B \subset A$ and card $(A \cap B) = 3$,
we may suppose that p and $-p$ belong to $A \cap B$, and therefore belong to B.
Then $[-p]$ and $[p]$ are two distinct solutions of $x^2 + cx + d = 0$ (since $p > 0$).
It follows that $B = \{x: [x] = [p] \text{ or } [-p]\}$.
Subcase 1: p is an integer: then $B = [-p, -p + 1) \cup [p, p + 1)$.
Thus B contains exactly two integers: $-p$ and p.
Suppose, for a contradiction, that a is an integer; then from (1), q is also an integer.
But $A \cap B \subset A$ and $A \cap B \subset B$, so q or $-q$ belongs to B.
It follows that $q = p$, a contradiction; so a is not an integer.
Subcase 2: p is not an integer: let $k = [p]$, k an integer.
Then $[-p] = -k - 1$ and $B = [-k-1, -k) \cup [k, k + 1)$.
Suppose, for a contradiction, that a is an integer; then from (1), q is not an integer.
As above, q or $-q$ belongs to B.
But, if q is in B, then $k < q < k + 1$, and so $-k-1 < -q < -k$ and $-q$ is in B.
If $-q$ is in B, we see similarly that q is in B.
Thus, in every case, q and $-q$ belong to B.
It follows that $A \subset B$ and card $(A \cap B) = 4$, a contradiction.
So in each case, a cannot be an integer.

121 Given a straight line l in the plane and three circles with centres A, B, C tangent to l and pairwise externally tangent to one another, show that triangle ABC has an obtuse angle and find all possible values for this angle.

Solution by Dr Z Reut; also solved by Niels Bejlegaard, Erich Gulliver, and J. N. Lillington.

Let the radii of the three circles with centres at A, B, C, be a, b, c;
then $AB = a + b$, $BC = b + c$, $AC = a + c$,
and let us assume that $a > b > c$, as in the figure.
Let the interior angle in the triangle ABC at C be γ.
The cosine law gives $\cos \gamma = -[(a + b)^2 - (a + c)^2 - (b + c)^2] / [2(a + c)(b + c)]$.
In the case where the two largest circles have equal radii ($a = b$), the triangle ABC becomes isosceles with equal sides of length $a + c$, and base of length $2a$.
Thus, M is the centre of the segment AB and we can apply Pythagoras' theorem to the right triangle AMC: $(a + c)^2 = a^2 + (a - c)^2$.
Arithmetic manipulation gives $a^2 = 4ac$, so $a = 4c$.
The cosine of the angle at C is then $\cos \gamma = -7/25$, and so the angle is obtuse and approximately equal to 106°.
It can be shown that this is the maximum value of the angle for all possible values of the radii, and that the minimum value approaches 90°.



The equality of projections of the sides of the triangle ABC onto the line l gives

$$[(a + b)^2 - (a - b)^2]^{1/2} = [(b + c)^2 - (b - c)^2]^{1/2} + [(a + c)^2 - (a - c)^2]^{1/2}.$$

This relation reduces, on squaring both sides in two stages, to the following equation:

$$(a - b)^2c^2 - 2ab(a + b)c + a^2b^2 = 0,$$

which is a quadratic equation in c.
The root with the negative sign satisfies the given conditions and

$$c = ab[a + b - 2(ab)^{1/2}] / (a - b)^2 = ab[a^{1/2} - b^{1/2}]^2 / [(a^{1/2} + b^{1/2})(a^{1/2} - b^{1/2})]^2.$$

Thus this solution can be written in the form $c = ab / (a^{1/2} + b^{1/2})^2$.
In the limit, as a increases indefinitely, the radius c approaches b and $\cos \gamma$ approaches 0, so that the angle approaches 90°.
In the limit, as b decreases indefinitely, the radius c approaches 0 and $\cos \gamma$ again approaches 0.

MATHDI - mathematics education on the Web

Gerhard König and Bernd Wegner

With the transition of the traditional journal *Zentralblatt für Didaktik der Mathematik* (ZDM) to a web service, a more systematic European extension of this originally German-based enterprise took place. The most prominent sign of this is the involvement of the EMS in the editing of the web versions, accompanied by the installation of some European backbones, helping with the management of the input (local and national), for the ZDM-database *MATHDI* (MATHematics DIdactics). Indeed, the combined printed service ZDM, providing survey articles and a documentation part, has been split between the database *MATHDI* and an electronic journal which publishes the ZDM-surveys. Both offers are easily accessible through EMIS, with its more than 40 mirrors.

MATHDI on the web

As mentioned above, *MATHDI* developed from the literature documentation activities in ZDM; its general aim is thus to provide an information service and referencing tool for education in mathematics and computer science, which was the traditional role of this part of ZDM. At present, *MATHDI* is the largest and most up-to-date world-wide database service in this field. Even before it was available on the web, this part of ZDM had been available electronically via STN for quite a long period, under the English subtitle *International Reviews on Mathematical Education*. Searches in *MATHDI* can thus be extended back over a period of 25 years.

The input for *MATHDI* has been taken from as many relevant documents as possible, and currently journal articles from more than 400 world-wide journals are covered. These are complemented by information on textbooks and other monographs, dissertations, conference papers, curricula, software and teaching aids in the theory and practice of education in mathematics and computer science. As is common practice with literature information databases, all publications are announced by bibliographic data, reviews or abstracts, and some additional information. The general texts and abstracts are usually in English, although exceptionally they may appear in French, German or Spanish.

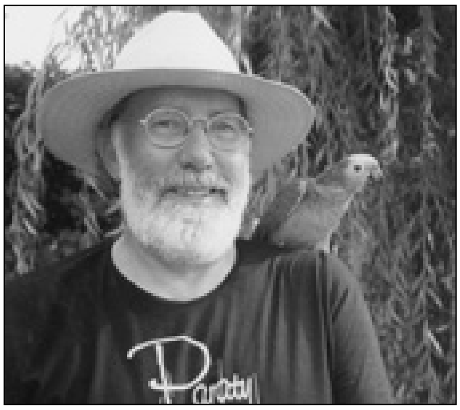
At present the contents of *MATHDI* comprise more than 100,000 entries, with an annual increase of 6000 entries; this includes about 21,000 reviews from relevant publications in the US. Current coverage of European publications is improving, by means of a more reliable acquisition and handling of national offers through co-operational units; here, in particular, Portugal, Spain, Italy, Greece, Hungary and Yugoslavia should be mentioned; hopefully, other European countries will catch up. World-wide coverage is also becoming more complete, as can be seen for Mexico and Argentina. Moreover, cooperation with *ERIC* in the US provides an excellent representation of US-American publications in *MATHDI*.

As a consequence of the involvement of the EMS in *MATHDI*, it has been possible to apply the same search software to this service as for its big brother *Zentralblatt MATH*. This software was made available from the partner MDC of *Zentralblatt MATH* in Grenoble, and it is continually improved there. As a result, a good interface and a selection of search menus of different levels of expertise are available. Search results are obtained in TeX-source code, but additional views such as displays in Postscript can be chosen. Linking facilities, such as hypertext links to authors, are made available and such facilities are growing. Classification codes are assigned regularly, according to an extended scheme for didactics and its reduced version in MSC 2000, and the free trial access for *Zentralblatt MATH* has been copied for *MATHDI*. Anyone can do searches without having a subscription, but in the latter case only the first three answers are displayed: just go to the URL *http://www.emis.de* and click on the *MATHDI*-box.

The subjects covered by *MATHDI* are wider than a non-experienced user might imagine. Information is provided on research in mathematical education, methodology of didactics of mathematics, mathematical instruction from elementary school to university teaching and teacher training, elementary mathematics and its applications, education-relevant popular mathematics, education in computer science, basic pedagogical and psychological issues for mathematics and general education in science, and administrative issues such as curricula and teaching programmes.

There is thus a variety of users for which *MATHDI* should be an important tool. Almost everyone thinks of professionals in didactics for mathematics and computer science, but it is also directed at all interested in research and education in these areas, at instructors and lecturers, and at teachers in all types of schools where mathematics is relevant. The information available from *MATHDI* is a basic infrastructure for the professional work of educational technologists, curriculum experts, and policy-makers in education and educational administrators. On the formal side, it also offers an important tool for librarians and information specialists.

As an additional attractive offer, *MATHDI* is distributed on CD-ROM. The most recent update is *MATHDI* 2001, and in spite of missing functionality for some linking facilities, it is a good solution for a stand-alone installation. Since the database is comparatively small and specialised, the price is kept low so that individuals may consider buying the CD-ROM for their private installation.



Bernt Wegner with Einstein

The electronic version of ZDM

Efforts to keep the pricing of ZDM at a low level led to the decision to separate the part dealing with information on publications from the journal-like part that provides complete articles. Moreover, acknowledging the growing importance of electronic media and taking into account the reduced production costs for electronic versions, it was simultaneously decided that the full articles should be offered in an electronic journal. Since traditional subscribers should not be ignored, this part is offered as a dual journal as long as there is sufficient interest in the print version.

As mentioned above, survey articles on education in mathematics and computer science will mainly appear here, and it has been no problem to convince authors invited to write an article that they should normally deliver their article in some not-too-sophisticated TeX-dialect. The journal is offered through FIZ Karlsruhe, but there is an agreement with ElibM in EMIS that back volumes will be made freely accessible. This is already the case, and those who are interested are invited to look at EMIS and click on the journal at the end of the journals box in EMIS under the electronic library. Frequent users may then enter a bookmark to their directories.

This change of ZDM is a consequence of the transition of publications to new media, and profits a lot from the support of the EMS. It furthermore underlines the engagement of the EMS in the development of education in mathematics.

Addresses: Gerhard König, ZDM, FIZ-Karlsruhe, 76344 Eggenstein-Leopoldshafen, Germany [gk@fiz-karlsruhe.de];
Bernd Wegner, TU Berlin, Fakultät II, Institut für Mathematik, 10623 Berlin, Germany [wegner@math.tu-berlin.de].

Forthcoming conferences

Compiled by Kathleen Quinn

Please e-mail announcements of European conferences, workshops and mathematical meetings of interest to EMS members, to k.a.s.quinn@open.ac.uk. 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

September 2001

27-30: Acoustics and Music: Theory and Applications 2001 (AMTA 2001), Skiathos Island, Greece
Information:
Web site: http://www.worldses.org/wses/calendar.htm
27-30: Mathematics and Computers in Biology and Chemistry 2001 (MCBC 2001), Skiathos Island, Greece
Information:
Web site: http://www.worldses.org/wses/calendar.htm
27-30: Mathematics and Computers in Business and Economics 2001 (MCBE 2001), Skiathos Island, Greece
Information:
Web site: http://www.worldses.org/wses/calendar.htm
27-30: Automation and Information: Theory and Applications 2001 (AITA 2001), Skiathos Island, Greece
Information:
Web site: http://www.worldses.org/wses/calendar.htm

October 2001

1-5: Aspects of Hyperbolic Geometry, Fribourg, Switzerland
Invited speakers: include J. Anderson (Southampton), M. Boileau (Toulouse), M. Bourdon (Lille), B. Bowditch (Southampton), S. Buyalo (St. Petersburg), J.-L. Cathelineau (Nice), C. Drutu (Lille), J. Dupont (Aarhus), U. Hamenstädt (Bonn), G. Knieper (Bochum), U. Lang (ETZ Zürich), G. Martin (Auckland), J.-P. Otal (ENS Lyon/Orléans), J. Parker (Durham), F. Paulin (ENS Paris), N. Peyerimhoff (Bochum), A. Reid (Austin), J.-M. Schlenker (Toulouse), B. Stratmann (St. Andrews), E. Vinberg (Moscow)
Scientific Board: Christophe Bavard (Uni. Bordeaux I), Gérard Besson (Uni. Grenoble I), Ruth Kellerhals (Uni. Fribourg), Viktor Schroeder (Uni. Zürich)
Site: Department of Mathematics, University of Fribourg, Switzerland
Information:
e-mail: hyp-geom@unifr.ch
Web site: http://www.unifr.ch/math/conference
2-5: SYM-OP-IS 2001 XXVIII Yugoslav Symposium on Operations Research (SYM-OP-IS), Belgrade
Topics: applications of operations research methods in organisational, technical, technological, economic and other systems
Programme: will be available by 21 September
Languages: Serbian and English
Programme committee: Sinisa Borovic (Belgrade), chairman
Organizing committee: Svetomir Minic (Belgrade), chairman; Obrad Cabarkapa (Belgrade), secretary. The organisation this year will be coordinated by the Military Academy of the Yugoslav Army
Sponsors: Yugoslav Army, Yugoslav Operational Research Society, Faculty of Transport and Traffic Engineering, Mihajlo Pupin Institute, Economics Institute, Faculty of Economics, Faculty of Mining and Geology, Faculty of Organizational Sciences, Faculty of Mechanical Engineering and Faculty of Mathematics
Proceedings: refereed proceedings of selected papers will be published prior to the conference and available to all participants
Site: Military Academy, Neznanog junaka 28, Belgrade, Yugoslavia
Deadlines: already expired
Information: contact SYM-OP-IS 2001 Organising Committee, Neznanog junaka 28, VP 2102-4, 11002 Belgrade
e-mail: symopis@vj.yu
Web site: http://www.vj.yu/symopis/
6: 1st Annual Arf Lecture, Ankara, Turkey
[in memory of Cahit Arf]
Speaker: Prof. Dr. Gerhard Frey (Essen)
Title: Bauer Groups and Data Security
Organisers: Department of Mathematics at Middle East Technical University, Ankara, and Turkish Mathematics Foundation
Advisory board: M. G. I. Keda, R. Langlands and P. Roquette

December 2001

2-8: International Centre for Mathematical Sciences Workshop on Classical and Quantum Integrable Systems and their Symmetries, Edinburgh, UK
[satellite workshop of the Isaac Newton Institute for Mathematical Sciences programme on Integrable Systems (July to December 2001)]
Theme: the emphasis will be on quantum integrable systems and the symmetry approach, where recent progress has been rapid and intense
Aim: to analyse current developments and to encourage the exchange of ideas between researchers in the field of integrable systems and those working in representation theory, string theory and other areas of modern mathematics and physics
Main speakers: expected to include John Cardy (UK), Ivan Cherednik (USA), Patrick Dorey (UK), Jonathan Mark Evans (UK), Kentaro Hori (USA), Michio Jimbo (Japan), Hitoshi Konno (Japan), André Leclair (USA), Jean-Michel Maillet (France), Barry McCoy (USA), Eugene Mukhin (USA), Maxim Nazarov (UK), Nikita Nekrasov (France), Francesco Ravanini (Italy), N. Reshetikhin (USA), Ryu Sasaki (Japan), Jun'ichi Shiraishi (Japan), Evgueni Sklyanin (UK), Feodor Smirnov (France), Kanehisa Takasaki (Japan), Gerard Watts (UK), Alexei Zamolodchikov (France)
Organising committee: Ed Corrigan (York), Chris Eilbeck (Heriot-Watt), Tetsuji Miwa (Kyoto), Robert Weston (Heriot-Watt)
Sponsors: Engineering and Physical Sciences Research Council and Isaac Newton Institute for Mathematical Sciences
Grants: limited funds (worth 250 pounds per person) to support the attendance of mathematicians or research students in UK universities
Site: Heriot-Watt University
Deadlines: for registration, 1 October
Information:
e-mail: icms@maths.ed.ac.uk
Web site: www.ma.hw.ac.uk/icms/current/cqis

February 2002

1 February-30 April: Special Research Trimester on Dynamical Systems, Pisa
Topics: non-uniformly and partially hyperbolic systems, quasi-periodic orbits, holomorphic dynamics and foliations, interaction between dynamical systems and biology, interaction between dynamical systems and physics (including celestial mechanics)
Main speakers: M. Brunella (CNRS Dijon), A. Chenciner (Universit de Paris VII), D. Dolgopyat (Pennsylvania State University), C. Favre (CNRS, Paris), R. Ferriere (Ecole Normale Paris), G. Forni (Princeton University), A. Giorgilli (Milano Bicocca), V. Yu. Kaloshin (Princeton University), R. Krikorian, J. Laskar (CNRS-IMC Paris), P. Le Calvez (Paris XIII), C. Liverani (Roma 'Tor Vergata'), S. Luzzatto (Imperial College London), S. Marmi (Udine and SNS Pisa), J. Mather (Princeton University), G. Moreira (IMPA), J. Palis (IMPA), J. Rivera (SUNY), D. Sauzin (CNRS, Paris), S. Smirnov (KTH Stockholm), L. Stolovich (Université Paul Sabatier,Toulouse), M. Viana (IMPA), J.-C. Yoccoz (College de France), L. S. Young (Courant Institute)
Programme committee: S. Marmi (Italy), J. Mather (USA), J. Milnor (USA), J. Palis (Brasil), J.-C. Yoccoz (France)
Organising committee: C. Carminati (Italy), G. Da Prato (Italy), M. Giaquinta (Italy), S. Marmi (Italy)
Sponsors: Istituto Nazionale di Alta Matematica, Scuola Normale Superiore
Site: Scuola Normale Superiore (Piazza dei Cavalieri 7, Pisa, Italy)
Grants: a limited number of grants supporting preferably long-term visits (at least one month) will be available for PhD students and Post Docs. Applications should be made as soon as possible
Information:
e-mail: dynsys@math.sns.it
Web site: http://www.math.sns.it/degiorgi/dynsys/
11-15: Neural Networks and Applications (NNA '02), Interlaken, Switzerland
Information:
Web site: http://www.worldses.org/wses/calendar.htm
11-15: Fuzzy Sets and Fuzzy Systems (FSFS '02), Interlaken, Switzerland
Information:
Web site: http://www.worldses.org/wses/calendar.htm
11-15: Evolutionary Computations (EC '02) Interlaken, Switzerland
Information:
Web site: http://www.worldses.org/wses/calendar.htm

March 2002

18-19: Workshop on Under- and Over-determined Systems of Algebraic and Differential Equations, Karlsruhe, Germany
Theme: algebraic or differential equations,

computer algebra, numerical analysis
Scope: computational approaches to under- and over-determined systems. Submissions are expected on theory and applications, algorithms and software. The workshop will be of an interdisciplinary nature; the intention is to bring together researchers from many different fields in order to foster communication between different communities
Topics: all aspects of under- and over-determined systems: completion, exact or approximate solutions, structure analysis, symbolic and/or numerical treatment, Gröbner or involutive bases for polynomial or differential systems, differential algebraic equations (DAEs), symmetry analysis, applications in all fields of mathematics or sciences
Call for papers: downloadable from the conference web site
Programme committee: J. Calmet (Karlsruhe, Workshop Chair), V. P. Gerdt (Dubna, Chair), W. M. Seiler (Mannheim, Chair), J. Apel (Leipzig), G. Carra Ferro (Catania), G. Czichowski (Greifswald), L. Lambe (Bangor/Rutgers), E. L. Mansfield (Canterbury), B. Mourrain (Sophia-Antipolis), P. J. Olver (Minneapolis), E. Pankratiev (Moscow), V. P. Shapeev (Novosibirsk), J. Tuomela (Joensuu)
Proceedings: submissions are not formally refereed and may be submitted later elsewhere. Informal proceedings will be distributed to participants. Authors of outstanding submissions will be invited to contribute to a special issue of the AAECC journal
Site: University of Karlsruhe
Deadlines: for submission, 1 December; for registration, 15 February
Information:
Web site:
http://iaks-www.ira.uka.de/iaks-calmet/ADE

21-22: Eighth Rhine Workshop on Computer Algebra, Mannheim, Germany
Aims: to serve as a regional forum for researchers in the field, and in particular to offer an opportunity to young researchers and newcomers to present their work
Topics: all aspects of computer algebra, from theory to applications and systems
Call for papers: downloadable from the conference web site
Programme committee: H. Kredel (Mannheim, Workshop Chair), W. M. Seiler (Mannheim, Chair), M. Bronstein (Sophia Antipolis), R. Buendgen (Boeblingen), J. Calmet (Karlsruhe), J. Della Dora (Grenoble), A. Cohen (Eindhoven), J. C. Faugere (Paris), V. P. Gerdt (Dubna), M. MacCallum (London), D. Mall (Zurich), E. L. Mansfield (Canterbury), T. Recio (Santander), M. Schlichenmaier (Mannheim), W. K. Seiler (Mannheim), T. Sturm (Passau), C. Traverso (Pisa), W. Werner (Heilbronn), F. Winkler (Linz), E. Zerz (Kaiserslautern)
Proceedings: submissions are not formally refereed and may be submitted later elsewhere. Informal proceedings will be distributed to participants
Site: University of Mannheim
Deadlines: for submissions, 1 December; for early registration, 15 February; late registration at higher fee until start of conference
Information:
Web site: http://www.uni-mannheim.de/RWCA

26-4 April: International Centre for Mathematical Sciences EuroSummer School and Instructional Conference on Combinatorial Aspects of Mathematical Analysis, Edinburgh, UK
Aim: to instruct young mathematicians in topics involving combinatorial ideas in mathematical analysis (10-day course)
Topics: combinatorial number theory, combinatorial methods in convexity, combinatorial methods in harmonic analysis, concentration of measure, geometric inequalities, Ramsey methods in Banach spaces
Main speakers: Keith Ball (UC London), Franck Barthe (Marne la Valle), William Beckner (U Texas, Austin), Béla Bollobás (Cambridge and Memphis), Anthony Carbery (Edinburgh), Michael Christ (U of California, Berkeley), Apostolos Giannopoulos (U of Crete, Heraklion), Gil Kalai (Hebrew University of Jerusalem), Michel Ledoux (Toulouse), Ted Odell (Texas A&M), Imre Ruzsa (Hungarian Academy of Science), Gideon Schechtman (Weizmann Institute), Terence Tao (UCLA), Christoph Thiele (UCLA)
Programme: the conference will take the form of a series of courses, each comprising 2, 3 or 4 one-hour lectures. The courses are structured so that the more basic material is presented during the first week, leading to more advanced lectures in the second week
Organising committee: Tony Carbery (Edinburgh), Mike Christ (UC Berkeley), Tim Gowers (Chair, Cambridge), Vitali Milman (Tel Aviv), Terry Tao (UCLA)
Sponsors: EC Framework V and the Engineering and Physical Sciences Research Council (EPSRC) of the UK
Site: the James Clerk Maxwell Building of the University of Edinburgh
Grants: some funding available to assist EU nationals who are under the age of 35. ICMS also has funds from the LMS to assist UK mathematicians. Please refer to the website for full details
Deadlines: for registration, 16 December
Information:
e-mail: icms@maths.ed.ac.uk
Web site: www.ma.hw.ac.uk/icms/meetings/2002/cama February 2002

May 2002

13-17: 34th Journées de Statistique, French Statistical Society, Brussels and Louvain-la-Neuve, Belgium
Themes: statistical analysis of functional data, actuarial and financial econometrics, resampling methods, non-parametric inference and modelling, voice and writing recognition, epidemics, genomics as well as mathematical statistics
Topics: sequential analysis, multivariate robust analysis, classification, applications of copulas in insurance and finance, change point detection, censored and missing data, Gibbs sampling, frontier estimation, extreme value theory, stochastic finance, data and files merging, the 150th anniversary of the first International Congress of Statistics, statistical software for text analysis, algebraic methods in time series analyses, non-standard mathematical methods in statistics and regression analysis, latent variables models, hierarchical Bayes models, stochastic models in telecommunication, large panels of time series data, deconvolution problems, stochastic processes in functional spaces, data depth, wavelets and time series, chemometrics, environmetrics, statistics in astronomy, statistics and language, continuous time stochastic processes, spatial and directional statistics, risk theory, image processing and neural networks
Languages: French and English
Programme committee: Marc Hallin (ULB), Chairman Lucien Birgé (Paris 6), Henri Caussinus (Toulouse), Christian Genest (Laval), Irène Gijbels (UCL), Ludovic Lebart (ENST-CNRS), Bernard Ycart (Paris 5)
Organizing committee: Léopold Simar (UCL), Chair, Jean-Jacques Droesbeke (ULB), Claude Cheruy (INS), Michel Denuit (UCL), Catherine Vermandele (ULB), Bernadette Govaerts (UCL), Thérèse Lekeux (ULB), Claudia Lemoine (UCL), Sophie Malali (UCL)
Grants: for students, statisticians from developing countries
Deadlines: for registration at lower fee, 15 March; for abstracts, 15 January
Information:
e-mail: jsbl2002@stat.ucl.ac.be
Web site: www.stat.ucl.ac.be/JSBL2002

25-3: XXII International Seminar on Stability Problems for Stochastic Models (SPSM) and Seminar on Statistical Data Analysis (SDA), Varna, Bulgaria
Topics of SPSM: limit theorems of probability theory, theory of probability metrics, asymptotic statistics, limit theorems for stochastic processes, queueing theory, applications of probability theory, insurance and financial mathematics
Topics of SDA: robust statistics, statistical algorithms, application of stochastic models in the industry
Organizing Committee: Vladimir Zolotarev (Russia, Chair of SPSM), Dimitr Vandev (Bulgaria, Chair of SDA)
Site: International Home of Scientists 'Frederic Joliot Curie'
Information:
Web site: http://stabil.fmi.uni-sofia.bg

27-29: Spring School on Frobenius Manifolds in Mathematical Physics, Enschede, The Netherlands
Information:
e-mail: nijpjes@sci.kun.nl

27-31: 6th Congress of SIMAI, Chia Laguna, Sardinia
Topics: applied mathematics and the applications of mathematics in industry, technology, environment and society
Information:
Web site:
http://www.iac.rm.cnr.it/simai/simai2002

June 2002

4-13: 3rd Linear Algebra Workshop BLED 2002, Bled, Slovenia
Main theme: the interplay between operator theory and algebra
Programme: talks in morning sessions, work in smaller groups in the afternoons
Programme committee: R. Drnovšek (SLO), L. Grunenfelder (CAN), T. Košir (SLO), M. Omladiè (SLO), H. Radjavi (CAN)
Organizing committee: R. Drnovšek (SLO), T. Košir (SLO), M. Omladiè (SLO)
Site: Hotel Golf, Bled
Deadlines: for registration, 1 December
Information:
e-mail: mkramar@fgg.uni-lj.si,
Web site: http://www.ijp.si/ftp/pub/STOp/law/

5-9: Conference in Honour of Hans Wallin, Umea, Sweden
Themes: 1) potential theory, function spaces, approximation theory and related topics; 2) mathematics education
Aim: to bring together researchers in some of the areas in which Hans Wallin has been working, in order to get a picture of some current research on these areas. We hope that the conference will be useful for a comparatively broad audience, and we especially encourage Ph.D. students to participate
Main speakers: A. Ambroladze (Sweden), D. Broomhead (Great Britain), L. Carleson (Sweden), Z. Cieselski (Poland), S. Janson (Sweden), D. S. Lubinsky (South Africa), P.

Mattila (Finland), E. B. Saff (USA), J.-O. Stromberg (Sweden), A. Teplayev (USA), O. Bjorkqvist (Finland), G. Gjone (Norway), M. Niss (Denmark)
Programme committee: Alf Jonsson, Johan Lithner, Kaj Nyström, Tord Sjödin, Peter Wingren
Organising committee: Margareta Brinkstam, Jan Gelfgren, Tord Sjödin, Britt-Marie Stocke
Site: Umea university, Umea, North of Sweden
Deadlines: for registration, 31 October
Information:
e-mail: margareta.brinkstam@math.umu.se
Web site: http://www.math.umu.se/aktuellt/HWkonferens.htm

10-16: Aarhus Topology 2002, Aarhus, Denmark
Theme: algebraic topology
Main speakers: include Raoul Bott (USA), Ralph Cohen (USA), Yakov Eliashberg (USA), Jesper Grodal (USA), Karsten Grove (USA), Lars Hesselholt (USA), Mike Hopkins (USA), Wolfgang Lück (Germany), Mike Mandell (USA), Fabien Morel (France), Bob Oliver (France), Erik K. Pedersen (USA), Zoltan Szabo (USA), Ulrike Tillmann (UK), Vladimir Turaev (France)
Organising committee: Johan Dupont (Chair), University of Aarhus; Hans Jørgen Munkholm, SDU, Odense University; Lars Hesselholt, MIT, USA; Lisbeth Fajstrup, Aalborg University
Site: University of Aarhus
Deadline: for registration, to be announced at our web site
Information:
Web site: http://www.imf.au.dk/AT2002/

17-19: BEM 24, 24th International Conference on Boundary Element Methods and Meshless Solutions Seminar, Sintra, Portugal
Organiser: Wessex Institute of Technology, UK and the University of Coimbra, Portugal
Sponsors: International Society of Boundary Elements (ISBE) and the International Journal of Engineering Analysis with Boundary Elements
Deadline: for papers, 15 January
Information: contact Conference Secretariat , BEM02, Wessex Institute of Technology, Ashurst Lodge, Ashurst Southampton, SO40 7AA, UK, *tel*: 44 (0) 238 029 3223, *fax*: 44 (0) 238 029 2853
e-mail: rgreen@wessex.ac.uk
Web site: http://www.wessex.ac.uk/conferences/2002/be02/index.html

27- 3 July: Fifth International Conference on Curves and Surfaces, Saint-Malo, France
Information:
e-mail: saint-malo@imag.
Web site: &http://www-lmc.imag.fr/saint-malo/

July 2002

16-22: 7th International Spring School: Nonlinear Analysis, Function Spaces and Applications (NAFSA 7), Prague, Czech Republic
Information:
e-mail: nafsa7@karlin.mff.cuni.cz
Web site: http://www.math.cas.cz/~nafsa7
[For details, see EMS Newsletter 40]

August 2002

3-10: Logic Colloquium 2002 (ASL European Summer Meeting), Münster, Germany
Main speakers: Jeremy Avigad (Pittsburgh, PA), Arnold Beckmann (Münster), Tim Carlson (Columbus, OH), Robert Constable (Ithaca, NY), Kosta Dosen (Toulouse), Moti Gitik (Tel Aviv), Volker Halbach (Konstanz), Bakhadyr Khoussainov (Auckland), Steffen Lempp (Madison, WI), Toniann Pitassi (Tucson, AZ), Thomas Scanlon (Berkeley, CA), Ralf Schindler (Wien), Patrick Speissegger (Madison, WI), Katrin Tent (Würzburg), Lev Beklemishev (Moscow/Utrecht), Steven Cook (Toronto, ON), Olivier Lessmann (Chicago, IL), Simon Thomas (Piscataway, NJ)
Sessions: ***Computability theory*** [organisers: Steffen Lempp (Madison, WI), Manuel Lerman (Storrs CT), Andrea Sorbi (Siena)], Frank Stephan (Heidelberg), Iskander Kalimullin (Kazan), Sebastiaan Terwijn (Amsterdam), Charles McCoy (Madison, WI), Vasco Brattka (Hagen), Ivan Soskov (Sofia), Elias Fernandez-Combarro Alvarez (Oviedo); ***Non-monotonic logic*** [organisers: Karl Schlechta (Marseille), Krister Segerberg (Uppsala)], Nick Asher (Austin, TX), Alexander Bochman (Holon), Dov Gabbay (London), Daniel Lehmann (Jerusalem), David Makinson (Paris), Rohit Parikh (New York, NY), Renata Wassermann (São Paulo); ***Set theory*** [organisers: Alessandro Andretta (Torino), Sy Friedman (Vienna)], David Aspero (Barcelona), Doug Burke (Las Vegas, NV), James Hirschorn (Helsinki), Ilijas Farah (New York, NY), Rene Schipperus (Beer-Sheva), Paul Larson (Toronto, ON), Su Gao (Pasadena, CA)
Programme committee: Klaus Ambos-Spies (Heidelberg), Sam Buss (San Diego CA), Zoé Chatzidakis (Paris), Alekos Kechris (Pasadena, CA, Chair), Peter Koepke (Bonn), Peter Komjath (Budapest), Manuel Lerman (Storrs, CT), Vann McGee (Cambridge, MA), Wolfram Pohlers (Münster), Michael Rathjen (Leeds), Krister Segerberg (Uppsala), Boris Zilber (Oxford)
Organising committee: Manfred Burghardt (Bonn), Justus Diller (Münster), Peter Koepke (Bonn), Benedikt Löwe (Bonn), Michael Möllerfeld (Münster), Wolfram Pohlers (Münster, Chair), Andreas Weiermann (Münster)
Sponsors: Association of Symbolic Logic
Information:
Web site: http://www.math.uni-muenster.de/LC2002/

10-11: Colloquium Logicum 2002, Münster, Germany
[satellite conference of *Logic Colloquium 2002*]
Main speakers: Toshiyasu Arai (Hiroshima), Joan Bagaria (Barcelona), Andre Nies (Chicago, IL), Martin Otto (Swansea), Charles Parsons (Harvard), Anand Pillay (Urbana-Champaign, IL), Michael Rathjen (Leeds), Johan van Benthem (Amsterdam/Stanford CA)
Organizing & scientific committee: Justus Diller (Münster), Peter Koepke (Bonn), Benedikt Loewe (Bonn), Wolfram Pohlers (Münster, Chair), Christian Thiel (Erlangen), Wolfgang Thomas (Aachen), Andreas Weiermann (Münster)
Organizer: DVMLG
Sponsors: Deutsche Vereinigung für Mathematische Logik und für Grundlagen der Exakten Wissenschaften (DVMLG)
Information:
Web site: http://wwwmath.uni-muenster.de/LC2002/

25-30: Wireless and Optical Communications (WOC '02), Miedzyzdroje, Poland
Information:
Web site:
http://www.worldses.org/wses/calendar.htm

25-30: Nanoelectronics, Nanotechnologies (NN'02), Miedzyzdroje, Poland
Information:
Web site:
http://www.worldses.org/wses/calendar.htm

September 2002

4-7: International Conference on Dynamical Methods for Differential Equations, Valladolid, Spain
Theme: the focus is on those recent advances in topological methods and ergodic theory which are relevant to the analysis of ordinary differential equations, partial differential equations and functional equations, as well as on their applications to science and technology
Scientific committee: Amadeu Delshams (Spain), Russell Johnson (Italy), Rafael Obaya (Spain), Rafael Ortega (Spain)
Organising committee: Ana I. Alonso, Sylvia Novo, Carmen Núñez, Rafael Obaya, Jesús Rojo (all Universidad de Valladolid, Spain)
Main speakers: L. Diaz (Brazil), A. Jorba (Spain), U. Kirchgraber* (Switzerland), P. Kloeden (Germany), R. Krikorian (France), Y. Latushkin (USA), R. de la Llave (USA), R. Markarian (Uruguay), W. de Melo* (Brazil), J. A. Rodríguez (Spain), G. R. Sell (USA), Y. Yi (USA) (* to be confirmed)
Proceedings: selected papers from the conference will be published in a special issue of *Journal of Dynamics and Differential Equations*
Site: Castillo de la Mota (Medina del Campo), Valladolid, Spain
Grants: a limited number of financial grants are available for graduate and doctoral students
Deadline: for pre-registration and submission of abstracts, 28 February
Information:
e-mail: dmde02@wmatem.eis.uva.es.
Web site: http://wmatem.eis.uva.es/~dmde02/

February 2003

5-7: 4th IMACS Symposium on Mathematical Modelling, Vienna, Austria
Aim: to give scientists and engineers using or developing models or interested in the development or application of various modelling tools an opportunity to present ideas, methods and results and discuss their experiences or problems with experts of various areas of specialisation
Scope: theoretic and applied aspects of the various types of mathematical modelling (equations of various types, automata, Petri nets, bond graphs, qualitative and fuzzy models, etc.) for systems of dynamic nature (deterministic, stochastic, continuous, discrete or hybrid with respect to time, etc.). Comparison of modelling approaches, model simplification, modelling uncertainties, port-based modelling, and the impact of items such as these on problem solution, numerical techniques, validation, automation of modelling and software support for modelling, co-simulation, etc. will be discussed in special sessions as well as applications of modelling in control, design or analysis of systems in engineering and other fields of application. Presentations of modelling and simulation software and a book exhibition will be organised
Organiser: Division for Mathematics of Control and Simulation (E114/3) at Vienna University of Technology.
Chair: of IPC, Univ. Prof. Dr. Inge Troch
Site: Vienna University of Technology
Deadlines: for submission of abstracts, 15 May 2002; for notification of authors, 15 October 2002, for full paper, 1 December 2002
Information:
Contact Univ. Prof. Dr. Inge Troch, Vienna University of Technology, Wiedner Hauptstrasse 8 - 10 A-1040 Wien, Austria, *tel*: +431-58801-11451, *fax*: +431-58801-11499
e-mail: inge.troch@tuwien.ac.at
Web site:
http://simtech.tuwien.ac.at/ MATHMOD

Recent books

edited by Ivan Netuka and Vladimír Souček

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

H. Bass and A. Lubotzky, *Tree Lattices*, *Progress in Mathematics **176**, Birkhäuser, Boston, 2001, 233 pp., DM 108, ISBN 0-8176-4120-3 and 3-7643-4120-3*
This is an advanced book on geometrical methods in group theory and combinatorial group theory. The authors study groups of autormorphisms of locally finite trees stressing parallels with the theory of Lie groups. Applications to combinatorics and number theory are given. In a sense, this is a continuation of the classical monograph of J. P. Serre, *Trees* (Springer, 1980), and indeed the book is dedicated to Serre 'in admiring tribute'. (jnes)

V. I. Bernik and M. M. Dodson, *Metric Diophantine Approximation on Manifolds*, *Cambridge Tracts in Mathematics **137**, Cambridge University Press, Cambridge, 1999, 172 pp., £27.50, ISBN 0-521-43275-8*
This book deals with metric Diophantine approximations on smooth manifolds embeddable in a Euclidean space. The text starts with an overview of basic problems and results on Diophantine approximation in one dimension, and the necessary analytic background on such manifolds needed for transition to metric aspects of the Diophantine approximation on manifolds. In the second chapter, they extend Khintchine's and Groshev's theorem on simultaneous approximation to certain manifolds, and prove a conjecture of A. Baker related to his previous extension of Sprindžuk's theorem. The next three chapters are devoted to Hausdorff dimension, especially to different techniques developed for upper and lower bounds of the associated null sets. Chapter 6 contains an account of p-adic Diophantine approximation on manifolds. The final chapter deals with various applications, such as the wave equation and the rotation number. Each chapter ends with notes containing material for further reading and historical comments. Especially valuable are those connected with results spread in journals within the former Soviet Union.

This book can be recommended not only to those interested in number-theoretic aspects, but also to those whose interests lie in topics related to dynamical systems. The book is essentially self-contained and very readable. (šp)

E. D. Bloch, *Proofs and Fundamentals. A First Course in Abstract Mathematics*, *Birkhäuser, Boston, 2000, 424 pp., DM 108, ISBN 0-8176-4111-4 and 3-7643-4111-4*
This book presents an elementary abstract basis of mathematics in three natural parts: logic, basic set notions and methods, and basic mathematical structures; the names of these parts are: Proofs, Fundamentals, Extras.

Part 1 is an explanation of elementary notions of first-order logic and an exposition of how to use them to produce logically correct arguments and proofs. Part 2 is a presentation of elementary informal set theory; the chapters are: Sets, Functions, Relations, Infinite and Finite Sets. Part 3 introduces such basic structures as groups, partially ordered sets, lattices, positive integers, rational and real numbers, and presents computations with finite sets. The text has over 400 exercises, with hints for selected ones.

The presentation of the subject is sufficiently precise, and motivations of introduced notions are discussed. The book can be seen as a solid base of general mathematical notions and methods. (jml)

D. Bao, S.-S. Chern and Z. Shen, *An Introduction to Riemann-Finsler Geometry*, *Graduate Texts in Mathematics **200**, Springer, New York, 2000, 431 pp., DM 98, ISBN 0-387-98948-X*
This book offers the most modern treatment of the topic and will attract both graduate students and a broad community of mathematicians from various related fields. The authors start with a short but informative historical exposition and with a guide to the contents of the book. They show how the original motivation of the topic came from physics and mention other fields of applications, such as ecology and biology.

Whereas a Riemann structure is a smooth family of inner products, a Finsler structure can be viewed as a smooth family of general Minkowski norms along a manifold. One of the main goals of this book seems to be to answer the following question: to what extent can the basic notions and theorems from global Riemann geometry be generalised to Finsler structures, either general ones, or specialised ones?

The exposition is based mainly on the so-called Chern connection and its curvature, which are studied in detail in the first part of the book. Through this approach, one learns that the following items make sense in a general Finsler geometry: Schur's lemma, the generalised Gauss-Bonnet theorem, Jacobi fields, the Hopf-Rinow theorem, index form and the Bonnet-Myers theorem, cut and conjugate loci and Synge's theorem, the Cartan-Hadamard theorem and Rauch's first theorem. These topics are studied in the second part of the book. The final part of the book is devoted to special Finsler spaces, and is connected with the names of H. Akbar-Zadeh, F. Brickel, A. Deicke and Z. Szabó. One chapter illustrates the general concepts in pure Riemannian geometry.

Full credit is given to the traditional Japanese, Romanian and other schools of Finslerian geometry, as well as to the mathematicians who made isolated contributions to the topic. The authors seem anxious to be fair as concerns citations. The book includes an impressive 393 exercises and some examples using Maple. (ok)

J. F. Bonnans and A. Shapiro, *Perturbation Analysis of Optimization Problems*, *Springer Series in Operations Research, Springer, New York, 2000, 601 pp., DM 139, ISBN 0-387-98705-3*
This monograph presents a compact overview of perturbation analysis of continuous optimisation problems. The framework of the book is abstract: the optimisation problem considered is parametrised by a parameter varying in a Banach space, theoretical results are formulated for Banach spaces, and the duality of Banach spaces is the main tool for proofs. The book investigates the continuity and differentiability of the optimal value and the set of all optimal solutions with respect to the parameter.

The book has seven chapters. The introductory chapter describes the topic's relation to other fields, such as non-linear programming, optimal control and variational inequalities. Chapter 2 contains the background material needed for a full understanding of the text: basic functional analysis, duality in Banach spaces, recession cones, directional differentiability of a function, tangent cones, the basic elements of multi-function theory, properties of convex functions, and conjugate (Fenchel) and Lagrangian duality. The third chapter discusses first- and second-order optimality conditions for the optimisation problems; this is based on Lagrangian duality extended to a generalized Lagrangian. Chapter 4 is the main part of the book, giving a comprehensive study of stability and sensitivity analysis of an optimisation problem parametrised by a parameter varying in a Banach space. Subsections present a first-order differentiability analysis of the optimal value and a discussion of the quantitative stability of optimal solutions and Lagrange multipliers, followed by a second-order analysis in Lipschitz and Hölder stable cases. A special subsection treats second-order analysis in function spaces. The fifth chapter brings additional materials and applications, including a discussion of variational inequalities, non-linear programming, semi-definite programming and semi-infinite programming. Chapter 6 is relatively self-contained, and considers optimisation problems based on partial differential equations, such as the Dirichlet problem, optimal control of a semi-linear elliptic equation, the state-constrained optimal control problem and the obstacle problem. The final chapter gives bibliographical notes and references for additional reading.

The monograph contains the present state of knowledge of the topic. The text is written in a clear and correct manner and is arranged in order to help the reader. The book can be recommended for graduate students, researchers and practitioners in optimisation theory. (pl)

X. Buff, J. Fehrenbach, P. Lochak, L. Schneps and P. Vogel, *Espaces de modules des courbes, groupes modulaires et théorie des champs*, *Panoramas et Synthéses **7**, Société Mathématique de France, Paris, 1999, 143 pp., FRF 120, ISBN 2-85629-073-6*
This book consists of lecture notes from a three-day workshop. The first two parts (Éléments de géométrie des espaces de modules des courbes, and Groupoïdes fondamentaux des espaces de modules en genre 0 et categories tensorielles tressées) are devoted to the structure of Teichmüller space of Riemann surfaces, while the third, more or less independent, part (Invariants de Witten-Reshetikhin-Turaev et théories quantiques des champs) is devoted to 'quantum group' invariants of links and 3-dimensional manifolds. Topics of these sections intersect in the notion of braided or strict monoidal category.

In the first part we find a definition of

Teichmüller space $T_{g,n}$ of Riemann surfaces of genus g with n distinct labelled points and also two alternative descriptions of this space – in terms of hyperbolic metrics and by subgroups of PSL(2, **R**). The space $T_{g,n}$ is topologised by the Fenchel-Nielsen coordinates which are then used to describe a compactification $CM_{g,n}$ of the corresponding moduli space $M_{g,n}$ by adding 'degenerate' points. The decorated Teichmüller space $T'_{g,n}$, intimately related to graph complexes of Kontsevich, is also studied.

The central object of the second part is the completed Teichmüller groupoid $T'_{0,n}$, that is, the profinite completion of the fundamental groupoid of the moduli space $CM_{0,n}$ based at a neighborhood of 'most degenerate' configurations of $CM_{g,n}$. This groupoid admits a natural action of the Galois group Gal(Cl(**Q**)/**Q**). The Grothendieck-Teichmüller group GT, isomorphic for $n \geq 4$ to the automorphism group of $T'_{0,n}$, is also introduced. The celebrated conjecture that Gal(Cl(**Q**)/**Q**) is isomorphic to GT is then formulated.

The third part explicates how a ribbon braided monoidal category induces a link invariant or, more generally, an invariant of pairs (M, L) of a 3-manifold M and a link L embedded in M. Particular examples of these braided monoidal categories are provided by representations of quantum groups. The rest of this part indicates how (in some cases) these invariants are equivalent to topological quantum field theories.

The concise and self-contained exposition is primarily aimed at non-specialists and graduate students, but a specialist might also find useful information and proofs that are difficult to locate in the existing literature. (mm)

D. Bump, ***Algebraic Geometry***, *World Scientific, Singapore, 1998, 218 pp., £26, ISBN 9-810-23561-5*

This book is designed as a text for a one-year course in basic algebraic geometry at the graduate level. It is divided into two parts.

The first part is devoted to the general theory of affine varieties over an algebraically closed field. The theory of affine varieties is systematically and clearly explained in the first part of the book, and some prerequisities from algebra are included. The dimension and products of affine varieties are studied and a section is devoted to theory of projective varieties. The second part is devoted to the theory of algebraic curves, and the main topic is the theory of complete non-singular curves. The questions studied are the ramification problem, extensions and completions of a field with respect to a valuation, differentials, residues and the Riemann-Roch theorem. Special attention is paid to the theory of elliptic curves and their properties and to the zeta function of a curve. As mentioned by the author, the most significant omission is intersection theory. Each chapter has a set of exercises illustrating its content and helping a better understanding of the theory. As a whole, the textbook offers a good introduction to algebraic geometry. (jbu)

E. B. Burger, ***Exploring the Number Jungle: A Journey into Diophantine Analysis***, *Student Mathematical Library **8**, American Mathematical Society, Providence, 2000, 151 pp., US$20, ISBN 0-8218-2640-9*

This book provides an excellent survey of Diophantine analysis. It is surprising how the author is able to explain many interesting and famous facts in the topic in just 150 pages. Twenty modules (chapters) are followed by many exercises, formulated as lemmas or theorems with many hints, and remarks and questions.

The book contains the Dirichlet and Hurwitz theorems, continued fractions, the Markoff spectrum, the Pell equation, Liouville and Roth's results, elliptic curves, the geometry of numbers and its application to simultaneous diophantine approximations, uniform distribution, and p-adic analysis. Many proofs are omitted (the Mordell and Mazur theorems), some are only sketched (the Roth theorem), while some are presented with full proofs (the Lagrange theorem, the Minkowski convex body theorem, the linear forms theorem and Kronecker's theorem). The book includes an index and references for further reading, and can be warmly recommended to students and university teachers. (bn)

M. Capiñski and T. Zastawniak, ***Probability Through Problems***, *Problem Books in Mathematics, Springer, New York, 2001, 257 pp., DM 109, ISBN 0-387-95063-X*

This book is intended to accompany an undergraduate course in probability; the only prerequisite are basic algebra (including elements of set theory) and calculus. A brief survey of the terminology and notation of set theory and calculus is provided at the beginning of the book.

The body of the book is divided into twelve chapters. Chapter 1 concerns elements of modelling of random experiments. Chapters 2-6 are devoted to classical probability spaces and related combinatorial problems, fields and σ-fields of sets, finitely and countably additive probability. Chapter 7 focuses on conditional probability and independence, Chapter 8 concerns random variables and their distribution functions, while Chapter 9 offers problems on their expectations and variances and is devoted to conditional expectations. Charateristic functions are the subject of Chapter 11, while Chapter 12 contains problems connected with the laws of large numbers and the central limit theorem, with an emphasis on consequences and applications. Each chapter is divided into theory (including basic notions and theorems), problems, hints and solutions. Hints are given for all problems and fully worked solutions for the majority of them. All problem sections include expository material. (mahu)

S. Choi, ***The Convex and Concave Decomposition of Manifolds with Real Projective Structures***, *Mémoires de la Société Mathématique de France **78**, Société Mathématique de France, Paris, 1999, 102 pp., FF 150, ISBN 2-85629-079-5*

This small book is devoted to a study of properties of real manifolds with a flat projective structure. The author introduces a notion of i-convexity, generalising the ordinary notion of convexity, and he proves a decomposition theorem showing that a real projective manifold of dimension n is either (n–1)-convex or can be decomposed into simpler real projective manifolds. Special attention is paid to the three-dimensional situation, as motivation for such a study came from the study of hyperbolic 3-manifolds. The methods developed are applied to a classification of radiant affine three-dimensional manifolds. The book brings a systematic and ordered treatment of this new field, which was not previously available in book form. (vs)

C. J. Colbourn and A. Rosa, ***Triple Systems***, *Oxford Mathematical Monographs, Clarendon Press, Oxford, 1999, 560 pp., £80, ISBN 0-19-853576-7*

This book presents the current knowledge about triple systems, collecting together common themes and providing an accurate portrait of an incredible variety of problems and results. Representative samples of major styles of proof techniques are provided. The book is intended primarily for readers with a basic knowledge of combinatorial design theory.

After a historical background, the first three chapters explain in detail the basic material on constructions and existence of triple systems. The next five chapters describe topics connected with triple systems: isomorphism, enumeration, subsystems and automorphisms. Chapters 9-23 treat a number of challenging problems on triple systems in detail. Chapters 24 and 25 provide a guide to two related classes of triple systems in which the triples contain ordered pairs. A comprehensive bibliography on triple systems is provided. (jj)

J. B. Conway, ***A Course in Operator Theory***, *Graduate Studies in Mathematics **21**, American Mathematical Society, Providence, 1999, 372 pp., US$49, ISBN 0-8218-2065-6*

This book is a continuation of the author's previous text *A Course in Functional Analysis* (Springer, 2nd ed., 1990). Its aim is to cover central topics of operator theory in a form that is accessible to graduate students.

The book is divided into eight chapters. The first two chapters, devoted to **C***-algebras and normal operators, overlap Chapters 8 and 9 from the previous edition, but they make the book more independent. The theory of **C***-algebras is continued in Chapter 5, where irreducible representations and positive maps are examined. As an application, the dilation theorem is proved. Chapter 3 discusses ideals of bounded operators in a Hilbert space, especially the ideal of compact operators. Chapter 6 deals with a study of Fredholm operators and compact perturbations. The Weyl-von Neumann-Berg theorem on almost diagonalisation of normal operators is proved here. There are two central chapters: Chapter 4 examines non-normal operators like isometries in particular shifts, and some deep connections between operator theory and analytic functions are shown; Chapter 7 treats von Neumann algebras and their classifications. The final chapter explores relations between sets of operators and their common invariant subspaces (reflexive and hyper-reflexive operators).

This book is written in a very readable style. In spite of the many recent results included, a reader is not lost in technical explanations, since the main ideas and comments are simultaneously given. Many exercises make this book convenient for independent study, with cross-references throughout. The whole text is well organised, rendering the book suitable for anybody interested in the above topics. (jmil)

A. Croft, R. Davison and M. Hargreaves, ***Engineering Mathematics, with CD***, *Pearson Education, London, 2001, 969 pp., £39.99, ISBN 0-130-26858-5*

This book was written to serve the mathematical needs of students of a first course in engineering, primarily for students of electronic, electrical, communication and system engineering.

The book has two main aims. The first is to provide an accessible and readable introduction to engineering mathematics at the degree level; the second is to encourage the integration of engineering and mathematics.

The first three chapters include a review of some important functions and techniques from previous courses. These chapters contain a review of algebraic techniques, engineering functions and trigonometric functions. The next chapters include descriptions of many topics: coordinate systems, sequences and series, vectors, matrix algebra, complex numbers, differentiation, integration, Taylor polynomials, Taylor and Maclaurin series, ordinary differential equations, the Laplace transform, difference equations and the z-transform, Fourier series and Fourier transform, functions of several variables, vector calculus, line and multiple integrals, statistics and probability. There are four appendices and an index. As a supplement, an interactive CD testing and assessment package is included. (jkof)

P. R. Cromwell, *Polyhedra,* *Cambridge University Press, Cambridge, 1999, 451 pp., £32.50, ISBN 0-521-55432-2 and 0-521-66405-5*
This book comprehensively documents many ways that polyhedra have appeared in the history of mathematics and the sciences. It is an unusual book as it combines the style of a historical essay with a description of scientific achievements and goals, and it aims to prove basic results and theorems. The figures are nice, ranging from Kepler and Dürer to modern times, and are complemented by a scholarly exposition. To quote one of the reviews: 'it is a labor of love' and successfully complements earlier books, most notably those of Grünbaum. In some places the writing is a bit vague: for example, while disscussing the proof of the 4-colour theorem, the author describes Appel and Haken's attempt without mentioning the recent work of Robertson, Seymour and Thomas. This is a book for a broad mathematical and scientific audience. (jnes)

J. W. Dauben (ed.), *The History of Mathematics from Antiquity to the Present: A Selective Annotated Bibliography,* *Revised edition on CD-ROM, American Mathematical Society, Providence, 2000, US$ 49, ISBN 0-8218-0844-3*
This is not a book, but a CD-ROM. This second CD-ROM edition is the revised and updated first edition, which was published in 1985 by Garland Publishing in New York. It is an unusual and comprehensive guide to the history of mathematics, containing some 4800 bibliographical entries with annotations; of these 2800 are entirely new and many of the remaining ones have been updated.

Thirty-eight historians of mathematics from ten countries have participated as contributing editors. They present the best database with the best introductions for all topics. The sections are devoted to Egyptian, Babylonian and Greek mathematics, the Arabic, Latin and Hebrew traditions, European mathematics in the 15th, 16th, 17th and 18th centuries, modern mathematics in the 19th and 20th centuries, mathematics in Africa and the Orient, and women in mathematics. Each section contains major works on any given topic or period, accompanied with critical descriptions of these works. The authors emphasise the most useful and authoritative secondary sources and other types of primary source (texts, manuscripts, correspondence, etc.). Anyone who wishes to become acquinted with the history of mathematics can begin with this impressive bibliographical database. (mnem)

M. Dimassi and J. Sjöstrand, *Spectral Asymptotics in the Semi-Classical Limit,* *London Mathematical Society Lecture Note Series **268**, Cambridge University Press, Cambridge, 1999, 227 pp., £ 24.95, ISBN 0-521-66544-2*
This book is based on a course given by the authors at various universities in France. Its main theme is an application of methods of microlocal analysis to spectral problems in semi-classical limit. Main notions are briefly reviewed (local symplectic geometry, self-adjoint operators), and the authors then develop the basic theory of h-pseudodifferential operators and a functional calculus for them). WKB methods are used for the construction of local asymptotic solutions of the Schrödinger operator and the method of stationary phase is explained. There are discussions of tunnel effects, asymptotic expansions for the trace and of spectral results in various special situations. Each chapter ends with historical remarks, useful comments and recommendations for further reading. The book can be used for a one-semester course on the topic. (vs)

S. Dineen, *Complex Analysis on Infinite Dimensional Spaces,* *Springer Monographs in Mathematics, Springer, London, 1999, 543 pp., DM 179, ISBN 1-85233-158-5*
This book contains a comprehensive study of properties of holomorphic functions on open subsets of infinite-dimensional complex topological vector spaces. The first two chapters are devoted to a study of polynomials in an infinite-dimensional setting. They are introduced using multi-linear maps and tensor products, their relation to geometric concepts of Banach space theory is discussed and the duality theory for polynomials is developed. Chapter 3 introduces basic definitions of holomorphic maps between infinite-dimensional spaces, studies their Taylor and monomial expansions and introduces main topologies on the space of holomorphic maps on an open set. The next two chapters contain the central theme of the book – a comparison of the main three topologies on the space of holomorphic maps. To understand conditions under which some of them coincide is a complicated question whose answer needs a surprising variety of tools. T h final chapter is devoted to extension properties of holomorphic maps in the infinite-dimensional situation. Each chapter ends with exercises containing additional material, and many of them are commented on in the Appendix.

A special feature of the book is a comprehensive and detailed description of the history of the subject and of its individual results, contained in the notes ending each chapter and in the appendix. The author's efforts in this respect add a special value to the book. The reader is supposed to know basic complex function theory, topology and Banach space theory; a knowledge of several complex variable theory is helpful, but not necessary. The book is very well written and can be recommended to mathematicians working in the field as well as those from other fields interested in the subject. (vs)

M. Dummett, *Elements of Intuitionism,* *Oxford Logic Guides **39**, Clarendon Press, Oxford, 2000, 331 pp., £60, ISBN 0-19-850524-8*
The first edition of this book appeared in 1977. The author's intention is to give basic information about the fundamental ideas of intuitionism, and especially to clarify two such ideas underlying intuitionistic mathematics. The first is a general theory of meaning for a mathematical language, according to which the only thing that can make a statement true is an intuitively acceptable proof, representing a certain kind of mental construction. The second is the concept of infinite 'effective' sequences, which are developed in Chapters 3 (Choice sequences and spreads), 4 (The formalism of intuitionistic logic) and 5 (The semantics of intuitionistic logic). Philosophical remarks form Chapter 7. Some parts from the first edition are revised – for example, the account of Brouwer's proof of the Bar theorem, as well the treatment of generalised Beth trees.

This book provides a comprehensive presentation of the subject and can be read without special preliminary knowledge. (jml)

J. Fauvel, R. Flood and R. Wilson (eds.), *Oxford Figures: 800 Years of the Mathematical Sciences,* *Oxford University Press, Oxford, 2000, 296 pp., £35, ISBN 0-19-852309-2*
This book chronicles the development of mathematical research and studies at Oxford University from its foundation to the 20th century. It is a story of the intellectual and social life of the mathematical community (the community of professors and students and the wider scientific community in Britain and throughout the world).

The authors describe those parts of mathematics that were covered in lectures and how they were treated at Oxford, the content of examinations and how they were realised, what and how was changed during more than 800 years (the transformation of the mathematical curriculum and the role of mathematics in British society). The aspects of the history of mathematics in the periods of medieval Oxford, renaissance Oxford, the mid-17th century, the Newtonian school, Georgian Oxford, the mid-19th century and the 20th century are described so that the reader can see how mathematics was developed century by century. There are stories about many well-known and sometimes surprising figures, such as Robert Boyle, Christopher Wren, Edmond Halley, Percy Bysshe Shelley, Charles Dodgson (Lewis Carroll), John Wallis, Isaac Newton, Thomas Hornsby, Henry Smith and James Joseph Sylvester.

Appendices containing lists of the holders of the Savilian, Sedleian, Waynflete, Rouse Ball and Wallis Chairs since their foundations, and an index of names, are included at the end of the book. The book is very well written and beautifully illustrated. It can be recommended to anyone interested in the history of mathematics and the history of teaching. (mnem)

D. Gardy and A. Mokkadem (eds.), *Mathematics and Computer Science. Algorithms, Trees, Combinatorics and Probabilities,* *Trends in Mathematics, Birkhäuser, Basel, 2000, 340 pp., DM 148, ISBN 3-7643-6430-0*
These proceedings of a colloquium held in Versailles in September 2000 consist of 28 refereed research papers on diverse mathematical problems, mainly motivated by computer

science. With a few exceptions, the questions belong to probability theory or combinatorial enumeration, and the topics include estimating various statistics of random trees, random generation of words, probabilistic analysis of algorithms (QUICKSORT, genetic algorithms, routing in a network, an algorithm for rendezvous in graphs, calculating the stationary vector for discrete-time stochastic automata, universal prediction algorithm for mixing sources), Markov chains, random walks, branching processes, large deviations for polling systems, general enumeration techniques, enumerating certain paths in lattices, asymptotic analysis of coefficients of multivariate generating functions, and 0-1 laws. A good 3-page overview of the contents is given in the preface. (jmat)

J. R. Giles, *Introduction to the Analysis of Normed Linear Spaces,* *Australian Mathematical Society Lecture Series* ***13****, Cambridge University Press, Cambridge, 2000, 280 pp., £19.95, ISBN 0-521-65375-4*

This book presents a basic course in functional analysis. The text is very readable and offers a detailed explanation of the subject. Some recent results are also included.

The book starts with basic properties of normed linear spaces (including the Schauder basis), classes of examples and the theory of Hilbert spaces. The next chapters deal with spaces of continuous linear mappings (including Banach algebras), the analytic form of the Hahn-Banach theorem, reflexivity and subreflexivity (including a complete proof of the Bishop-Phelps theorem), the open mapping and closed graph theorems and the uniform boundedness principle. Further chapters are devoted to various types of continuous linear mappings (conjugate mappings, adjoint operators, projection and compact operators), main properties of spectra of linear and compact operators (a proof of Lomonosov's theorem on invariant subspaces) and spectral theory (culminating with spectral theories for normal, compact and hermitian operators).

The text includes many exercises, both elementary and advanced. An appendix contains the set theory results used in the text (Zorn's lemma, the Schröder-Bernstein theorem and the Hamel basis). At the end of the book there are historical notes showing the development of functional analysis from the late 19th century. Two late significant advances concerning (Ekeland's) variational principles and Asplund spaces are treated.

The book is addressed mainly at senior undergraduate and beginning postgraduate students, who are assumed to be familiar with elementary real and complex analysis, linear algebra and the theory of metric spaces. (jl)

J. Hadamard (J. J. Gray and A. Shenitzer (eds.)), *Non-Euclidean Geometry in the Theory of Automorphic Functions,* *History of Mathematics* ***17****, American Mathematical Society, Providence, 1999, 95 pp., US$19, ISBN 0-8218-2030-3*

In the 1920s J. Hadamard wrote a survey on automorphic functions, in connection with the preparation of an edition of the collected works of N. I. Lobachevski. It was translated by A. V. Vasiliev into Russian and edited by B. A. Fuks and published in 1951. The text is now available in a very readable English edition, prepared by Abe Shenitzer. Most of the results in the booklet are stated without proof, and are not intended for novices. However, it can be recommended as supplementary reading to anybody interested in the subject.

The text is divided into six chapters and enlarged by two introductory prefaces written by J. Gray. The first preface (just 1 page) describes the historical background and Hadamard's connections with Russian mathematics. The second one gives a very useful brief account of the history of the theory of automorphic functions from 1880 to 1930. The Hadamard chapters range from realisations of the Lobatchevskian plane, the most important properties of properly discontinuous subgroups, and Fuchsian and Kleinian functions, to the uniformisation of algebraic curves and solutions of ordinary differential equations with algebraic coefficients.

This booklet provides interesting reading for anybody interested in the theory of automorphic functions, and this English edition will certainly be of interest not only to this group of working mathematicians. (šp)

M. Hazewinkel (ed.), *Handbook of Algebra,* Vol. 2, *Elsevier, Amsterdam 2000, 878 pp., US$177.50, ISBN 0-444-50396-X*

This handbook is the second part of a comprehensive guide through modern algebra. The whole project is divided into nine sections, and the second volume partially covers six of them. Section 2 contains a treatment of category theory, some parts of homological and homotopical algebras and model-theoretic algebras. Section 3 presents the theory of commutative rings and algebras, associative rings and algebras and the deformation theory of rings and algebras. In Section 4 varieties of algebras and Lie algebras are explained. Section 5A is devoted to groups and semigroups and Section 6C deals with the representation theory of continuous groups. Part E is devoted to abstract and functorial representation theory. (lbi)

C. Hillermeier, *Nonlinear Multiobjective Optimization: A Generalized Homotopy Approach,* *International Series of Numerical Mathematics* ***135****, Birkhäuser, Basel, 2001, 135 pp., DM 88, ISBN 3-7643-6498-X*

This book motivates and surveys the principles and classical methods of multi-objective optimisation, including a recent stochastic approach and concentrating on the presentation of a new generalised homotopy approach.

The homotopy methods require that all functions in the optimisation problem are twice continuously differentiable. They have been analysed mostly in the one-dimensional parameter case, whereas the proposed approach allows a multi-dimensional parametrisation useful for the solution of multi-objective optimisation problems. The set of efficient points is examined from the viewpoint of differential topology, and the suggested numerical algorithm is applied both to an academic example and to optimisation problems dealing with the design and operation of industrial systems. The book will interest applied mathematicians and engineers. (jd)

S. Kaufmann, *A Crash Course in Mathematica,* *Birkhäuser, Basel, 1999, 200 pp. (CD-ROM included), DM 48, ISBN 3-7643-6127-1 and 0-8176-6127-1*

This book, and the accompanying Mathematica notebooks on the CD-ROM, give the reader the basics of Mathematica in a compact form. The book itself is basically a printout of the Mathematica notebooks contained on the CD-ROM. The author discusses the following points: user interface (front end), actual calculator (kernel) and additional macros (packages).

Everything is complemented by examples that are kept at a simple mathematical level and are largely independent of special technical or scientific applications. Emphasis is placed on solving such standard problems as equations and integrals, and on graphics. After working through this course, readers will be able to solve problems independently and to find additional help in the on-line documentation. Depending on their interests and needs, completing the first two parts of this course may be sufficient, as they include the most important calculations and graphics functions. The third part is more technical, and the fourth part introduces programming in Mathematica.

The CD-ROM can be used with MacOS, Windows 95/98/NT or Unix. Up-to-date information and any corrections to the book can be accessed at http://www.ifm.ethz.ch/\~{}kaufman. (mbr)

A. G. Kulikovskii, N. V. Pogorelov and A. Yu. Semenov, *Mathematical Aspects of Numerical Solution of Hyperbolic Systems,* *Monographs and Surveys in Pure and Applied Mathematics* ***118****, Chapman & Hall/CRC, Boca Raton, 2001, 540 pp., £63.99, ISBN 0-8493-0608-6*

This book presents various methods and techniques for the numerical solution of hyperbolic systems of partial differential equations, and treats a number of problems with important applications.

The book consists of seven chapters. In Chapter 1 the basic concepts and notations are introduced. Chapter 2 is concerned with the formulation of basic approaches to the numerical solution of quasi-linear hyperbolic systems, both in the conservative and non-conservative forms. The methods of Godunov, Courant-Isaacson-Rees, Roe and Osher are treated, and attention is paid to higher-order schemes with reconstruction and limiting procedures. The next chapters are devoted to particular mechanical problems. Chapter 3 deals with gas dynamics equations and the solution of Euler equations equipped with various state equations. In Chapter 4, shallow water equations are considered, and Chapter 5 is devoted to numerical solution of MHD problems. Chapter 6 is an attempt to outline problems of solid dynamics that are governed by hyperbolic systems. Finally, Chapter 7 introduces the notion of non-classical discontinuity, discusses its various aspects and treats several applications.

This book is a substantial addition to the existing literature, particularly because it contains a number of applications. It will be of interest to students and researchers in fluid dynamics and continuum mechanics and in various fields of physics. It contains a number of figures and examples and will be useful for specialists dealing with practical computation. Although the word 'Mathematical' appears in the title, it is not written in a mathematical style. The results are not formulated as theorems and the mathematical theory of numerical schemes as convergence and error estimates is not mentioned. (mf)

S. Lang, *Fundamentals of Differential Geometry,* *Graduate Texts in Mathematics* ***191****, Springer, New York, 1999, 535 pp., DM 109, ISBN 0-387-98539-X*

There are many books on the fundamentals of differential geometry, but this one is quite exceptional; this is not surprising for those who know Serge Lang's books. The aim is to present the fundamentals shared by differential topology, differential geometry, and differential equations.

The various notions of the smooth calculus on manifolds form the core of the book as usual, but there are two distinct guidelines visible; the coordinate-free treatment of all proofs and main theorems, and the emphasis on the developments in global analysis and geometry after the 1960s. These features fit well together, since much of the recent interest heads towards various aspects of an infinite-dimensional character, while the coordinate-free approach leads naturally to differential geometry modelled on Banach spaces (manifolds without further structure), self-dual Banach spaces (pseudo-Riemannian structures), and Hilbert spaces (Riemannian structures). Although these models are not general enough to include many standard infinite-dimensional objects, such as the spaces of all smooth mappings between finite-dimensional manifolds, Lang's treatment provides the most conceptual way that completely recovers and generalises (but also simplifies) the more usual expositions with $x_1,\ldots,x_n$, $dx_1,\ldots,dx_n$, Γ^i_{jk} , etc.

To indicate the wide area covered in about 500 pages, we list the chapter titles: differential calculus; manifolds; vector bundles; vector fields and differential equations; operations on vector fields and differential forms; the theorem of Frobenius; metrics; covariant derivatives and geodesics; curvature; Jacobi lifts and tensorial splitting of the double tangent bundle; curvature and the variation formula; an example of seminegative curvature; automorphisms and symmetries; immersions and submersions; volume forms; integration of differential forms; the Stokes theorem; applications of the Stokes theorem; the spectral theorem. The book is designed rather for graduates, although it is explicitly based only on elementary calculus, topology and linear algebra. It can be warmly recommended to a wide audience. (jslo)

E. H. Lieb and M. Loss, *Analysis,* *2nd edition, Graduate Studies in Mathematics* ***14****, American Mathematical Society, Providence, 2001, 346 pp., US$39, ISBN 0-8218-2783-9*

The first edition of the book appeared in 1997 (for its review, see EMS *Newsletter* **25**, September 1997). In this second edition, besides correcting misprints, the authors have added a new Chapter 12 containing a discussion of a semi-classical approximation for the Schrödinger equation, using the Glauber coherent states and various bounds on eigenvalues and their sums. In addition, Chapter 8 has been extended (compactness criterion, and Poincaré, Nash and logarithmic Sobolov inequalities) and there are further additions in Chapter 1 (integration using simple functions) and Chapter 6 (Yukawa potential). The number of exercises has been increased. This attractive book can be highly recommended for its style, clarity and interesting choice of material. (vs)

M. Mesterton-Gibbons, *An Introduction to Game-Theoretic Modelling*, *Second edn., Student Mathematical Library* ***11****, American Mathematical Society, Providence, 2000, 368 pp., US$39, ISBN 0-8218-1929-1*

This is the second updated edition of a successful textbook. It is an introduction to game theory and applications from the perspective of a mathematical modeller. Unlike theoretically oriented textbooks, the emphasis is on concrete examples, and the author's explanation proceeds from specific to general, so that students can follow the motivation of general mathematical concepts and constructions. The author avoids rigorous statements and proofs of theorems, referring instead to standard mathematical texts. Thus the reader needs only basic knowledge of calculus and linear algebra and some experience with studying mathematical texts.

By tradition, games are classified as either cooperative or non-cooperative, although the author considers this dichotomy imperfect, since almost every conflict has an element of cooperation and almost all cooperations have an element of conflict.

The book is divided into seven chapters. The explanation begins with the concept of Nash equilibrium in non-cooperative games. In Chapter 1 the author shows that a non-cooperative game can have several Nash equilibria. The next chapter gives three criteria enabling us in such situations to distinguish qualitative properties of different Nash equilibria; in particular, various concepts of equilibrium stability are introduced and compared. Chapters 3 and 4 are devoted to cooperative games; the author introduces cooperative games in strategic form and the corresponding Nash bargaining solution, characteristic function games, Shapley value and the Shapley-Shubik index. In Chapter 5, the concept of the well-known Prisoner's Dilemma is described and a closely related concept, the so-called 'Cooperator's Dilemma', is introduced. Using the latter concept, the author investigates cooperation within the context of a noncooperative game. Chapter 6 is devoted to population games; this chapter shows that games are valuable tools in a study of both animal and human behaviour in some non-cooperative conflict situations. Chapter 7 contains some concluding remarks, whose aim is to give an objective evaluation of the usefulness of games for studying real conflict situations.

Each chapter concludes with exercises, whose solutions are presented in an appendix. Another appendix contains an explanation of the tracing procedure suggested by Harsanyi. (kzim)

T. Miwa, M. Jimbo and E. Date, *Solitons,* *Cambridge Tracts in Mathematics* ***135****, Cambridge University Press, Cambridge, 2000, 108 pp., £ 25, ISBN 0-521-56161-2*

The simplicity of the structure of the set of solutions of linear equations is due to the fact that it is a linear vector space. Nothing comparable applies to non-linear equations. Nevertheless, for certain classes of non-linear PDEs, such as KP-hierarchy of the famous *KdV* equations, there is an extraordinary substitute for a missing linear structure: the set of solutions is an orbit of an infinite-dimensional Lie group, and this symmetry makes a description of the set of solutions possible. The book contains a discussion of these equations from many complementary point of views (symmetries of *KdV* equations, Lax form of equations, integrable systems, Hirota equations and vertex operators, bosonic and fermionic Fock spaces, the Boson-Fermion correspondence, transformation groups of equations and tau function, infinite-dimensional Grassmannians, Young diagrams and characters, Hirota equation as Plücker relations). The treatment is based on ideas of M. Sato, developed by M. Kashiwara and the authors.

The book has the pleasant spirit of informal lectures on the subject, but basic facts are proved. Reading of the book requires only a basic background and there are a lot of examples illustrating the theory. The authors succeed in explaining the essentials in just 100 pages, and this charming book can be recommended to anybody interested in the modern development in the mathematics arising from mathematical physics. (vs)

K. Peeva, H.-J. Vogel, R. Lozanov and P. Peeva, *Elsevier's Dictionary of Mathematics,* *Elsevier, Amsterdam, 2000, 997 pp., US$209.50, ISBN 0-444-82953-9*

This is a useful guide for readers, writers and translators and all specialists exploring the multilingual scientific terminology in English, German, French and Russian. The dictionary contains nearly 12000 entries with almost 5000 cross-references. The terminology covers arithmetic, algebra, geometry, set theory, discrete mathematics, logic, linear algebra, calculus, differential equations, vector algebra, field theory, probability and statistics, optimisation, numerical methods, mathematical programming, modern algebra, computer algebra, category theory, applied mathematics, the theory of automata and formal languages, the theory of games and commonly used entries in computer architecture. (in)

G. M. Phillips, *Two Millenia of Mathematics. From Archimedes to Gauss,* *CMS Books in Mathematics* ***6****, Springer, New York, 2000, 223 pp., US$49.95, ISBN 0-387-95022-2*

This book is an extended collection of interesting mathematical topics from number theory and analysis – such as Archimedes and π, the discovery of exponential and logarithmic functions, Napier and Briggs's logarithms, Newton's interpolation polynomial, finite and other differences, the Euclidean algorithm, Fibonacci numbers, prime numbers, Gauss's congruences, and Diophantine equations) – ranging over two millennia. It does not pretend to be a comprehensive history of mathematics of this period.

In five chapters (From Archimedes to Gauss, Logarithms, Interpolation, Continued fractions, More number theory), the author shows that many interesting and important results in mathematics have been discovered by ordinary people and not only by great geniuses. Each chapter includes the history of its topic with an interpretation of the mathematical problems. The book shows how and why some results in mathematics have been discovered or obtained, by following in the steps of well-known mathematicians who discovered them. It is a useful source of mathematical material for teachers, undergraduate students, students and the vast numbers of amateurs who love mathematics. (mnem)

L. Polterovich, *The Geometry of the Group of Symplectic Diffeomorphisms,* *Lectures in Mathematics, Birkhäuser, Basel, 2001, 132 pp., DM 44, ISBN 3-7643-6432-7*

The main topic of the book is a discussion of a role of the group $Ham(M, \Omega)$ of Hamiltonian diffeomorphisms of a symplectic manifold (M, Ω) in geometry and classical mechanics. Under suitable assumptions on M, the group $Ham(M, \Omega)$ is the connected component of the identity of the group of all symplectic diffeomorphisms. In mechanics it is just the group of admissible motions. A basic question related to elements $f \in Ham(M, \Omega)$ is how to evaluate the minimal amount of energy required to generate the given diffeomorphism f. The answer can be obtained using a distance defined on the group $Ham(M, \Omega)$ by means of the canonical biinvariant metric on $Ham(M, \Omega)$ which is a solution of a certain natural variational problem on (M, Ω). The theory is based on geometrical properties of the group $Ham(M, \Omega)$, developed first by Hofer in 1990. In recent years these questions have been intensively studied in the framework of symplectic topology, using the Gromov theory of pseudo-holomorphic curves, Floer homology and the theory of symplectic connections.

The book is a good introduction to the topic and offers a description of recent developments in Hofer geometry and its applications in dynamics and ergodic theory. It can be recommended for mathematicians and physicists interested in problems related to symplectic geometry and mechanics. (jbu)

S. Rigot, ***Ensembles quasi-minimaux avec contrainte de volume et rectifiabilité uniforme,*** *Mémoires de la Société Mathématique de France* ***82****, Société Mathématique de France, Paris, 2000, 104 pp.,FRF 150, ISBN 2-85629-086-0*
In this volume, interesting results are achieved concerning a useful generalisation of the classical isoperimetric problems. In particular, the regularity of quasi-minimising sets for a variational problem related to isoperimetric inequality is investigated.

The object of study is a measurable set G satisfying

$\int |grad\ \chi_G| \le \int |grad\ \chi_H| + g(|G \Delta H|)$,

for each measurable test set H with relatively compact symmetric difference $G \Delta H$ and $|H|$ finite and equal to $|G|$ (integration over the whole of $\mathbf{R}^n$). Here g: $(0, \infty) \to (0, \infty)$ is fixed so that $g(t) = o(t^{(n-1)/n})$ as $t \to 0$. It is shown that a suitable representative of the set G has the Ahlfors regular boundary, and that the numbers of connected components of G and $\mathbf{R}^n \backslash G$ are estimated by an universal constant. Moreover, when $g(t)$ is of the form Ct^p, then $C^{1,\alpha}$-partial regularity of the boundary is obtained, and for $n \le 7$, full $C^{1,\alpha}$ regularity follows. In the final chapter, the above results are applied to the (physically motivated) problem of the minimisation of

$E(G) = H^{n-1}(\partial G) + \int_{G \times G} K(x-y)\, dx\, dy$,

where H^{n-1} is Hausdorff measure and K is an integrable kernel with compact support. (jama)

A. Rubinov, ***Abstract Convexity and Global Optimization***, *Nonconvex Optimization and its Applications* ***44****, Kluwer Academic Publishers, Dordrecht, 2000, 490 pp., £135, ISBN 0-7923-6323-X*
The contents of this book can be divided into two parts. The first part presents the notion of abstract convexity and the basic and advanced theorems relating to this topic. These results are then applied to the study of some classes of functions and sets. This approach includes elements of monotonic analysis and elements of star-shaped analysis, as well as a study of quasi-convex functions. The results of the first part are then used in the study of global optimisation, which is the subject of the second part of the book. The classical notions of Lagrange and penalty functions are presented and extended. New methods of global optimisation based mainly on solvability results for inequality systems and optimisation of the difference of abstract convex functions are then developed. The final chapter is devoted to the numerical aspects of global optimisation.

The book is recommended to specialists in global optimisation, mathematical programming and convex analysis, as well as to engineers and specialists in mathematical modelling. (jvy)

D. G. Saari, ***Chaotic Elections! A Mathematician Looks at Voting****, American Mathematical Society, Providence, 2001, 159 pp., US$23, ISBN 0-8218-2847-9*
Two events motivated the author to write this book: the 2000 U.S. Presidential election and the election debate about its outcome in Florida, and the final resolution, in some of the author's recent papers, of a 200-year-old mathematical problem concerning the source and explanation of the paradoxes and problems of voting procedures. The purpose of the book is to explain what can go wrong in elections, and why.

The book is divided into six chapters. Chapter 1 has an introductory character, and contains a critical analysis of the voting procedure employed in the 2000 U.S. Presidential election; in this chapter Arrow's Impossibility Theorem is presented. In Chapter 2, the author explains the importance of the choice of election procedure. Although little interest is usually devoted to this problem, the choice of election procedure can substantially influence the outcome of the elections. This is demonstrated on examples both from the recent past (U.S. Presidential elections in the 1990s) and from earlier (such as the 1860 election in which Lincoln won the Presidency with a majority vote in the Electoral College). Some general results concerning chaotic election outcomes and their consequences are presented in Chapter 3, while Chapter 4 analyses the so-called strategic behaviour of voters. This behaviour means that the voters do not vote 'sincerely' according to their real preferences, but try by a different choice to achieve a better total election result indirectly from their subjective point of view. In Chapter 5, the author discusses a provoking question concerning the conditions under which the outcome of an election with a chosen voting procedure reflects the real will and preferences of the voters. The final chapter generalises some experience from the analysis of elections and investigates a more general concept of aggregation, which is involved both with various election procedures, and also in other areas far beyond voting, such as the choice of power indices, non-parametric statistics and various probability assertions.

The book is not a research monograph; its reading requires little more than high-school mathematics, since the author wanted to inform practitioners involved with designing practical voting or aggregation rules (political, economic or technical) what may happen whenever any group makes a choice under given rules. (kzim)

A. Semmes, ***Some Novel Types of Fractal Geometry,*** *Oxford Mathematical Monographs, Clarendon Press, Oxford, 2001, 164 pp., £49.95, ISBN 0-19-850806-9*
Let (M, d) be a metric space with a doubling measure μ. If A is a subset of M and f: $A \to \mathbf{R}$ is a function, then the quantity $D\varepsilon\, f(x) = \varepsilon^{-1} \sup\{|f(y) - f(x)| : y \in A,\ d(x, y) \le \varepsilon\}$ with a small $\varepsilon > 0$ measures oscillation of f near the point x, just as the ordinary gradient does in the classical Euclidean setting. A 'decent calculus' is possible on a space, if one can estimate large-scale quantities by integrating microscopic measurement oscillations.

One exact statement of this type consists of inequalities of Poincaré type. The validity of Poincaré inequalities is a property of the space (M,μ), which holds if there exist positive constants C and k such that

$\int_B |f(x) - a|\, d\mu(x) \le Cr \int_{kB} D\varepsilon\ f(x)\, d\mu(x)$,

for any ball $B = B(x, r)$, any function f defined on kB (with mean value a over B) and any positive $\varepsilon < r$. There are many recent treatments that consider the Poincaré inequalities as a starting axiom. It is then important to understand in which situations this postulate may hold. As fractal-like structures, Ahlfors regular spaces of dimension s are considered: these are spaces on which the s-dimensional Hausdorff measure can be taken as the reference measure μ. Among them BPI spaces are studied as an appropriate generalisation of self-similarity. An important class of spaces is based on Laakso's construction, where the key step consists in taking the product of an Ahlfors regular space of dimension s–1 with the line interval. Another source of spaces comes from geometric structures such as Heisenberg groups (or, more generally, Carnot spaces). Besides the validity of Poincaré's inequalities, various other mapping properties are investigated, such as measure-mapping properties, rigidity of the structure under mappings, and continuous families of mappings. Tangential properties of Lipschitz and regular mappings are also studied, including rectifiability and its generalisations.

This book provides a thorough discussion on the current state and perspectives of the topic. The visionary aspect is emphasised. There are many questions and conjectures in the text, but fewer theorems. Proofs, where included, are rather indicated than elaborated in detail. This volume is a great source of inspiration and a guide for students and researchers looking for new areas to study. (jama)

R. Siegmund-Schultze, ***Rockefeller and the Internationalization of Mathematics Between the Two World Wars,*** *Science Networks/Historical Studies* ***25****, Birkhäuser, Basel, 2001, 341 pp., DM 170, ISBN 4-7643-6468-8*
This book is the first detailed study of the brief but very influential role played by the Rockefeller family in the field of mathematics. It is based on extensive research by the Rockefeller Archive Center in the archives of Harvard University and the Universities of New Hampshire, Göttingen and New York City.

In the first chapter the author comments on the process of internationalisation and modernisation of mathematics and the conditions for international scientific collaboration between the First World War and the Nazi dictatorship after 1933. The second chapter describes the beginning of the International Education Board, a central role of the Fellowship Program in the careers of the modern generation of mathematicians (S. Banach, A. Weil, B. L. van der Waerden, etc.) and the support of the Rockefeller Foundation for new mathematical publications and for the foundation of new mathematical journals. The third chapter analyses the comparative developments of mathematics in Europe and USA in the 1920s and 1930s. The fourth chapter explains the practice of the Fellowship Programs of the International Education Board between 1923 and 1928 and of the Rockefeller Foundation after 1928. Here the reader can find the criteria for selections of Fellows, the Fellowship programs, some

Fellowship lists, etc. The rise of Soviet (Russian) mathematics and problems of its collaboration with the Rockefeller Foundation and its political self-isolation are commented on. The fifth chapter shows the role of Rockefeller's help in the foundation of new scientific institutes, mainly in Europe. It includes the foundation of the new Mathematical Institute in Göttingen, the Institute of Henri Poincaré in Paris, the Mathematical Institute in Djursholm in Sweden and the School of Mathematics of the Institute for Advanced Study in Princeton, and their role in promoting cooperation in science. The sixth chapter shows the changes of programmes of the Rockefeller Foundation after 1933 and during the first years of the Second World War. The seventh chapter gives a very short review of Rockefeller support for mathematics between 1945 and 1950.

The book concludes with seventeen appendices. The first fourteen are letters and reports of distinguished mathematicians, workers or clerks of the Rockefeller Foundation, illustrating Rockefeller's contribution to science, and mathematics in particular. The next three appendices contain lists of Fellows in mathematics up to 1945, Guggenheim Fellows in mathematics up to 1945 and mathematicians from Europe who were supported by the Rockefeller Foundation Emergency Fund. This book can be recommended to everybody who wants to know more about the birth of modern and international mathematics during the first half of the 20th century. (mnem)

K. A. Sikorski, *Optimal Solution of Nonlinear Equations,* *Oxford University Press, Oxford, 2001, 238 pp., £39.50, ISBN 0-19-510690-3*
The aim of this book is to review the state of the art in methods for optimal (or nearly optimal) solution of non-linear problems. In particular, the following problems are considered: finding roots of non-linear equations, approximation of fixed points (of both contractive and non-contractive functions) and computation of the topological degree. The methods are required to be 'robust', and guarantee that the computed and exact solutions differ by a prescribed tolerance for a specified class of problems. The notion of optimality is developed by means of information-based complexity theory, which creates the least overhead for the particular method.

This book is self-contained. Each chapter is provided with exercises and detailed annotations that encourage further reading. The prospective audience of the book ranges from researches in computational complexity to practitioners in numerical computation. For the latter group, the book represents an alternative view to the classical local convergence analysis of non-linear iterative techniques. (vj)

S. M. Stigler, *Statistics on the Table. The History of Statistical Concepts and Methods,* *Harvard University Press, London, 1999, 488 pp., £30.95, ISBN 0-674-83601-4*
This book is a collection of twenty-two essays, divided into five parts: Statistics and social science, Galtonian ideas, Some seventeenth-century explorers, Questions of discovery, and Questions of standards. The author is well known for his papers dealing with the history of statistics; these papers were published in prominent journals and now serve as basic material for most of the essays. The title of the book is borrowed from a letter of Karl Pearson: *I am too familiar with the manner in which actual data are met with the suggestion that other data, if they were collected, might show something else to believe it to have any value as an argument. "Statistics on the table, please," can be my sole reply.*

To give a flavour of the essays, I quote a few sentences from the chapter Stigler's Law of Eponymy: *For "Stigler's Law of Eponymy" in its simplest form is this: "No scientific discovery is named after its original discoverer." ... Thus in the field of mathematical statistics it can be found that Laplace employed Fourier Transforms in print before Fourier published on the topic, that Lagrange presented Laplace Transforms before Laplace began his scientific career, that Poisson published the Cauchy distribution in 1824, ... and that Bienaym, stated and proved the Chebychev Inequality a decade before and in greater generality than Chebychev's first work on the topic.* One might also expect that 'Gaussian distributions' were known before 1809 when Gauss associated it with the least squares method. In fact, Gauss himself cites Laplace who dealt with this distribution in 1774; moreover, both Gauss and Laplace knew a 1733 publication by A. de Moivre, which is now considered as the origin of the 'Gaussian' (or 'normal') distribution. By the way, the title of the next essay is 'Who discovered Bayes's Theorem?'

All the essays are very interesting, and some of them should be a compulsory part of the general education of every statistician – in particular, the chapters devoted to the history of the maximum likelihood method and the invention of the least squares method. This book can be warmly recommended to anyone interested in probability and statistics and in their history. (ja)

O. Stormark, *Lie's Structural Approach to PDE Systems,* *Encyclopaedia of Mathematics and its Applications **80**, Cambridge University Press, Cambridge, 2000, 572 pp., £70, ISBN 0-521-78088-8*
This monograph is a comprehensive introduction to geometric methods for the study of systems of partial differential equations. The results presented here concern local solutions of systems. The geometric approach is based on ideas developed by Sophus Lie, Elie Cartan and Ernest Vessiot. Any system of PDEs can be considered as a submanifold in the corresponding jet bundle, which is equipped with a canonical contact pfaffian system or dually with a canonical system of vector fields. The problem of solving the system is transported into the problem of finding integral manifolds of the pfaffian or vector field system.

In the book, the duality between these concepts is described, and the Frobenius and Cartan local existence theorems are proved. The notions of involutivity and prolongations of a given system of PDEs are introduced and the results obtained are applied to special first- and second- order PDEs. Another object related to a system of PDEs on M is the contact transformation, a local diffeomorphism of M that preserves the system. The family of all contact transformations form a (Lie)-pseudogroup of local diffeomorphisms of M. For the special first-order PDE system there is a special Lie pseudogroup,called a local Lie group, whose structure plays an interesting role in the study of solutions of the system. The Cartan theory of Lie pseudogroups is also explained, together with the equivalence problem. Using the Drach classification, an arbitrary PDE system can be reduced to a first- or second-order in one unknown, and both cases are studied in detail here. Many special and interesting examples of PDEs are discussed, and their solutions are described at the end of the book. This book is a good source for anybody interested in PDEs, differential geometry, Lie group theory and related fields. (jbu)

Tian-Xiao He, *Dimensionality Reducing Expansion of Multivariate Integration*, *Birkhäuser, Boston, 2001, 225 pp., DM 156, ISBN 0-8176-4170-X and 3-7643-4170-X*
This book discusses a technique for numerical integration by using dimensionality-reducing expansions (DRE) to reduce a higher-dimensional integral to lower-dimensional integrals, with or without a remainder. Some important and common aplications of DRE include the construction of boundary-type quadrature formulas (BTQF) and asymptotic formulas for oscillatory integrals.

The book is organised as follows. Chapters 1 and 2 discuss the construction of DREs and BTQFs with various degrees of algebraic precision. In Chapters 3 and 4, the author uses DREs to approximate oscillatory integrals, and establishes their corresponding numerical quadrature formulas. Chapter 5 demonstrates how to construct DREs over a complex region, by using the Schwarz function and the Bergman kernel. The final chapter examines how the solutions of certain differential equations can be used to construct exact DREs, and how, conversely, some DREs can be utilised to derive a scheme of the boundary element method, used for evaluating the numerical solution of a boundary-value problem of a partial differential equation.

This book will be a useful guide for a wide range of readers in pure and applied mathematics, statistics and physics, and can also be used as a textbook for graduate and advanced undergraduate students. (knaj)

J. L. Walker, *Codes and Curves,* *Student Mathematical Library **7**, American Mathematical Society, Providence, 2000, 66 pp., US$15, ISBN 0-8218-2628-X*
This booklet arose from a series of lectures held at the Institute for Advanced Study in Princeton. It consists of seven chapters and three appendices, written in a clear and 'conversational' style and oriented towards a general audience. The reader obtains an introduction to classical coding theory, particularly its algebraic geometric branch.

The first two chapters include the basic notions and results of coding theory: Hamming's distance and weight, dimension, etc.; all introduced notions are illustrated using basic types of codes as error detecting or correcting, linear, cyclic, Reed-Solomon or ISBN. The illustrations are carefully selected and are naturally embedded into the exposition. There follow basic results on the dimension and on absolute and asymptotic bounds (Plotkin or Gilbert-Varshanov) on the maximum number of codewords. In the introductory geometric part, the reader learns the basics of algebraic curves (Chapter 3), their singularities and genus (Chapter 4) and functions and divisor theory on curves (Chapter 5); these are necessary for the last two chapters, which are devoted to the description of Goppa's construction of algebraic geometry codes (Chapter 6) and the Tsfasman, Vladut and Zink bound for asymptotically good codes (Chapter 7). Appendices review basic algebraic notions, such as groups, rings, ideals and finite fields, and collect some important topics in coding theory that are not covered in the text.

As already mentioned, the book is written in a lucid style. It contains worthwhile exercises scattered through the text, and can be warmly recommended to all interested to learn about the basics of classical coding theory. (šp)

Jianhong Wu, *Introduction to Neural Dynamics and Signal Transmissions Delay*, *De Gruyter Series in Nonlinear Analysis and Applications* ***6****, Walter de Gruyter, Berlin, 2001, 182 pp., DM 99, ISBN 3-11-016988-6*

This book is a textbook for graduate and senior undergraduate students. The mathematics used is 'elementary', in the sense that it requires only basic knowledge of the theory of matrices and of ODEs. It is not fully self-contained, as it also makes use of theorems from literature, quoted without proof.

The contents of the book are as follows. Chapter 1 outlines the basics of neuroscience – in particular, the structure of a single neuron and of a network of neurons, and the mechanism of neural signal transmission. Chapter 2 introduces a general mathematical model describing the dynamics of neural networks. In Chapter 3, models of simple networks that can perform some elementary functions (storing, recalling and pattern recognition) are analysed. Chapter 4 aims at a global analysis of neural networks from the viewpoint of the existence and stability of equilibria: two important approaches, via Liapunov functions and monotone dynamical systems, are developed. The final, and longest, chapter focuses on how the dynamics of a neural network is altered when allowing for time-delayed terms; the problems addressed here include delay-independent stability, delay-induced periodic/chaotic oscillations and delay-induced change of the domain of attraction. (dp)

M. Zinsmeister, *Thermodynamic Formalism amd Holomorphic Dynamical Systems*, *SMF/AMS Texts and Monographs* ***2****, American Mathematical Society, Providence, 1999, 82 pp., US$19, ISBN 0-8218-1948-8*

This book links two different parts of mathematics and physics: the formalism of statistical physics and the theory of holomorphic dynamical systems. It is intended for researchers from other fields, and is inspired by classical treatises on these subjects, such as D. Ruelle's book *Thermodynamic formalism: the mathematical structures of classical equilibrium statistical mechanics* (Addison-Wesley, 1978). The first four chapters of this book deal with the concepts of ergodicity, entropy (of a dynamical system) and the Perron-Frobenius theorem. Chapters 5 and 6 deal with conformal repellers and iteration of quadratic polynomials; in particular, the Hausdorff dimension of Julia sets of these mappings is disscused. Finally, Chapter 7 introduces the notion of a phase transition and applies some tools of this theory (in particular that of Legendre transform) to a further study of the above problems.

There are few texts on the relationships between statistical mechanics and the theory of iterated quadratic maps in a plane. This short book successfully helps to fill this gap. It is clearly written and gives an excellent introduction to the subject. (mzah)

D. Zwillinger and S. Kokoska, *Standard Probability and Statistic Tables and Formulae*, *Chapman & Hall/CRC, Boca Raton, 2000, 554 pp., ISBN 1-58488-059-7*

This book is in the form of a handbook, providing tables and comprehensive lists of defintions, concepts, theorems and formulae in probability and statistics. Its emphasis is on basic statistics, as taught in most statistical courses, but also covers many advanced topics from statistics and probability theory, such as non-parametric statistics, quality control, experimental design, Markov chains, martingales, resampling, queueing theory, self-similar processes and the elements of stochastic calculus. Almost every table is accompanied by a textual description and at least one example that uses a value from the table. Most concepts are illustrated with examples and step-by-step solutions. One section is devoted to 'classic and interesting problems', where the reader finds formulations and solutions of a number of well-known probability problems, such as Buffon's needle problem, Bertrand's box paradox, Simpson's paradox and the secretary problem. The book also contains information on electronic resources. (mah)

The 2002 Ferran Sunyer i Balaguer Prize

Ferran Sunyer i Balaguer (1912-1967) was a self-taught Catalan mathematician who, in spite of a serious physical disability, was very active in research in classical Mathematical Analysis, an area in which he acquired international recognition. Each year in honour of the memory of Ferran Sunyer i Balaguer, the Institut d'Estudis Catalans awards an international mathematical research prize bearing his name, open to all mathematicians. This prize was awarded for the first time in April 1993.

CONDITIONS OF THE 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.

§ 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 prize, amounting to 10,000 euros, is provided by the Ferran Sunyer i Balaguer Foundation. 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 submission of a monograph implies the acceptance of all of the above conditions.

§ The name of the prize-winner will be announced in Barcelona in April 2002.

SCIENTIFIC COMMITTEE

The winner of the prize will be proposed by a Scientific Committee consisting of:

§ H. Bass (University of Michigan)

§ A. Córdoba (Universidad Autónoma de Madrid)

§ W. Dicks (Universitat Autónoma de Barcelona)

§ P. Malliavin (Université de Paris VI)

§ A. Weinstein (University of California at Berkeley)

SUBMISSION OF THE MONOGRAPHS

Monographs should preferably be typeset in TEX. Authors should send a hard copy of the manuscript and two disks, one with the DVI file and one with the PS file (PostScript), and enclosing an accompanying letter to the Ferran Sunyer i Balaguer Foundation. Submissions should be sent before 1 December 2001 to the following address:

Centre de Recerca Matemàtica (IEC)
Fundació Ferran Sunyer i Balaguer
Apartat 50
E-08193 Bellaterra
e-mail: crm@crm.es

PREVIOUS WINNERS

§ Alexander Lubotzky (Hebrew University of Jerusalem), *Discrete groups, expanding graphs and invariant measures*, Progress in Mathematics 125.

§ Klaus Schmidt (University of Warwick), *Dynamical Systems of Algebraic Origin*, Progress in Mathematics 128.

§ V. Kumar Murty and M. Ram Murty (University of Toronto), *Non-vanishing of L-Functions and Applications*, Progress in Mathematics 157.

§ A. Böttcher and Y. I. Karlovich (TU Chemnitz-Zwickau) and (Ukrainian Academy of Sciences), *Carleson Curves, Muckenhoupt Weights, and Toeplitz Operators*, Progress in Mathematics 154.

§ Juan J. Morales-Ruiz (Universitat Politècnica de Catalunya), *Differential Galois Theory and Non-integrability of Hamiltonian Systems,* Progress in Mathematics 179.

§ Patrick Dehornoy (Université de Caen), *Braids and Self-Distributivity* , Progress in Mathematics 192.

§ Juan-Pablo Ortega and Tudor Ratiu (École Polytechnique Fedérale de Lausanne), *Hamiltonian Singular Reduction* (to be published).

§ Martin Golubitsky (University of Houston) and Ian Stewart (University of Warwick), *The Symmetry Perspective* (to be published).

For further information on the Ferran Sunyer i Balaguer Foundation, see
Web: http://www.crm.es/info/ffsb.htm

Citation Checker and Cross Reference Link Generator offered by *Zentralblatt MATH*

BERND WEGNER

For some time *Zentralblatt MATH* has offered the facility of exporting BIBTEX-files to users' machines, from the hit list obtained by retrieving information from the *Zentralblatt MATH* database. This has proved to be a useful tool for authors preparing lists of references for their articles. Responding to frequent demand, *Zentralblatt MATH* now provides an additional new service in order to enable convenient and quick checking of article literature references and provide persistent links to individual *Zentralblatt MATH* database items. This tool is freely available and will soon be extended to the *Jahrbuch* database.

The search menu for the citation checker is available under the URL: *http://www.emis.de/ZMATH/x-ref.html*

Users will be requested to enter information on the citation item in four fields: last name of (first) author, significant word in the title, volume number, first page. In nearly all cases this is sufficient to pinpoint the single item looked for – in particular, when all four fields are used. In the rather unlikely case that more than three items match the search criteria, the three most recent items are displayed. If the requested item does not belong to them, then the standard retrieval forms for *Zentralblatt MATH* may provide further help for those with a subscription to this service.

The search result offers precise standardised bibliographic data to be exported by users into their own referencing systems. The addition of the *Zentralblatt MATH* annotation number will add a unique identifier for the article, which will be suitable as a persistent link to the electronic offer of this publication and may serve as a tool for reference linking to a wider range than that provided by DOI, for example.

Société Française de Statistique
French Statistical Society
34th Journées de Statistique
May 13-17, 2002

The *34th Journées de Statistique* of the Société Française de Statistique will be held in Brussels and Louvain-la-Neuve in Belgium. This event is jointly organized by the Institutes of Statistics of the Université libre de Bruxelles and of the Université catholique de Louvain.

The main topics include statistical analysis of functional data, actuarial and financial econometrics, resampling methods, nonparametric inference and modelling, voice and writing recognition, epidemics, genomics as well as mathematical statistics. In addition to these main topics, a number of invited sessions will focus on various subjects.

The conference is open to all persons interested in statistics, affiliated to universities, national institutes of statistics, business or industry.

For further information, please consult :
JSBL 2002
Institute of Statistics, Université catholique de Louvain
20 Voie du Roman Pays, B-1348 Louvain-la-Neuve, Belgium
Telephone : +32 10 47 43 54 -Fax : +32 10 47 30 32

ULB

UNIVERSITE LIBRE DE BRUXELLES

OUVERTURE D'UN POSTE EN GEOMETRIE COMBINATOIRE

Moyennant l'accord des autorités, l'Université Libre de Bruxelles devrait annoncer prochainement l'ouverture d'un poste au Département de Mathématiques dans le domaine de la géométrie combinatoire.

L'engagement est prévu au 1er octobre 2002 au titre de chargé de cours, soit le premier échelon dans la carrière des professeurs d'université en Belgique.

Les candidats sont invités à prendre contact dès maintenant avec l'un des signataires, de préférence par e-mail et en joignant leur curriculum vitae.

Après une première sélection, certains candidats seront invités au début de l'année 2002 à présenter un exposé et à se prêter à une interview à l'Université Libre de Bruxelles.

Pour plus de renseignements ou pour annoncer votre candidature, veuillez contacter :

Jean-Paul Doignon	ou	Jean Doyen
doignon@ulb.ac.be		jdoyen@ulb.ac.be
+32.2.650.58.63		+32.2.650.58.72

Université Libre de Bruxelles,
Faculté des Sciences,
Département de Mathématiques,
Campus Plaine c.p. 216,
Bd du Triomphe,
B-1050 Bruxelles, Belgique.