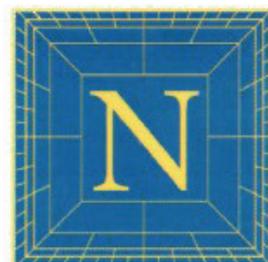


# European Mathematical Society



June 2001

Issue 40

## *Editorial*

David Salinger



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## *The Methodology of Mathematics*

Ronald Brown  
& Timothy Porter



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## *Interviews*

Björn Engquist  
& Manuel Valdivia



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# NEWSLETTER

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**EUROPEAN MATHEMATICAL SOCIETY****NEWSLETTER No. 40****June 2001**

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*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 August 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

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**EMS Agenda****2001****19-21 June**

EMS lectures at the University of Heraklion, Crete (Greece)

*Lecturer: Prof. George Papanicolaou (Stanford, USA)*

*Title: Time Reversed Acoustics*

*Contact: David Brannan, e-mail: d.a.brannan@open.ac.uk*

**9-25 July**

EMS Summer School at St Petersburg (Russia)

*Title: Asymptotic combinatorics with applications to mathematical physics*

*Organiser: Anatoly Vershik, e-mail: vershik@pdmi.ras.ru*

**15 August**

Deadline for proposals for 2003, 2004 and 2005 EMS Summer Schools

*Contact: Renzo Piccinini, e-mail: renzo@matapp.unimib.it*

Deadline for submission of material for the September issue of the *EMS Newsletter*

*Contact: Robin Wilson, e-mail: r.j.wilson@open.ac.uk*

**19-31 August**

EMS Summer School at Prague (Czech Republic)

*Title: Simulation of fluid and structure interaction*

*Organiser: Miloslav Feistauer, e-mail: feist@ms.mff.cuni.cz*

**24-30 August**

EMS lectures in Malta, as part of the *10th International Meeting of European Women in Mathematics*

*Lecturer: Michèle Vergne (Ecole Polytechnique, Palaiseau, France)*

*Title: Convex polytopes*

*Contact: Dr. Tsou Sheung Tsun, e-mail: tsou@maths.ox.ac.uk*

**1-2 September**

EMS Executive Committee meeting, Berlin (Germany)

**3-6 September**

1st EMS-SIAM conference, Berlin (Germany)

*Organiser: Peter Deuffhard, e-mail: deuffhard@zib.de*

**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)*

*Contact: Jean-Pierre Bourgignon, e-mail: jpb@ihes.fr*

**2002****9-10 February**

Executive Committee Meeting in Brussels, at the invitation of the Belgian Mathematical Society and the Université Libre de Bruxelles

**24 February-1 March**

EMS Summer School in Eilat (Israel)

*Title: Algebraic Geometry, Computations 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**

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 (*4ecm*), Stockholm (Sweden)

# Editorial

David Salinger

## *The Bologna Declaration: a Bachelor's degree for all*

On 19 June 1999, 29 European Education Ministers signed a document that has become known as the *Bologna Declaration*.

### *What did they sign up to?*

The Declaration envisages the creation of a 'European Higher Education Zone', in order to improve the employability and mobility of European citizens and to increase the international competitiveness of Higher Education in Europe. This is to be achieved by:

- the adoption of a common framework for comparable degrees, and the prescribing of a transcript known as the 'Diploma Supplement';
- a measure of standardisation of degree lengths: a first degree should be no shorter than 3 years and 'relevant to the European labour market as an appropriate qualification';
- this first degree should be the passport to any higher degree (Masters or Doctorate), which would last from two to five years;
- a credit system, such as European Credit Transfer System (ECTS), also covering lifelong learning;
- a European dimension in quality assurance;
- the elimination of any remaining obstacles to the mobility of students and teachers.

The countries involved should introduce the necessary changes by 2010.

Many of the signatories have now brought forward proposals to bring their systems of Higher Education in line with the Declaration. In several countries where the first degree has usually taken more than four years to complete (for example, in Germany, Spain, the Netherlands and Denmark), this could mean a drastic change. However, Germany has taken the unusual step of



introducing the new system while continuing with the old pattern, and several countries have essentially repackaged the old system as a 'Bachelor + Master' degree.

The majority view seems to be that a Bachelor degree should normally take 3 years (or 180 ECTS credits); however, there is allowance for Bachelor degrees taking 4 years (or 240 credits), as is the case in Scotland and Ireland: it is possible that the 4-year course known as the MMath in England and Wales would also come into this category.

### *What are the implications for mathematics degrees?*

Certainly, less can be done in a shorter time-frame. If this is coupled with the requirement to make degrees more relevant to the labour market, a very bleak picture could be painted: a downgraded first degree, in which applications are taught without their theoretical underpinnings; comparatively few students continuing to higher degrees; a decrease in mathematics positions in universities.

To my mind this is one (but only one)

possible outcome of a reform that has been imposed from above without consultation with the academic disciplines. Indeed, the picture could be even bleaker: the ominous phrase 'a European dimension to quality assurance' conjures up a vision of philistine bureaucratic control, and maybe the imposition of a common curriculum.

To be fair, the Bologna Declaration declares specifically that it is aiming for convergence, not uniformity, and the evidence so far is that each country is interpreting the Declaration in its own way. One of the strengths of European Higher Education is its diversity and its ability to generate and inspire outstanding teachers, students and researchers. It would be foolish to throw that away.

Without falling into the trap of imposing its own uniformity, the European Mathematical Society would like to know whether sufficient consensus exists within the Society to draw up a position paper on the basis of which to try to influence the way things develop.

Obvious questions are:

- 3 or 4 years for a Bachelor degree?
- is a degree in mathematics already sufficiently 'relevant to the labour market'?
- should there be an informal common idea of what is done in the first year, or two, of a mathematics degree?

I hope that you think this issue is sufficiently important to contribute to a debate in the *EMS Newsletter*, in your National Society, or within the EMS itself.

The text of the Bologna Declaration is available at [www.qaa.ac.uk/crntwork/nqff/bmb/bologna%2Dtextonly.htm](http://www.qaa.ac.uk/crntwork/nqff/bmb/bologna%2Dtextonly.htm) and a report on progress in implementing the Declaration may be found at [www.oph.fi/publications/trends2](http://www.oph.fi/publications/trends2)

*David Salinger teaches in the School of Mathematics, University of Leeds, UK, and is the Publicity Officer of the EMS.*

## Canadian Mathematical Society

A reciprocity agreement has been signed between EMS and the Canadian Mathematical Society (Société mathématique du Canada). This continues a growing list of such reciprocal agreements, which already includes the American Mathematical Society and the Australian Mathematical Society.

## JEMS

(Journal  
of the  
European Mathematical Society)

The latest issue of *JEMS* (Vol. 3, No. 2) contains:

N. Gamara, *The CR Yamabe conjecture: the case  $n = 1$*

G. Bouchitté and G. Buttazzo, *Characterization of the optimal shapes and masses through Monge-Kantorovich equation*

T. Fisher, *Some examples of 5 and 7 descent for elliptic curves over  $\mathbb{Q}$*

## CALL FOR PROPOSALS: SUMMER SCHOOLS

The European Mathematical Society intends to make an application to the European Union with the aim of financing nine Summer Schools for the years 2003, 2004 and 2005. The topics must be of interest to a relatively large audience of young Ph.D. students in Pure and Applied Mathematics. Please send your proposal to the Chairman of the EMS Summer School Committee: Prof. Renzo Piccinini, Dipartimento di Matematica e Applicazioni, Università di Milano-Bicocca, Via Bicocca degli Arcimboldi, 8, 20126 Milano, ITALY

Deadline for submitting proposals: 15 August 2001.

For more information, please contact the EMS office (c/o Tuulikki Makelainen, at [makelain@cc.helsinki.fi](mailto:makelain@cc.helsinki.fi)).

# Applied Mathematics in our Changing World



September 2-6, 2001 Berlin, Germany

First SIAM-EMS Conference

ORGANIZED BY: EMS, SIAM and ZIB

CHAIRS: R. Jeltsch, G. Strang and P. Deuffhard

INTERNET: <http://www.zib.de/amcw01> E-MAIL: [amcw01@zib.de](mailto:amcw01@zib.de)



It is a pleasure to write about the cooperation between SIAM and the European Mathematical Society. A special (and very substantial) joint conference comes this year to Berlin: September 2-6 at the ZIB Institute (Konrad-Zuse-Zentrum). The list of invited speakers – on a really wide range of applied mathematics – is really impressive.

May I ask you to look at [www.zib.de/amcw01](http://www.zib.de/amcw01) for the details of the conference. The date for submission of abstracts and posters (30 June) is still ahead. The title of the conference is also the title of this note to you – this is not a conference to miss.

Just a word about the genesis of the conference. I very much want SIAM to help applied mathematicians world-wide. It is not an American society (the 'A' in SIAM is for Applied!) and nearly 40% of our members live and work outside the US. I think an important feature is its non-exclusiveness, mathematically and in every way. Activity Groups were recently established in Computational Science and Engineering, Mathematics of the Life Sciences, and Imaging Science. The whole society welcomed our efforts to serve our members and all of applied mathematics in Europe, and this Berlin conference is a major step.

The conference began from conversations with Peter Deuffhard, who offered the excellent facilities of ZIB in Berlin. Peter has chaired the whole effort admirably. Rolf Jeltsch picked up the idea and proposed a joint conference with the EMS – brilliant! Our scientific committee and all our plans have been the result of excellent collaboration, and we all want to continue.

This is something good for our subject and also for our own research. I am very happy to have the chance to write about it, and to attend it!

*Gilbert Strang [gs@math.mit.edu] is Professor of Mathematics at MIT*

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 Heinz Engl, Linz, Austria  
 Björn Engquist, Stockholm, Sweden  
 David Levermore, Maryland, USA  
 Volker Mehrmann, Berlin  
 Bill Morton, Oxford, UK  
 Stefan Müller, Leipzig, Germany

## INVITED PLENARY SPEAKERS

*Medicine:* Alfio Quarteroni, I / CH  
*Biotechnology:* Michael Waterman, USA  
*Materials Science:* Jon Chapman, UK  
*Environmental Science:* Andrew Majda, USA  
*Nanoscale Technology:* Michael Griebel, D  
*Communication:* Martin Grötschel, D  
*Traffic:* Kai Nagel, CH  
*Market and Finance:* Benoit Mandelbrot, USA  
*Speech / Image Recognition:* Pietro Perona, USA  
*Engineering Design:* Thomas Y. Hou, USA

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 Konrad-Zuse-Zentrum Berlin (ZIB)  
 Takustr. 7  
 D-14195 Berlin-Dahlem  
 Germany

INTERNET: <http://www.zib.de/amcw01>  
 E-MAIL: [amcw01@zib.de](mailto:amcw01@zib.de)

## DEADLINES

June 30 Deadline for submission of abstracts and posters  
 July 30 Programme and collected abstracts

## REGISTRATION FEES

SIAM / EMS Members	Non-Members
<i>Early Registration (prior to 04/01/01)</i>	
US\$150,—	US\$200,—
DM300,—	DM400,—
EUR150,—	EUR200,—
<i>Full Registration (after 03/31/01)</i>	
US\$210,—	US\$260,—
DM420,—	DM520,—
EUR210,—	EUR260,—

Meals and accommodation expenses are not covered.



*Peter Deuffhard*

*There will be invited talks, minisymposia, contributed talks and posters. Please consult our website for registration, accommodation information and submission guidelines. The conference office prefers on-line registration and on-line submission of abstracts.*

## TOPICS

### 1. Medicine

medical imaging methods;  
 computational assistance of surgery,  
 therapy planning;  
 hospital information systems;  
 pharmacokinetics, tumor growth modeling;  
 artificial organs, immune system modeling;  
 infectious disease control,  
 epidemic spreading;  
 physiology (e.g. dynamics of cardiovascular or of respiratory system).

### 2. Biotechnology

biomolecular structural storage schemes,  
 patent recognition and circumvention;  
 conformational molecular dynamics, drug design, cell factory;  
 mathematical modelling in biopolymerization;  
 sequence alignment, fuzzy reasoning;  
 density functional theory, ab-initio computation.



### 3. Materials science

realistic modelling and simulation of composite materials, magnetic material, polymers, glass, and paper; crack propagation and further failure mechanisms; phase transitions, crystal growth, superconductivity, and hysteresis; control of phase transitions and solidification, modelling of ironmaking process; coupling of atomistic and continuum models, quantum-classical approximation and calculation.

### 4. Environmental science

climate and climate impact research, stochastic climate modelling, intermediate complexity modelling; short and medium range meteorology and oceanography; pollution transport in air, water, and soil; atmospheric chemistry, ozone hole; computational hydrology.

### 5. Nanoscale technology

integrated optics, optical networks; quantum electronics and optics, general microwave technology; nanoscale techniques in medicine, porous materials.

### 6. Communication

telecommunication and optical networks: analysis, simulation, optimization; transmission rate optimization; survivable networks, network design; frequency assignment, channel allocation, load balancing.

### 7. Traffic

optimal periodic train scheduling, network planning; schedule synchronization; discrete and continuous traffic flow models; traffic on-line simulation and control, route guidance and planning; traffic assignment

### 8. Market and finance

financial mathematics and statistics; option pricing; derivative trading, risk management; economic time series.

### 9. Speech and image recognition

signal analysis; pattern recognition.

### 10. Engineering design

transport systems in air, in water, or on land; energy conversion, distribution and conservation; smart design of consumer products.

### MATHEMATICAL SUBJECTS

PDE analysis and modelling, complex coupled PDE systems, optimal control of PDEs and heterogeneous systems, variational principles, inverse problems, stability and bifurcation analysis, PDE computational finite element methods, spatial and temporal homogenization, spatial statistics, stochastic geometry, interacting particle systems, stochastic analysis,

multiscale analysis and algorithms, multigrid and domain decomposition, wavelets, turbulence modelling.

### *Applicants for financial support to attend the 1st EMS-SIAM Conference, Applied Mathematics in our Changing World*

EU will support the 1st EMS-SIAM conference with 44,000 euro to give grants to young researchers from EU and associated states. EMS is paying 3000 euro for those from Eastern Europe who do not belong to associated states. Please distribute this information as widely as possible.

Complete information on the conference is given on the website <http://www.zib.de/amcw01/> Here are the requirements a young researcher has to submit to be considered.

As mentioned in our website, we need the following requirements in order to process your application for financial support:

1. Short curriculum vitae
2. Letter/s of recommendation from Dean or department head
3. List of publications
4. Letter of application stating the reasons for attending the conference, with reference to study and research fields
5. Type and title of conference contribution, with an abstract not exceeding 75 words.

Applications will be reviewed by the Organising Committee. Funds may then be available from the German Scientific Foundation, from the European Commission and from the European Mathematical Society. However, full financial support cannot be guaranteed.

You can send the above requirements to the Conference Office: *fax*: +49 (30) 841 85-107.

**Deadline for submission is 30 June 2001.**

# Executive Committee meeting

Kaiserslautern (Germany), 10-11 March 2001

David Brannan

The agenda of the EC meeting had been e-mailed in advance to the chairs of the EMS committees, seeking their comments and input; this will be standard practice in future.

*Present:* Rolf Jeltsch (President, in the Chair), David Brannan, Bodil Branner, Doina Cioranescu, Luc Lemaire, Olli Martio, Renzo Piccinini, Marta Sanz-Sole and Mina Teicher; (by invitation) Carles Casacuberta, Tuulikki Makelainen and David Salinger; and (by invitation to a portion of the meeting) Ari Laptev and Bernd Wegner. Apologies were received from Victor Buchstaber and Robin Wilson.

The President thanked the *Institute for Industrial Mathematics* (ITWM = Institut für Techno- und Wirtschafts Mathematik) in Kaiserslautern for its hospitality.

## Officers' Reports

The *President* reported that he had recently sent letters to committee members whose terms of office had come to an end, to the *Newsletter* team, and to all EMS individual and corporate members. He had also been informed of a new publisher, European Science Publisher, with R. Stumpe and H. Schwer in charge. He and about 800 others had attended the GAMM Annual Meeting in Zürich on 12-15 February. The President had received an invitation to attend the Jürgen Moser memorial conference in Leipzig on 30 May-3 June.

The *Treasurer* reported briefly on the Society's financial statement for the year 2000. He noted that the variation in the income from dues is mostly due to fluctuations in the patterns in which the corporate members send the fees they have collected; that individual membership of the Society is slowly rising; that various institutions help out the EMS by subsidising the travel costs of attendance at EC meetings; that the annual cost to individual members of an EMS subscription is approximately equal to the annual cost of producing and mailing the four issues of the *Newsletter* to that member; and that income from advertising in the *Newsletter* had risen considerably. The year 2000 was the first year the Society had made a deficit, mostly due to costs related to the Council meeting and the Congress *3ecm* in Barcelona.

## Electronic Votes

Since the previous EC meeting in London, the following decisions had been taken by electronic voting: to approve the proposed Statutes for the European Mathematics Foundation [EMF]; and to add the Institut Henri Poincaré (IHP), Centre Emil Borel, and the Emmy Noether Research Institute for Mathematics to the membership of ERCOM.



Ari Laptev and Tuulikki Mäkeläinen

## Membership

Based on the editorial of Anatoly Vershik in the December 2000 issue of the *EMS Newsletter*, the committee discussed ways to improve cooperation with corporate members from Central and Eastern Europe. The EC also discussed ways to promote individual membership: it wished it to be made easy to join the EMS. It decided to ask its corporate member societies to give appropriate information on the EMS to their members, especially to young persons; to encourage their members to subscribe to both the national society and the EMS at the same time; to encourage member societies and individual members to pay the EMS dues of some young mathematicians; and to encourage member societies to mention that they are members of the EMS on their home pages and newsletters.

Although the EMS has a membership application form on the EMIS web site, the EMS prefers that individual members should join the EMS via their national mathematical society; this avoids any potential clash of interest with a national society, and avoids the need for the EMS to pay prohibitive bank charges. The Administrator pointed out that EMS members can now pay by credit card.

## Council Meeting in 2002

The Council meeting will be held on 1-2 June 2002 in Oslo, with the first session starting at 10 a.m. on 1 June 2002. An announcement would be made in the March 2001 *Newsletter*.

The Working Group formed to suggest changes needed to the Statutes (David Brannan, Olli Martio, Andrzej Pelczar and Mina Teicher) presented its draft, and several items were discussed. Among them: *Article 3.4* states that the expulsion of a member shall be by a decision of the Council; the item is formulated in more detail in By-Law I.6. The EC wished to

separate the way that corporate and individual members are expelled. For example, would it be possible to consider a non-paying individual member as having resigned? Two years' non-payment was suggested as being the maximum allowable. *Article 7.2* states that members of the Executive Committee shall be elected for a period of 4 years, but that consecutive service shall not exceed 8 years. This was discussed, together with the question of the period of service of a President, whether the Society should have a President Elect, and whether there should be slots on the EC for a President Elect and Past President. *Rules 15 and 16* in the By-Laws concerning the President were discussed. It was agreed that the rule that the President must be a delegate should be deleted. In *Rule 27*, it was agreed that the fee of a reciprocity member's individual membership should be 2y.

The composition of the next Executive Committee was discussed. It was thought that the President needs to be someone with considerable time and energy, the ability and funds to travel widely, the support of their own institution, and funds for various expenses; and that the President and Secretary should normally come from different countries.

## 4th European Congress of Mathematicians, 4ecm

The dates 27 June-2 July 2004 were fixed. The associated Council meeting will be held from Friday 25 June to Saturday 26 June.

It was agreed to draft a Letter of Understanding between the EMS and the *4ecm* organisers. The EC was assured of the safe financing of the Congress, and a draft budget would be prepared for the Berlin EMS EC meeting.

The EMS EC congratulated Ari Laptev for the financial contributions acquired, and for a very innovative outline programme. Selection of the speakers would take place in Spring or Autumn 2002, or Spring 2003; the early selection of plenary speakers was considered important; proposals will be asked for suggestions for speakers from corporate members. The *4ecm* organisers had suggested that some network meetings could be held in Stockholm in 2004, and that other groups should be able to be invited as mini-symposia. Having poster sessions was recommended to the organisers, because funding for attendance often requires participants to present a poster as a minimum requirement.

The composition of the Prize Committee for *4ecm* was discussed, and also rules for the operation, conduct and operational timing of the Prize Committee. It was recalled that the Felix Klein Prize is paid by the IUTWM Fraunhofer Institute and

has its own rules of conduct for its prize committee.

### The EU

There was a lengthy discussion of the EU's Sixth Framework Programme, which starts in 2003. (Further information about the Framework can be found on the website [http://www.cordis.lu/improving/call/acm\\_2000\\_02.htm](http://www.cordis.lu/improving/call/acm_2000_02.htm)). The EC felt that the present draft of the Sixth Framework Programme seemed to favour big projects over a long period of time, a scheme ill suited for mathematics. The EMS suggestion of 'return home fellowships' for Marie Curie Fellows was included in the present draft; also, there is a possibility of inviting Fellows from 'other countries', meaning apparently any country, which is what EMS had always asked for. The old 'Networks' and all forms of 'Euroconferences' appear to have vanished from funding opportunities.

The EC decided to send in the EMS comments again, and to try to influence a change in EU policy through the organisation 'Euroscience'. The Executive Committee thanked Luc Lemaire for the valuable work he had done for the EMS in this area.

The EMS is a scientific advisor to the extension of the EULER Project; more information on this can be found on the EMIS/EULER web site. The Reference Levels project would hold a final meeting on 11-12 May 2001 in Luxembourg. The EMS is also a partner in the LIMES project (Large Infrastructure in Mathematics - Enhanced Services), where FIZ is the main contractor; the EMS represents the users of *Zentralblatt*; the next meeting of the LIMES partners would be in April in Copenhagen.

### EMS Committees

For readers' information, the Chairs and their terms of office are as follows:

*Applied Mathematics*: H. Engl (1998-2001);

*Database Committee*: L. Guillopé (2001-2004);

*Developing Countries*: C. Lobry (1999-2002);

*Education*: Tony Gardiner (2001-2004);

*Electronic Publishing*: Bernd Wegner (2001-2004);

*ERCOM*: O. Barndorff-Nielsen (1999-2002);

*The Group on Relations with European Institutions*: R. Jeltsch (1999-2002);

*Publications*: Carles Casacuberta (1998-2001);

*Raising Public Awareness of Mathematics*:

Vagn Lunsgaard Hansen (2001-2004);

*Special Events*: J.-P. Bourguignon (1999-2002);

*Summer Schools*: R. Piccinini (2000-2003);

*Support of East European Mathematicians*: H. Zieschang (1998-2001);

*Women and Mathematics*: E. Mezzetti (2000-2003).

The EMS would be holding a workshop on *Applied Mathematics in Europe* on 4-6 May 2001 in Berlingen, Switzerland. The President had sent out invitations to the EMS corporate members and to several

other applied societies.

The objective was to find out what is expected from the EMS, how to make applied mathematicians feel more at home in the EMS, how best to represent the applied field in Brussels, and the role of applied mathematics in curricula.

Mark Roberts was elected chair of the *Committee for Developing Countries* for the years 2001-2004.

On the recommendation of the chair of the *Education Committee*, its membership was agreed as follows: Tony Gardiner (University of Birmingham, UK) in the chair, Willi Dörfler (University of Klagenfurt, Austria), Sava Grozdev (Bulgarian Academy of Sciences), Rudolf Straesser (University of Bielefeld, Germany), Eva Vasahelyi (Eötvös-Lorand University, Hungary), Abraham Arcavi (Weizmann Institute, Israel), Gerd Brandell (University of Lulea, Sweden) and Olli Martio (Helsinki). Vinicio Villani (University of Pisa, Italy) had agreed to remain a member in the short term to give advice, etc. The TOME contract had been signed, and a Group of Experts would now be appointed by the Education Committee.

There was an interesting discussion concerning a joint declaration of the European Ministers of Education, who had convened in Bologna on 19 June 1999; a follow-up meeting will be held in Prague in 2001. As a result of the 'Bologna Declaration', Swiss universities have made guidelines to change their degrees to conform to the Bachelor's and Master's degrees. It was felt that the EMS should form a view on the Declaration. (Relevant information can be found on the web sites: [www.qaa.ac.uk/crntwork/nqf/bmb/bologna%2Dtextonly.htm](http://www.qaa.ac.uk/crntwork/nqf/bmb/bologna%2Dtextonly.htm) and <http://www.unige.ch/cre/activities/>)

### Special Events

The Fifth Diderot Mathematical Forum, on *Telecommunications*, will take place on 22-23 November 2001 in Eindhoven (Netherlands), Helsinki (Finland) and Lausanne (Switzerland).

### Summer Schools

Impressive posters for the St Petersburg Summer School have been prepared by David Salinger. The AMS and NSF have given support to some US participants. The Prague Summer School had received financing from the European Science Foundation as an AMIF grant; its web page was ready, and the poster had been printed.

A *Summer School in Fluid Mechanics* is planned to be held in Romania in July 2002. The other Summer School for 2002 will be held in Eilat (Israel) during the last week of February.

The deadline for submission applications for summer schools in 2003 was moved to 15 August 2001.

The EC decided to grant up to 2000 euro to enable Eastern European mathematicians to attend the EMS lectures by Professor Michele Vergne during the *10th Meeting of the European Women in*

*Mathematics* in Malta.

There was a discussion of possible names for the EMS Lecturer in 2002.

### Publications

Carles Casacuberta was re-elected Publications officer for the years 2001-2002, and Chair of the Publications Committee. The membership of the Publications Committee will thus comprise: Carles Casacuberta (Chair); Publicity officer, David Salinger; *JEMS* Editor-in-Chief, Jürgen Jost; *Newsletter* Editor, Robin Wilson; Chair of Electronic Publishing Committee, Bernd Wegner; Managing Director of EMSPh, Thomas Hintermann.

It was reported that four books are in preparation in the EMS Springer series, one coming out this year. An advertisement for *JEMS* had been e-mailed to all EMS corporate members.

There was an interesting discussion about a possible recommendation of information on the first page of papers in mathematical journals. A proposal considered suggested that journals should present on the first page of each article: title of journal (and/or common abbreviation); volume/issue number; ISSN; URL/DOI/other identifier of the journal; other common bibliographic information specific to this journal/issue; publication year or other date of publication; copyright date (if different from above); URL/DOI/other identifier of the article if available; author(s) names, spelled out full first name(s); affiliation(s); title; page range; primary MSC classification(s); secondary MSC classification(s); English keywords; abstract. The EC supported concerted action on such uniformisation, and the matter was referred to LIMES.

On the recommendation of the *Raising Public Awareness of Mathematics Committee*, EC approved three prizes of 200, 150 and 100 euros for an EMS-competition for the best article on mathematics for a general audience. The RPA Committee will act as the jury for the competition.

### European Mathematics Foundation [EMF] and EMS Publishing House [EMSph]

The final Statutes of EMF were approved by an e-mail vote of the EC.

A further meeting of EMSPh had been held on 9 March; the Managing Director would start work on 1 September 2001. The logo for the EMF will be the EMS logo with different letters. The EC extended its thanks to Rolf Jeltsch for his work for the Foundation and Publishing House.

### Zentralblatt für Mathematik

There was a discussion of the business of Zbl, a venture jointly owned by the four bodies represented on the Consultative Committee: Springer-Verlag, the Heidelberg Academy, FIZ and EMS. France supports Zbl via its editorial unit in France.

### Relations with Mathematical Institutions, Organisations and Consortia

The EULER (European Libraries and

Electronic Resources in Mathematical Sciences) project had finished in December 2000, and is being continued until December 2001; the EMS is a partner in this. A further continuation from January 2002 is probable, and it was discussed whether the EMS should be a partner in this further extension of the project.

IWI (Institut für Wissenschaftliche Information, *Institute for Scientific Information*) had a founding meeting on 13 November 2000 in Osnabrück, at which Rolf Jeltsch had represented the EMS; MPRESS (Mathematical PREprint Server System) was defined as its main activity in the IWI statutes. MPRESS will be managed from Osnabrück by IWI; it was agreed that the EMS should join IWI as a member.

Olli Martio was elected to represent the EMS on the Committee for the *Banach International Center* in Warsaw for 2001-2004.

The theme of the First *SIAM-EMS Conference* on 2-6 September 2001 in Berlin will be *Applied Mathematics in our Changing World*.

It was reported that the agreement with the *Canadian Mathematical Society* had now been signed.

The *American Mathematical Society* allows its reciprocity member societies to nominate four individuals for free membership, three of whom must be students. It was agreed that the President should select the persons for free AMS membership.

#### Relations with Funding Organisations and Political Bodies

A grant had been received from UNESCO-Roste; this had been partly used to cover some costs of the Alhambra 2000 meeting and those of the St Flour EMS summer school.

The list of EURESCO Conferences in 2001 in Mathematics was discussed; it was felt that it would be good to start a series in biology or medicine if a suitable person to take responsibility for it could be identified.

#### Publicity

The Publicity Officer reported that an application form for EMS individual membership had been inserted in the December issue of the *Newsletter*. Forms were also available at the GAMM meeting in Zürich; the EMS had shared a booth with *Zentralblatt* at the GAMM meeting. The EMS will have a booth at the EMS-SIAM meeting in Berlin in September 2001.

#### Future meetings

There will be an EC meeting during the EMS-SIAM Conference in Berlin on 1-2 September. The Spring 2002 meeting will be held in Brussels on 9-10 February; and the Summer 2002 meeting will be in Oslo before the Council on Friday 31 May 2002.

#### And finally ...

The EC members expressed their appreciation to Rolf Jeltsch for his effective and cheerful management of the meeting.

## The Institute for Industrial Mathematics (Institut für Techno- und Wirtschaftsmathematik, ITWM)

The Institute for Industrial Mathematics (Institut für Techno- und Wirtschaftsmathematik, ITWM) was founded in 1995 by members of the research groups on Technomathematics and Economathematics at the University of Kaiserslautern (Germany). From the beginning, it was managed by the Fraunhofer-Gesellschaft, striving for integration. After a successful evaluation in 1999, the ITWM became a member of the Fraunhofer-Gesellschaft from the beginning of 2001. It is the first Fraunhofer institute with a mathematical focus.

The Fraunhofer-Gesellschaft is the leading organization for institutes of applied research in Germany, undertaking contract research on behalf of industry, the service sector and the government. Commissioned by customers in industry, it provides rapid, economical and immediately applicable solutions to technical and organisational problems.

Within the framework of the European Union's technology programs, the Fraunhofer-Gesellschaft is actively involved in industrial consortia that seek technical solutions to improve the competitiveness of European industry; the Fraunhofer-Gesellschaft also assumes a major role in strategic research. Commissioned and funded by Federal and Länder ministries and governments, the organisation undertakes future-oriented research projects that contribute to the development of innovations in key technologies and spheres of major public concern. The creation of images of the real world in the virtual world of models and software, and their application for the solution of problems, is of central importance today and refers to all fields of industry, from space technology to textile industry.

Mathematics is the technology required for the creation of these images and their efficient implementation into software, and is the raw material for the models and the basis of each computer simulation. In this context, the main objective of the ITWM is to develop real applications of mathematics by using methods of mathematical modelling and scientific comput-

ing to adapt theorems and algorithms to practical models, and to find practicable solutions which often differ from optimal ones. Here, the classical disciplines of applied mathematics, such as numerics, differential equations, stochastics and optimisation, represent ITWM's basic competence. Also, there are other fields of theory that have turned out to be mostly mathematically oriented domains between mathematics and technology, such as fluid dynamics, image processing, neural networks, inverse problems, SPH, system and control theory, queueing theory, fluid-structure interactions and facility location planning. Since its foundation, the ITWM has carried out more than 200 different projects on the basis of these competences, regarding its central departments:

- virtual material and product design;
- simulation and optimisation of technical and logistics processes;
- systems of diagnosis in quality and process control and in medicine.

The product range includes software developed on the basis of our know-how, consulting, support, and system solutions. At the ITWM, simulation software is both used and developed, often in cooperation with leading software enterprises.

The cooperation partners of the ITWM are companies from very different branches, such as the automobile and aeronautical industry, classical engineering, electronics, and the whole range of textile industry. Other partners are service providers, such as the German Railway and Lufthansa, research institutes, and institutions of the social system.

Today, the ITWM is the spearhead of mathematics in industry, and it intends to strengthen and enlarge this position. Currently, about 80 full-time scientists and PhD students (mainly mathematicians and physicists) work at the ITWM, with 50 part-time employees. The annual income (2000) amounted to almost 10 million DM (5.1M £). Nearly 75 per cent of the annual turnover results from projects placed by industry or public funding. The head of the institute is Professor Dieter Prätzel-Wolters, who in Summer 1999 replaced its founder, Prof. Helmut Neunzert.



# Workshop on Applied Mathematics in Europe

Berlingen (Switzerland), 4-6 May 2001

Sebastià Xambó-Descamps

This workshop can be seen as the first major initiative by the European Mathematical Society (EMS) in addressing the problem of making sure that 'applied mathematicians can feel that the Society is also their home'.

The main result of the workshop was the *Berlingen declaration*, which was agreed upon and signed by all participants. It consists of the following nine points:

1. The presence of applied mathematics in EMS bodies and policy decision making should be significantly increased.
2. The applied mathematics committee must be kept an active body for the time being. Its mission statement should be adapted to the new role of the committee. The chair should be invited to the Executive Committee meetings.
3. Pure and applied mathematics should be equitably represented in the publications of the EMS.
4. Special interest groups should be created gradually.
5. EMS should consider increasing its activities by collaborating with international, national and regional societies in organising meetings.
6. The EMS should further develop its Summer School Programme. It is noted with satisfaction that the existing programme includes topics in both pure and applied mathematics.
7. EMS should work towards the goals that (a) the students majoring in mathematics should be exposed to applications of mathematics in sciences or other areas; (b) high school teachers have adequate education in applied mathematics and mathematical modelling.
8. EMS should formulate a position with regard to the Bologna declaration of 1999.
9. It is noted with satisfaction that the EMS established a committee to raise public awareness of mathematics. EMS should promote local initiatives, encourage collaboration with various organisations, and collect and disseminate information on initiatives of member societies in this area.

Signed by Saul Abarbanel, Goetz Alefeld, Luis Bonilla, Bodil Branner, Franco Brezzi, Vincenzo Capasso, Doina Cioranescu, Svetlana Cojocaru, Georgias Dassios, Emilia Di Lorenzo, Heinz Engl, Bjorn Engquist, Andras Frank, Constantin Gaidric, Mats Gyllenberg, Rolf Jeltsch, Allan Larsen, Zoran Markovic, Mireille Martin-Deschamps, Olavi Nevanlinna, Julia Norton, Mihael Perman, Colette Picard, Renzo Piccinini, Olivier Pironneau, Franz Rendl, Marilena Sibillo, Léopold Simar, Erkki Somersalo, Silvana Stefani,



Trevor Stuart, Mina Teicher, Jef Teugels, Jean-Philippe Vial, Sebastià Xambó-Descamps and Anatoly Yagola, at Berlingen, Sunday 6 May 2001.

The workshop was meant to be a 'brainstorming week-end', which should 'initialise a positive discussion', hopefully to be 'followed up during the EMS-SIAM meeting in Berlin' (2-6 September 2001). In the view of the reporter, the meeting developed in a positive and constructive manner by all participants and altogether it was a definite success.

On arrival at Berlingen it was a pleasant surprise to see that the EMS President, Rolf Jeltsch, was waiting in front of the hotel to greet the participants: he had received back surgery the previous Friday, recovery from which needs more than one week for most people. Actually he participated actively in most of the events (and everybody perceived that his back improved steadily as a result of this engagement!), but the person that actually chaired the joint discussions – with great skill, I should say – was EMS Vice-president Bodil Branner.

Friday afternoon was devoted to short presentations of the societies that were present at the meeting:

- five international applied mathematics societies: Bernoulli Society, ECCOMAS (European Community on Computational Methods in Applied Sciences), ICIAM (International Congress on Industrial and Applied Mathematics), Institute of Mathematical Statistics, Mathematical Programming Society;

- five national societies: Belgian Statistical Society, Danish Operations Research, Finnish Inverse Problems Society, Italian Association of Mathematics Applied to Economic and Social Sciences, SIMAI (Society of Industrial and Applied Mathematics in Italy);
- four applied mathematics members of the EMS: ECMI (European Consortium on Mathematics in Industry), ESMTB (European Society on Mathematics and Theoretical Biology), GAMM (Gesellschaft für Angewandte Mathematik und Mechanik), SMAI (Société de Mathématiques Appliquées et Industrielles);
- other member societies: Catalan Mathematical Society, Hellenic Mathematical Society, Institute of Mathematics and Computer Science of Moldavia, János Bolyai Mathematical Society, London Mathematical Society, Mathematical Institute SANU-Yugoslavia, Slovenian Mathematical, Physical and Astronomical Society, Société Mathématique de France, Society of Romanian Mathematicians.

After that, and before dinner, the EMS was presented (its structure, activities and self-introductions of the members of the Executive Committee that were present) and a preliminary list of topics to be discussed in the workshop was written down. After dinner the EMS presentation continued (*4ecm*, EMS publishing house, EMS activities at the European Union level), and the list of topics was discussed and improved. The *4ecm* outline, presented by

Björn Engquist, was found to be consistent with the spirit of the workshop, and hence with the strategy of the EMS, particularly because it devotes an equal amount of time to physics, chemistry and biology, and also because it includes network lectures and sections.

On Saturday morning, five topics were chosen (structure, publications, scientific activities, education, awareness) and each participant decided to which he/she would like to belong. Since the groups on scientific activities and on education had only two members each, they were merged into a single group of four members, so that at the end only four working groups were formed. These groups, which worked independently for the rest of the morning, presented their conclusions in a joint meeting in the afternoon. Each group ended with a written statement that took into account the discussion that followed the presentations. These statements were combined into a single document draft by a subgroup consisting of one or two representatives of each of the four working groups, plus the members of the Executive Committee that were present, and finally a short declaration draft of nine points was distilled from it late on Saturday evening. Both the declaration and the document

were discussed on the Sunday morning and were further modified until everybody was happy with their phrasing. The long draft, and the previous documents that led to it, will be known and used by the Executive Committee, whereas the declaration was meant to be made public and to be included in this report.

The reporter believes that the Berlingen declaration will become an important step in the history of the EMS. Being a highly synthetic document, woven on the basis of consensus, it cannot reflect the lively and witty discussions that led to it. Here are a few hints, however, on the spirit of the discussion of some of the key issues. It was noted, for example, that the declaration fits well with the Statutes and By-Laws of the EMS (cf. Article 2 of the Statutes, on the purpose and nature of its activities).

When the 'Applied Mathematics Committee' was discussed, its present mission statement, as approved by the Executive Committee, was taken into account, and in particular the following points:

The Committee sees its role in promoting Applied Mathematics as a whole through and within EMS, since applications cannot be separated from mathe-

matical methods.

The Committee, instead of competing, wants to cooperate with other, sometimes more specialised, societies on the European and international level and with applications-oriented member societies especially in further improving the public and political awareness about the importance of mathematics to cultural, economic and social development.

In any case, everybody felt that the success of this committee will result in its becoming unnecessary.

Consensus on point 8 of the declaration was not easy, for many participants thought it should have been considerably tighter on what the EMS stance concerning the Bologna declaration should be. The main difficulty was that some key terms involved in the more comprehensive statements that were discussed did not mean the same in different European countries. To mention one example: no agreement could be reached concerning the number of years that should be required to become a 'professional mathematician', although it seemed to this reporter that a good number of participants thought that, whatever its meaning, it should be greater than three years.

## OBITUARIES

### Jacques-Louis Lions

(1928-2001)

Michel Bercovier

Jacques-Louis Lions died during the night of 16-17 May in Paris after a long illness.

Born in 1928 he graduated from the Ecole Normale Supérieure, Paris, in 1950 and received his Doctorat d'Etat in 1954, with Laurent Schwartz as his advisor. He was successively professor at the Université de Nancy, Université de Paris and Ecole Polytechnique, and then held a chair at the Collège de France (Emeritus from 1998).



He served as the secretary-general of the IMU, and then as its president. He was a member of l'Académie des Sciences, and was its president for two years. While teaching and carrying on his research he was Inria's president (from 1980-84) and then president of the French space agency (CNES) from 1984-92. In his last years he was active in industry, being a board member or scientific adviser.

His exceptionally prolific work covered both analysis and applications in partial

differential equations. In the early 1960s he developed a school of numerical analysis in PDEs, using a systematic and rigorous variational approach. He also was at the origin of control theory in PDEs and can be credited for the use of Sobolev spaces in Engineering. He directed dozens of 'Doctorat' students, who would also apply these ideas to an analysis of the finite element method. His numerous students have taught around the world, keeping in touch with him, giving rise to a new French mathematical school headed by him, and exerting a lasting and widespread influence on the international community.

He was a member of 20 academies in countries such as the former USSR, US, UK, EC, as well as in the Third World, and a Doctor *Honoris Causa* of nineteen universities. He won many major prizes and awards, including the Von Neumann prize (1986), the Japan Prize for Science (1991), the Technion's Harvey prize (1991) and the Reid's SIAM prize (1998).

His students mourn the passing of a great man, a scientific father and friend.

For a short CV see: <http://www.college-de-france.fr/college/bibliographies/Lions.html>

A register for condolences has been opened at <http://acm.emath.fr/amm/condolences.html> (in French) and <http://acm.emath.fr/amm/condolences-en.html> (in English).

*Michel Bercovier was a doctoral student of Jacques-Louis Lions, and now teaches at the Hebrew University of Jerusalem.*

### John Fauvel

1947-2001



We regret to announce the death of **John Fauvel**, Historian of Mathematics, at the age of 53. A distinguished scholar and pioneer and promoter of the uses of the history of mathematics in education at all levels, he was a man of wide interests, a book-lover and collector, an inveterate enthusiast and facilitator, a source of encouragement and inspiration to so many, and a much-loved friend to all.

He was a good friend of the *EMS Newsletter*, having recently written articles on the Keele University Turner Collection (*issue 31*) and John Napier (*issue 38*) and interviewed Jan van Maanen (*issue 34*) and Bernhard Neumann (*issue 39*).

# GAMM Annual Scientific Conference 2001

Zürich (Switzerland), 12-15 February 2001

Rolf Jeltsch

The *Gesellschaft für Angewandte Mathematik und Mechanik* (GAMM) usually holds its annual meeting in a German speaking city. The previous two conferences took place at Metz in the Alsace (France), and at Göttingen (Germany).

On 12-15 February 2001, more than 800 participants accepted an invitation from colleagues at the Swiss Federal Institute of Technology (ETH) to visit Zürich. Researchers came from 34 different countries, including a large group from Central and Eastern Europe, and ETH opened a shelter where participants could stay free of charge. In addition, the Swiss National Science Foundation and ETH gave grants to support participants from Central and Eastern Europe.

The event started with a welcoming party for those registering on Sunday. At the opening ceremony Rolf Jeltsch welcomed the participants on behalf of the local organising committee, and mentioned that the last Zürich meeting had been held in 1967, organised by the late Professor Peter Henrici. As President of the EMS he announced the forthcoming *1st EMS-SIAM meeting* in Berlin in September and the recent EMS workshop on *Applied Mathematics in Europe* in Berlingen, Switzerland (see report on page 9). The Vice-President of Research at ETH, Albert Waldvogel, welcomed the participants on behalf of ETH. In his presentation he presented a survey of ETH in Zürich, especially the gradually rising number of students: it is interesting to note that over 25% of the graduate students are foreign, with about 50% at faculty level. He also discussed the emergence of computational sciences and engineering and how ETH is making an effort to support this new development.

Göetz Alefeld, the President of GAMM, opened the conference with remarks on the development of students and the importance of producing IT-educated specialists who also have a background in classical engineering. At its annual meeting, GAMM awards the Richard von Mises prize to a young scientist for exceptional research in applied mathematics and mechanics. This year's winner was Herbert Steinrück of the Technical University of Vienna, who studied mathematics at the Institute of Technology in Vienna and received the prize for his work in several fields, especially in fluid mechanics where he intensively studied mixed convection on horizontal plates. In particular, he showed that the boundary layer at the upper side of a cooled horizontal plate can move against the flow direction; this implies that the boundary layer equations do not have a unique solution and that numerical instabilities cannot be avoided.

bilities cannot be avoided.

The scientific activities started with the traditional Prandtl lecture, introduced by J. Szodruch, President of the DGLR (Deutsche Gesellschaft für Luft- und Raumfahrt), and delivered by P. G. Hamel, Director since 1971 of the Institute of Flight Mechanics at the DLR in Braunschweig. He lectured on the modelling of flight dynamics, stability and control – a perfect mix of fluid dynamics, mathematical control and engineering.

At this highly intensive meeting there were more than 600 contributed lectures on mathematics and mechanics, arranged in 21 sections. There were fourteen plenary lectures and a dozen mini-symposia focused on new subject areas. As is GAMM's tradition, one of the plenary lectures was a public lecture. This year, Werner Stützle, from the University of Washington in Seattle, gave an insight into mathematical aspects of three-dimensional photography. The main goal is the 'inverse' of computer-aided manufacturing: given a physical object such as a human body, a model of a car, a turbine blade, or a house, create a computer model of the object that captures its shape and appearance. A special feature of the Zürich conference was a second public lecture, presented by Marco Avellaneda of the Courant Institute in New York. He lectured on Monte Carlo simulation in quantitative finance, giving a very lively introduction to this attractive and modern subject.

Without doubt, the good weather enabled participants to enjoy Zürich and its environs, as well as to experience good science.

The next annual GAMM meeting will be at Augsburg (Germany), from 25-29 March 2002.



*P G Hamel, Prandtl lecturer*



*G Alefeld, GAMM President*



*Herbert Steinrück, von Mises prizewinner*



*Opening ceremony, GAMM 2001*

# The Methodology of Mathematics

RONALD BROWN and TIMOTHY PORTER

*This article is in two parts; the second part will appear in the September 2001 issue.*

This article is based on a talk given by the first author to students and staff of the *Departamento de Geometria e Topologia* at the University of Seville in November 1993. The issues presented there have been part of a continued debate and discussion at Bangor over many years, and this explains why this is a joint paper. Various versions of this article have been published. [1].

The aim of the talk, and the reason for discussing these topics, was to give students an understanding and a sense of pride in the aims and achievements of their subject, and so to help them explain these aims and achievements to their friends and relatives. This pride in itself would be expected to contribute to their enjoyment of the subject, whatever their own level of achievement. Because of this, and because of its origin, the tone of the article is principally that of an address to students.

We do not claim to be alone in addressing these questions. For some years Dr Allan Muir (City University, London) has organised a *How Mathematics works* group, and there is a similar group in the U.S.A. Many of these issues are discussed in the books by Davis and Hersh [3, 4].

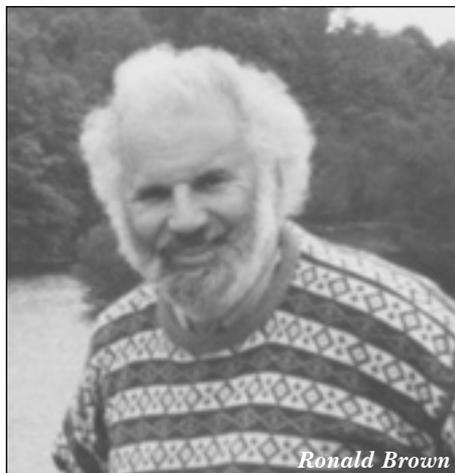
## Some basic issues for mathematicians

We start by seeking discussion by teachers of mathematics at all levels as to what extent the training of mathematicians should involve professional discussion of, and assessment in, possible answers to questions of the following type:

1. *Is mathematics important? If so, for what, in what contexts, and why?*
2. *What is the nature of mathematics, in comparison with other subjects?*
3. *What are the objects of study of mathematics?*
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?*

It may be thought by some that these questions are beside the point, a waste of time, and not what a real mathematician should be considering. Against this we would like to give a quotation from Albert Einstein (1916) [5]:

*How does a normally talented research scientist come to concern himself with the theory of knowledge? Is there not more valuable work to be done in his field? I hear this from many of my professional colleagues; or rather, I sense in*



Ronald Brown

*the case of many more of them that this is what they feel.*

*I cannot share this opinion. When I think of the ablest students whom I have encountered in teaching – i.e., those who have distinguished themselves by their independence and judgement and not only mere agility – I find that they have a lively concern for the theory of knowledge. They like to start discussions concerning the aims and methods of the sciences, and showed unequivocally by the obstinacy with which they defend their views that this subject seemed important to them.*

*This is not really astonishing. For when I turn to science not for some superficial reason such as money-making or ambition, and also not (or at least exclusively) for the pleasure of the sport, the delights of brain-athletics, then the following questions must burningly interest me as a disciple of science: What goal will be reached by the science to which I am dedicating myself? To what extent are its general results 'true'? What is essential and what is based only on the accidents of development? . . . Concepts which have proved useful for ordering things easily assume so great an authority over us, that we forget their terrestrial origin and accept them as unalterable facts. They then become labelled as 'conceptual necessities', 'a priori situations', etc. The road of scientific progress is frequently blocked for long periods by such errors. It is therefore not just an idle game to exercise our ability to analyse familiar concepts, and to demonstrate the conditions on which their justification and usefulness depend, and the way in which these developed, little by little . . .*

There are a number of reasons, apart from the authority of Einstein, to consider the above questions. A professor of mathematics in the UK with whom we discussed them suggested that the aim of considering them was to get students to reflect on the methods of mathematics. He remarked, as if seeing this for the first time, that there was a well known differ-

ence between human beings and other animals, that humans have this ability to reflect on what they do, and that this ability affects beneficially a lot of human activity. One aspect of this reflection is that it leads to the notion of value judgement, again a faculty which humans have which is not apparently shared by other animals, or at least not in a way in which we can communicate, by and large.

Reflection on an activity is, generally, a useful way of increasing its effectiveness, as we are able to analyse what is essential, what is important, and how the activity can be done avoiding the easiest of mistakes in method. On these grounds it is reasonable that we should reflect on the activity of mathematics. In reflection, we also usually are aware of the value of the activity.

Another reason for our considering these questions was through a comparison with aspects of education in art. We have heard it argued that education in art and design is considerably ahead of science education in arousing the interest and independence of students, so it is worth considering how these educators go about things. Here are aims that have been given for a course in design:

1. *To teach students the principles of good design;*
2. *To encourage independence and creativity;*
3. *To give students a range of practical skills so that they can apply the principles of good design in employment.*

Is there something here from which mathematics courses can learn? Is it reasonable aims for a mathematics course to replace in the above the word 'design' by the word 'mathematics'? If not, why not?

Here is another quotation, from the book by T. Dantzig [2]:

*This is a book on mathematics: it deals with symbols and form and with the ideas which are back of the symbol or the form. The author holds that our current school curricula, by stripping mathematics of its cultural content and leaving a bare skeleton of technicalities, have repelled many a fine mind. It is the aim of this book to restore this cultural content and present the evolution of mathematics as the profoundly human story it is.*

Is there something in this from the point of view of a higher level of teaching of mathematics? This book dates from the 1930s. Have we made much progress since then in dealing with the points he raises?

Now let us consider the questions (1)-(6) in turn.

**What is the importance of mathematics?**

It is not generally recognised how much of a part mathematics plays in our daily lives. Some of the mathematics is of course quite old: every day we use numbers, graphs, addition and multiplication.

It is easy to forget that the invention of these was at one time a great discovery. The replacement of Roman numerals by Arabic numerals, and so the possibility of a good bookkeeping system, is said to have led to the prosperity of Venice in the 14th century. It is also of interest here to note the importance of pedantry in mathematics. A key aspect of the Arabic system is its use of the number zero. At first it seems absurd to count the number of objects in an empty box. The surprise is how essential this is for an adequate numeration system, in which the number 0 is used as a place marker.

The lack of this concept of zero held up the progress of mathematics for centuries.

On a higher level, without the mathematics of error correcting codes we would not have had the beautiful pictures of Jupiter from *Voyager II* [9].

This mathematics is also essential in many aspects of telecommunications and of computers, and in particular for CD players. There is an amusing story about this last application [7]. Negotiations were held by top management between Sony and the Dutch company Philips about the standards for CD. The Japanese considered Philips' proposal for error correction inferior to theirs, and in the end the Japanese proposal was accepted. Back in Eindhoven, the embarrassed managers called in their science directors to declare that the company did not have sufficient expertise in this area called 'coding theory' and to find out where in Europe the real experts could be found. To their dismay, the answer was 'in Eindhoven!', in the person of the Dutch number theorist Van Lint!

Without the mathematics of cryptography, there would not be possible the current level of electronic financial transactions crossing the world, and involving billions of dollars. Currently, the mathematics of category theory, a theory of mathematical structures, is being used to give new insights into future logics and algebras for the design of the next generation of programs and software.

The enormous applications of mathematics in engineering, in statistics, in physics, are common knowledge. The theories of the big bang, of fundamental particles, would not be possible without mathematics. It is also imagined that the role of mathematics is being taken over by the use of supercomputers.

It is not so generally realised that these supercomputers are the servants of mathematical and conceptual formulations: the electronics is marvellous in that it does the calculations so quickly and accurately. For example, body scanners are an application, a realisation, of a piece of 19th-century mathematics expressing how to reconstruct a solid object of vary-

ing density from views through it of an X-ray, where the only measurement is the change of intensity as the ray passes through the body, for a large number of varying positions of the ray.

**What is the nature of mathematics?**

There is here a mystery. The Nobel prize-winner E. Wigner has written a famous essay 'The unreasonable effectiveness of mathematics in the natural sciences' [8]. For us, the key word is 'unreasonable'.

He is talking about the surprise that the use of mathematics is able to give predictions that are in accord with experiment to the extent of nine significant figures. How is such astonishing accuracy possible?

It seems likely that a full 'explanation' of the success of mathematics would need more understanding of language, of psychology, of the structure of the brain and its action, than is at present conceivable.

Even worse, the development of such understanding might need, indeed must need, a new kind and type of mathematics. It is still important to analyse the scope and limitations of mathematics. It is also reasonable that such an analysis should be a necessary part of the education and assessment of a student of mathematics. Of what use is a student who does not know such things?

Here then are some quotations from this article:

*... that the enormous usefulness of mathematics in the physical sciences is something bordering on the mysterious, and that there is no rational explanation for it.*

*Mathematics is the science of skilful operations with concepts and rules invented just for this purpose [this purpose being the skilful operation ...].*

*The principal emphasis is on the invention of concepts.*

*The depth of thought which goes into the formation of mathematical concepts is later justified by the skill with which these concepts are used.*

*The statement that the laws of nature are written in the language of mathematics was properly made three hundred years ago; [it is attributed to Galileo] it is now more true than ever before.*

*The observation which comes closest to an explanation for the mathematical concepts' cropping up in physics which I know is Einstein's statement that the only physical theories which we are willing to accept are the beautiful ones. It stands to argue that the concepts of mathematics, which invite the exercise of so much wit, have the quality of beauty.*

In order to discuss this, it is of interest to compare mathematics with other subjects, and to link this with the question of the objects of study of a subject, and of its importance.

Suppose we ask questions of a few of our fellow scientists as to why one should study their subject. Their answers might run as follows:

*The astronomer:* In astronomy we study the

beginnings of the universe, and the flow of time over billions of years, as well as the furthest distances of space. What could be more enthralling? We have some money for this study, with various telescopes over the world, but of course not enough.

*The physicist:* In physics, we study the fundamental constituents of matter. What could be more fascinating? Without physics, there would be no astronomy, for example. Thus many more of the best students should study physics, and the Government should give us a lot of money.

*The chemist:* In chemistry, we make molecules do things for us, so that chemistry is part of our everyday lives. Without the understanding found by chemistry, there would no study of the stars, and no understanding of biology, of the formation of the planets. So, many of the brightest students should study chemistry, and the Government should give us a lot more money.

*The biologist:* Biology is about life. What is life? How did it come about? How does it interact with us and the world? We are all concerned with life. So, many more students should study biology, and the Government should give us a lot more money.

*The engineer:* Engineering is about making things that control our environment and do things for us. Without engineering, modern civilisation is inconceivable. Many more students should study engineering, and the Government should give us a lot more money.

Of course there are many more protagonists in this story. Also, we have exaggerated the concern with finance. Yet, the financing of an activity is one measure of the importance attached to it.

Let us turn now to the mathematician, and ask for his/her story and justification for existence in the hustle and struggle for a place in the scheme of things. It is quite possible that from even a well-known mathematician you will get no clear answer. It might be claimed as an important achievement that, for example, the solution has now been obtained of Fermat's last theorem. Does such a solution, however, bring in the crowds or the cash? Why should it? Certainly, the solution is an achievement, but what is its general import? Why was so much effort devoted to it? Is it merely comparable with breaking another record? There are answers to these questions, but the questions seemed not to be asked in the glory of an apparent solution to a long-standing problem.

These questions are not idle. Resources are limited. Any one person's interests are limited. We need a more convincing answer for the support of our subject, and to persuade people to study it. Here is our try:

*The mathematician:* Mathematics is about the study of pattern and structure, and the logical analysis and calculation with patterns and structures. In our search for understanding of the world, driven by the need for survival, and simply for the wish to know what is there, and to make sense of it, we need a science of structure, in the abstract, and a method of knowing what is true, and what is interesting, for these structures. Thus mathematics in the end underlies and is necessary for all these other subjects. This is part of our claim for your attention, and for the support for our studies.

Another part of this claim is the fascination and wonder at the new patterns and structures, the surprising relationships, which our study has found. Mathematics also brings humility. We know how hard it can be to decide the truth of but one apparently simple and clear statement. We are aware of the limitations of mathematical truth, that not all that is true can be proved, as shown by the undecidability results of Gödel. You will not find a mathematician writing that the final solution, the unified theory that will solve everything, is at hand. Rather, we are looking for the surprises that show us a new view of the world, and new riches to explore. Experience leads us to expect these to appear. For the mathematician, the world is not only stranger than you imagine, but stranger than you can now imagine. It is our job to investigate this strangeness.

**What are the objects of study of mathematics?**

This has already been answered to some extent. Mathematics does not study things, but the relations between things. A description of such a relation is what we mean by a 'concept'. Thus we talk about the distance between towns, and might feel this is less 'real' than the towns themselves. Nonetheless, relations between things, and our understanding of these relations, is crucial for our operation in

and interaction with the world. In this sense, mathematics has the form of a language. It must be supposed that our ability to operate with concepts, with relationships, had and maybe continues to have an evolutionary value.

It is also curious in this respect that the achievements of mathematics are generally held by mathematicians to be the solution of some famous problem. Certainly such a solution will bring to the solver fame and fortune, or at any rate a certain fame within the world of mathematicians. Yet the history of mathematics and its applications shows that it is the language, methods and concepts of mathematics which bring its lasting value and everyday use. We have earlier mentioned some examples of this.

At a more advanced level, we can say that without this language – for example, that of groups and of Hilbert spaces – fundamental particle physics would be inconceivable.

Some of the great concepts that have been found important and have been given rigorous treatments through this mathematicisation are: *number, length, area, volume, rate of change, randomness, computation and computability, symmetry, motion, force, energy, curvature, space, continuity, infinity, deduction.*

Very often the problem to make some mathematics is, in the words of a master of new concepts, Alexander Grothendieck, 'to bring new concepts out of the dark' [6]. It is these new concepts that make the difficult easy, which show us what has to be done, which lead the way.

More important is the way mathematics deals with and defines concepts, by combining them into mathematical structures. These structures, these patterns, show the relations between concepts and their structural behaviour. As said before, the objects of study of mathematics are patterns and structures. These patterns and structures are abstract, a notion discussed in the sequel, where we also return to questions (4)-(6).

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**Correction to Problem Corner**

In the Problem Corner in *EMS Newsletter* 39, Problem 123 was incorrectly printed. The correct version should be:

123. The sequence  $\{x_n\}$  satisfies  $\sqrt{(x_{n+2} + 2)} \leq x_n \leq 2$ , for all  $n \geq 1$ . Find all possible values of  $x_{1986}$ .

# Interview with Björn Engquist

(NADA, KTH, Stockholm, and UCLA, Los Angeles)

interviewer: Olavi Nevanlinna, Helsinki University of Technology

*Last weekend we met in Berlingen, Switzerland, and now you are here in Princeton. Where would I find you next week?*

I will go on to a meeting on electromagnetic theory in Victoria, Canada, and then Zürich, Stockholm and Moscow. This period is unusually hectic, but some people close to me think it's always like that and claim that I get jetlag when I don't travel.

*So let us travel both in space and time, to Sweden in the 60's: why Uppsala, why mathematics and why numerical analysis?*

Uppsala was by default. In those days, in Sweden, we were not sophisticated enough to choose the best place depending on our goals. You went to the closest university if you planned to continue your education, and in my case that was in Uppsala. I was interested in physics and had to start with a full year of mathematics. I loved it and was hooked. When Lennart Carleson left Uppsala for the Mittag-Leffler Institute, I switched to numerical analysis with Heinz-Otto Kreiss as professor; both were very charismatic teachers. I was fortunate to be one of his students when the Kreiss school of numerical analysis was formed. The school lasted for at least 25 years – maybe it's still there. Even if many of us have changed focus, you might say we often function as a homogeneous group.

*What is needed for a school or a tradition in mathematics to be established and to last? In other fields a big laboratory gives the focus and continuity, whereas a group of mathematicians can just pack their suitcases and move.*

The leading person behind the school obviously means the most, but there are also the right time and the right place. After the Second World War, analysis was very strong in the Nordic countries. This was fertile ground for the new ideas in numerical analysis from the US. Kreiss had close links to the Courant Institute and I later spent a post-doc year there. From the 1960s to the 1980s we had very little interaction with other European mathematicians. It is much better now.

*This brings us to the meeting in Berlingen on the role of applied mathematics in the EMS. Why do we need affirmative action with respect to applied maths in the EMS?*

Pure mathematics dominates many of the national organisations in the EMS, and this was carried over. It is natural for a society to focus on core areas. This is what happened with the IMU, and then ICIAM was created as a forum for applied mathematics. I believe it is essential for the health of mathematics to have good relationship

between pure and applied maths. Some organisations should contain both: I hope the EMS will be one of them.



*You are involved in the planning of 4ecm, which will be in Stockholm in 2004. What will you do differently from earlier congresses?*

I hope we will re-emphasise the theme of unity in mathematics from the Budapest congress, and will have a healthy mix from core areas and from fields with closer ties to other sciences and to the rest of society. We will make room for some European research programmes and maybe add a Swedish touch with a Nobel symposium. Even if there is no Nobel Prize in mathematics, it is clear that mathematics and computation play an increasing role in the research behind the science and economics prizes.

*In Stockholm, at the Royal Institute of Technology, you have started a program in CSE – computational science and engineering. For how long do you expect CSE to fly?*

CSE may not live more than 10 years as a label, but I see it as a link in the fundamental and very powerful development of computational techniques applied to science and engineering that we have had during the last fifty years. We have used the labels 'numerical analysis' and 'scientific computing' in earlier stages of this development. A new label both stimulates and indicates a change of focus, but not a change of the overall direction.

*What can we expect next – computational bio-informatics?*

Bio-informatics will be very important for society, and computation will be very important for bio-informatics. Whether it will also be a driving force for developments in computational science is not yet clear.

*Another thing you started at the Royal Institute is PSCI, a very nice and functioning concept. Could you say a few words about it?*

PSCI stands for Parallel and Scientific Computing Institute, and is a centre for university cooperation with industry. The centre is sponsored by industry and government and supports over twenty graduate students. The industries take an active part in the research and the mentoring. We work mainly in a pre-competitive phase in which several industries can join in a common project. The aim is to include the full scientific computing process in the projects – from modelling and analysis, via algorithms, to software.

*I am interested in time-scales related to science and education. Earlier we talked about typical time-scales for mathematical schools: they may last for 100 years or more and shift focus in 20 years. In modern high-tech industry 20 years is already a very long time. Does that create a difficulty for education?*

I do think we need to adjust to the faster pace of changes in the technology of today. Students are not competitive if they only know yesterday's technology. In the future we cannot expect an application to be as central as fluid mechanics has been in applied mathematics during the last fifty years. The computational tools also change rapidly.

It is, however, important to realise that this fast pace affects only a fraction of education. The major part (at least two-thirds) of the education in mathematics and its applications deals with fundamental principles, and should be roughly the same today as when I started over thirty years ago. We should also remember that the university provides only the foundation and that education will continue in the industry.

*A final question. How do you find energy for all your work? Have you any hobbies?*

The brief moment when you realise that a proof works or an algorithm and code does what you hoped for, that's the reward. These days the rewards often come from seeing students develop and finding those moments of joy. Unfortunately most hobbies are crowded out of my schedule, but I enjoy skiing as long as my children let me join them. In the summers I enjoy setting the spinaker to reach one of my favourite islands in the Stockholm archipelago, and then I am certainly not thinking of the existence of classical solutions to the Navier-Stokes equations

# Looking back: Manuel Valdivia (Valencia)

interviewer: Joan Cerdà (Barcelona)

**Initially you were oriented towards other fields. How were you attracted by mathematics, and what were your first experiences in the subject?**

I began my contact with mathematics research very late: I was over thirty years old. At that time, I was working in Madrid as an agricultural engineer at the National Institute for Agronomic Research, and to make some extra money I was teaching mathematics at the School of Agriculture Engineers.

I have always felt very attracted to mathematics, even when I was a child attending primary school in the village where I was born – Martos, in the Andalusian province of Jaén. After some years I arrived in Madrid to study at the University, where I enrolled in Law studies; afterwards, in the 1950s, under the influence of some friends, I chose to follow Agriculture Engineer studies. Engineer studies in Spain were designed in such a way that there was an entrance examination, the 'Ingreso', held at certain private schools during June and September. Only when you had passed the Ingreso were you allowed to enrol in that School to follow your studies. Usually, people had to spend three to five years passing that examination, and five more years to finish their studies at the School.

To prepare for the Ingreso, one had to study several subjects, split in parts. The exams of three of those parts were very difficult to pass: biology, the first part of mathematics, and the second part of mathematics. In the first part of mathematics we studied algebraic analysis (following a book by Rey Pastor), trigonometry and metric geometry; in the second part of mathematics, we studied calculus, classical algebra and analytic geometry. I very much enjoyed studying that kind of mathematics at that time.

**Do you think that you entered mathematics at a difficult time?**

For me, the 1950s was a very difficult period. I did not have financial means to support my studies, so I had to study and work simultaneously. During my years preparing the Ingreso, I gave private high-school lessons, and afterwards, when I was a student at the Agriculture Engineer School, I taught mathematics privately to prepare the Ingreso in that school.

In 1960 I enrolled to study mathematics at the Complutense University. I was a 'libre' (free) student, which required me to prepare the subjects by myself without attending the lectures. I went to the University for the exams only, and so I had very little contact with professors.



**Which of your teachers, colleagues and students do you remember most?**

As I mentioned earlier, I was quite old when I made my initiation into mathematical research. It was my friend Dario Maravall Casesnoves, PhD in mathematics and an agricultural engineer, who put me in contact with Professor Ricardo San Juan Llosá, full professor of mathematical analysis at the Complutense University. San Juan was the one that introduced me to research in mathematics. I learnt a lot from him: he was my PhD advisor. In spite of our age difference, we were very good friends. San Juan, who had been a student of Professor Julio Rey Pastor, was a very deep person. I consider myself very fortunate for having met him and for the long relationship I maintained with him.

In 1966, when I had already become full professor of mathematical analysis at Valencia University, I developed a keen interest in functional analysis.

Before I began working with San Juan, Professor J. Horváth visited Madrid, invited by Professor San Juan, and gave a course on quasi-analytic classes at Complutense University. After that, both professors maintained a very good relationship. It was San Juan who wrote to Horváth about me and my interest in functional analysis. The answer was prompt and Professor Horváth introduced me to M. De Wilde, who had great success with his thesis on the closed graph theorem. De Wilde was a student of Garnir. In 1970, Professor Garnir organised an important functional analysis meeting in Liège (Belgium), and he invit-

ed me to attend it. There I met Yosida, Schwartz, Garnir and Köthe. Since then I have been several times to Germany, invited by Professor Köthe. Fortunately I have a lot of friends in the mathematical community around the world. But I would like to single out my friend Professor Klaus Floret and the wonderful meetings he has organised over the years in the beautiful location of Spiekeroog and Vangerooze, two German Frisian Islands in the North Sea.

**From your current position as Emeritus Professor in the Universitat de Valencia, how do you regard the changes that the Spanish community experienced during the second half of the 20th century?**

When I arrived in Valencia, I found a desolate landscape. The full professorship position I got did not have even a single book of mathematics. I went to Madrid, to the Education Ministry, and mentioned the problem to the under-secretary; they gave me 100,000 pesetas to buy some books. Those were very difficult times. We had no subscriptions to mathematics journals. We were isolated. There was no mathematical community: only some isolated individuals doing mathematics.

It is always possible to find competent people who can do research, but it is necessary to put them on the right track. Fortunately, it was possible to do some positive work during these years: contacts with foreign mathematicians increased and also attendance at conferences. Young mathematicians of great strength appeared, and there was a radical change in the position of mathematics in Spain. You only have to see now how many publications were produced by Spanish mathematicians to realise the progress attained at that time. I believe that we should be happy with the positive achievements that were made in Spain.

**Have your scientific activities been mainly with pure mathematics? What is your opinion about the duality between pure and applied mathematics?**

My scientific activity has mostly focused on what one may call pure mathematics. However, I do not believe that there is a duality between pure and applied mathematics. The choice of the term 'applied', as it is commonly used, has not been very fortunate, since it causes much confusion. If one wants to classify mathematics, it should be done in terms of quality, a much clearer and more important concept. Fortunately, applied mathematics of great quality is done here in Spain, but honestly it is hard for me to differentiate between it and pure mathematics.

***In your field, what will the future developments be? Do you think that functional analysis, and mathematical analysis in general, should borrow ideas from other fields, such as physics, biology or economics? Should students be oriented towards some specific topics?***

It is quite difficult to predict the future of functional analysis, but I believe that it will continue to be applied quite a lot, since it appears in a natural way in many problems. I am also certain that mathematical analysis will take ideas from other fields, such as physics, biology or economical sciences. Concerning the orientation of students towards certain fields of research I believe that we have not taken much time here in Spain to study the real application of mathematics to other scientific fields, and there is in my opinion a great amount of interest and future in this type of research.

***How do you view the near future? What can be done to attract new young students into mathematics?***

I am very much concerned about the future of mathematics in Spain. It is quite hard to convince young students to do research in mathematics when so little can be offered by our universities. I fear that if the administration does not take appropriate steps, the level that Spain has achieved in mathematical research, with so much effort and sacrifice, will undoubtedly decrease.

***... and about attracting good scientists, do you think that it is difficult to recruit the best qualified mathematicians for our***

***departments?***

Although the mathematical level of Spain has clearly been raised during the 20th century, providing a good basis in order to form good professionals and researchers, we have a hard time when trying to take profit from our intellectual resources. The problem of recruiting the best qualified mathematicians for our departments is clearly attached to the existence of good expectations for the future, and this is not so at the moment. I believe that our universities urgently need to make changes in certain aspects.

***What should be the role of institutions and societies in the world of mathematics?***

This question is much too wide for me but, speaking about Spain, I believe there are lots of things to be done. To acquire some ideas, it may suffice to take a look at what is being done by other more advanced countries with a longer mathematical tradition. It is really astonishing for me that in Spain the C.S.I.C does not have an Institute for Mathematical Research. The existence of such an institute, in which one could do basic mathematics of quality among other things, would be good not only for Spanish mathematics but also for the C.S.I.C. itself, since it would gain more prestige.

***Do you think that there is too strong (or weak) a pressure to publish?***

The pressure on publishing comes, in our universities, from its economical reward, since one's salary is increased by a complementary amount after six years of publishing papers, if these are positively evaluat-

ed. On the other hand, there is also a certain pressure to publish in particular journals, since in the evaluation, done in the Ministry of Education, the Citation Index is the reference used. This may simplify things, especially if the papers are somehow identified with the journals in which they appear, since journals are already classified in a given order. Personally, I think they give the Citation Index more credit than it really deserves from a scientific point of view. To evaluate papers by their contents seems to me much more justified, although, obviously, it is longer and harder to do. I believe that the evaluation method they use in our country should be modified.

***Which parts of your professional life do you remember with most pleasure?***

Personally, I have taken great pleasure in teaching. I have dedicated many hours of my life to the teaching of mathematics, and this has always been done following my vocational trends. In particular, I remember with great pleasure when I had my first group of research students in Valencia and when I began to be a PhD advisor. This was an unforgettable experience, since it was the first time that I experienced such activity and I felt very happy to find myself with these vocational and capable students.

***Does mathematics share your time with other hobbies?***

I enjoy music quite a lot. Also different aspects of literature, novels, essays and poetry, and history too. I frequently spend time reading and listening to classical music.

## ***Applied Mathematics in Austria Significantly Strengthened***

**Heinz W. Engl (Linz) and Norbert Mauser (Vienna)**

In Austria, applied mathematics have been strongly fostered by recent joint activities of scientists from the University and Technical University (TU) Vienna: the new Wolfgang Pauli Institute (WPI), founded by several START and Wittgenstein prizewinners (comparable to the Hess and Leibniz-prize in Germany) has the mission to provide an excellent infrastructure for such 'high end' projects of the Austrian National Science Foundation (FWF) and to create a 'centre of excellence' in mathematics, informatics and their application in the sciences.

Since applied mathematics is more and more transcending national boundaries, the WPI is also particularly designed to host European projects like Marie Curie Training sites or networks.

The founding members of the WPI are working in PDEs and ODEs – for example, in mathematical physics and semiconductor modelling (P. A. Markowich, N. J. Mauser, C. Schmeiser and P. Szmolyan) or financial mathematics (W. Schachermayer) and mathematically oriented informatics

(G. Gottlob).

The WPI is an open structure, open both for other projects that have passed a very selective international evaluation, and open for a development of the WPI towards an Austrian variant of the Max Planck Institute, including places outside Vienna.

The WPI also hosts the new interdisciplinary *Wissenschaftskolleg* (doctoral school) on *Modelling with Differential Equations* where TU engineers like A. Klwick and H. Troger participate as well as the strong Austrian school in *biomathematics* (K. Sigmund) and the differential geometric approach of P. Michor, which provided a link to the Erwin Schrödinger Institute (Vienna).

In general, Austrian applied mathematics has been quite successful in recent years: The percentage of research funding going from FWF to mathematics has doubled, and especially applied mathematics has been over-proportionally represented in the high-end programs of FWF: Wittgenstein prizes, START prizes, SFBs

(Spezialforschungsbereich, coordinated research programs with yearly funding of close to 1 million euro each): There are mathematical SFBs in Graz (*Optimisation and Control*) and in Linz (*Numerical and Symbolic Scientific Computing*) and a similar large-scale project including four universities and the Austrian Academy of Sciences on *Number Theoretic Algorithms*, another SFB on *Quantitative Methods in Economics* has a large mathematical core.

Recognising the increasingly strong position of applied mathematics in Austrian science, the Academy of Sciences is currently discussing the possible founding of an Institute in that field.

Finally, also on the 'extreme' applied end – for example, in Industrial Mathematics, new 'Competence Centres' (co-funded by industry and government) are emerging.

With all these initiatives, especially if properly linked, Austria can become a global player in selected areas of applied mathematics. It goes without saying that this strength in applied mathematics is deeply rooted in traditional Austrian strengths in pure mathematics; for a project like *Number Theoretic Algorithms* which has a span from very 'pure' topics to timely applications in finance, even the question if this is to be considered 'pure' or 'applied' mathematics does not make sense.

## *Société Mathématique de France (SMF)*

Colette Picard and Mireille Martin-Deschamps

The SMF is an association, created in 1872, whose purposes are 'defending and promoting mathematics and mathematicians'. It currently has around 2000 members, mainly researchers and university teachers, and also institutions, such as libraries and mathematics departments. The head office is located in Paris, at the Institut Henri Poincaré, but there is also an agency in Marseille, the SMF House, which is devoted to the distribution and storage of the publications. The SMF employs six persons.

### Scientific publishing

SMF is the main publisher in France for mathematical books and journals at a high level, partly in French.

*Journals:* The *Bulletin*, founded in 1873, and its supplement, the *Mémoires*; *Astérisque*, created in 1973, at the centenary of the SMF; *The Revue d'histoire des mathématiques*, created in 1994.

*Series:* Panoramas et Synthèses, Cours Spécialisés, Séminaires et Congrès.

Thanks to grants from the French ministries of education and research, and also thanks to the work of many French mathematicians, these journals and books, partly in French, are distributed all over the world, and are internationally famous.

We have been taking care, for a few years, of the distribution, as well as the scientific and editorial work.

Today, one of our main concerns is the transition to electronic publishing. Besides the paper version, we have set up an electronic version of the *Bulletin* for our subscribers. We are also planning the digitisation of old issues.

We are also launching a *reedition serie* of mathematical texts, or letters, which can give a historical perspective on classical subjects.

### An exchange and meeting place

Created by, and for, the mathematical community, SMF is a privileged go-between for mathematicians and those in politics and economics. Through joint actions, SMF keeps close ties with most academics or professional groups interested in the future of mathematics, and also with the other sciences, through their organisations. We are especially concerned with questions of teaching at every level.

The SMF's concern to inform a wider group about the actual mathematics led to the establishment in 1984 of the *d'Alembert Prize*, which is awarded every two years for a work that makes a piece of mathematics accessible to the public. Moreover, we celebrated World Mathematical Year 2000 by awarding four special d'Alembert Prizes to young students: these prizes were awarded for lectures presenting actual mathematics within the reach of young students.

Concerning communication inside the French mathematical community, two of our publications, the *Officiel* and the *Gazette des Mathématiciens*, announce main events (seminars and conferences), give information on open faculty positions, and convey members' opinions on various issues.

Our server (<http://smf.emath.fr>) gathers useful information for mathematicians, a directory of the members, a discussion platform, an on-line order form for books and journals, information concerning past and new publications, etc.

### Scientific activities

The annual meeting, open to a wide audience, offers lectures on a topic of current interest. Bi-annual scientific sessions on the 'state of the art' aim at bringing together the most advanced researchers in a subject as well as students and non-specialists. One-day meetings on a particular theme are organised on a subject on the border between mathematics and other sciences.

### International relations

The SMF has representatives in the IMU and the EMS (it contributed to its creation) and has reciprocity agreements with many foreign societies and exchange agreements with foreign journals.

Since 1998, we have had a publishing contract with the AMS, which translates some of our French books into English.

### The CIRM (Centre International de Rencontres Mathématiques)

The CIRM is a centre of research and training, which was created by the SMF in 1981, along the lines of the German Forschungsinstitut Oberwolfach. Its tasks are:

- the organisation of international meetings, bringing together mathematicians or researchers in related fields from France and abroad;
- the training of young researchers – in particular, through intensive courses or summer schools.

The CIRM can accommodate around 60 participants. It is located in the heart of an estate on the Luminy university campus near Marseille, and is housed in an entirely renovated country house. These features enable the centre to offer special facilities for scientific and research meetings. Everything has been planned and organised so that working and living conditions are of the highest standard.

The mathematical library contains 35,000 books and the same number of periodical journals, representing 375 different titles, in addition to a bibliography research service. The database of the library is accessible by computer networks. The participants can use various computers and connect with every place in the world, and two lecture rooms are entirely

equipped with audio-visual facilities.

### Relationships between the SMF and SMAI

The SMF and the SMAI try to work together whenever possible. Here are some recent examples of joint action:

- in collaboration with the Ecole Polytechnique, an international conference on Mathematics in Industry and the services (16-17 November 2000);
- a conference in honour of the French prize winners of the 3rd European Mathematical Congress at Barcelona (9 November 2000);
- establishment of a think-tank group on the teaching of mathematics (commission Kahane);
- publishing of a booklet promoting mathematics to a large audience;
- diffusion of information in real time about the recruitment of teachers in the French universities (opération Postes);
- an on-line information service for young applicants for academic jobs (Livret du candidat);
- diffusion of information on seminars and conferences by setting up the database ACM (supported also by the EMS).

### Special announcement

In April 2001, the SMF published a special issue of the *Gazette*, which contained a paper by Alessandra Carbone and Michael Gromov on mathematical slices of molecular biology.

## *SMAI (France)*

Colette Picard and  
Mireille Martin-Deschamps

The *Société de Mathématiques Appliquées et Industrielles* (SMAI) was founded in 1983 by a group of French applied mathematicians who had become aware of the specific nature of their discipline and wanted to work together for its continuing growth.

The SMAI now has about 1200 members from both the academic and the industrial communities. Members include experts in scientific computing, numerical analysis, partial differential equations, applied probability theory, statistics, control, automatic control, optimisation, discrete mathematics, and so on.

### Goals of the society

The main goal of the Society is to help develop applied mathematics through research, industrial applications, teaching and the training of researchers and engineers.

The SMAI strives to increase awareness of new developments in the use of applied mathematics, and to encourage and facilitate them. The Society thus intends to be an organisation where all persons interested in applied mathematics and its uses can come together. In particular, it provides a meeting ground for universities and industry.

The Society also takes a strong interest in the teaching of applied mathematics in universities and engineering schools, as well as in secondary education. In addition, the SMAI works to encourage continuing education in the various fields of applied mathematics.

### Structure

The SMAI is a non-profit organisation created under the French law of 1901. It consists of individual and institutional members (university or industrial laboratories).

The Board of Directors, one third of which is renewed every year during the General Assembly, establishes the policy of the Society. It elects the President, Treasurer and Secretary from among its members. They, in turn, constitute an Executive Board, which meets monthly to implement the policy decisions of the Society, as defined by the Board of Directors.

Within the Society, there are currently four special scientific interest groups:

- the GAMNI (Groupe pour l'Avancement des Méthodes Numériques de l'Ingénieur), founded in 1973 as an independent organisation and integrated within the SMAI at its creation, is concerned with the development of numerical analysis in industry.
- the MAS group (Modélisation Aléatoire et Statistique), founded in 1991, promotes statistical methods and applied probability theory in a wide range of technologies or applications.
- the MODE group (Mathématiques de l'Optimisation et de la Décision), also founded in 1991, is dedicated to the development of applied mathematics in such domains as non-linear analysis, optimisation, discrete mathematics, operations research, mathematical modelling in economy, finance and social sciences.
- the AFA group (Association Française d'Approximation) is issued from an association created in 1989 and has been integrated as a group of the SMAI in March 2000. Its goal is to promote the study and the use of functions approximation, modelling and geometric design, multi-resolution analysis, smoothing, signal analysis, image analysis, tomography and scientific visualisation.

### Activities of the society

The SMAI engages in several publishing endeavours and organises meetings, workshops, congresses and summer schools.

### Publications

Three times a year the Society publishes its newsletter *Matapli*; it is sent to all members. This newsletter presents scientific articles, generally in the form of reviews, as well as information on congresses, doctoral dissertations, recent publications and news of the applied mathematical community.

The SMAI's monograph series, *Mathématiques & Applications*, publishes textbooks, mostly based on graduate courses (DEA) at universities and engineering schools. By early 1998, the collection com-

prised some thirty-five titles, published by Ellipses (Vols. 1 to 9) and by Springer-Verlag (starting with Vol. 10).

Since 1995, the SMAI has assumed the scientific responsibility for the journal *M2AN Mathematical Modeling and Numerical Analysis*, which was founded by the AFCET with the publisher Gauthier-Villars. Starting in 1998, an electronic version has been available on the Web. Since 1999, the publishing house EDP Sciences, as its new owner, has been in charge of the publication.

Also in 1995, with the help of a grant from the Ministry of Education, Research and Technology, the SMAI launched a new *European Series in Applied and Industrial Mathematics*, called ESAIM, a series of electronic publications consisting of three journals, with scientific criteria that are on a par with those of the best paper journals (editorial board, strict referee system). These journals are *ESAIM COCV* (Control, Optimisation & Calculus of Variations), *ESAIM P&S* (Probability & Statistics) and *ESAIM Proc* (Proceedings). Since 1998, the *ESAIM* series has been produced in cooperation with EDP Sciences. Since 1999, the series has included *ESAIM M2AN*. A full paper-version of the yearly volumes is published at the end of each year.

### Workshops, congresses, summer schools

Within France, the Society organises the yearly *Congrès d'Analyse Numérique* which brings together more than 300 participants to offers high level lectures. It also gives an opportunity to a large number of young PhD students to present the results of their current research.

The 'Journées du groupe MODE', also organized yearly, provide the same type of format for its members and young PhD students. Similarly, the MAS group organises its 'Journées du groupe MAS' every other year.

The GAMNI, as co-founder of the 'European Community on Computational Methods in Applied Sciences' (ECCOMAS), whose goal is to promote scientific computing in industry at the European level, takes part in the ECCOMAS Conferences. The GAMNI itself organises several workshops and congresses every year as well.

The SMAI also organizes a summer school of scientific computing, the CEM-RACS, 'Centre d'été Mathématique de Recherche avancées en Calcul Scientifique'.

This action is supported by the French Department of Education, CNRS, European funding, and is hosted by the CIRM, 'Centre International de Recherches Mathématiques', SMF House. The training is both theoretical and applied. First the participants attend a series of lectures at ASCI (Laboratoire de calcul scientifique intensif du CNRS) in the University of Paris-Sud in Orsay for about two weeks in July. The goal of these lectures, delivered by well-known scientists, is to present the state of the art on the topic of interest. Then the students move to

CIRM in Marseille, and start a research period of about one month on problems defined in cooperation with industry. For the students, it is an opportunity to work on really applied problems, and to develop useful contacts. Each year, the topic of the school changes. This year, it is oriented toward multi-scale problems.

The SMAI and GAMNI founded and fund the Blaise Pascal Prize, which is awarded every year by the French Academy of Sciences for an outstanding contribution in applied mathematics and numerical computation in the engineering sciences.

### Relations with other learned societies and international relations

The SMAI maintains and develops relations with French and foreign learned societies. In France, the Society coordinates its efforts with those of societies interested in related fields: the SMF (Société Mathématique de France), the SFdS (Société Française de Statistique), and is actively involved in the GRIAM (Groupe de réflexion Inter-Associations pour les Mathématiques).

Today, research, whether theoretical or applied, is international. Thus, the SMAI is itself an institutional member of the EMS and of ECCOMAS. At the same time, the Society has formed ties throughout the world with societies concerned with the development of applied mathematics, such as the AMS (American Mathematical Society) and SIAM (Society for Industrial and Applied Mathematics) in the United States, the IMA (Institute for Mathematics and its Applications) in the United Kingdom, in Germany the DMV (Deutsche Mathematiker Vereinigung), which is a co-editor of the journal *ESAIM:P&S*, the Gesellschaft für Angewandte Mathematik und Mechanik (GAMM) in Germany and surrounding countries, the Società Italiana di Matematica Applicata e Industriale (SIMAI) in Italy, and the Sociedad Española de Matemática Aplicada (SEMA) in Spain. These collaborations have led to reciprocity agreements and to the organisation of joint conferences, as exemplified by the active participation of the SMAI as a member of CICIAM (Committee for International Conferences in Industrial and Applied Mathematics). The latter organises the International Congress for Industrial and Applied Mathematics (ICIAM) every four years. The first ICIAM was organized by the SMAI in Paris in 1987; ICIAM 1995, held in Hamburg, drew close to 3000 participants.

Together with the SIMAI and the SEMA, the SMAI has established the \$3000 CICIAM Lagrange Prize, in recognition of a life-time contribution to applied mathematics. This prize, together with other CICIAM prizes, was awarded for the first time at ICIAM in 1999 in Edinburgh to Jacques Louis Lions.

For more information, use the website or write to SMAI, Institut Henri Poincaré, 11 rue Pierre et Marie Curie, F-75231 Paris Cedex 05, FRANCE.

# The Romanian Mathematical Society

*Societatea de Stiinte Matematice din Romania*

Madalina and Vasile Berinde

'Enthusiasm, harmony, unselfish work, continuous sacrifice' – these words have guided the journal *Gazeta Matematica* (Mathematical gazette) through the years, from its first issue in 1895. If the identity of a society of any kind is given by its activities, and if the activity of an academic society is mainly expressed through its publications, it is clear why the Romanian Mathematical Society has always been associated with the monthly *Gazeta Matematica* – its pennon publication – and with these words. However, this identity between the society and the journal is unofficial: the society publishes two other journals, both quarterly; but it is generally accepted that, through its large audience, *Gazeta Matematica* has been, and still is, the society's soul.

Here we present some chronological landmarks in the history of the Romanian Mathematical Society, and focus on its activities, describing its role in high-level mathematical education, and mentioning a few of its outstanding personalities. Because the Society's largest audience has been for its journal on elementary mathematics, *Gazeta Matematica*, we focus on that journal and on its spirit which has ensured

the continuity of its ideas and traditions promoted by successive generations of Romanian mathematicians.

The forerunners of today's Romanian Mathematical Society were the *Romanian Society of Sciences* and the *Society Gazeta Matematica*.

The *Romanian Society of Sciences* was founded in 1897, when a society called The Friends of Mathematical Sciences merged with the Society of Physico-Chemical Sciences; both of these had been founded in 1894. The journal *Bulletin de la Societe Roumaine de Sciences* was born with the Society itself, but split later in 1922 into the *Bulletin Mathématique de la Société Roumaine de Sciences* and the *Bulletin de Physique de la Société Roumaine de Sciences*. In the first journal the papers focused mainly on higher mathematics, while *Gazeta Matematica* published papers on elementary topics. The Romanian Society of Sciences lasted until 1949 when, following the reform of the educational system, it merged with the *Society Gazeta Matematica*.

The *Society Gazeta Matematica* was born in 1910, when the Romanian Parliament approved a law concerning its statutes and

organisation, although it had existed *de facto* since the first issue of *Gazeta Matematica* on 15 September 1895. Joining the Romanian Society of Sciences in 1949 to form the *Society of Mathematical and Physical Sciences*, with new statutes and under the presidency of a mathematician, Grigore Moisil, the *Society Gazeta*



C. Gogu - the first president of RSS

*Matematica* continued its traditions and activities in the hybrid (mathematics and physics) society until 1964, when it split back into two societies, one of them being *Societatea de Stiinte Matematice din Romania*. Because of the role of the *Society Gazeta Matematica* in ensuring a large audience among mathematicians, teachers and students, the Romanian Mathematical Society is now officially considered to have been founded in 1910, the same year as the Swiss Mathematical Society, but still rather late in the European mathematical scenery.

As a result of the close links between the origins of the Romanian Mathematical Society and the journal *Gazeta Matematica*, the main characteristic of the society has always been its deep involvement in education, from the foundation of *Gazeta Matematica* to the famous International Olympiads.

Unlike similar societies all over Europe, the first aims of *Gazeta Matematica* were to 'improve the knowledge in mathematics of high school students', rather than to provide a forum for those occupied with higher mathematics. It was an age of great need for engineering professionals, and the birth of *Gazeta Matematica* arose from such a cause: in 1894, correcting admission papers for the School of Bridges and Highways (now the Politechnica University in Bucharest) and noting the very poor level of mathematical knowledge of those who aimed at a career in the field, five

## GAZETA MATEMATICA

APARE O DATA PE LUNA

ANUL I.



NUMARUL 1. SEPTEMBRIE 1895

**SUMARUL**

1. Introducere
2. Suprafata si volumul produs prin rotatia unui cerc sau poligon regulat ce se invertele in jurul unei drepte paralele din planul sau . . . . . A. G. Ionescu
3. O chestie de doborâti . . . . . I. Ionescu
4. Maximul si minimul fractiunii  $\frac{ax^2 + bx + c}{rx^2 + bx + c}$  . . . . . V. Cristescu
5. Teorema lui Pitagora . . . . . I. Ionescu
6. Probleme propuse.

ABONAMENTUL 6 LEI PE AN.



Gh. Titeica

young engineers, **Ion Ionescu**, **Victor Balaban** (who gave the journal its name, but died just seven days after its first issue), **Vasile Cristescu**, **Mihail Roco** and **Ioan Zottu**, decided to issue a monthly journal which could help scholars to solve problems and study mathematics at a higher level than they had done in school. Soon after, **Andrei Ioachimescu** and **Gheorghe Titeica**, the first pure mathematician, joined the Editorial Board.

In the first issue, the board fixed their objectives:

1. to publish original papers in mathematics;
2. to develop an appetite for the study of mathematics and doing original research.

Through the years, a special atmosphere formed around the *Gazeta Matematica*, a continual concern in developing a high mathematical culture, not only among its readers. Besides the high scientific quality of the published papers and problems, the first books of a series *The Library of Gazeta Matematica* appeared in 1901, a series that continued with translations of such classic



Gr. Moisil

books as Euclid's *Elements*, with modern papers of the time, and with original books of Romanian mathematicians. The Roumanian Mathematical Society was also involved in publishing school books.

But the most important and effective

method for attracting the most talented youngsters was the introduction of contests, beginning with the annual *Gazeta Matematica* contests (first organized in 1902), continuing with the National Olympiad from 1949, and initiating and organising the *International Mathematical Olympiad* for the first time in 1959. (Articles have already appeared on this topic in Paul Jainta's 'Problem Corner' in *EMS Newsletters* 32, 34 and 36). The excellent results of the Romanian team through the years are just one example of the high level of mathematical education, promoted by the Romanian Mathematical Society and the *Gazeta Matematica*, together with other achievements of the representatives of the Romanian Mathematical School. It has become natural in Romania for gifted scholars in mathematics to work with *Gazeta Matematica* – generations of brilliant mathematicians have been involved with this journal, that has appeared continuously since its foundation, even in time of war, and whose monthly audience increased to 100,000-120,000 copies in the period 1970-1989.



S. Haret

Not only scholars, but also teachers are the objects of the activities of the Romanian Mathematical Society and of *Gazeta Matematica*: meetings, symposia, congresses, summer schools and courses in which university professors and school-teachers meet to discuss the problems and challenges of mathematical education. In addition, a methodological series of *Gazeta Matematica* has appeared since 1949 (except for six years from 1974 to 1980), which publishes mainly didactical papers. So, every serious educational initiative in the field of mathematics spins around the old and ever young Romanian Mathematical Society, and around *Gazeta Matematica*. Other activities of the Romanian Mathematical Society have included the *Congresses of Romanian Mathematicians*: four of these have been organised so far, in 1929, 1932, 1945 and 1956, and have attracted Romanian mathematicians and outstanding foreign mathematicians, including H. Poincaré, P. Montel, V. Volterra, G. Darboux, H. Lebesgue, A. Denjoy, J. Hadamard.

The Romanian Mathematical Society has

also been the organiser or co-organiser of several important international congresses. These include:

- the Congress of Mathematicians of Latin Expression (commemorating E. Cartan), held in Brasov in September 1969; among the participants were G. de Rham, J. Cerf and H. Cabannes (France), P. Lelong (Switzerland), L. Gaudeaux (Belgium), P. Ribenboim (Canada), M. Piccone (Italy), O. Boruvka (Czechoslovakia), D. Kurepa (Yugoslavia), N. Kuhlmann (Germany) and C. Foias (Romania).
- the 3rd Congress of the Inter-Balkan Mathematics Union, held in Bucharest in 1966.
- the annual conferences of the Romanian Mathematical Society, held since 1997 (Bucharest 1997, Cluj-Napoca 1998, Craiova 1999, Constanta 2000, and Brasov 2001), where Romanian and foreign mathematicians report on their recent research results.



I. Ionescu

On five occasions the Romanian Mathematical Society has organised the International Mathematical Olympiad: the first one in 1959, then in 1960, 1969, 1978 and 1999 (for the 40th anniversary). The Romanian Mathematical Society has also partially supported its members to attend the International Congresses of Mathematics in Moscow 1966, Nice 1970, and Helsinki 1978, as well as other international congresses, by organising so-called 'scientific excursions'.

Romanian mathematicians have also been strongly involved in editing its third publication: the *Bulletin Mathématique de la Société des Sciences Mathématiques de Roumanie*, devoted to higher mathematics only. We mention, in particular, Ion Ionescu, one of the founders of the *Gazeta Matematica* and called its *spiritus rector*, Spiru Haret, who as Minister of Education introduced a new education law in 1898, thereby establishing a modern mathematical educational system in Romania, Gh. Titeica, T. Lalescu, A. Ioachimescu, D. Pompeiu, P. Sergescu, Gr. Moisil (President of the Romanian Mathematical

Society from 1949 to 1973), N. Teodorescu (President of the Romanian Mathematical Society from 1973 to 1995 and Honorary president from 1995 to 2000), T. Popoviciu and C. Iacob.

Today's objectives of the Romanian Mathematical Society include leading the educational and research activities, participating in the international scientific life, organising the Olympiads, discovering and encouraging talent, creating a proper climate for communication and for developing original mathematical values, and keeping the good tradition of a mathematical community around the old *Gazeta Matematica*, a community capable of affirming its values and contributing to the European and World scientific patrimony. For further information, see or the Romanian Mathematical Society's home page:

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*The authors of this article are Madalina Berinde, 'Babes-Bolyai', University Cluj-Napoca, and Vasile Berinde, North University of Baia Mare.*

## Appeal for Romanian science

Miles Reid (Warwick)

The purpose of this appeal is to draw attention to the devastating effect of the current brain drain on Romanian science, and to suggest ways in which Western scientists and funding organisations could mitigate it with a relatively modest outlay of effort and money.

**The problem**

Romania has almost unique strengths in several areas of intellectual activities, and supplies any number of top scientists to Western universities. Its high school and undergraduate programmes are still among the strongest in the world, and its graduates are eagerly sought after by US and European universities, and increasingly also by computer and software companies. Of math students at Bucureshti alone, the top 20 students are offered places abroad, in many cases even before graduation; just imagine how Harvard or the Ecole Normale or Cambridge UK would fare in such a regime. The Romanian academy and the faculties of their universities also feature high quality researchers, but the group is greying —

there is practically no-one under 50 left to teach the younger generation..

Economically speaking, Romania is uniquely disadvantaged among the candidates for EU membership. The salary of an established university lecturer is likely to me no more than US\$250 a month, at a time when the cost of living is rapidly converging to Western levels. It is quite probable that the economy has finally bottomed out, and is set to grow over the next 20 years (possibly somewhat unevenly); however, this will certainly take a long time to feed through to basic science, and there is a very real fear that by the time Romania is on its feet again, and (say) can satisfy the criteria for EU membership, its magnificent scientific schools will have disappeared from the face of the earth.

Quite apart from issues of morality or human solidarity or fairness, there are at least three imperative reasons of pure self-interest for the West to support Romanian science. First, to preserve what is unarguably an extraordinarily fruitful training ground for young recruits into Western science. Second, to foster the eventual emergence in Romania of a strong economic partner with its excellent scientific tradition still in place. Finally, preserving a solid educational system and intellectual tradition could provide an effective bulwark against demagogic and nationalistic politics of the extreme right or left that could well emerge as a threat to peace in the region; the pen, after all, is likely to be considerably cheaper than the sword.

**What can be done about it?**

*'Return to Romania' fellowships*

At present, one hears repeatedly from many Romanian post-docs in Western universities that they would like to return to their country home, but that this is absolutely impossible for financial reasons. In many such cases, a very modest stipend would make all the difference. (Estimated price tag: US\$1,000 a month in living expenses, plus US\$200 research expenses and a similar amount for the host institution: total US\$16,800 per year, to last for 3 or 4 years per individual, possibly with intermission to allow foreign travel.) Such a programme already exists: the United States Agency for International Development (USAID)'s scheme 'Return to Romania': [www.irex.org/programs/rtr](http://www.irex.org/programs/rtr), but much more is needed.

*Small-scale financial help*

Romanian scientific centres need small-scale financial help from the West to develop bilateral partnerships with other former communist countries, such as their closest neighbours Hungary, Bulgaria, Czech Republic, Poland, etc. There is tremendous scope here for mutual help in a context in which the brain-drain is not such a serious issue. Since two countries stand to benefit, this would be a doubly effective use of Western money. As a somewhat longer shot, a very modest outlay would even allow Romanian universities to replace some of their own lost generation of graduate students with recruits from countries

such as Cuba, Vietnam and (eventually) North Korea.

*Scientific collaboration*

Finally, the importance of direct scientific collaboration should not be overlooked: inviting senior Romanians to Western conferences, and visiting them in return. For those of us that have enjoyed the company, and benefited from the scientific abilities of Romanian graduate students and post-doctoral fellows, it seems particularly appropriate to return the compliment to the schools that produced them.

*Note:* Romanian scientists currently receive grants from the West under a number of projects, and they are very grateful for this help. For example, Romania participates as an EU 'associated state' in EU Framework 5 scientific networks and projects. On the positive side, this means that they already have some resources, such as adequate computing facilities, and the experience of managing grants; they are thus in a good position to benefit from the kind of financial help advocated above. The problem with the present grants is that they are always tied down by legal restrictions, so that they cannot be used where most needed, for example, to give their young people 'Return home' fellowships. In addition, EU money (such as fellowship and conference money) is in large measure restricted to researchers under 35, with the unintended consequence that essentially no resident Romanian scientist can benefit.

**Historical and philosophical conclusion**

The Romanian intellectual tradition has deep roots, going back into the 18th and early-19th century, when their students started travelling to France or Germany, to be influenced by all the successive fashions and revolutionary ideas of the West. The unification of the Romanian principalities in 1859 was an almost casual consequence of manipulation by the Great Powers after the Crimean War. From then on right through to the Second World War, Romanian social and economic thinkers dissected in extraordinary detail the problems of a developing nation, including issues such as agrarian versus industrial, state intervention versus laissez-faire, protectionism versus free trade, foreign investment versus self-reliance, etc. In short, how can a new nation such as theirs make an honest living in the world? It would certainly have astonished these thinkers to know that after the ravages of the Second World War, and after the catastrophe unleashed on the country by the vicious and megalomaniac policies of Ceaucescu, one of their principal remaining commodities – the brains of their young scientists – is being systematically plundered for absolutely no return by Western universities and companies.

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# Personal Column

Please continue to send the Editor information on awards, appointments and deaths to this Column. The next Personal Column will appear in issue 42 (December 2001).

## Awards

**Vladimir I. Arnold** (Moscow/Paris) has been awarded a 2001 Wolf Prize for his influential work in dynamical systems, differential equations and singularity theory.

**Grzegorz Bobinski** (Torun) and **Andrzej KomisarSKI** (Warsaw) have received the two first Marcinkiewicz Prizes for students' research papers.

**Carlo Cercignani** (Milan) and **Claudio Procesi** (Rome) have been elected Fellows of the Accademia dei Lincei.

**Kyzysztof Ciesielski** and **Zdzislaw Pogoda** (Krakow) have received the Steinhaus Prize for the best Polish books popularising any kind of science in the past four years.

**Alain Connes** (Paris) is being awarded the 2001 Crafoord Prize in Mathematics by the Royal Swedish Academy of Sciences for his work in the theory of operators and non-commutative geometry.

**Friedrich Hirzebruch** (Bonn) has been awarded the Banach Medal by the Banach Mathematical Centre.

**Werner Hürlimann** (Winterthur) has received the Gunnar Benktander Prize for work on financial data analysis.

**Marek Kaluszka** (Lodz) has received the Great Prize of the Polish Mathematical Society for his research in statistics.

**Stanislaw Kasjan** (Torun) has received the Kuratowski Prize, awarded to Polish mathematicians aged 30 or less.

**Francis Kirwan** (Oxford), **Adrian Smith** (London), **Ian Stewart** (Warwick) and **Alex Wilkie** (Oxford) have been elected Fellows of the Royal Society, London.

**Slawomir Kolodziej** (Krakow) has received the Zaremba Great Prize of the Polish Mathematical Society for his research in pluripotential theory.

**Zbigniew Marciniak** (Warsaw) has received the Sierpinski Great Prize of the Polish Mathematical Society for his research in algebra.

**Witold Marciszewski** (Warsaw) has received the Mazurkiewicz Great Prize of the Polish Mathematical Society for his research in topology.

**Yurii Nesterov** (Louvain) has been award-

ed the 2000 George Dantzig Prize, for his contributions to interior point methods for convex programming.

**Sandu Popescu** (Hewlett-Packard/Bristol) has been awarded the Adams Prize of the University of Cambridge, for research in quantum information.

**Saharon Shelah** (Jerusalem) has been awarded a 2001 Wolf Prize for his fundamental contributions to mathematical logic and set theory.

**Jozef Siciak** (Krakow) has been awarded an Honorary Doctorate by the University of Uppsala.

**Ian Stewart** (Warwick) has been awarded the 2001 Ferran Sunyer I Balaguer Prize, with Martin Golubitsky (Houston), for their monograph: *The symmetry perspective..*

**Jacek Tabor** (Krakow) has received the Prize of the Polish Mathematical Society for young mathematicians.

**Harold Thimbleby** (London) has been appointed Gresham Professor of Geometry, in succession to Sir Roger Penrose.

**Robin Wilson** (Milton Keynes/Oxford) has been appointed Visiting Professor in the History of Mathematics at Gresham College, London.

**Günther Ziegler** (Berlin) has been awarded a 2001 Gottfried Wilhelm Leibniz prize by the Deutsche Forschungsgemeinschaft (DFG) for his work in discrete geometry.

## Deaths

We regret to announce the deaths of:

**G. H. Bailey** (17 November 2000)

**I. Noel Baker** (20 May 2001)

**Ernest-August Behrens** (1 Dec 2000)

**Zygmunt Charzynski** (29 January 2001)

**John G. Fauvel** (12 May 2001)

**Walter Felscher** (9 December 2000)

**F. G. Friedlander** (20 May 2001)

**John Hawkes** (11 April 2001)

**Michael R. Herman** (2 November 2000)

**Roman Kaluza**

**Gottfried Meyer** (13 September 2000)

**Crispin Nash-Williams** (20 January 2001)

**Rogério Silva Sousa Nunes** (Feb 2000)

**Robert A. Rankin** (27 January 2001)

**J. J. Seidel** (May 2001)

**Claude Shannon** (24 February 2001)

**Arthur Geoffrey Walker** (31 March 2001)

**J. A. Weightman** (15 January 2001)

**Helmut Wielandt** (May 2001)

**Laurence Chisholm Young** (24 Dec 2000)

## Letter to the Editor

Interview with Bernhard Neumann in *EMS Newsletter* 39

I am writing about the publication in the above article of remarks made by Bernhard Neumann about Professor George Steward, who was one of my predecessors as Head of Mathematics here at the University of Hull. Although I arrived here after he retired, I came to know George Steward well through visiting him and he was a considerable help to me in my early days as head of the Pure Mathematics Department. Several of my colleagues in the Department here also know him – either because they were here before he retired or came to know him later like me.

This letter is to express our view that publication of such remarks is unacceptable and offensive to the memory of Professor Steward and to those of us who knew him either as friend or colleague. We would appreciate an appropriate acknowledgement and apology for this action, which does not fit at all well with the mission of an organisation such as the EMS.

Nigel Cutland

*Editor's note. While the views expressed were entirely those of Professor Neumann, and not those of the EMS, we apologise for any offence that may have been caused.*

*Applications are invited for 2 Full Professorships (C4) in Mathematics University of Bielefeld, Germany*

For one of the positions the Department is looking for either an algebraist or a number theorist, and for the other either a topologist or a geometer.

The person taking up the position is expected to:

- participate fully in the teaching and research duties of the Department,
- become actively involved in the Department's present and future research projects,
- have an interest in mathematics not restricted to their own field of expertise,
- be open to the possibilities of interdisciplinary cooperation.

Applications received by 30 September 2001 will be assured of consideration.

These should be sent to the Chairman of the Department of Mathematics, University of Bielefeld, Box 100131, 33501 Bielefeld, Germany.

The starting dates for these positions are provisionally set for 1 October 2002 and 1 April 2003, respectively.

# Five Years of Documenta Mathematica

Ulf Rehmann (Bielefeld)

The fifth annual volume of *Documenta Mathematica* is currently being published in printed form, which seems to be a good reason to look back on the journal's history. Without any commercial assistance, more than 300 articles (covering 5000 pages) have been published in most fields of mathematics and including the three-volume extra edition of the *ICM'98 Proceedings*.

The recent annual volume shows the liveliness and actuality of our discipline, in twenty-one interesting articles (covering 731 pages) from various branches of mathematics. A particular highlight in this volume's electronic version is the article *Cross-over collision of scroll wave filaments* by B. Fiedler and R. M. Mantel, which contains, together with exciting research results on parabolic differential equations, extensive video-illustrations of the most fascinating research aspects of the article. This shows the superiority of the electronic way of journal production: such impressive visual presentation could never be achieved by a book or by a conventionally produced journal.

During the last five years, *Documenta Mathematica* has become a successful and internationally known journal. It is well accepted by authors and by readers: its usually quick decisions on publication and its author-friendly copyright regulations attract many good manuscripts. The selection of articles is careful and deliberate.

Positive publication decisions are made on the basis of peer review and by the unanimous vote of the managing editors upon the suggestion of the communicating editor of each article. Everybody who is an author of a *Documenta* article can be proud to be so.

But an author can also be sure to find a big readership. *Documenta Mathematica* is freely broadcasted on the world wide web by its two 'native' servers in Bielefeld and Urbana, and also by the more than forty mirror servers of the European Mathematical Society, and is therefore world-wide accessible to everyone on the web.

The access rates for the articles are surprisingly high: on average each article is downloaded twice every three days, as a dvi file, postscript file or pdf file (hence in its full text); these numbers are from the Bielefeld and Urbana servers, and do not include access by robots and automatic search engines (which also contribute to the distribution as they often serve local mirrors). Many libraries in various countries subscribe to the printed version, which is currently always produced after each annual volume is complete.

Recently, *Documenta Mathematica* has been selected by the SPARC initiative (<http://www.arl.org/sparc/>) of scientific libraries in the USA as a journal in the 'Leading edge' category; *Documenta* considers this selection as a particular success. The SPARC initiative of more than 200 scientific institutions includes libraries from all the Ivy League universities in the US, and also from several leading European universities. The goal of this initiative is to recommend high-level scientific journals that are produced and offered at a modest price, in order to compete with the price inflation of scientific journals. Usually, the recommended journals are produced by universities or learned societies, which operate the journals as a non-profit organisation.

Several well known, international commercial publishers have tried to take over *Documenta Mathematica*, admitting that they would not be able to keep the price of *Documenta Mathematica* as low as it is right now. But it is unnecessary to raise the price of the journal. *Documenta Mathematica* so far has been an economic success. (A management report on its first four years was given by its managing editors in September 1999: see <http://www.mathematik.uni-bielefeld.de/DMV/archiv/documenta99.html>).

The journal has never taken financial support from any source, in spite of the fact that several offers have been made; these were rejected in order to maintain the financial independence of the journal. On the contrary, with its low-budget production of the *ICM'98 Proceedings*, *Documenta Mathematica* contributed to the fact that the ICM ended up with a financial surplus, which was then used to establish a new scientific prize for mathematicians: see the author's article 'Efficient Production of Mathematical Literature' for the workshop 'Future of Mathematical Communication 1999' at Berkeley, on <http://www.mathematik.uni-bielefeld.de/~char126rehmann/EP/>.

Using such a financial surplus from scientific publication for the welfare and benefit of our science, is something which many of us like to support, and *Documenta Mathematica* is proud for having already, as a relatively young journal, contributed to such a desirable goal.

*Editor's note: In Ulf Rehmann's article 'The Price Spiral of Mathematics Journals' (EMS Newsletter 38), an incorrect web address was given; instead of <http://www.mathematik.uni-bielefeld.de/~char126rehmann/BIB/> it should read <http://www.mathematik.uni-bielefeld.de/~rehmann/BIB/>*

# HYKE

## A Proposed European Network in Applied Mathematics

Norbert Mauser

(WPI and University of Vienna)

In the last call for Research Training Networks of the 5th framework programme of the EU, the trend towards application-oriented training was enhanced.

The proposed IHP network *Hyperbolic and Kinetic equations: asymptotics, numerics, applications* (HYKE), coordinated by N. J. Mauser (WPI Vienna) and B. Perthame (ENS Paris), includes 200 applied mathematicians in 15 groups with satellites in 12 countries, including Poland, Czechia and Israel.

Created from the two successful TMR networks *Hyperbolic systems of conservation laws* and *Asymptotic methods in kinetic theory*, and adding some key figures of the TMR network *Viscosity solutions and applications* (including P. L. Lions), HYKE will attempt significantly to strengthen European applied mathematics. From the mathematical point of view, there is important synergy between these three fields and the new network is set to be a global player.

At the core is a broad and complementary international high level training programme on 'modelling-analysis-numerics' which intends to produce applied mathematicians (in the sense of 'pure mathematics plus applications') who can easily switch between academia and industry. To this end, a link to ECMI is formed by including, for example, M. Anile, H. W. Engl, and H. Neunzert.

The network comprises a variety of scientific expertise in the fields of differential equations, numerical analysis, scientific computing, and also in various branches of theoretical mechanics (continuum physics, kinetic theory and quantum mechanics). As the focus of mechanics within the applied mathematics community is shifting, driven by the fact that modern applications often require modelling via microscopic physics, the proposed research on time-dependent PDEs seems very timely.

These kinds of large networks should also yield a positive impact on the European Research Area, the new meta-goal of the framework programmes.

A similar large network in the field of algebraic geometry with an orientation towards application (the EAGER network), coordinated by A. Conte (Torino), was successful in the previous call.

# 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](mailto: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

## June 2001

### 27-2 July: Midnight Sun Workshop on Stochastic Analysis and Mathematical Finance, Kautokeino, Norway

**Aim:** to bring together researchers and students in stochastics and finance, and to discuss the latest developments in this exciting and rapidly developing area of research under inspiration from the midnight sun

**Organising committee:** Fred Espen Benth and Bernt Øksendal (University of Oslo, Norway)

**Programme:** presentations by invited speakers and workshop participants

**Sponsor:** NorFa via the network Stochastic Analysis and its Applications, led by Professor Paavo Salminen, Aabo Academy, Finland

**Deadline:** for registration, already passed  
**Information:** contact Fred Espen Benth or Bernt Øksendal, Department of Mathematics, University of Oslo, PO Box 1053 Blindern, N-0316 Oslo, Norway

*e-mail:* [fredb@math.uio.no](mailto:fredb@math.uio.no) or [oksendal@math.uio.no](mailto:oksendal@math.uio.no)

## July 2001

### 1-6: Eighteenth British Combinatorial Conference, Brighton, UK

**Information:**

*e-mail:* [bcc2001@susx.ac.uk](mailto:bcc2001@susx.ac.uk)

*Web sites:* <http://www.maths.susx.ac.uk/Staff/JWPH/>  
<http://hndel.maps.susx.ac.uk/TAGG/Confs/BCC/index.html>

[For details, see EMS Newsletter 36]

### 3-7: Barcelona 2001 EuroPhD Topology Conference, Bellaterra, Barcelona

**Information:**

*Web site:* <http://www.crm.es/b2001etc>

[For details, see EMS Newsletter 39]

### 4-6: MathFIT workshop: The Representation and Management of Uncertainty in Geometric Computations, Sheffield, UK

**Information:**

*Web site:* <http://www.shef.ac.uk/~geom2001/>

### 4-6: Variational Methods for Discontinuous Structures, Applications to Image Segmentation and Continuum Mechanics, International Workshop, Como, Italy

**Speakers:** E. Acerbi (Parma), J. M. Ball (Oxford), G. Bouchitté (Toulon), G. Buttazzo (Pisa), G. Del Piero (Ferrara), I. Fonseca (Pittsburgh), N. Fusco (Napoli), D. Kinderlehrer (Pittsburgh), R. Kohn (New York), A. Leaci (Lecce), R. March (Roma), J. M. Morel (Paris), U. Mosco (Roma), D. Owen (Pittsburgh), M.

Paolini (Brescia), D. Percivale (Genova), L. Truskinowski (Minneapolis), J. Shah (Boston).

**Organisers:** G. Dal Maso (S.I.S.S.A.) and F. Tomarelli (Politecnico di Milano)

**Location:** Villa Erba, Cernobbio

**Information:**

*Web site:* [www.mate.polimi.it/villaerba2001](http://www.mate.polimi.it/villaerba2001)

### 5-7: British Congress of Mathematics

**Education, Keele, UK**

**Information:**

*Web site:* <http://www.bcme.org.uk>

### 8-13: Second Workshop on Algebraic Graph Theory, Edinburgh, Scotland

**Information:**

*e-mail:* [p.rowlinson@maths.stir.ac.uk](mailto:p.rowlinson@maths.stir.ac.uk)

*Web site:* <http://www.ma.hw.ac.uk/icms/current/graph/index.html>

[For details, see EMS Newsletter 38]

### 8-14: Differential Geometry Valencia 2001, Spain

[International Meeting on the Occasion of the 60th Birthday of Professor A. M. Naveira]

**Main speakers:** 50 minute talks: T. Aubin (Paris), M. Barros (Granada), J.-P. Bourguignon (IHES), M. P. do Carmo (IMPA), K. Grove (Maryland).

40 minute talks: L. Alias (Murcia), D. Blair (Michigan), A. Borisenko (Kharkov), F. Brito (Sao Paulo), P. B. Gilkey (Oregon), O. Gil-Medrano (Valencia), D. Johnson (Lehigh), S. Salamon (Oxford), L. Vanhecke (Leuven)

**Organising committee:** Manuel Barros (Granada), Francisco Carreras (Valencia), María Luisa Fernández (País Vasco), Ángel Ferrández (Murcia), Olga Gil-Medrano (Valencia), Ximo Gual (Castellón), Luis Hervella (Santiago de Compostela), Vicente Miquel (Valencia), Salvador Segura (Alicante)

**Sponsors (provisional):** Ministerio de Ciencia y Tecnología, Generalitat Valenciana, Universitat de Valencia, Caja de Ahorros del Mediterráneo

**Information:**

*e-mail:* [Valencia2001@uv.es](mailto:Valencia2001@uv.es)

*Web site:* <http://radon.act.uji.es/~naveira/>

### 9-15: Symmetry in Nonlinear Mathematical Physics, Kiev, Ukraine

**Topics:** classical, non-classical, conditional and approximate symmetry, of equations of mathematical physics, symmetry in non-linear quantum mechanics, quantum fields, gravity, fluid mechanics, mathematical biology, mathematical economics, representation theory,  $q$ -algebras and quantum groups, symbolic computations in symmetry analysis, dynamical systems, solitons and integrability, supersymmetry and paraspersymmetry

**Main speakers:** J. Beckers (Belgium), O. Bogoyavlenskij (Canada), P. Clarkson (UK), Edward Corrigan (UK), H.-D. Doebner (Germany), B. K. Harrison (USA), E. Ivanov (Russia), M. Lakshmanan (India), J. Niederle (Czech Republic), A. Nikitin (Ukraine), Y. Samoilenko (Ukraine), M. Tajiri (Japan), A. Klimyk (Ukraine), R. Zhdanov (Ukraine)

**Call for papers:** those wishing to present an oral communication or a poster should send the registration form (see the web-site) and abstract (plain ASCII or TeX) to [appmath@imath.kiev.ua](mailto:appmath@imath.kiev.ua)

**Organising committee:** A. Nikitin and A.

Samoilenko (Co-Chairs, Ukraine), J. Beckers (Belgium), G. Bluman (Canada), P. Clarkson (UK), N. Debergh (Belgium), H.-D. Doebner (Germany), G. Goldin (USA), B. K. Harrison (USA), N. Ibragimov (Sweden), M. Lakshmanan (India), J. Niederle (Czech Republic), M. Tajiri (Japan), P. Winternitz (Canada), A. Klimyk, M. Shkil, I. Skrypnyk, I. Yehorchenko and R. Zhdanov (Ukraine)

**Site:** Institute of Mathematics of National Academy of Sciences of Ukraine and Ukrainian Pedagogical University

**Information:**

*e-mail:* [appmath@imath.kiev.ua](mailto:appmath@imath.kiev.ua)

*Web site:* <http://www.imath.kiev.ua/~appmath/conf.html>

### 9-22: European Summer School on Asymptotic Combinatorics with Applications to Mathematical Physics, St Petersburg, Russia

**Information:**

*e-mail:* [emschool@pdmi.ras.ru](mailto:emschool@pdmi.ras.ru)

*Web site:* [www.pdmi.ras.ru/EIMI/2001/emschool/index.html](http://www.pdmi.ras.ru/EIMI/2001/emschool/index.html)

[For details, see EMS Newsletter 38]

### 10-15: Advanced Course on Symplectic Geometry of Integrable Hamiltonian Systems, Bellaterra, Barcelona

**Information:**

*Web site:* <http://www.crm.es/sgihis>

[For details, see EMS Newsletter 39]

### 11-16: Geometry, Symmetry and Mechanics I, Lisbon, Portugal

**Scope:** this meeting will focus on the geometry, dynamics and numerics of mechanical systems with symmetry and applications to areas such as atomic and molecular spectroscopy and continuum mechanics. It is being organised under the auspices of the EC Research Training Network 'Mechanics and Symmetry in Europe' (MASIE) and is sponsored by CAMGSD (Lisbon), but is open to all scientists with interests in the relevant areas

**Programme:** several minisymposia on (tentatively): Hamiltonian relative equilibria and periodic orbits, singularities and perturbation of integrable systems, non-holonomic systems, numerics of Hamiltonian systems, qualitative aspects of atomic and molecular systems, semi-classical methods, Hamiltonian PDEs and continuum mechanics. Contributions to these are particularly invited.

**Speakers:** H. Broer, D. Chillingworth, P. Chossat, R. Cushman, G. Derks, F. Fassò, S. Gottwald, A. Iserles, B. Leimkuhler, R. Littlejohn, C.-M. Marle, J. Montaldi, R. Montgomery, J. Nataro, San Vu Ngoc, W. Oliva, J.-P. Ortega, G. Patrick, T. Ratiu, S. Reich, M. Roberts, D. Sadovskii, J. Scheurle, E. Sousa Dias, G. Tanner, M. West, C. Wulff, B. Zhilinskii, and other members of the MASIE Network

**Organising committee:** Mark Roberts (Warwick, UK), Esmeralda Sousa Dias (IST, Portugal)

**Sponsors :** MASIE-RTN contract number: MASIE-HRPN-CT-2000-00113, CAMGSD-Centro de Análise Matemática Geometria e Sistemas Dinamicos (IST, Lisboa)

**Site:** Instituto Superior Técnico, Lisboa

**Deadlines:** for contributed talks and accommodation, already passed

**Information:**

*e-mail:* [gsmi@math.ist.utl.pt](mailto:gsmi@math.ist.utl.pt)

*Web site:* <http://www.math.ist.utl.pt/~edias/MASIE/GSMI>

### 15-20: Algorithms for Approximation IV International Symposium, Huddersfield, UK

**Information:**

*e-mail:* [A4a4@Hud.Ac.Uk](mailto:A4a4@Hud.Ac.Uk)

## CONFERENCES

Web-site: <http://Helios.Hud.Ac.Uk/A4a4/>  
[For details, see EMS Newsletter 38]

### 17-23: Advanced Course on Global Riemannian Geometry: Curvature and Topology, Castelló de la Plana

Information:  
Web site: <http://www.crm.es/geom2001>  
[For details, see EMS Newsletter 39]

### 18-28: Advanced Course on Modular Forms and $p$ -adic Hodge Theory, Bellaterra, Barcelona

Information:  
Web site: <http://www.crm.es/tn2001>  
[For details, see EMS Newsletter 39]

### 23-27: 20th IFIP TC 7 Conference on System Modelling and Optimization, Trier, Germany

Information:  
*e-mail*: [ifip2001@uni-trier.de](mailto:ifip2001@uni-trier.de)  
Web site: <http://ifip2001.uni-trier.de>  
[For details, see EMS Newsletter 38]

## August 2001

### 5-18: BALTICON 2001, Banach Algebra Theory in Context, Krogerup Hojskole, Humlebaek, Denmark

Information:  
*e-mail*: [balticon2001@math.ku.dk](mailto:balticon2001@math.ku.dk)  
Web site: <http://www.math.ku.dk/conf/balticon2001/>  
[For details, see EMS Newsletter 38]

### 5-18: Groups St Andrews 2001, Oxford, UK

Information:  
*e-mail*: [gps2001@mcs.st-and.ac.uk](mailto:gps2001@mcs.st-and.ac.uk)  
Web site: <http://www.bath.ac.uk/~masgcs/gps01/>  
[For details, see EMS Newsletter 36]

### 12-18: 39th International Symposium on Functional Equations, Denmark

Organising committee: Peter Friis and Henrik Stetkaer (Aarhus University)  
Information:  
*e-mail*: [isfe39@imf.au.dk](mailto:isfe39@imf.au.dk)  
Web site: <http://www.mi.aau.dk/isfe39/>

### 12-19: Summer School 2001 Homological Conjectures for Finite Dimensional Algebras, Nordfjordeid, Norway

Information: contact Øyvind Solberg ([oyvinso@math.ntnu.no](mailto:oyvinso@math.ntnu.no), NTNU, Trondheim)  
Web sites: <http://www.mathematik.uni-bielefeld.de/~sek/summerseries.html>  
<http://www.math.ntnu.no/~oyvinso/Nordfjordeid/>  
[For details, see EMS Newsletter 38]

### 18-24: Convex Geometric Analysis, Anogia, Crete

Main speakers: K. Ball (London), I. Barany (Hungarian Academy of Sciences), P. Gruber (Vienna), A. Koldobsky (Missouri, U.S.A.), A. Pajor (Marne La Vallée, France), G. Schechtman (Israel), S. Szarek (U.S.A.)  
Coorganiser: University of the Aegean (Department of Mathematics)  
Organisers: A. Giannopoulos (Crete), V. Milman (Tel Aviv), R. Schneider (Freiburg), S. Szarek (U.S.A./Paris)  
Information: contact Susanna Papadopolou, Department of Mathematics, University of Crete, 71409 Heraklion, Crete, Greece; fax: 81-393881  
*e-mail*: [souzana@math.uch.gr](mailto:souzana@math.uch.gr)

### 19-25: 9th Prague Topological Symposium, International Conference on General Topology and its Relations to Analysis and Algebra, Prague, Czech Republic

Information:

Web site: <http://www.karlin.mff.cuni.cz/~toposym/>  
*e-mail*: [toposym@karlin.mff.cuni.cz](mailto:toposym@karlin.mff.cuni.cz)  
[For details, see EMS Newsletter 39]

### 20-24 Variational Sequences and Bicomplexes: Advanced 5-day course, Opava, Czech Republic

Lectures: Group invariant solutions to differential equations and reduction of variational bicomplexes; introduction to variational sequences; geometric aspects of conservation laws of non-linear differential equations  
Lecturers: I. M. Anderson (Utah), D. Krupka (Opava), A. Verbovetsky (Moscow)  
Language: English  
Information:  
Web site: <http://www.math.slu.cz/levoca.html>

### 20-25: 3rd International ISAAC Congress, Berlin, Germany

Theme: Analysis  
Aim: to promote and advance analysis, its applications, and its interaction with computation  
Scope: real, complex, hypercomplex analysis, potential theory, differential geometry, differential equations, operator theory, applied and numerical analysis, computation  
Main speakers: N. S. Bakhvalov and M. E. Eglit (Moscow), A. D. Bruno (Moscow), M. Essén (Uppsala), P. Kuchment (Wichita), V. Maz'ya (Linköping), S. M. Nikol'skii (Moscow), T. Nishitani (Osaka), I. Prigogine and I. Antoniou (Brussels), S. Saitoh (Kiryu), M. Singer (Raleigh), D. Tataru (Evanston)

Sessions: function spaces and fractional calculus, asymptotic decomposition (methods of small parameters, averaging theory), integral transforms and applications, analytic functionals, hyperfunctions, and generalised functions, geometric function theory, complex function spaces, value distribution theory and complex dynamics; Clifford analysis, octonions; non-linear potential theory, classical and fine potential theory, holomorphic and finely holomorphic functions; differential geometry and control theory for PDEs, differential geometry and quantum physics; singular boundary value problems for ODEs, dynamical systems, attractors for PDEs, spectral theory of differential operators, pseudodifferential operators, quantisation and signal analysis, integral equations and pseudodifferential equations, microlocal analysis, complex and functional analytic methods in PDEs, geometric properties of solutions of PDEs, qualitative properties of solutions of hyperbolic and Schrödinger equations; homogenisation, moving boundaries, and porous media, constructive methods in applied problems, hysteresis problems in applications, pattern formation, waves in complex media, non-linear waves, mathematical analysis of problems in solid mechanics, direct and inverse scattering, inverse problems, inverse problems in medicine, mathematical methods in non-destructive evaluation and non-destructive testing, stochastic processes, mathematical biology; numerical methods for PDEs, systems and optimisation, the analysis and computation of complex systems, wavelets, computer algebra and computer analysis

Languages: for presentations, English, French, German, or Russian; for Proceedings, English  
Programme and organising committee: ISAAC Board

Grants: some ISAAC Awards are available for younger scientists (below age 40) in analysis, its applications and computation  
Sponsors of the awards: Siemens, DaimlerChrysler, Motorola, Berlin Mathematical Society

Proceedings: contributions to proceedings not exceeding 10 pages should be sent before 1 November to [wengel@math.fu-berlin.de](mailto:wengel@math.fu-berlin.de)

Abstracts: submission of abstracts through <http://at.yorku.ca/cgi-bin/amca/submit/cahk-01>  
Deadlines: for applications and suggestions for ISAAC awards, passed; for submission of abstracts, 15 August  
Information: fax: +49-30-83875403 about ISAAC  
*e-mail*: [isaac01@math.fu-berlin.de](mailto:isaac01@math.fu-berlin.de)  
Web site: <http://www.math.udel.edu/isaac>  
<http://www.math.fu-berlin.de/rd/ag/isaac>

### 21-23: Ukrainian Congress of Mathematics (UCM-2001), Kiev, Ukraine

Information:  
Web site: <http://www.imath.kiev.ua/~congress/>

### 24-30: 10th International Meeting of European Women in Mathematics, Malta

Information: contact Dr. Tsou Sheung Tsun (EWM01), Mathematical Institute, 24-29 St Giles, Oxford OX1 3LB, UK, fax: +44-1865-273583  
Web site: <http://www.maths.ox.ac.uk/~ewm01/>

### 27-31: Equadiff 10, Czechoslovak International Conference on Differential Equations and their Applications, Prague, Czech Republic

Information:  
*e-mail*: [equadiff@math.cas.cz](mailto:equadiff@math.cas.cz)  
Web site: [www.math.cas.cz/~equadiff/](http://www.math.cas.cz/~equadiff/)  
[For details, see EMS Newsletter 38]

## September 2001

### 1-6: Number Theory and Arithmetical Geometry: Arithmetic Aspects of Fundamental Groups, Acquafredda di Maratea (near Naples), Italy

Topics: arithmetic aspects of Galois groups, higher class field theory and generalisations, algebraic fundamental groups of schemes, motivic Galois groups, Galois action on fundamental groups, motivic structures on fundamental groups, the anabelian programme  
Scope: recent progress in understanding arithmetic structures on algebraic fundamental groups of schemes and related topics – in particular, number-theoretic aspects of the theory of algebraic fundamental groups of schemes, where much progress has been made in recent years  
Main speakers: Pierre Debes (France), Pierre Deligne (USA), Ido Efrat (Israel), Ivan Fesenko (UK), Jean-Marc Fontaine (France), Gerhard Frey (Germany), Sasha Goncharov (USA), Yasutaka Ihara (Japan), Uwe Jannsen (Germany), Pierre Lochak (France), Makoto Matsumoto (Japan), Hiroaki Nakamura (Japan), Michel Raynaud (France), Mohamed Saidi (UK), Alexander Schmidt (Germany), Leila Schneps (France), Michael Spiess (UK), Akio Tamagawa (Japan), Isabelle Vidal (France), Kay Wingberg (Germany), Zdzislaw Wojtkowiak (France), Leonardo Zapponi (Germany)

Organising committee: Chair: Anthony J. Scholl (Durham, UK), Vice-Chair: Michael Spiess (Nottingham, UK)

Grants: available for younger scientists – in particular, those from less favoured regions in Europe; limited funding for participants from Central and Eastern Europe is also available  
Notes: open to researchers world-wide, whether from industry or academia. Participation is limited to 100. The emphasis will be on discussion about new developments

Deadline: for applications, already passed  
Information: contact Dr. J. Hendekovic, European Science Foundation, 1 quai Lezay-Marnesia, 67080 Strasbourg Cedex, France, tel: +33 388 76 71 35, fax: +33 388 36 69 87  
*e-mail*: [euresco@esf.org](mailto:euresco@esf.org)  
Web site: <http://www.esf.org/euresco/01/pc01109a.htm>

**2-6: First SIAM-EMS Conference: Applied Mathematics in our Changing World, Berlin, Germany**

**Scope:** the conference will not only have a scientific impact, but also an impact on the community of applied mathematicians in Europe and North America. The major feature of the conference is to show that applied mathematics is much more than just the classical application towards classical engineering, like for example fluid dynamics or structural mechanics. Hence an emphasis will be on modern applications in life sciences (medicine, biotechnology), materials sciences, nanoscale technology, and communication

**Topics:** medicine, biotechnology, materials science, environmental science, nanoscale technology, communication, traffic, market and finance, speech and image recognition, engineering design. These include mathematical subjects like PDE analysis and modelling, complex coupled PDE systems, optimal control of PDEs and heterogeneous systems, variational principles, inverse problems, stability and bifurcation analysis, PDE computational finite element methods, spatial and temporal homogenisation, spatial statistics, stochastic geometry, interacting particle systems, stochastic analysis, multiscale analysis and algorithms, multigrid and domain decomposition, wavelets, turbulence modelling

**Main speakers:** medicine: Alfio Quarteroni (I/CH); biotechnology: Michael Waterman (USA); materials science: Jon Chapman (USA/UK); environmental science: Andrew Majda (USA); nanoscale technology: Michael Griebel (D); communication: Martin Grötschel (D); traffic: Kai Nagel (CH); market and finance: Benoit Mandelbrot (USA); speech and image recognition: Pietro Perona (USA); engineering design: Thomas Y. Hou (USA)

**Programme:** 10 plenary lectures, about 20 minisymposia, contributed talks, poster sessions, round table discussions, multimedia and software presentations, satellite activities  
**Conference chairs:** Gilbert Strang (MIT, Cambridge), Rolf Jeltsch (ETH, Zürich), Peter Deuffhard (ZIB, Berlin)

**Programme committee:** Peter Deuffhard (Chair, Berlin), Heinz Engl (Austria), Björn Engquist (Stockholm), Stefan Müller (Germany), David Levermore (USA), Volker Mehrmann (Germany), Bill Morton (Great Britain)

**Organising committee:** Eberhard Bänsch (WIAS), Peter Deuffhard (Chair), Herbert Gajewski (WIAS), Hans-Christian Hege (ZIB), Matthias Holschneider (Uni Potsdam), Peter Inkeller (HU Berlin), Rupert Klein (PIK), Ralf Kornhuber (FU Berlin), Jens Lang (ZIB), Roswitha März (HU Berlin), Volker Mehrmann (TU Berlin), Rolf H. Möhring (TU Berlin), Ulrich Nowak (ZIB), Konrad Polthier (TU Berlin), Werner Römisch (HU Berlin), Christof Schütte (FUB), Jürgen Sprekels (WIAS), Fredi Tröltzsch (TU Berlin)

**Site:** the Free University of Berlin and the Konrad-Zuse-Zentrum (ZIB) in Berlin-Dahlem  
**Grants:** some funding may be available from the German Scientific Foundation, the European Commission, the EMS, and possibly UNESCO-ROSTE: see web site for how to apply

**Deadlines:** for submission of abstracts and posters, 30 June; for submission of applications for financial support, already passed (for Eastern European countries), 30 June (for EU-Member states or EU-associated states)

**Information:**  
*Web site:* <http://www.zib.de/amcw01>  
*e-mail:* [amcw01@zib.de](mailto:amcw01@zib.de)

**3-8: Sixth International Conference on**

**Function Spaces, Wrocław, Poland**

**Information:**  
*Web site:* [www.im.pwr.wroc.pl/~fsp/](http://www.im.pwr.wroc.pl/~fsp/)  
*e-mail:* [fsp@im.pwr.wroc.pl](mailto:fsp@im.pwr.wroc.pl)  
*[For details, see EMS Newsletter 39]*

**5-7: LMS Workshop on Domain Decomposition Methods in Fluid Mechanics, Greenwich, UK**

**Information:**  
*Web site:* <http://cms1.gre.ac.uk/conferences>  
*[For details, see EMS Newsletter 39]*

**12-14: Seventh Meeting on Computer Algebra and Applications (EACA-2001)**

**Information:**  
*e-mail:* [eaca2001@unirioja.es](mailto:eaca2001@unirioja.es)  
*Web site:* <http://www.unirioja.es/dptos/dmc/eaca2001/>  
*[For details, see EMS Newsletter 39]*

**12-15: EuroConference on Combinatorics, Graph Theory and Applications, Bellaterra, Barcelona**

**Information:**  
*Web site:* <http://www.crm.es/comb01>  
*[For details, see EMS Newsletter 39]*

**14-18: International Conference: Function Spaces, Proximities and Quasi-uniformities, Italia, Caserta**

[on the occasion of Som Naimpally's 70 birthday]  
**Information:**  
*e-mail:* [topological.sun@unina2.it](mailto:topological.sun@unina2.it)  
*Web site:* <http://www.unina2.it/topological.sun/homesun.html>

**16-22: Conference of the Austrian Mathematical Society and the German Mathematical Society, Vienna, Austria**

**Information:**  
*e-mail:* [oemg.mathematik@univie.ac.at](mailto:oemg.mathematik@univie.ac.at)  
*Web site:* <http://www.mat.univie.ac.at/~oemg/Tagungen/2001/index.html>  
*[For details, see EMS Newsletter 39]*

**17-21 Euroconference on Asymptotic Methods and Applications in Kinetic and Quantum-Kinetic Theory, Granada, Spain**

**Theme:** partial differential equations  
**Topics:** kinetic and quantum-kinetic equations, nonlinear drift-diffusion models and entropy methods, granular media flows, biology applications, non-linear dynamics in low-dimensional semiconductor structures, quantum molecular chemistry, stochastic differential equations, astrophysics, cometary flows, combustion

**Main speakers:** A. Bobylev, J. Brey, E. Carlen, C. Cercignani, L. Desvillettes, M. Fischetti, P. Gerard, R. Glassey, F. Golse, K. P. Hadeler, A. P. Jauho, C. Joulin, A. Linan, A. Marquina, E. Oran, G. Papanicolaou, F. Poupaud, M. Pulvirenti, P. Souganidis, W. Strauss, L. Vega, J. J. L. Velazquez, C. Villani, W. Zimmermann  
**Organising committee:** J. Soler (Chair, Spain), L. L. Bonilla (Spain), J. L. Vazquez (Spain)

**Sponsors:** European Commission, Spanish Government, Junta de Andalucía, Universidad Carlos III de Madrid, Universidad Autónoma de Madrid, Universidad de Granada  
**Site:** Palacio de Congresos  
**Deadlines:** for abstracts, passed  
**Information:**  
*e-mail:* [kinetic@ugr.es](mailto:kinetic@ugr.es)  
*Web site:* [www.ugr.es/local/kinetic/eurokit](http://www.ugr.es/local/kinetic/eurokit)

**17-26: Functional Analysis VII, Dubrovnik, Croatia**

**Information:**  
*e-mail:* [congress@math.hr](mailto:congress@math.hr)  
*Web page:* <http://www.math.hr/~congress/Dubrovnik01/>

*[For details, see EMS Newsletter 39]*

**18-22: Euro Summer School on Proper Group Actions, Bellaterra, Barcelona**

**Information:**  
*Web site:* <http://www.crm.es/group-actions>  
*[For details, see EMS Newsletter 39]*

**19-22: International Conference on Algebraic Geometry and Singularities, Sevilla, Spain**

[in honour of Professor José Luis Vicente Córdoba, on his 60th birthday]  
**Main speakers:** S. Abhyankar (USA), J. M. Aroca (Spain), J. Bueso (Spain), A. Campillo (Spain), E. Casas (Spain), A. Holme (Norway), S. González (Spain), J. Giraud (France), G.-M. Greuel (Germany), K. Kiyek (Germany), Le Dung Trang (France), I. Luengo (Spain), O. A. Laudal (Norway), M. Lejeune-Jalabert (France), F. Loeser (France), Z. Mebkhout (France), T. T. Moh (USA), V. Navarro (Spain), T. Recio (Spain), T. Sánchez (Spain), B. Teissier (France), A. Todorov (USA), F. Topsoe (Denmark), O. Villamayor (Spain)  
**Programme committee:** F. J. Castro Jiménez, L. Narváez Macarro, E. Briales Morales, P. Pisón Casares

**Organising committee:** F. J. Castro Jiménez, L. Narváez Macarro, E. Briales Morales, F. J. Herrera Govantes, R. Piedra Sánchez, P. Pisón Casares

**Site:** Facultad de Matemáticas. Avda. Reina Mercedes, s/n. 41012 SEVILLA

**Grants:** probably support for young mathematicians

**Deadlines:** registration by 20 July  
**Information:**  
*e-mail:* [secalg@algebra.us.es](mailto:secalg@algebra.us.es)  
*Web site:* <http://www.us.es/da/>

**24-28: Fourth European Conference on Elliptic and Parabolic Problems: Applications, Gaeta, Italy**

**Information:**  
*e-mail:* [rolduc@amath.unizh.ch](mailto:rolduc@amath.unizh.ch), [gaeta@amath.unizh.ch](mailto:gaeta@amath.unizh.ch)  
*Web site:* <http://www.math.unizh.ch/rolducgaeta>  
*[For details, see EMS Newsletter 38]*

**24-28: III International Conference, Analytic and Probabilistic Methods in Number Theory, Palanga, Lithuania**

[in honour of J. Kubilius]  
**Information:**  
*e-mail:* [palanga01@centras.lt](mailto:palanga01@centras.lt)  
*Web site:* <http://www.mif.vu.lt/ttsk/palanga.htm>  
*[For details, see EMS Newsletter 39]*

June 2002

**10 - 16: Aarhus Topology 2002, University of Aarhus, 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)

**Deadline:** for registration, to be announced at the web site  
**Information:**  
*Web site:* <http://www.math.auc.dk/~fajstrup/AT2002/>

# Oberwolfach Programme 2002

Mathematisches Forschungsinstitut Oberwolfach

Lorenzenhof, D-77709 Oberwolfach-Walke, Germany

*Names of organisers are in square brackets. Participants at the Oberwolfach meetings are invited personally by the director of the institute. Participation is subject to such an invitation. Interested researchers, in particular young mathematicians, can contact the administration of the institute. Since the number of participants is restricted, not all inquiries can be considered. Mini-Workshops offer to about 15 participants the possibility to meet in Oberwolfach. The support is the same as for the normal meetings: the Institute covers all living expenses, but travel costs cannot be paid. The Mini-Workshops should be research oriented. The aims could be to learn together an attractive new development or to study a specific problem. The deadline for applications is half a year before the date of the Mini-Workshop. Applications should contain a description of the planned activity and the list of participants. They can be sent at any time. Information is also available on the web site <http://www.mfo.de>.*

## Meetings

### 6-12 January: Combinatorics

[Laszló Lovász (New Haven), Hans Jürgen Prömel (Berlin)]

### 13-19 January: Optimization and Applications

[Florian Jarre (Notre Dame), Claude Lemarechal (Saint Ismier), Jochem Zowe (Erlangen)]

### 20-26 January: Mengenlehre

Sy Friedman (Wien), Ronald Jensen (Berlin), Menachem Magidor (Jerusalem), Hugh Woodin (Berkeley)]

### 27 January-2 February: Singularities and Concentration Phenomena in Nonlinear Elliptic and Parabolic PDEs

[Henri Berestycki (Paris), Bernhard Kawohl (Köln), Yanyan Li (Rutgers)]

### 3-9 February: Orders in Arithmetic and Geometry

[Jürgen Ritter (Augsburg), Martin J. Taylor (Manchester)]

### 3-9 February: The Arithmetic of Fields

[Wulf-Dieter Geyer (Erlangen), Moshe Jarden (Tel Aviv)]

### 10-16 February: Stochastic Geometry, Spatial Statistics and Statistical Physics

[Adrian J. Baddeley (Nedlands), Dietrich Stoyan (Freiberg), Wolfgang Weil (Karlsruhe)]

### 17-23 February: Positivität von Polynomen

[Eberhard Becker (Dortmund), Christian Berg (Kobenhavn), Alexander Prestel (Konstanz)]

### 17-23 February: Functional Analytic and Complex Analytic Methods in the Theory of Linear PDEs

[Reinhold Meise (Düsseldorf), B. Alan Taylor (Ann Arbor), Dietmar Vogt (Wuppertal)]

### 24 February-2 March: Regelungstheorie

[Frank Allgöwer (Stuttgart), Huibert Kwakernaak (Twente)]

### 3-9 March: Miniworkshops

(Hints for applications: see above)

### 10-16 March: Probability and Statistics of Random Algebraic Structures

[Jean-Dominique Deuschel (Berlin), Persi Diaconis (Stanford), Friedrich Götze (Bielefeld)]

### 17-23 March: Reelle Algebraische und Analytische Geometrie

[Eberhard Becker (Dortmund), Ludwig Bröcker (Münster), Michel Coste (Rennes)]

### 24-30 March: Nichtkommutative Geometrie

[Alain Connes (Paris), Joachim Cuntz (Münster), Marc A. Rieffel (Berkeley)]

### 31 March-6 April: Arbeitsgemeinschaft mit aktuellem Thema

(wird in Heft 1/2002 der DMV-Mitteilungen bekannt gegeben)

### 7-13 April: Mathematische Logik

[Yiannis N. Moschovakis (Los Angeles), Helmut Schwichtenberg (München), Anne S. Troelstra (Amsterdam)]

### 14-20 April: Interactions between Algebraic Geometry and Noncommutative Algebra

[Dieter Happel (Chemnitz), Lance T. Small (La Jolla), J. Toby Stafford (Ann Arbor), Michel Van den Bergh (Hasselt)]

### 21-27 April: Curvature and Dispersion Effects in Nonlinear Partial Differential Equations

[Carlos E. Kenig (Chicago), Herbert Koch (Dortmund), Daniel Tataru (Evanston)]

### 21-27 April: Discontinuous Galerkin Methods

[Dietmar Kröner (Freiburg), Christoph Schwab (Zürich), Endre Süli (Oxford)]

### 28 April-4 May: Enveloping Algebras and Algebraic Lie Representations

[Walter Borho (Wuppertal), Michel Duflo (Paris), Anthony Joseph (Paris/Revohot), Rudolf Rentschler (Paris)]

### 5-11 May: Mechanics of Materials

[Reinhold Kienzler (Bremen), David McDowell (Atlanta), Ewald Werner (München)]

### 12-18 May: Quadratic and Hermitian Forms

[Detlev Hoffmann (Besancon), Alexandr Merkurjev (Los Angeles), Jean-Pierre Tignol (Louvain-la-Neuve)]

### 19-25 May: Oberwolfach-Seminars

### 26 May-1 June: Classical Algebraic Geometry

[David Eisenbud (Berkeley), Joe Harris (Cambridge), Frank-Olaf Schreyer (Bayreuth)]

### 2-8 June: Geometric Analysis and Singular Spaces

[Jean-Michel Bismut (Orsay), Jochen Brüning (Berlin), Richard B. Melrose (Cambridge)]

### 9-15 June: Renormalization Group

[David Brydges (Virginia), Horst Knörrer (Zürich), Manfred Salmhofer (Leipzig)]

### 16-22 June: Geometric Convex Combinatorics

[Bert Gerards (Amsterdam), Andras Sebö (Grenoble), Robert Weismantel (Magdeburg)]

### 23-29 June: Miniworkshops

### 30 June-6 July: Calculus of Variations

[Gianni Dal Maso (Trieste), Gero Friesecke (Oxford), Tristan Riviere (Cachan/Paris)]

### 7-13 July: Arithmetic and Differential Galois Groups

[David Harbater (Philadelphia), B. Heinrich Matzat (Heidelberg), Marius van der Put (Groningen)]

### 14-20 July: Reelle Analysis

[Detlef Müller (Kiel), Elias M. Stein (Princeton), Hans Triebel (Jena)]

### 21-27 July: Nonlinear and Stochastic Systems and Their Numerics

[Michael Dellnitz (Paderborn), Wolfgang Kliemann (Ames), Edwin Kreuzer (Hamburg-Harburg), Sri Namachchivaya (Urbana)]

### 28 July-3 August: Dynamical System Methods in Fluid Mechanics

[Jerrold E. Marsden (Pasadena), Jürgen Scheurle (München)]

### 4-10 August: Algebraische K-Theorie

[Dan Grayson (Urbana), Uwe Jannsen (Regensburg), Bruno Kahn (Paris)]

### 11-17 August: Mathematical Methods in Tomography

[F. Alberto Grünbaum (Berkeley), Alfred K. Louis (Saarbrücken), Frank Natterer (München)]

### 18-24 August: Mathematical Theory and Modelling in Atmosphere-Ocean-Science

[Rupert Klein (Berlin), Andrew J. Majda (New York)]

### 25-31 August: Komplexe Analysis

[Jean-Pierre Demailly (Grenoble), Klaus Hulek (Hannover), Thomas Peternell (Bayreuth)]

### 1-7 September: Groups and Geometries

[Michael Aschbacher (Pasadena), William M. Kantor (Eugene), Franz-Georg Timmesfeld (Gießen)]

### 8-14 September: Fundamental Groups in Geometry

[Fedor A. Bogomolov (New York), Jürgen Jost (Leipzig), Mina Teicher (Ramat-Gan), Michael Zaidenberg (Saint-Martin-d'Herès)]

### 15-21 September: Homotopietheorie

[Mike Hopkins (Cambridge), Karlheinz Knapp (Wuppertal), Erich Ossa (Wuppertal)]

### 22-28 September: Topologie

[Cameron Gordon (Austin), Wolfgang Lück (Münster), Bob Oliver (Paris)]

### 29 September-5 October: Geometrie

[Victor Bangert (Freiburg), Yuri Burago



(St Petersburg), Ulrich Pinkall (Berlin)]  
**6-12 October: Arbeitsgemeinschaft mit aktuellem Thema**

(wird in Heft 3/2002 der DMV-Mitteilungen bekannt gegeben)

**13-19 October: Oberwolfach-Seminars**

**20-26 October: Mathematische Methoden der Geometrischen Datenverarbeitung**

[Carl de Boer (Madison), Helmut Pottmann (Wien), Ulrich Reif (Darmstadt)]

**27 October-2 November: Stochastic Analysis**

[Gerard Ben Arous (Lausanne), Jean-Dominique Deuschel (Berlin), Ofer Zeitouni (Haifa)]

**3-9 November: Miniworkshops**

**10-16 November: Oberwolfach-Seminars**

**17-23 November: Lehrerfortbildung**

**24-30 November: Combinatorial Optimization**

[Thomas M. Lieblich (Lausanne), Rolf Hermann Möhring (Berlin), Uwe T. Zimmermann (Braunschweig)]

**1-7 December: New Trends in Boundary Elements**

[Jean-Claude Nedelec (Palaiseau), Christoph Schwab (Zürich), Ernst P. Stephan (Hannover), Wolfgang L. Wendland (Stuttgart)]

**8-14 December: Algorithmische Graphentheorie**

[Derek Corneil (Toronto), Klaus Jansen (Kiel), Ingo Schiermeyer (Freiburg)]

**15-21 December: Thermodynamische Materialtheorien**

[Kolumban Hutter (Darmstadt), Ingo Müller (Berlin)]

### Seminars

#### OBERWOLFACH-SEMINARS 2001

*These seminars are a continuation of the DMV-Seminars initiated by Deutsche Mathematiker Vereinigung. They address postdocs and PhD students from all over Europe. The aim is to introduce the participants to a particular new development. The seminars take place at the Mathematisches Forschungsinstitut Oberwolfach and the number of participants is restricted to 25. Applications, including a short summary of previous work and interest, should be sent to Prof. Dr. Matthias Kreck, Universität Heidelberg, Mathematisches Institut, Im Neuenheimer Feld 288, 69120 Heidelberg, Germany.*

#### Noncommutative Geometry

Alain Connes (Paris)

14-20 October 2001,

Deadline for application: 1 September

*Subjects:* We describe basic concepts of noncommutative geometry and a general construction that extends the familiar duality between ordinary spaces and commutative algebras to a duality between quotient spaces and noncommutative algebras. The basic tools of the theory,  $K$ -theory, cyclic cohomology, Morita equivalence, operator-theoretic index theorems and Hopf algebra symmetry are reviewed. We discuss the foundational problem of 'what is a manifold in NCG?' and explain the fundamental role of Poincaré duality in  $K$ -homology which is the basic reason for the spectral point of view.

This leads us, when specializing to 4-geometries to a universal algebra called the 'Instanton algebra' (joint work with G. Landi). We describe examples of noncommutative manifolds and develop the basic notions of curvature and spectral action. We show that any compact Riemannian spin manifold whose isometry group has rank  $r > 1$  admits isospectral deformations to noncommutative geometries. We give a survey of other recent developments, in particular from joint work with H. Moscovici and D. Kreimer.

#### Numerical Methods for Free Boundary Problems

Gerhard Dziuk (Freiburg) and Ricardo Nochetto (Maryland)

14-20 October 2001,

Deadline for application: 1 September

*Subjects:* Free boundary problems arise in a variety of applications from phase transitions (crystal growth or continuous casting) to geometry (curvature-driven motion of surfaces or curves). This course will provide an introduction to mathematical models for free boundary problems and to the design and numerical analysis of algorithms. Topics will include numerical methods for isotropic and anisotropic mean curvature flow (parametric model and level set model), as well as for variational inequalities and degenerate parabolic equations (with emphasis on error control and adaptivity).

*Prerequisites:* Basic knowledge of theory and numerics for partial differential equations.

#### Mathematical Challenges of Molecular Biology

Andreas Dress (Bielefeld), Peter Schuster (Wien) and Gönter Wagner (Yale)

11-17 November 2001,

Deadline for application: 1 October

*Subjects:* Molecular biology is currently undergoing a technological revolution. As more and more genomic and structural data become available, fundamental questions about evolution, sequence-structure relations and functional genomics can be studied for the first time in a quantitative way, allowing for computer simulation and mathematical analysis. The new developments involve many mathematical fields, including dynamical systems, combinatorics, random graph theory and evolution in random media, topology and Fourier analysis. Specific topics will include: old and new models of phylogenetic evolution and their underlying mathematical structure; sequence-structure relations of bio polymers, based on the concepts of combinatorial maps and landscapes; analysis of the genotype-phenotype map and modeling of gene interaction (space configuration topology and their Fourier decomposition; continuum effect models).

*Prerequisites:* This seminar is open to all mathematicians interested in questions arising from molecular biology. Working knowledge of combinatorics and some basic ideas about combinatorial algorithms and dynamical systems. *References:* A. Dress, W. Terhalle, ICM 98, pp. 565-574 <http://www.mathematik.uni-bielefeld.de/docu/menta/xvol-icm/16/16.html>

P. Schuster, Math Unlimited, Springer, 2001, pp. 1019-1038, and additional literature available from <http://www.tbi.univie.ac.at/papers/>

#### Front Propagation, Homogenization for First- and Second-Order PDE and Applications

Guy Barles (Tour) and Panagiotis Souganidis (Austin)

11-17 November 2001,

Deadline for application: 1 October

*Subjects:* Models in phase transitions and combustion give rise to interfaces moving with prescribed normal velocities. The theory of viscosity solutions provides a very good framework for the rigorous analysis of such models. Asymptotic problems in periodic and random environments are also related to homogenization questions for first- and second order pde, as well as to stochastic nonlinear pde. Topics to be covered in the course are:

(i) a theory for generalized front propagation and its applications to asymptotic problems, reaction diffusion equations and particle systems, turbulent combustion;

(ii) homogenization theory for Hamilton-Jacobi equations and fully nonlinear second-order pde and its connections to phase transitions and Hamiltonian dynamics;

(iii) fully nonlinear stochastic pde.

*Prerequisites:* A good background in pde; some probability knowledge will also be useful, but is not required.

# 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.

The reviews of the books by H. Krause and C. M. Ringel, and J.-E. Rombaldi, appeared in EMS Newsletter 39 with incorrect titles. The editor apologises for this unfortunate mistake.

**R. P. Agarwal, M. Meehan and D. O'Regan:** *Fixed Point Theory and Applications*, Cambridge Tracts in Mathematics 141, Cambridge University Press, Cambridge, 2001, 170 pp., £37.50, ISBN 0-521-80250-4

This excellent book provides a clear exposition of the flourishing field of fixed point theory. The reader will find applications to many areas of current interest in analysis. The book consists of 12 chapters, and problems of varying difficulty are given at the end of each chapter. The very extensive bibliography lists 191 items.

The book starts from the basics of Banach's contraction theorem and Schauder's theorem for non-expansive maps. Fixed point results are established for several classes of maps: single-valued maps in finite- and infinite-dimensional Banach spaces, non-self maps, multivalued mappings, and maps defined on Hausdorff locally convex linear topological spaces. The three main approaches to establishing continuation principles are also presented. A chapter on degree theory concludes the volume.

This nicely written book presents an extensive survey of the area and will undoubtedly be very valuable for researchers and graduate students in applicable analysis. (knaj)

**S. R. Alpern and V. S. Prasad,** *Typical Dynamics of Volume Preserving Homeomorphisms*, Cambridge Tracts in Mathematics 139, Cambridge University Press, Cambridge, 2001, 216 pp., £30, ISBN 0-521-58287-3

This monograph covers the authors' work over the past twenty-five years on generalisations of classical results of John Oxtoby and Stan Ulam on the typical dynamical behaviour of manifold homeomorphisms preserving a fixed measure. Examples of properties of homeomorphisms considered include transitivity, chaos and ergodicity. A key idea here is the interrelation among typical properties of volume-preserving bijections of the underlying measure space.

The book is divided into three parts. The authors make the first part very concrete by considering volume-preserving homeomorphisms of the unit  $n$ -dimensional cube. They prove fixed point theorems of Conley-Yehnder-Franks) in a number of short self-contained chapters, which would be suitable for an undergraduate analysis seminar or a

graduate lecture course. Part II shows how these results may be generalised to homeomorphisms of a compact manifold that preserve a certain finite measure. The second type of generalisation of the result of Oxtoby and Ulam, covered in Part III, concerns results without a compactness assumption for the underlying manifold, and the concomitant consideration of infinite preserved measures. A fuller description of the authors' work on non-compact manifolds appears in the Introduction to Part III.

This monograph will be very valuable for anybody interested in ergodic or measure theory. (knaj)

**B. K. Bagchi,** *Supersymmetry in Quantum and Classical Mechanics*, Monographs and Surveys in Pure and Applied Mathematics 116, Chapman & Hall/CRC, Boca Raton, 2001, 222 pp., £49.99, ISBN 1-58488-197-6

The aim of this book is to describe the main lines of developments that have taken place in super-symmetric quantum and classical mechanics (SUSYQM and SUSCM) in recent years. In Chapter 2, the basic principles of SUSYQM are outlined, starting with the harmonic oscillator problem. A fairly complete presentation of the mathematical tools associated with SUSYQM are given, together with potential applications of the theory and self-contained introduction to superspace formalism. In Chapter 3, SUSYCM is considered and studied in the framework of generalised Poisson brackets and quantisation rules. The concept of SUSY breaking and the Witten index is developed in Chapter 4, where the relevance of the notions such as finite temperature SUSY, regulated Witten index and quantum group deformation of oscillator algebras is discussed in more detail. Chapter 5 offers an elaborated treatment of factorisation methods, shape invariance condition, and generation of solvable potentials. Chapter 6 deals with the radial problem and spin-orbit coupling and in Chapter 7, applications of SUSY to non-linear systems and a method of constructing supersymmetric KdV equation are discussed. Parasupersymmetry and some of its models are addressed in Chapter 8, including those obtained from truncated oscillator algebra. Finally, in the Appendix, a mathematical treatment of the derivation of the form of the  $D$ -dimensional Schrödinger equation is broadly outlined. (pso)

**J. M. Ball and J. C. R. Hunt (eds.),** *ICIAM 99. Proceedings of the Fourth International Congress on Industrial and Applied Mathematics*, Edinburgh, Oxford University Press, Oxford, 2000, 336 pp., £65, ISBN 0-19-850514-0

This volume presents the proceedings of the Fourth International Congress on Industrial and Applied Mathematics, held in

Edinburgh in July 1999. The Congress was jointly organised by the Institute of Mathematics and its Applications and the International Centre for Mathematical Sciences, with involvement from the Mathematics Departments at Edinburgh University and Heriot-Watt University. Over 1700 applied mathematicians from 66 countries attended the Congress. The programme for the half-day sessions normally consisted of two plenary lectures in parallel, followed by two-hour parallel sessions of mini-symposia and contributed talks. In addition to the 31 plenary lectures, 250 mini-symposia, 400 contributed papers and 60 poster presentations were given.

The proceedings includes texts of plenary lectures covering a wide range of topics in applied and industrial mathematics, ranging from the familiar areas of solid and fluid mechanics and scientific computation to newer subjects such as financial mathematics and the internet. Also included are summaries of the mini-symposia, details of prizes awarded, a list of participants, and texts of the addresses at the opening ceremony.

This is an important summary of topical and applicable mathematics from the world's leading authorities in the subject. It will be an inspiration for graduate students and researchers. (knaj)

**H. Bart, I. Gohberg and A. C. M. Ran (eds.),** *Operator Theory and Analysis. The M. A. Kaashoek Anniversary Volume*, Operator Theory Advances and Applications 122, Birkhäuser, Basel, 2001, 433 pp., DM 238, ISBN 3-7643-6499-8

This volume contains the proceedings of the international workshop at the Vrije Universiteit, Amsterdam, on the occasion of the sixtieth birthday of M. A. Kaashoek, one of the leading experts in operator theory and its applications. The workshop focused on areas in mathematical and functional analysis, where his ideas and results played an important role.

The book starts with articles describing the life and mathematical achievements of Kaashoek and a list of his publications. The main part of the book consists of original research papers containing new and interesting results. The proceedings contains the sixteen main contributions presented at the workshop. These papers cover a wide range of topics centred around factorisation of matrix-valued functions, interpolation theory and spectral theory. Other papers deal with canonical systems of differential equations, operators in indefinite inner-product spaces, and the effect of small delays on stability and control of partial differential equations. The book will be a useful guide for a wide range of readers in pure and applied mathematics and engineering. (knaj)

**R. Berndt,** *An Introduction to Symplectic Geometry*, Graduate Studies in Mathematics 26, American Mathematical Society, Providence, 2001, 195 pp., US\$36, ISBN 0-8218-2056-7

Symplectic geometry is a broad and well-developed subject with numerous and strong ties to other fields of mathematics. This book offers a systematic exposition of symplectic geometry for graduate students with

a basic knowledge in algebra and analysis. It is a translation of the book published (in German) by the publishing house Vieweg in 1998.

In the introductory chapter, a mathematical formulation of classical theoretical mechanics is summarised for readers with a mathematical background: symplectic vector spaces and the symplectic group are introduced and studied from an algebraic point of view. Symplectic manifolds form the main topic of the book, and are defined and studied in the second chapter, together with examples (cotangent bundles, complex projective spaces, Kähler manifolds and coadjoint orbits). Hamiltonian vector fields and the Poisson bracket are introduced in the third chapter, followed by a treatment of contact manifolds. The next two chapters contain an introduction to the moment map and a study of the symplectic reduction; this has many applications and makes it possible to construct further interesting examples of symplectic manifolds. The last chapter is devoted to quantisation. There are four appendices containing very short summaries of facts from other mathematical disciplines needed in the book. Readers are expected to have a certain knowledge of the theory of differential equations (the Frobenius theorem, in particular).

This book is an excellent introduction to symplectic geometry, carefully written and containing many interesting examples and comments. It can be recommended to anybody interested in this interesting and important field of mathematics. (jbu)

**A. I. Bobenko and R. Seiler (eds.), *Discrete Integrable Geometry and Physics*, Oxford Lecture Series in Mathematics and Its Applications 16, Clarendon Press, Oxford, 1999, 370 pp., £45, ISBN 0-19-850160-9**

This book is an introduction to a new emerging field of discrete geometry which has very strong ties to the theory of integrable systems, both continuous and discrete, classical and quantum. It is a collection of invited review papers, both by mathematicians and physicists who collaborated during the preparation of the publication.

The book is divided into three parts. The first part concentrates on discrete analogues of various classes of surfaces and their relations to (smooth and discrete) integrable systems. It contains contributions written by A. I. Bobenko, U. Pinkall, U. Hertrich-Jeromin, T. Hoffmann, W. K. Schief, A. Doliwa and P. M. Santini. The second part contains a discussion of discretisations of classical integrable systems, based on the  $R$ -matrix approach or symmetry concepts for difference equations. It consists of contributions by Y. B. Suris, F. W. Nijhoff and N. Kutz. The last part of the book is on quantum integrable systems and covers several themes. A paper by J. Kellendonk, N. Kutz and R. Seiler contains a discussion of the spectral theory of Schrödinger operators describing electric particles moving in discrete two-dimensional space under the influence of a perpendicular magnetic field. A chapter by L. Fadeev and A. Y. Volkov discusses quantum integrable models in 1+1-dimensional discrete space-time. A possible

interpretation of the affine Toda field theory as a 2+1-dimensional model with discrete second space coordinate is described by R. M. Kashaev and N. Y. Reshetikhin. A paper by R. M. Kashaev discusses quantum hyperbolic invariants of knots, and a short note by T. Richter and R. Seiler shows possible applications for the quantum Hall effect.

The book gives many specific examples of relations between discrete geometry and various types of (discrete) integrable models. It will be useful for interested readers, both mathematicians and physicists. (vs)

**J. Boos, *Classical and Modern Methods in Summability*, Oxford Mathematical Monographs, Oxford University Press, Oxford, 2000, 586 pp., £75, ISBN 0-19-850165-X**

This book is in three parts. The first two are devoted to classical methods and functional-analytic methods in summability, while the last one contains material in which these methods are combined. The book seems to be the most comprehensive monograph on summability methods and so will be a very valuable source for graduate students interested in the field and for researchers in summability or in topological sequence spaces. As prerequisites, it requires a basic knowledge of linear algebra and function theory, combined with some parts of functional analysis.

The book contains a brief self-contained exposition of infinite matrices (Chapter 2) or required topological notions (Chapters 6 and 7). The first introductory chapter explains the history of summability methods, and presents basic definitions and notions. Then classical methods are studied: results include the classical Toeplitz-Silvermann theorem (also proved later in Chapter 7 by a functional analytic method) and other results from the first decades and the end of the twentieth century. The bibliography includes 268 items: the list of symbols, subject index and name index make searching the book easy. The book can be recommended for all mathematical libraries, graduate students and researchers in the field. (jive)

**H. W. Braden and I. M. Krichever (eds.), *Integrability. The Seiberg-Witten and Whitham Equations*, Gordon and Breach Publishers, 2000, 276 pp., £47, ISBN 90-5699-281-3**

Integrable systems in mathematics have had a long history with ups and downs. The works of Jacobi, Abel, Riemann and Weierstrass led to the solution of a number of important integrable problems from mechanics and physics. Following the results of Poincaré and de Bruns, integrable systems lacking any group symmetry were perceived as something exotic. This situation changed drastically with the discovery of soliton theory, inverse scattering techniques and Seiberg-Witten theory. Yet, although many connections now exist between Seiberg-Witten theory and integrable systems, the correspondence still remains poorly understood.

This volume includes contributions to a conference on Integrability: the Seiberg-Witten and Whitham equations, in

Edinburgh in 1998. They consist mostly of surveys given by plenary speakers at this meeting and cover various areas of the subject. The proceedings of this conference provide an excellent introduction to the ideas and methods surrounding these exciting theories. (ae)

**B. Bruce and D. Mond (eds.), *Singularity Theory*, London Mathematical Society Lecture Note Series 263, Cambridge University Press, Cambridge, 1999, 440 pp., £29.95, ISBN 0-521-65888-8**

The meeting held in 1996 in Liverpool, on the occasion of the sixtieth birthday of C. T. C. Wall, covered a broad range of topics in singularity theory. The book contains 23 contributions, many of them giving overviews of specific subfields of the theory. These papers are divided into five main topics – complex singularities, stratifications and equisingularity theory, global singularity theory, singularities of maps, and applications of singularity theory.

The first part contains reviews by K. Altmann (singularities of toric varieties), W. Ebeling (on Arnold's strange dualities), G.-M. Greuel and E. Shustin (geometry of equisingular families of curves), E. Looijenga (Knizhnik-Zamolodchikov equations and cohomology of local systems on the complements of hyperplane arrangements), A. Némethi (signatures of special types of 4-manifolds) and papers by J. Damon (a topological proof of a strengthened version of the Varchenko conjecture), J. H. M. Steenbrink (calculations of the spectra of isolated singularities of complete intersections of certain types) and T. Urabe (constellations of simple singularities on fibres of a deformation of a triangle singularity). In the second part, there is a paper by J. P. Brasselet and A. Legrand (differential forms on singular varieties), two papers by A. A. du Plessis (related to the topological stability theorem), a survey by T. Gaffney and D. Massey (equisingularity theory of complex analytic sets and mappings) and a paper by M. Tibar (regularity at infinity of polynomial functions). The third part includes three papers by V. V. Goryunov and J. W. Hill (Legendrean knots in  $\mathbf{R}^3$ ), A. Libgober (Abelian branched covers of the projective plane) and O. Saeki and K. Sakuma (elimination of singularities). Singularities of mappings are represented by papers by K. Houston (an image-computing spectral sequence), K. Houston and N. Kirk (a classification of germs of maps from dimension 3 to dimension 4) and two papers by W. L. Marar, J. A. Montaldi and M. A. S. Ruas and by T. Fukui (zero-dimensional invariants for certain types of maps). The part describing applications contains three papers by P. S. Donelan and C. G. Gibson (singular phenomena in kinematics), G. Ishikawa (singularities of developable surfaces), and S. Izumiya (singularities of first order PDEs).

The book is a representative overview of research in the field. (vs)

**E. Casas-Alvero, *Singularities of Plane Curves*, London Mathematical Society Lecture Note Series 276, Cambridge University Press, Cambridge, 2000, 345 pp., £29.95, ISBN 0-**

## RECENT BOOKS

521-78959-1

This book is devoted to the theory of algebraic curves in the complex projective plane. Singularities of algebraic varieties form a very interesting and classical field of research that combines techniques and viewpoints from different fields, such as algebra, geometry, topology and analysis. The basic viewpoint in the book is geometrical, based on the concept of infinitely near points on a curve. The idea of using such a tool to describe singularities comes from the work of M. Noether, and was further developed by F. Enriques. Most of the results presented here have appeared in the literature, but the description based on infinitely near points is somewhat new. To read the book, the only prerequisites are a basic knowledge of algebra and complex analysis. The basic facts, needed throughout the book are summarized in the introductory chapter.

In the first two chapters, the proof of the Puiseux theorem on roots of a power series in two variables is presented. The main algebraic properties can be deduced, including the Weierstrass theorems and geometrical properties of germs of a curve. In the third and fourth chapters, the basic ideas of geometry of infinitely near points are introduced and used to describe the singularities of a curve; in particular, the Enriques diagrams and dual graphs are treated here. In the other chapters, the Plücker formula, a computation of the Milnor numbers, and the study of linear families of germs of the curve (including the Bertini theorem) are studied. In the last chapter, a geometric theory of valuations is presented. Each chapter includes a sufficient number of exercises.

The book will be useful for graduate students as a first step in the study of singularities, and for non-specialists who wish to learn the basic facts about singularities of plane curves. (jbu)

**K. Chen, P. Giblin and A. Irving,** *Mathematical Explorations with MATLAB*, Cambridge University Press, Cambridge, 1999, 238 pp., £15.95, ISBN 0-521-63078-9 and 0-521-63920-4

This book is another attempt to use computers and mathematical software in basic university mathematics courses. The computer system chosen is the package MATLAB, but no *a priori* knowledge of this package is assumed. (There is a short introduction to MATLAB in Chapter 1.) The aim of the book is to promote some mathematical skills to students by solving various mathematical problems with the help of MATLAB.

The book is divided into three parts. The first part introduces techniques of MATLAB that can be used in the projects later in the book. The topics in Part 1 include matrices, integers and elementary number theory, curve plotting, data analysis, simulation of random number generation and differential equations. Each chapter in this part ends with exercises, designed to check knowledge of the topic and of MATLAB techniques. The second part of the book contains a lot of projects built on ideas from Part 1 – for instance, the project Magic squares is an application of matrices. The projects explore mathematical problems that include

mathematical or computational exercises. The third part of the book covers the modelling of situations: cafeteria queues, fish growth, epidemics, etc.

The book can be used as a course text, as a source of examples for project work in various mathematical courses, or as a book for students who like to solve mathematical problems. It is recommended to everybody interested in mathematics. (ml)

**I. Chudinovich and C. Constanda,** *Variational and Potential Methods in the Theory of Bending of Plates with Transverse Shear Deformation*, *Monographs and Surveys in Pure and Applied Mathematics 115*, Chapman & Hall, CRC, Boca Raton, 2000, 236 pp., £46.99, ISBN 1-58488-155-0

This volume presents the analysis of linear models of thin plates which yield the deflection of the middle section, as in Kirchhoff's theory, and account for transverse shear deformation. The authors consider a number of boundary value problems concerning the equilibrium bending of an elastic plate: these include the Dirichlet and Neumann problems, the problem with mixed boundary conditions, the plate on a generalised elastic foundation and the model of the plate weakened by a crack. Existence, uniqueness and stability of weak solutions of variational formulations of the problems are studied. The solutions are sought in the form of plate potentials: the problem is reduced to integral equations on the boundary of the domain. In the appendix, some basic material on distribution theory and on Sobolev spaces is given.

The book will be useful for mathematicians, theoretical engineers and all interested in mathematical modeling in elasticity. (oj)

**J. H. Davis,** *Differential Equations with Maple. An Interactive Approach (CD-ROM incl.)*, Birkhäuser, Boston, 2001, 409 pp., DM148, ISBN 0-8176-4181-5 and 3-7643-4181-5

This introduction to differential equations features an exciting interactive approach to the subject, integrating the basics of ODE and the symbolic computation package Maple. The book provides a solid introduction to Maple in parallel with a standard ODE course for advanced undergraduate and beginning level graduate students.

The material covers many topics (Introduction to Maple, Introduction to DE, First order equations, Introduction to numerical methods, Higher order DE, Laplace transform methods, Systems of equations, Stability, Periodic problems, Impedances and DE, Partial DE, Introduction to Maple applications, Plotting with Maple, Maple and Laplace transforms, Maple linear algebra applications, Runge-Kutta designs, Maple packages, Review problems, Laplace transform table). The book contains many user-friendly presentations of rigorous mathematics, excellent examples, numerous graphical interpretations of solutions, a careful introduction to Maple, harder Maple programming projects, Maple worksheets, and supplementary material for instructors.

Differential equations is a key subject in pure and applied mathematics, engineering, biology, and physics. This book provides an excellent combination of basic ODE theory and Maple. (pp)

**M. Demuth, E. Schrohe, B.-W. Schulze and J. Sjöstrand (eds.),** *Evolution Equations, Feshbach Resonances, Singular Hodge Theory*, *Advances in Partial Differential Equations*, 16, Wiley-VCH, Berlin, 1999, 431 pp., DM198, ISBN 3-527-40233-0

This book consists of six papers describing recent progress in several topics concerning evolution partial differential equations; all the contributions are self-contained.

The first article by G. Lumer studies the asymptotic behaviour of solutions of singular parabolic transition/interaction problems with distribution or hyperfunction data. The paper by G. Lumer and F. Neubrander is devoted to applications of asymptotic Laplace transform to semigroups generated by operators whose resolvents have large growth (existence, uniqueness, well-posedness). The third contribution, by G. Lumer and R. Schnaubelt, is on local operator methods for linear and semilinear parabolic problems with time-dependent coefficients in non-cylindrical domains or on networks. The well-posedness is characterised by barrier conditions which are verified for a large class of singular domains.

The second part of the book is devoted to more abstract topics connected with pseudodifferential operators. The article by M. Rouleux is about resonances for a self-adjoint  $h$ -pseudodifferential operator on  $L^2(\mathbf{R}^+) \oplus \mathbf{C}^2$  with Dirichlet boundary conditions and a conical intersection of the characteristic variety. This problem arises in the one-dimensional Born-Oppenheimer approximation of the transitions of nuclei. A. Boulet de Monvel and R. Purice present a variant of the Mourre theory of conjugate operators and its application to various Hamiltonians in a class of Besov spaces. The typical feature of this approach is the very weak assumptions on the regularity of Hamiltonians. Finally, the contribution of B.-W. Schulze and N. Tarkhanov describes elliptic complexes of pseudodifferential operators on manifolds with edges. To each complex there correspond two sequences of symbols controlling interior ellipticity and ellipticity at the edges; in this setting, the authors establish the Fredholm property of complexes in weighted Sobolev spaces and present the Hodge theory for them. (jmil)

**F. J. E. Dillen and L. C. A. Verstraelen (eds.),** *Handbook of Differential Geometry, Vol. I*, North-Holland, Amsterdam, 2000, 1054 pp., US\$177.50, ISBN 0-444-82240-2

This book is the first volume of a series whose aim is to give a rather complete survey of the field of differential geometry. To realise this project, the editors asked experts in specific topics to prepare review papers containing both old and recent research results. The authors had freedom in length, style and depth, so the volume contains different types of papers.

Volume I contains contributions by M. A. Akivis and V. V. Goldberg (Differential

geometry of webs), D. E. Blair (Spaces of metrics and curvature functionals), B.-Y. Chen (Riemannian submanifolds), A. Derdzinski (Einstein metrics in dimension four), P. B. Gilkey (The Atiyah-Singer index theorem), U. Lumiste (Submanifolds with a parallel fundamental form), K. Shiohama (Sphere theorems), U. Simon (Affine differential geometry), G. Thorbergsson (A survey on isoparametric hypersurfaces and their generalizations) and T. Willmore (Curves). In particular, the contribution by A. Derdzinski is a nice and detailed exposition (288 pp.) on the local and global theory of four-dimensional Einstein manifolds, including indefinite Einstein metrics and Petrov's classification of its curvature types, and topological obstructions for the existence of Einstein metrics on a given compact four-dimensional manifold. The contribution by P. B. Gilkey presents a nice and short overview of index theory, including the main ideas, results and applications. Finally, in T. Willmore's contribution discusses the role of curves in geometry, and shows how the concept of a curve has evolved through the ages; in particular, he presents a study of special curves related to some geometrical problems (immersions of manifolds into a Riemannian manifold, holonomy groups of Riemannian manifolds, etc.). All the contributions are very interesting, and the book can be recommended to all mathematicians interested in geometry. (jbu)

**R. M. Dudley, *Uniform Central Limit Theorems*, Cambridge Studies in Advanced Mathematics 63, Cambridge University Press, Cambridge, 1999, 436 pp., £55, ISBN 0-521-46102-2**

Central limit theorems for independent identically distributed random variables with values in general spaces form the main topic discussed in this book. A number of recent results of Talagrand and others are surveyed without proofs, in separate sections. At the end of each section, there are problems for solution, various notes and a list of references.

The book consists of ten chapters (including chapters on Gaussian measures and processes, the Donsker classes, Vapnik-Cervonenkis combinatorics and corresponding limit theorems, metric entropy, universal and uniform central limit theorems) and a number of appendices. The reader is assumed to be familiar with some real analysis, including Lebesgue integration and probability based on it, and the finite-dimensional central limit theorem.

The book should be of interest to mathematicians working in probability, to mathematical statisticians and to computer scientists working in computer learning theory. (mahus)

**C. F. Dunkl and Y. Xu, *Orthogonal Polynomials of Several Variables*, Encyclopedia of Mathematics and its Applications 81, Cambridge University Press, Cambridge, 2001, 390 pp., £55, ISBN 0-521-80043-9**

This modern book presents a comprehensive theory of orthogonal polynomials of several variables in an elegant form and with modern concepts and notation. It consists of

nine chapters, notes and bibliography.

Chapter 1 is a summary of tools from the theory of orthogonal polynomials of one variable. In Chapters 2 and 3, the authors give various examples of families of orthogonal polynomials in several variables and present their properties. Coxeter groups are treated systematically in a self-contained way in Chapter 4. A key part of this chapter are the fundamental theorems for the differential-difference Dunkl operators. Chapter 5 presents  $h$ -harmonics, the analogue of harmonic homogeneous polynomials associated with reflection groups. Chapter 6 is a detailed treatment of orthogonal polynomials on the simplex, the ball, and of Hermite type. Summability theorems for expansions in terms of these polynomials are presented in Chapter 7, and the non-symmetric Jack polynomials appear in Chapter 8; this chapter treats analysis associated with symmetric groups. Finally, Chapter 9 shows how to use non-symmetric Jack polynomials to produce bases associated with the octahedral groups; this chapter contains a short discussion of how these polynomials and related operators are used to solve the Schrödinger equations of the Calgero-Sutherland systems.

This book will be welcomed by research mathematicians and applied scientists, including mathematicians, physicists, chemists and engineers. (knaj)

**J. Duoandikoetxea, *Fourier Analysis*, Graduate Studies in Mathematics 29, American Mathematical Society, Providence, 2001, 222 pp., US\$35, ISBN 0-8218-2172-5**

This book is a translation of *Análisis de Fourier* by Javier Duoandikoetxea Zuazo, published in Spanish by Addison-Wesley and Universidad Autónoma de Madrid in 1995. Its purpose is to develop Fourier analysis using the real variable methods introduced by A. P. Calderon and A. Zygmund in the 1950s.

The book consists of 9 chapters. The first three chapters give a review of Fourier series and integrals, and introduce the Hardy-Littlewood maximal functions and the Hilbert transform. Its higher dimensional analogues are known as singular integrals, and are discussed in Chapters 4 and 5 along with their modern generalizations. In Chapter 6 the author studies the relationship between  $H^1$ ,  $BMO$  and singular integrals. Chapter 7 presents the elementary theory of weighted norm inequalities. Littlewood-Paley theory is discussed in Chapter 8; its origins date back to the 1930s, but it has had extensive later development which includes a number of applications; those presented in this chapter are useful in the study of Fourier multipliers, which also uses the theory of weighted inequalities. The book concludes with an important result from the 1980s, the  $T1$  theorem which has been of crucial importance to the field.

At the end of each chapter there are extensive references and notes on additional results. The bibliography at the end contains only books that treat in depth the presented ideas. The material in the book comes from a graduate course taught at the Universidad Autónoma de Madrid in 1988-89. The book is an excellent text for gradu-

ate students and is also suitable as a general self-study resource for professionals in Fourier analysis. (knaj)

**J. Elschner, I. Gohberg and B. Silbermann (eds.), *Problems and Methods in Mathematical Physics, Operator Theory Advances and Applications 121*, Birkhäuser, Basel, 2000, 523 pp., DM248, ISBN 3-7643-6477-7**

This volume presents the proceedings of the 11th Conference on Problems and Methods in Mathematical Physics, held in Chemnitz in March 1999. The conference was dedicated to the memory of Sigfried Prössdorf who made important contributions to the theory and numerical analysis of operator equations and their applications in mathematical physics and mechanics.

The book starts with articles describing his life and mathematical achievements, together with the list of his publications. The main part of the book consists of original research papers containing new and interesting results. The topics range from integral and pseudodifferential equations, boundary value problems, operator theory, boundary element and wavelet methods, approximation theory and inverse problems to various concrete problems to applications in physics and engineering. They reflect Prössdorf's broad spectrum of research activities.

The book is addressed at a wide audience in the mathematical and engineering sciences. (kn)

**E. Flapan, *When Topology Meets Chemistry. A Topological Look at Molecular Chirality*, Cambridge University Press, Cambridge, 2000, 241 pp., £16.95, ISBN 0-521-66254-9 and 0-521-66489-9**

This book describes topological techniques with applications in chemistry and molecular biology. Recently, there was substantial interaction among these different scientific disciplines with an interesting impact of topology itself.

The main topics treated here are knot theory, topology of embedded graphs and three-dimensional manifold theory. Each chapter starts with an explanation of the corresponding topic from biology or chemistry and a description of their relations to specific geometric or topological structures. In the first chapter, stereochemical topology is introduced as a study of three-dimensional structure of molecules, using the topology of graphs embedded in three-dimensional space. In the second chapter, the chirality of complex molecules and its relation to the theory of knots and links are studied. One interesting geometrical object used here is the Möbius ladder, which is a special type of graph; its embeddings into three-dimensional manifolds, and into the sphere  $S^3$  in particular, are studied in the context of topological chirality. Some non-trivial results from graph theory concerning their possible embeddings in the plane or space are used here, and the symmetries of embedded graphs of different types are applied in the theory as well. The last chapter is devoted to a study of DNA using topological techniques; the main topic used here is the theory of tangles (originally developed by Conway), and

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their equivalences and properties. At the end of each chapter, there are exercises.

The book is interesting from different points of view, and in particular because of its interdisciplinary character and its description of applications of topology in biology and chemistry. An effort was made to make the material accessible also to chemists and molecular biologists, and the technicalities are kept to a minimum whenever possible. (jbu)

**J. Gil, D. Grieser and M. Lesch (eds.),** *Approaches to Singular Analysis. A Volume of Advances in PDE, Operator Theory Advances and Applications 125, Birkhäuser, Basel, 2001, 256 pp., DM170, ISBN 3-7643-6518-8*

This book, based on the Workshop 'Approaches to Singular Analysis' held in 1999 in Berlin, presents various approaches to analytic problems arising in analysis on singular spaces, in particular on manifolds with corners. The approaches to analysis via partial differential equations on singular spaces may be divided into pseudodifferential calculus adapted to the underlying configuration, and a direct approach consisting of an analysis of geometric differential operators (Laplace, Dirac) in special geometric situations.

This book contains articles by workshop participants and invited contributions. There are introductory lectures on the  $b$ -calculus of R. Melrose and cone algebras. B. W. Schulze proposes a systematic study of elliptic PDEs on manifolds with singularities, in terms of pseudodifferential algebras with hierarchies of symbols. J. Brüning examines resolvent expansions for Laplace-type operators on a certain class of isolated singularities. The index theorem for elliptic operators on toric manifolds with conical singular points is studied by Fedosov, Schulze and Tarkhanov. (ps0)

**J. J. Gray (ed.),** *The Symbolic Universe: Geometry and Physics 1890-1930, Oxford University Press, Oxford, 1999, 289 pp., £55, ISBN 0-19-850088-2*

This book is a collection of nine articles that were presented at a conference held at the Open University in March 1996. They are devoted to history of mathematics and physics and their mutual interrelations in the period 1890-1930. The authors are highly competent, with a profound understanding of the subject and a good knowledge of history, and the articles are far from being a mere collection of data and facts – on the contrary, they offer deep analyses of the situation in mathematics and physics in the periods of interest, explain why mathematicians and physicists were interested in these and not other problems, and why they used certain methods. They take into account the general ambience and the country where the work took place. Moreover, many notions are explained from the point of view of contemporary mathematics and physics, which can be very helpful; they show mathematicians and physicists of those times as complex personalities, and this enables us also to understand better their work. I do not often read books on the history of mathematics and physics, but this collection is the best I

have read in recent years. It proves that all specialists in mathematics or physics should be well informed about the history of their field, because it definitely (and sometimes surprisingly) brings ideas for their own research.

This collection will be interesting for mathematicians working in differential geometry and for physicists interested in relativity. But there is a lot of interesting material for geometers in general, for people working in analysis (especially complex analysis), representation theory of groups, topology, and other areas. The articles should also attract the attention of physicists interested in optics, field theories, quantum physics, and other areas. The great pioneers of mathematics and physics, whose lives and work this collection describes, cannot be associated with one or two subjects only. (jiva)

**D. F. Griffith and G. A. Watson (eds.),** *Numerical Analysis 1999, Research Notes in Mathematics 420, Chapman & Hall/CRC, Boca Raton, 2000, 279 pp., £45, ISBN 1-58488-020-1*

This text is based on lectures presented at the 18th Dundee Biennial Conference on Numerical Analysis, held at the University of Dundee in July 1999. It contains full versions of all the invited papers and the list of titles of all contributed talks together with names and addresses of the lecturers.

The papers cover a wide range of topics from partial differential equations to linear algebra and approximation theory and contain contributions from leading experts in the field (adaptive and mixed  $hp$ -finite element methods; optimal control problems; finite volume approximations; variational PDE methods; subgrid scales; Krylov subspace methods for radial basic function interpolation; homotopy methods for mixed complementary problems based on PATH solvers; Störmer-type numerical integrators; domain decomposition methods; a polynomial interpolation on the sphere). The applications range from image processing and molecular dynamics to superconductivity (an incompressible flow; a problem of boundary control in superconductivity; image processing; a model of superconducting vortices; a perturbed Hamiltonian system; reduction techniques for large-scale dynamical systems; data fitting problems).

The book offers inspiration for further research. It can be strongly recommended to researchers and postgraduate students involved in numerical analysis, and to engineers or scientists using numerical methods. (knaj)

**K. Hulek, F. Catanese, C. Peters and M. Reid (eds.),** *New Trends in Algebraic Geometry, London Mathematical Society, Lecture Note Series 264, Cambridge University Press, Cambridge, 1999, 484 pp., £29.95, ISBN 0-521-64659-6*

Formally, this volume contains seventeen contributions from the July 1996 Warwick European algebraic geometry conference, which is considered one of the major algebraic geometry events of the last decade – but the real aim of this collection is to pre-

sent the main trends of contemporary algebraic geometry; it was exactly this idea which was behind the choice of the articles.

Five of the articles are expository and survey articles, and in the rest there is a survey aspect. The intention of the editors was to assemble a collection of articles that could create a picture of contemporary algebraic geometry, even for non-specialists in the field. We do not want to pretend that a reader with no knowledge of algebraic geometry is able to read these articles; nevertheless, the editors have been quite successful, and a non-specialist with certain background from algebraic geometry, who likes this field, can probably understand a lot; this applies also to postgraduate students.

The articles can be divided into three main groups. The first group, consisting of four papers, is devoted to the Gromov-Witten invariants. The second group, also consisting of four articles, deals with Calabi-Yau 3-folds and mirror symmetry. The third group covers various other topics; these are very interesting and high quality articles that deserve attention. This collection is indispensable for specialists in algebraic geometry, and for postgraduate students in this field. (jiva)

**S. Jiang and R. Racke, Evolution Equations in Thermoelasticity, Monographs and Surveys in Pure and Applied Mathematics 112, Chapman & Hall/CRC, Boca Raton, 2000, 308 pp., £53.99, ISBN 1-58488-215-8**

The aim of this book is to present the state of the art in the theory of evolution equations in thermoelasticity, to which the authors have also contributed. The evolution problem under consideration is a coupled system of a parabolic and a hyperbolic equation, considered either on the whole space  $\mathbf{R}^n$  or on a bounded domain in  $\mathbf{R}^n$  with boundary conditions. Local existence and asymptotic behaviour for one- and multi-dimensional models are studied separately, both for linear and non-linear equations. The impact of the parabolic and hyperbolic structures is demonstrated on the propagation of singularities. The last two chapters are devoted to contact problems and other related results. To help the reader, there is a short derivation of the equations in Chapter 1 and a general existence theory and other tools that are used throughout the book, are summarised in an Appendix. This book is essentially devoted to one type of evolution problem and describes several theories applied to its different modifications. It might thus be suitable for demonstrating the theory of evolution equations on a special, although advanced, example. Graduate students will appreciate that material previously published only in papers is collected in this book, and experts will find some new results here. A basic knowledge of linear partial differential equations is assumed. (efa)

**W. J. Kaczor and M. T. Nowak, Problems in Mathematical Analysis I. Real Numbers, Sequences and Series, Student Mathematical Library 4, American Mathematical Society, Providence, 2000, 380 pp., US\$39, ISBN 0-8218-2050-8**

This book is the first volume of a series of

problem books in mathematical analysis. It contains 78 problems on real numbers, 244 problems on sequences, and 299 problems on series. The problems are nicely chosen and solutions of all of them are provided. It is an ideal book for problem seminars and also for self-study. The problems are by no means new, but books of this type in English are still rare. The second volume already exists in Polish and is being translated into English. Problems on structures, such as metric or topological spaces, will be published in a separate volume.

This book can be recommended for libraries and for students with a deeper interest in mathematical analysis. (jive)

**H. Krause and C. M. Ringel (eds.), *Infinite Length Modules, Trends in Mathematics*, Birkhäuser, Basel, 2000, 439 pp., DM198, ISBN 3-7643-6413-0**

This book is based on invited lectures at a Euroconference held at the University of Bielefeld in September 1998. The main topic is the role of infinite length modules in the representation theory of algebras.

The book consists of 23 survey papers written by the leading experts in the field. The scene is set by a survey by Ringel, with many illuminating examples. There follow papers on algebraically compact modules (Huisgen-Zimmermann, Prest), decomposition theory (Eklof, Facchini, Göbel, Pimenov-Yakovlev), dimension theory (Bavula, Lenagan, Schröer), functor categories (Kuhn, Powell), homological methods (Martsinkovsky, Schwartz, Smalo), localisation and moduli spaces (Rickard, Schofield), modular representations of finite groups (Benson, Carlson), and tameness (Bautista, Krause, Lenzing, Zwara). This book is indispensable for anyone interested in current trends and methods of representation theory. (jurl)

**T. Krisztin, H.-O. Walther and J. Wu: *Shape, Smoothness and Invariant Stratification of an Attracting Set for Delayed Monotone Positive Feedback*, Fields Institute Monographs 11, American Mathematical Society, Providence, 1999, 245 pp., US\$69, ISBN 0-8218-1074-X**

This book is devoted to the study of global dynamics for a delay differential equation of the type  $(dx/dt)(t) = -\mu x(t) + f(x(t-1))$  with a monotone feedback  $f$ . Such equations arise in various applications in engineering, biology, or neural networks. A natural object for studying long-time behaviour of solutions is a global attractor (provided it exists) or, more generally, an unstable manifold of the stationary point 0.

This book follows this approach and demonstrates the richness of dynamics of delay differential equations. Although the subject is rather technical, it is not too difficult to read this text. The presentation is clear and the book is self-contained, since it contains appendices on basic facts from the theory of (smooth) dynamical systems (invariant manifolds, Floquet and Poincaré-Bendixson theory for delay equations, etc.). This book will be suitable for graduate students with interests in differential equations and/or dynamical systems. Some prelimi-

nary knowledge from parts of the textbooks of J. K. Hale, S. M. Verduyn Lunel or O. Diekmann, S. A. van Gils, S. M. Verduyn Lunel, H.-O. Walther would be useful. Specialists will find recent results here. (jmil)

**H. G. Kwatny and G. L. Blankenship, *Nonlinear Control and Analytical Mechanics. A Computational Approach*, Control Engineering, Birkhäuser, Boston, 2000, 317 pp., DM128, ISBN 0-8176-4147-5 and 3-7643-4147-5**

This monograph is devoted to a modern treatment of analytical mechanics and nonlinear control theory with very strong computational aspects. After introducing the basic concepts of Banach spaces and stability theory for ordinary differential equations, the basic geometric properties of dynamical systems are introduced. The authors present these basic properties in an easily understandable form, without unnecessary details but in a clear and correct manner. The authors also provide a short introduction to differential geometry and introduce necessary concepts (vector fields, flows, distributions, Lie groups and algebras) for the formulation of dynamic equations. This makes the book an excellent introduction into the subject.

The much developed numerical aspects of the treatment make it possible to demonstrate the behaviour of dynamical systems on a computer. Each copy of the book is equipped with a CD-ROM containing the package ProPac, which can be used as a MATHEMATICA (3 or 4) package for simulation of motions of dynamical systems. It can also be used in MATLAB/SIMULINK. Using this software, the authors give many examples of how to simulate the behaviour of simple multibody systems (for instance, planar mechanisms) or smooth affine control systems. The last two chapters of the book are devoted to robust and adaptive controls for non-linear systems and to applications of feedback linearisation methods for uncertain systems. Discontinuity of control functions over smooth surfaces is also considered. The book provides an excellent introduction to dynamical systems and control theory for anyone interested in examples and practical applications. The use of its software package could considerably improve the understanding of the subject. (ak)

**Yu. I. Manin, *Frobenius Manifolds, Quantum Cohomology, and Moduli Spaces*, Colloquium Publications 47, American Mathematical Society, Providence, 1999, 303 pp., US\$55, ISBN 0-8218-1917-8**

Quantum cohomology is a specific formal deformation of the cohomology ring  $H = H^*(V)$  with complex coefficients of a projective algebraic variety  $V$ . The resulting abstract algebraic structure is called the Frobenius manifold and can be described by: (i) a 'potential'  $\Psi$  in coordinates on  $H$ ; (ii) an action of an operad on  $H$ ; (iii) a completely integrable system on the formal manifold  $H$ ; structure (ii) is also called the cohomological field theory.

The book is a compendium of lectures given by the author at the Max-Planck-

Institut für Mathematik in Bonn. The first part (Chapters I-IV) is devoted to abstract Frobenius manifolds and to implications of this notion, while the construction of the quantum cohomology itself is postponed to Chapters V and VI. While the first part of the book is more-or-less self-contained, the construction of the quantum cohomology needs quite advanced techniques of algebraic geometry, and the reader is supposed to work with references.

Although the book assumes a rather broad preliminary knowledge of algebraic and differential geometry, it might yet give, even to a non-specialist, some basic orientation in the above topics which belong to the main stream of research in mathematics and have, moreover, a strong physical flavour. (mm)

**V. Maz'ya, S. Nazarov and B. Plamenevskij, *Asymptotic Theory of Elliptic Boundary Value Problems in Singularly Perturbed Domains, I, II, Operator Theory Advances and Applications, 111, 112*, Birkhäuser, Basel, 2000, 435 pp., 323 pp., DM268, ISBN 3-7643-6397-5 and 3-7643-6398-3**

This book is devoted to the development and applications of asymptotic methods to boundary value problems for elliptic equations in singularly perturbed domains. The first volume contains Parts I-IV, in which boundary value problems with perturbations near isolated singularities of the boundary of the domain are studied. The second volume contains Parts V-VII, which deal with other kinds of perturbations (problems with perturbations of the boundary of singular manifolds, problems in thin domains, and problems with rapid oscillations of the boundary of domain or coefficients of differential operators).

In Part I the authors discuss boundary value problems for the Laplace operator. Part II is devoted to the study of general elliptic boundary value problems. Parts III and IV deal with the expansion of functionals over solutions of boundary value problems and eigenvalues in the asymptotic series. In Part V, the authors study boundary value problems in domains perturbed near multidimensional singularities of the boundary. The behaviour of solutions of boundary value problems in thin domains is investigated in Part VI. Part VII deals with elliptic boundary value problems with oscillating coefficients. (dmed)

**H. Nakajima, *Lectures on Hilbert Schemes of Points on Surfaces*, University Lecture Series 18, American Mathematical Society, Providence, 1999, 132 pp., US\$21, ISBN 0-8218-1956-9**

The purpose of this book is to describe various properties of Hilbert schemes of points on surfaces. The subject has its origin in algebraic geometry and is related to many other branches of mathematics, such as singularities, symplectic geometry, representation theory and even theoretical physics. The topic can be explained from various points of view. The presented lectures are intended for graduate students having already a basic knowledge of algebraic geometry and homology groups of manifolds, but some chapters require a more extended background, such as spectral

## RECENT BOOKS

sequences, intersection cohomology and perverse sheaves.

The first chapter collects basic facts, needed in later chapters, on the Hilbert scheme of points on a surface; other chapters in the book can be read independently. Resolutions of simple singularities are studied in Chapter 4, and the Poincaré polynomial of Hilbert schemes in Chapters 5 and 6. Chapter 8 contains a description of the homology group of Hilbert schemes. This book is not the first (and hopefully not the last) on Hilbert schemes of points on surfaces, but the author has avoided repetition of material from earlier books on the same subject. (ae)

**R. Narasimhan and Y. Nievergelt, *Complex Analysis in One Variable*, Birkhäuser, Boston, 2001, 381 pp., DM148, ISBN 0-8176-4164-5 and 3-7643-4164-5**

This book is an extended version of a book published by the first author. It now appears with slight changes and enlarged by the second author, with 365 carefully chosen exercises. It is based on graduate courses given by the authors, with the aim of relating complex analysis to other fields of mathematics. In about 250 pp., it contains traditional material and also such topics as functions of several complex variables, compact Riemann surfaces, the Corona theorem, and more than 40 pages on subharmonic functions and related topics. The second part with exercises (about 110 pp.) follows the structure of the first part and contains references to other sources. Most exercises are chosen to complete the exposition of the theory rather than to master more-or-less routine calculations. Carefully written comments and bibliography at the end of each chapter of the first part, as well as final comments to exercises, are very useful. This is a good source for teachers leading seminars on complex function theory and for self-study by graduate students. (jive)

**J. Oprea, *The Mathematics of Soap Films: Explorations with Maple*, Student Mathematical Library 10, American Mathematical Society, Providence, 2000, 266 pp., US\$29, ISBN 0-8218-2118-0**

Nature tries to minimise the surface area of a soap film through the action of surface tension; the process can be understood mathematically by using differential geometry, complex analysis, and the calculus of variations. This book employs ingredients from each of these subjects to tell the mathematical story of soap films. The text is fully self-contained, combining a mixture of types of mathematics with a bit of physics that underlies the subject, and requires no advanced background material from either mathematics or physics. Through Maple applications, the reader is given tools for creating shapes that are being studied. Maple procedures creating the surfaces of soap film are presented, together with many figures as their output in various situations. The author also includes descriptions of experiments and photographs that let one see real soap films on wire frames.

The book is an excellent presentation of a beautiful subject. It can be used for inde-

pendent study or as an interesting text for seminar lectures. (pp)

**M. S. Osborne, *Basic Homological Algebra*, Graduate Texts in Mathematics 196, Springer, New York, 2000, 395 pp., DM98, ISBN 0-387-98934-X**

The title characterises this book very well. The author wrote it when teaching courses on homological algebra: he needed a textbook leading quickly to the functors *Tor* and *Ext* which would then offer possibilities for proceeding further in several different directions. The possibilities are best depicted in his diagram on Chapter/Appendix Dependencies. One can continue, for example, with dimension theory, applications in ring theory, and abstract homological algebra.

The book is well written. We find here many examples. Each chapter is followed by exercises, and at the end of the book there are outline solutions to some of them. The organisation of the book is such that the readers meet the more abstract notions only when they are already familiar with their special instances. I especially appreciated the lively style of the book; compared with some other books on homological algebra, one has here the good feeling that one understands why a notion is defined in this way, that one can easily remember at least the structure of the theory, and that one is quickly able to find necessary details. The prerequisite for this book is a graduate course on algebra, but one can get quite far with a modest knowledge of algebra. The book can be strongly recommended as a textbook for a course on homological algebra. (jiva)

**F. Pacard and T. Rivière, *Linear and Nonlinear Aspects of Vortices. The Ginzburg-Landau Model*, Progress in Nonlinear Differential Equations and Their Applications 39, Birkhäuser, Boston, 2000, 342 pp., DM178, ISBN 0-8176-4135-5 and 3-7643-4133-5**

The Ginzburg-Landau functional is studied as a model for superconductivity. Critical points of the functional are called Ginzburg-Landau vortices. The existence part uses the fixed-point method to obtain a solution of the problem, with a given small parameter  $\varepsilon$  which is close to an approximate solution, previously constructed with the aid of the linearised problem. Letting  $\varepsilon \rightarrow 0$ , the solutions converge to one of solutions of the limit problem and the zeros of the solutions converge to singular points of the limit problem. The solution of the limit problem is a harmonic map with values in  $S^1$ , and its topological degree plays an important role. The uniqueness consists of proving that, roughly speaking, for sufficiently small values of the parameter such a solution is unique, provided that the asymptotic behaviour and boundary data are prescribed; this concerns the simplified model  $E_\varepsilon(u)$ . In the last chapter, a more complicated model is investigated, which better reflects the physical reality. Deep uniqueness results are achieved here, making a step towards a solution of the so-called Jaffe and Taubes conjecture.

The theory of Ginzburg-Landau vortices is a beautiful piece of mathematics, motivat-

ed by direct applications to physics. Recently the theme has become a favourite topic, and is topical because there remain many basic open problems to be solved or better understood. Many interconnections with other areas of analysis can be observed; among methods used in the authors' approach, we mention glueing theorems, functional analysis on weighted Hölder spaces, conservation laws, Pohozaev formula for conformal fields, and comparison principles. The book is a nicely written and interesting treatment of the topic. (jama)

**T. Peterfalvi, *Character Theory for the Odd Order Theorem*, London Mathematical Society Lecture Note Series 272, Cambridge University Press, Cambridge, 2000, 154 pp., £24.95, ISBN 0-521-64660-X**

The famous theorem of W. Feit and J. G. Thompson states that every finite group of odd order is soluble. The proof of this theorem consists of two parts; the first part has been revised by H. Bender and G. Glaubermann in the LMS Lecture Notes 188 (Cambridge, 1994). Throughout the proof a minimal counter-example is considered, and the first part consists of describing its maximal subgroups. These are classified into five types, the first of which is associated with a Frobenius subgroup, while the others are associated with a cyclic subgroup. A revision of the second part of the proof is presented in the first 95 pages of Peterfalvi's book. He uses character theory to show that none of the settings described in the first part of the proof can be actually realised.

In the book there are seven chapters of preparatory computations that concern Dade isometries of class functions, and  $\mathbf{Z}$ -linear isometries of irreducible characters (coherence theorems). Chapter 8 presents the output theorems of Bender's and Glaubermann's book, and the following six chapters apply the preparatory computations to show the non-existence of the counter-example. The rest of the book gives, in 35 pages, a revised proof of a theorem of M. Suzuki, that a doubly transitive finite group, whose stabiliser is a semidirect product of an even-order and odd-order group, has to contain (if involutions satisfy an additional condition) a normal subgroup isomorphic to  $PSL(2, q)$ ,  $Sz(q)$  or  $PSU(q)$ . The proof uses various properties of linear groups, and some other facts, most of which are gathered on 15 pages in four appendices (a theorem of Huppert, near-fields, Suzuki 2-groups, and the Feit-Sibley theorem). (ad)

**M. H. Protter, *Basic elements of real analysis*, Undergraduate Texts in Mathematics, Springer, New York, 1998, 273 pp., DM79, ISBN 0-387-98479-8**

While *A First Course in Real Analysis* by Morrey and Protter is designed for a comprehensive one-year course in analysis, this book is intended for a 'shortened' course aimed at students who intend to study the physical sciences or computer science. It covers the most important topics in an elementary way. Apart from traditional material, some basics of metric space theory, differentiation and integration in  $\mathbf{R}^n$ , the derivative of the integral and the theorems of

Green and Stokes are included. The course does not leave major items to be filled in by readers. One cannot expect advanced results to be included, but the course gives a good knowledge of the important basic concepts for non-specialists. Many problems (the odd-numbered ones with answers) are included.

The book can be recommended to students desiring a good solid background in mathematics for the study of other sciences without unnecessary detours. (jive)

**E. Risler, *Linéarisation des perturbations holomorphes des rotations et applications*, Mémoires de la Société Mathématique de France 77, Société Mathématique de France, Paris, 1999, 102 pp., Fjs150, ISBN 2-85629-076-0** This little book is devoted to a typical problem from the theory of quasi-periodic dynamical systems, which has attracted a lot of attention in recent years. It contains part of the author's thesis, prepared under the guidance of J.-C. Yoccoz. The main topic is a study of holomorphic maps  $F$  from an annulus  $A$  in the complex plane to itself, which are conjugates to rotations – that is, for which there is a rotation  $T_a$  of (a possibly smaller) annulus  $A'$  and a holomorphic map  $h$  from  $A'$  to  $A$  such that  $F \circ h = h \circ T_a$  in  $A'$ . In the book, the attention is restricted to local problems – that is, to maps which are close to rotations.

The first part contains results in a neighbourhood of a map conjugated to a rotation with a parameter satisfying the so-called Bruno condition. The main tool used is a renormalisation of the dynamics analogous to one used by J.-C. Yoccoz for the case of diffeomorphisms of the circle. This renormalisation concerns an analytic family of maps instead of one map, and additional tools needed include methods of several complex variables. In the second part, earlier results are extended from real parameters to complex ones, and the resulting correspondence is regular in the sense of Whitney. The third part describes some consequences for previous results of singular rotation domains of rational maps on a Riemann sphere.

The book will be valuable for mathematicians interested in dynamical systems. (vs)

**J.-E. Rombaldi, *Analyse matricielle: Cours et exercices résolus*, EDP Sciences, Les Ulis, 1999, 304 pp., Fjs210, ISBN 2-86883-425-6**

This is a thorough and mathematically neat textbook on matrix theory. The algebraic and topological properties of the matrix vector algebra (over both real and complex numbers) are presented in a self-contained manner, starting with a condensed treatment of the normed vector spaces that can be easily followed by any reader familiar with elements of linear algebra. Standard results of classical matrix theory are proved comfortably via the endomorphism interpretation, and applications to systems of linear differential equations are carefully presented with respect to possible numerical problems. Each chapter is accompanied by a collection of relevant solved exercises.

The textbook is meant as a teaching text at first- or second-year graduate level, to

provide the background for a course on numerical analysis, for example. Some readers might miss applications to linear programming or Markov chains. (jstep)

**M. Schechter, *Linking Methods in Critical Point Theory*, Birkhäuser, Boston, 1999, 294 pp., DM118, ISBN 0-8176-4095-9 and 3-7643-4095-9**

This carefully written monograph addresses several interesting topics from critical point theory and semilinear elliptic partial differential equations. In the first area, the book presents the first systematic study of finding critical points of the functionals, defined in a Banach space, that are neither minima nor maxima. The key role is the method of linking: a set  $A$  links another set  $B$  if the supremum of the functional values over  $A$  does not exceed the infimum of the values of the functional over  $B$ . (In the mountain pass geometry,  $A$  consists of two points: one lies inside an open set  $Q$ , the second outside the closure of  $Q$ , and  $B = \partial Q$ .) It is proved that  $A$  links  $B$  if they are disjoint and  $A$  cannot be continuously shrunk into a point without intersecting  $B$ . With this general approach the author obtains new results and applies them to semilinear elliptic PDEs, analysing such questions as the solvability of boundary value problems, the existence of non-trivial solutions, the multiplicity of solutions, non-linear eigenvalues and resonance effects. Although the subject is technical, the book is clearly organised.

With its pedagogical presentation, various new results in important fields, greatly generalised approaches and an extensive bibliography, the book can be recommended to specialists and to anyone interested in critical point theory or non-linear PDEs. (jmal)

**J. Stalker, *Complex Analysis. Fundamentals of the Classical Theory of Functions*, Birkhäuser, Boston, 1998, 228 pp., DM84, ISBN 0-8176-4038-X and 3-7643-4038-X**

This is an unusual textbook, incorporating material showing how classical function theory can be used. It has three chapters: Special functions, Analytic functions, and Elliptic and modular functions, and an appendix containing a quick review of real analysis. The general scheme is to show the reader how things were developed without following the traditional approach of most books on function theory. Thus, the first chapter contains information on the distribution of primes and on the gamma, beta and hypergeometric functions, while the second chapter is devoted to contour integration, power series, the Cauchy integral formula, etc.

This book can be recommended to those who like to see applications of the theory taught in 'classical courses'. (jive)

**B. F. Torrence and E. A. Torrence, *The Student's Introduction to Mathematics, A Handbook for Precalculus, Calculus, and Linear Algebra*, Cambridge University Press, Cambridge, 1999, 280 pp., £16.95, ISBN 0-19-853576-7**

This book is another member of the family of books devoted to the computer algebra system Mathematica and its use in mathe-

matical courses. It is not a manual of Mathematica, or a calculus or algebra textbook with exercises for students, but is a very helpful text that explains what commands and features of Mathematica can be used to solve problems in calculus and/or algebra courses. No prerequisites other than high school level mathematics are assumed.

There is a very nice introduction to the Mathematica program in Chapters 1 and 2. The different features of Versions 3 and 4 are shown, as are platform specific information for Apple Macintosh and Microsoft Windows. A warning sign indicates paragraphs that can be skipped by beginners but can be interesting for advanced users. The topics in Chapters 3-7 are typical ones from precalculus, calculus, multivariable calculus and linear algebra courses: functions, graphs, equations, limits, integrals, vectors, matrices, etc.

The book can be used as a supplementary text in calculus or algebra courses and also as a textbook for students who wish to learn Mathematica and use it to solve mathematical problems. The book is nicely written and is recommended to anyone studying mathematics. (ml)

**N. Weaver, *Lipschitz Algebras*, World Scientific, Singapore, 1999, 223 pp., £30, ISBN 9-81-023873-8**

Let  $X = (X, \rho)$  be a metric space. The Lipschitz number  $L(f)$  of a function  $f: X \rightarrow \mathbf{R}$  is the infimum of all  $a = 0$  with the property that  $|f(y) - f(x)| = a\rho(y, x)$  for each  $x, y$  in  $X$ . The space  $Lip X$ , the class of all bounded Lipschitz functions on  $X$ , endowed with the norm  $\|f\|_L = \max\{\|f\|_\infty, L(f)\}$ , is one of the spaces studied in the book.

First of all, they are Banach spaces, and this point of view is considered in Chapter 1. They are also dual spaces, and the proof is based on non-trivial constructions studied in Chapter 2; applications to the mass transfer problem are given. The little Lipschitz spaces are studied in Chapter 3; they consist of functions for which  $\lim_{(x,y) \rightarrow 0} |f(y) - f(x)|/\rho(x, y) = 0$ . This space is trivial if  $X = \mathbf{R}^n$  with the Euclidean metric, but in the general theory their role is significant. In Chapter 4, Lipschitz spaces are studied as Banach algebras. Among the main goals are results of Stone-Weierstrass type, studies of carrier spaces and spectral synthesis. Lattice properties are studied in Chapter 5. The definition of a Lipschitz function can be adapted to measurable metric spaces; this topic is studied in Chapter 6. The last chapter is devoted to derivations, functionals satisfying the product rule  $D(fg) = fDg + gDf$ .

Generally, the book deals with topics based on the general metric structure of  $X$ ; problems such as differentiability of Lipschitz functions on Euclidean domains are beyond its scope. The author is one of the best experts in the field, and the book, probably the first monograph devoted exclusively to Lipschitz algebras, is a valuable guide to a modern, little known, part of functional analysis. Some open problems are mentioned, and possible interesting future developments are considered. It should be interesting for both researchers and students. (jama)