

# European Mathematical Society



March 1998

Issue 27

## *Editorial*

The president



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## *Interview*

Sir Michael Atiyah



p. 8

## *World Mathematical Year 2000*

Report on preparations



p. 18

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# NEWSLETTER

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## EDITORS

Prof Roy Bradley  
Department of Mathematics  
Glasgow Caledonian University  
GLASGOW G4 0BA, SCOTLAND

*Editorial Team Glasgow:*

R. Bradley, J. Gomatam, V. Jha,  
G. Kennedy, M. A. Speller, J. Wilson

*Editor - Mathematics Education*

Prof. Vinicio Villani  
Dipartimento di Matematica  
Via Bounarroti, 2  
56127 Pisa, Italy  
e-mail villani@dm.unipi.it

*Editors - Brief Reviews*

I Netuka and V Souček  
Mathematical Institute  
Charles University  
Sokolovská 83  
18600 Prague, Czech Republic  
e-mail:  
netuka@karlin.mff.cuni.cz  
soucek@karlin.mff.cuni.cz

## USEFUL ADDRESSES

*President:*

Jean-Pierre Bourguignon  
IHES, Route de Chartres, F-94400  
Bures-sur-Yvette, France.  
e-mail: jpb@ihes.fr

*Secretary*

Peter W. Michor  
Institut für Mathematik,  
Universität Wien, Strudlhofgasse  
4, A-1090 Wien, Austria.  
e-mail: michor@esi.ac.at

*Treasurer*

A. Lahtinen  
Department of Mathematics,  
P.O.Box 4  
FIN-00014 University of Helsinki  
Finland  
e-mail: lahtinen@csc.fi

*EMS Secretariat*

Ms. T. Mäkeläinen  
University of Helsinki  
(address above)  
e-mail makelainen@cc.helsinki.fi  
tel: +358-9-1912 2883  
telex: 124690  
fax: +358-9-1912 3213

*Newsletter editor*

R. Bradley, Glasgow Caledonian  
University (address above)  
e-mail r.bradley@gcal.ac.uk

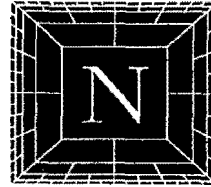
*Newsletter advertising officer*

M. A. Speller, Glasgow Caledonian  
University (address above)  
e-mail msp@gcal.ac.uk

*Website*

<http://www.emis.de>

## EUROPEAN MATHEMATICAL SOCIETY



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## NOTICE FOR MATHEMATICAL SOCIETIES

Please note labels are prepared during the second half of the month before the next issue. Would you please send your updated lists before this time.

Many thanks.

Ms T Mäkeläinen

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## E.M.S. : Why and How

Jean-Pierre Bourguignon  
*President of the European Mathematical Society*

I am happy to inaugurate this new column of the Newsletter, and thus to be given the opportunity of presenting the way in which the EMS is developing. This occasion gives me the pleasure of thanking Professor Martin Speller, and the new team of the Newsletter from Glasgow Caledonian University, for all the work done, and for their willingness to adopt a new format in spite of the extra work involved.

Born only 8 years ago, *the EMS is still a young society*. This is at the same time a strength and a weakness. It means that, within the EMS, new initiatives can be easily developed without being obstructed by long established bad habits, and at the same time that the guiding principles inherited from a long tradition may be missed when important decisions are to be taken. In more concrete terms : its being a new structure should help convince colleagues that the EMS can address questions of common interest not tackled so far ; on the other side of the coin, too many colleagues have not even heard of the EMS.

It is therefore of paramount importance to review now why the European Mathematical Society should exist, and how its present structure allows it to meet the challenges that brought it into being.

### Why a European Mathematical Society ?

*The central mission of the EMS is to help the emergence of an identity among European mathematicians.* This parallels the steady trend that has been reshaping the life of all European societies since the end of World War II, and is bringing European nations closer. We are witnessing the construction of a European scene in all facets of social activity, and this process takes many different forms. The European Union is gaining weight year after year, and its influence is growing, not only in countries which already belong to it, but also in those which aspire to join it. For mathematicians, *a professional society appeared as the most appropriate structure to allow debate on these perspectives, to promote Mathematics and to represent the community with the newly established structures, and also to help our discipline meet the challenges that it faces around the world.*

Nowadays, Society puts much tougher questions to scientists in general, and to mathematicians in particular. We must come to grips with these demands, without harming the long-term development of our discipline. Short-term views are

almost surely harmful, and we have to argue for the preservation of free thinking, precisely in order to be in a good position to answer the pressing questions of tomorrow. Mathematics has a much longer timeframe than other sciences.

The need for a structure bringing together mathematicians on the European level has another root. I strongly feel that *it is only by doing things together that we can really learn from each other, and measure*

the richness and the complexity that diversity brings to human actions. Indeed Europe is diverse, culturally, linguistically, structurally, some of its countries have a long tradition of large central organizations, others cherish county or village structures. For me, this is an advantage, and is to be preserved. *The key word is compatibility, not uniformization.*

By working together, we will not only acquire some new ways of doing things, but we should be able to address certain questions at the critical level. The basis of modern society is communication and networking. On this front too, the EMS is the appropriate structure for action. It is light enough to move quickly when necessary, decentralized enough to catch information where and when it is useful. It is evident that *the EMS needs a large membership* and the active involvement of its member societies. It should be made easy for them to work with the EMS. They should find there visibility for their endeavours of wider interest than their normal constituency, and support for some of their actions that naturally have a European dimension. The EMS has to develop its actions at a level which, without ambiguity, must be different from that of its member societies. It also relies on them to relay some of its activities, typically those which imply collecting information in various countries or regions.

If all possible national or regional societies in Europe have now joined the EMS, a lot remains to be done to attract individual members, the most serious problem being to overcome economic obstacles for colleagues from less favoured regions. However, we recently succeeded in introducing the possibility for colleagues who act as referees for the Zentralblatt für Mathematik to pay their fee through their royalties.

Another front on which mathematicians are involved the world around is education. If students are to circulate easily in the European job market,

the various education systems have to be put in phase, again while preserving the diversity that is perhaps one of the main resources that Europe has to offer. Mathematics is likely to play an important role in these discussions as its teaching is often controversial. A structure representing the mathematical community for discussions on these questions is certainly important since we do not want closed lobbies to gain control over such issues.

A final important point : *EMS does provide a good framework for the development of Mathematics in its unity.* Let us remember that this was the motto adopted by the Scientific Committee of the last European Mathematics Congress in Budapest. The speakers selected provided a vivid illustration of the rightness of this choice. *Pure and applied mathematicians have to feel equally at home in the EMS,* and it should keep this in mind in all its actions and developments. This is a must if one is to properly address many questions having to do with the training of students, relations with society and with executives from the private sector as well as from public organizations.

#### **How the European Mathematical Society ?**

In order to fulfil its objectives *the EMS has set up a number of tools and is pursuing actions on several fronts.* Let me quickly describe them, taking this opportunity to remind you in what perspective they were set, and in which direction we try to develop them further.

The *EMS Newsletter* is of course the natural link between members, and the new series inaugurated in this issue aims at improving contacts. Each issue will contain regular columns : an editorial by a person who holds a post of responsibility in the EMS, an interview with a prominent scientist or industrialist, the presentation of a special institute. We also hope that this renewed content will generate an interesting debate with our readers that will be made available to everybody through a lively Readers Column.

*EMIS*, the EMS server which is the child of the present EMS Secretary, Peter Michor, and was developed by Michael Jost, from the FIZ-Berlin office, is a great success. It now plays a very important role, not only by the large amount of information that it displays but also by the example it sets on a number of fronts. Of course, like any well built server, it provides links to the world to which it belongs, namely that of mathematicians, and information on the institution that put it up, the EMS. Beyond that, it offers numerous services, such as *Euro-Math-Job*, a link to available jobs (that we hope to transform into a real job placement service), *MATH-Zentralblatt für Mathematik*, the electronic

bibliographic data basis, *Elib-Math*, the electronic library which now contains 23 journals (and 10 more soon to come), 7 proceedings of conferences, and 1 monograph. On EMIS will soon be available the *Current Awareness Programme*, which will enable any mathematician to have access, free of charge, to a large number of abstracts of articles that have appeared in the last year. Résumés from the *Annales de l'Institut Fourier* and of publications of the *Société Mathématique de France* are already automatically loaded in CAP.

Very early, it was decided by the Executive Committee to found *JEMS*, the Journal of the EMS. This is just one of the directions in which the EMS is developing its publication policy. It is the responsibility of the EMS Publications Officer, formerly Stuart Robertson from Southampton, who was also the animator of the previous Newsletter team, and now Carles Casacuberta, from Barcelona. *JEMS* now has reached a critical stage : the Editor-in-Chief, Jürgen Jost, one of the directors of the newly founded Max-Planck-Institut für Mathematik in den Naturwissenschaften based in Leipzig, has started to work, in close connection with the main editors, Luigi Ambrosio (Pavia), Gérard Ben Arous (ÉPFL, Lausanne), John Coates (Cambridge), Helmut Hofer (Courant Institute) and Alexander Merkurjev (UCLA). The editorial board is being completed by about 30 associate editors. The first issue is due in January 1999, and the journal is to be presented at the International Congress of Mathematicians in Berlin next August.

The most visible manifestations that the EMS has been involved in are the European Congresses of Mathematics. Paris and Budapest hosted these events in 1992 and 1996 respectively, and Barcelona will host ECM2000. There too, the EMS is innovating by implementing a broader format than the traditional ICMs. Besides the scientific programme, round tables provide forums for discussion on a number of issues of common interest to European mathematicians. Some are organizational (such the circulation of persons between institutions in Europe), others are about foreseeing the future by gathering and disseminating information about the demography of mathematicians,...

A number of initiatives taken by the EMS address young mathematicians. *EMS Prizes* are given at the ECMs to 10 young mathematicians. Each year, two *EMS Summer schools* are organized, one in pure Mathematics, the other on more applied topics. Applications for the organization of summer schools are called for and studied by the Summer Schools Committee, chaired by Professor Giovanni Monegato. The EMS makes a great effort to have

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these schools held in Eastern European countries to help colleagues from these countries develop their activities. We have a good record as far as our applications for support from the European Commission are concerned. Special funds have to be found for schools held in Central and Eastern Europe. The UNESCO Venice office has so far shown great interest in a partnership in this.

The *Diderot Mathematical Forum* series was set up with the explicit aim of opening up contacts with other scientists and other components of Society. The scheme, a 2-day conference held simultaneously in 3 different cities linked for part of the manifestation by audio-visual means, aims at maximizing the confrontation between different points of view and sensibilities while keeping the local organization light, since at each node only about 100 people are expected. It is true that putting up the telecommunication part turned out to be a non-trivial task. We may just be a bit ahead of our time. Topics treated so far are "*Mathematics and Finance*", "*Mathematics and Environment : problems connected to water*" ; the ones which are in the making deal with "*Mathematics as a leverage for cultural evolution*", "*Mathematics and Music*" (these two are by now well defined), "*Mathematics and Telecommunications : problems connected to mobile telephones*", "*Mathematics and Risks*", "*Mathematics and Medicine*". For this again, your input is crucial, both for topics, potential partners and locations. For me showing the willingness of the mathematical community to discuss issues in which Mathematics is concerned both at the fundamental and at the applied levels is crucial. The hope is to make the series a major tool for renovating the image of Mathematics with a broad public in mind, and to call the attention of our colleagues on the breadth of possible interactions of our discipline.

This series complements other activities such as the *EMS Lectures* which are geared towards our community, and have twice already functioned successfully. The scheme is to support a series of lectures by an outstanding scientist in a not too large institution with the obligation of making the course readily available to a wider audience than the local one. The University of Besançon, hosting Professor Hendrik Lenstra in 1995, and the University of Helsinki, hosting Professor Nigel Cutland in 1997, did play their role remarkably well.

The science policy of the European Commission lives on a 4-year tempo, corresponding to the approval of the Framework Programmes for Research and Development. The 5th will soon be approved and will come into operation in early 1999. The EMS took part in the preparatory discussions through

a widely distributed position paper available on EMIS. It prompted very positive reactions from mathematicians and scientists of other disciplines as well. We fought of course for a better recognition of the role of Mathematics in EC programmes, and have been heard on some points. The energetic presence in Brussels of the EMS Liaison Officer with the European Commission, Luc Lemaire, helped the EMS become a well recognized partner in these circles.

In our declaration, we stated as first priority the recognition by the European Commission of the data base *MATH-Zentralblatt für Mathematik* as a large infrastructure for European mathematicians. Thanks to the openmindedness of the mathematical section of the Heidelberger Akademie, chaired by Professor Dieter Puppe, of the FachInformationZentrum, and of Springer-Verlag, considerable progress has been achieved. It all started by a French-German collaboration, encouraged on the German side by the Editor-in-Chief of the data base, Professor Bernd Wegner, and conducted on the French side by the newly established structure MathDocCell, a joint structure of the University Joseph Fourier (Grenoble) and the Centre National de la Recherche Scientifique, under the responsibility of Professor Pierre Bérard and Professor Laurent Guillopé, now at the University of Nantes. A major contribution of this structure to the database is the new search and retrieval software used for the local servers, for the main server in Berlin and for its international New York and Strasburg mirrors. On his side, the Editor-in-Chief has considerably developed partnerships in Eastern European countries, with the aim of a truly distributed constitution of the data base. From the moment it was associated to the discussions, the EMS insisted on having critical opinions received, analyzed and turned into improvements of the database. This mechanism will be achieved through an Innovation Committee, chaired by Professor John Coates, that has been put immediately to work. *Since November 1997, the EMS shares the copyright of the database.* The aim is now well defined : go much beyond the present partnerships, and make *MATH-Zentralblatt für Mathematik* a truly European endeavour, involving many countries through diverse entities, and many colleagues through their contributions.

*EMPRESSA, the EMS Press Agency*, has been set up in Strasburg. It is still in its infancy. The objective is to help mathematicians whose function in the community is to circulate information of common interest, both technical and general, by putting together different sources. It should also provide journalists with first-hand information on what is going on in the mathematical world and who

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are the people most likely to help them when they intend to cover mathematical topics.

As I mentioned earlier, mathematicians pay special attention to questions connected to teaching. This is why the EMS accepted a request from Ms. Edith Cresson, the commissioner in charge of science at the European Commission, to participate in a project aiming at establishing *European reference levels* for mathematical teaching at ages 16, 18 and after two years of university. A special working group has been set up under the responsibility of Professor Villani from Pisa University. It has just begun its activity, and will associate colleagues from many different countries to have a concrete and documented view of the situation, which is very diverse, as it should be. Here again, the aim is to ease compatibility, and certainly not plan uniformity.

Considerable efforts have gone into helping colleagues in appreciating EMS activities : members of the Executive Committee presented EMS actions at scientific meetings, an agenda describing the 1998 EMS activities has been sent to many mathematical departments and institutes, identifiable posters for EMS events are now systematically produced. Most of the tools that were developed for these purposes are due to the commitment of the EMS Publicity Officer, Mireille Chaleyat-Maurel, and the talent of Marie-Claude Vergne, secretary at the IHÉS, but also a dedicated painter. The aim is to build an image of the EMS around its logo, which represents the European mathematical community through the melting of the letters E, M, S into a new symbol

while keeping its diversity displayed in the woven colours of the background. Dossiers giving a full account of EMS projects is available in French and in English, an idea of Professor Marc Brunaud. Colleagues who are interested in using them to make the EMS better known can request them.

As you can imagine, all this could not be achieved without the active involvement of a fairly large number of colleagues. It will stay that way in the future. Most of the work is carried out by committees (the EMS has 14 by now, besides its Executive Committee), which make suggestions, prepare calls, select applications, collect the information necessary for applications to sponsoring agencies, act when necessary, etc. Conditions for the success are an efficient management and sound finances. Keeping them in order has been remarkably achieved by Tuulikki Mäkeläinen, secretary of our Helsinki office, and the EMS Treasurer, Aatos Lahtinen, also based at Helsinki University. This gives me a good opportunity to remind you of the critical role that this university has played in the life of the EMS, by hosting the first meeting ever of the European Council, the EMS incubator, and by offering to host the office of the society, which is incorporated under Finnish law.

The EMS can live only because it has many hard working people behind it. This is also, in my view, the only way in which we can progress in our endeavour to help the emergence of an identity among European mathematicians. We need it. We will achieve it through our commitment.

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## An interview with Sir Michael F. ATIYAH, FRS

by Jean-Pierre Bourguignon

**JPB :** *Sir Michael Atiyah, could you give us your view about the role that the index theorem plays in many different areas of Mathematics? Did you and Singer foresee the possibility of such developments when you first worked at the proof?*

**MFA :** The index theorem provides a very concrete topological answer to a basic analytic question. It is not therefore too surprising that it has turned out to have many ramifications. It grew out of the Riemann-Roch Theorem so we always knew it was important in algebraic geometry and complex analysis. Its more general role in differential geometry, through spinors, was latent in the formulas of Hirzebruch which had provided one of our starting points. The move into abstract functional analysis was an attempt to replace sheaf theory and was stimulated by Singer's background in analysis. We did not foresee the scale of developments in non-commutative  $C^*$ -algebras, but were certainly interested in the interaction with group representation theory. This was partly stimulated by Serre's introduction of equivariant  $K$ -theory for finite groups and partly by formulas emerging from the Selberg trace formula.

Where we were totally taken by surprise, and in this we were not alone, was the relevance of the index theorem for theoretical physics. This was a very remarkable development and a key part of the recent rapprochement between Theoretical Physics and modern Differential Geometry, as demonstrated in particular by Edward Witten.

I have to say that, since I worked at various developments and generalizations of the index theorem for at least 10 years, it is hard now to remember what our ideas were at the start. They evolved as we dug deeper into the various applications and extensions. Many people also influenced the development.

**JPB :** *You have been one of the founders of  $K$ -theory which has expanded in so many different directions. Do these multi-faceted developments suggest anything to you on the way Mathematics evolves and grows?*

**MFA :** My experience with  $K$ -theory is that many major developments in mathematics come from unexpected and unpredictable directions. However, these are likely to emerge out of a deep study of classical problems of a quite concrete kind. Abstract generalizations can be very powerful, provided they are grounded in important classical results and, at

the same time, have an essential simplicity. I think  $K$ -theory satisfied these criteria.

**JPB :** *You have been a great advocate of a scheme of development of Mathematics in which mathematicians borrow ideas from Theoretical Physics to explore new frontiers. What are your opinions on the present impact of these ideas? on the future of this interaction?*

**MFA :** My advocacy of using ideas from Theoretical Physics in Mathematics was born out of experience and not out of some a priori reasoning. I find the success of Quantum Field Theory in Geometry spectacular, totally surprising and very mysterious. What is clear is that it has been a continuing process for the past 20 years, going from strength to strength. The impact on many branches of Mathematics has been profound, and we are still trying to come to terms with it. In a sense it represents a marriage between Geometry and Functional Analysis at a much deeper and more subtle level than anyone could have predicted. Internal mathematical development by itself would never have discovered the rich structures that are now being unravelled.

For the future the impact of these ideas in Mathematics will leave a permanent mark. No doubt mathematicians will polish and simplify the story to the point where the original Physics gets well hidden.

The more general lesson is that Mathematics grows by importing ideas from outside, so that we must never close our doors. Who knows where the most fruitful mathematical ideas of the future will come from?

**JPB :** *Other scientific disciplines are also coming up with big challenges for mathematicians, (to name just two, Computer Science and Biology). How do you value these challenges? Do you foresee these leading to the emergence of really new chapters of Mathematics? Would you favour a shift in the training of mathematics students to meet these challenges?*

**MFA :** I agree that new scientific disciplines offer opportunities for future mathematicians. I feel sure that they will generate new problems and concepts which mathematicians should explore. One cannot guarantee automatic success but I would be surprised if subjects like Computer Science and Biology did not provide promising material for

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mathematicians. In fact one can already point to particular areas, such as Complexity Theory or Evolutionary Biology, where serious work is being done.

As far as the training of mathematicians is concerned, I would argue for a sound training in Pure Mathematics, as in the past, together with a more open attitude towards applications. Moreover, at a later stage, doctoral or post-doctoral, students should be exposed to a multi-disciplinary environment, as provided for example by the programmes at the Newton Institute.

**JPB :** *In 1978 you started the European Council, which finally gave birth to the European Mathematical Society in 1990. Fritz Hirzebruch likes to say that you were President number 0 of the EMS. How do you see the present development of the EMS? What, in your opinion, should be its main priorities?*

**MFA :** I was naturally very pleased that the EMS was finally established and got off to such a good start. I would like to see it, in particular, encourage an outward-looking attitude in the European mathematical community. Concern with education, with applications and with the general role of Mathematics in society are among the priorities I would like to see.

**JPB :** *Have you a definite vision of the role of mathematicians in the emerging European global society? Do you see differences between this role and that of our colleagues in Northern America for example ?*

**MFA :** Each country has its own history and its own educational system. Europe has much diversity and much strength, different in many ways from the American model. I think we should build on our strengths but also learn from the American experience.

**JPB :** *You have been a member of the Advisory Board of the Zentralblatt für Mathematik for a long*

*time. As you know, a process of Europeanisation of this major bibliographical database is under way with the involvement of the EMS. How do you see the future of such tools for the working mathematician?*

**MFA :** I am sure the new electronic era of the 21st century will affect the way mathematicians work and communicate. This will be of special benefit to those who are in isolated environments. This applies to parts of Europe but even more to other parts of the world. I hope European mathematicians will be in the forefront of those who encourage colleagues in less fortunate parts of the world. Imagine Ramanujan with e-mail !

**JPB :** *You have devoted a lot of time and energy to found the Isaac Newton Institute of Mathematical Sciences in Cambridge. What place do you see for institutes of this nature among mathematical institutions?*

**MFA :** The Newton Institute has essentially no permanent staff. It is a meeting place, designed to bring together mathematical scientists for extended periods of several months. This is long enough for a serious exchange of ideas. It does not replace university departments. On the contrary, it offers an external stimulus to mathematicians in universities. My view that the health and prosperity of Mathematics in the future will be greatly enhanced by working with other disciplines, and places like the Newton Institute offer one way that this can happen. Collaboration is necessary both for the internal health of Mathematics and for the continuance of external support. Society will not pay the bill unless mathematicians show a willingness to be involved with others.

To be effective on the political level mathematicians must work with other scientists and must emphasise the social and economic benefits of Mathematics.

**JPB :** *Thank you for your willingness to inaugurate this new column of the EMS Newsletter.*



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## The Jahrbuch-project and Digital Math Archive

The Jahrbuch ueber die Fortschritte der Mathematik (JFM) was founded in 1868 by the mathematicians Carl Ohrtmann and Felix Mueller. It contains more than 200,000 reviews of mathematical publications and was published from 1868-1943. The goal of this project is to make the contents of the JFM freely available as a searchable database on the WWW. This project will also serve as a tool to select about 20,000 of the most important of these publications (1,200,000 pages) for digitization and wide public distribution at the SUB Goettingen.

The JFM-project is sponsored by the Deutsche Forschungsgemeinschaft (DFG). The editors for the project are Keith Dennis (Cornell University) and Bernd Wegner (TU Berlin). They gratefully acknowledge the permission of de Gruyter Verlag Berlin to use the contents of the JFM for the production of a public database.

The structure of the database and the search interface will be the same as that for Zentralblatt fuer Mathematik. In particular both internal and external linking will be possible via unique identifying numbers. The preliminary version and the enhanced version will be accessible from the

EMIS web servers.

The Jahrbuch-project has started and the keyboarding of volume 1 of the JFM is now complete. The first sets of data are available for distribution to volunteer mathematical experts for enhancement: English keywords and MSC classifications are to be assigned, titles are to be translated into English, comments on the value of the work are to be added, and they are to be ranked in importance for scanning. In addition the librarians in Goettingen will assign standard names, identify and give the location of a library where the item may be found. The final product will also include a link to the scanned image of the articles selected for the electronic archive.

For additional information, see

<http://www.emis.de/projects/JFM/>

Additional volunteer mathematicians, knowledgeable in German, are needed for the project. If you are interested, please send an e-mail to one of the editors:

Keith Dennis: [dennis@math.cornell.edu](mailto:dennis@math.cornell.edu)  
Bernd Wegner: [wegner@math.tu-berlin.de](mailto:wegner@math.tu-berlin.de)

## MEETING of the EXECUTIVE COMMITTEE

*Capri (Italy), October 10-11, 1997*

### SCIENTIFIC ACTIVITIES

#### Third European Congress of Mathematics, 3ECM

July 10-14, 2000, Barcelona (Spain)

The Scientific Committee has been appointed, after consultation of the Chairman.

The members of the Prize Committee and the Round table Committee should be chosen at the next EC meeting.

Corporate members are asked to appoint contact persons with the Barcelona Congress.

*Information:* on the Web site [www.iec.es/3ecm](http://www.iec.es/3ecm)

#### Diderot Mathematical Forums

**DMF3**, *Mathematics as a Force of Cultural Evolution* (June 5-6, 1998)

The three sites will be *Berlin, Florence and Krakow.*

**DMF**, *Mathematics and Music* (Autumn 1999)

Two of the three sites will be *Lisbon and Paris.*

A preliminary workshop is planned in Torino in 1998.

#### *Other topics*

- "Mathematics and Telecommunications" concentrating on mobile telephone systems;
- "Mathematics and Cryptology";
- "Mathematics and Risks": note that the OECD is interested in such an event;
- "Mathematics and Robotics";
- "Mathematics and Traffic Regulation".

*Contact:* Mireille Chaleyat-Maurel [mcm@ccr.jussieu.fr](mailto:mcm@ccr.jussieu.fr)

#### Summer Schools

##### *Summer Schools 1998*

The one in pure Mathematics is organized by N. Telean (Ancona) in Cluj, Romania, July 27 - August 14, "Singularities in Geometry", and may be supported by UNESCO.

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The one is applied Mathematics is organized by A. Cohen (Paris) on "Wavelets and their Applications" in Orsay, France, June 20-July 10. An application to the European Commission is pending.

#### *Summer Schools 1999*

A call for application for summer schools 1999 has to been sent to member societies.

Contact: Giovanni Monegato [monegato@itopoli.it](mailto:monegato@itopoli.it)

### INFORMATION SERVICES

#### Server EMIS

There are 28 mirrors operating and, now, EMIS mirrors IMU servers, increasing the visibility of EMS. In the electronic library, ElibEMS, there are now 22 journals, with 7 more in preparation. The server also hosts the service Euro-Math Job, pointing to job opportunities in the different countries.

Address of the main site: [www.emis.de](http://www.emis.de)

### EMS COMMITTEES

#### Applications of Mathematics

H. Engl (Austria) is appointed as chair of the Committee.

#### Eastern Europe

H. Zieschang (Germany) has accepted to serve as chair.

#### Education

Z. Semałeni (Poland) is appointed as member to the committee.

#### Electronic Publications

Because of the complaint of many mathematicians that there is a lot of discussion but nearly no action on the problem of rising costs of journals, P. Michor had proposed that the EMS should launch a series of electronic journals, in a concerted action with some national societies. This proposal will be discussed at the Electronic Publications Committee of EMS, with the request to come up with a concrete proposal.

#### European Research Centres Committee (ERCOM)

An EMS committee consisting of Scientific Directors of European Research Centres in the Mathematical sciences has been created. Only centres for which the number of visiting staff substantially exceeds the

number of permanent and long-term staff and that cover Mathematical Sciences broadly are eligible for representation in ERCOM.

This Committee aims to contribute to the unity of Mathematics, from fundamentals to applications.

### Publications

C. Casacuberta (Barcelona) is appointed chair of the Publications Committee and Publications Officer of EMS.

### World Mathematical Year 2000

A resolution on WMY 2000 has been adopted by the General Conference of UNESCO. An IMU-UNESCO committee has been set up by the UMI with M. Chaleyat-Maurel as chairperson (see the article on events prepared in this context in this issue).

The EMS project of having posters in the subways of some European cities has been accepted in principle by the Paris subway company. Other cities are encouraged to do the same.

EMS member Societies are asked to inform the EMS of their plans for the year 2000.

Contact:

Vagn Lundsgaard Hansen [hansen@mat.dtu.dk](mailto:hansen@mat.dtu.dk)

### RELATIONS WITH MATHEMATICAL INSTITUTIONS

#### International Mathematical Union (IMU)

The International Mathematical Union is proposing to its adhering bodies to change its statutes to allow affiliate members; EMS could become one of them. The President will represent the EMS as observer at the next IMU General Assembly in August 1998.

### LIFE OF THE SOCIETY

#### Membership

If membership payments are collected during the European or International Congresses for individual members, it should be made for two years.

#### Council Meeting

The Council meeting will be held at Humboldt University, Berlin, on August 28-29, 1998.

### NEXT EXECUTIVE COMMITTEE MEETINGS

◊ March 21-22, 1998, *Helsinki* (Finland)

◊ August, 1998, *Berlin* (Germany), during ICM98.

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## COUNCIL ELECTIONS

The EMS Secretariat received 6 nominations for Council delegates representing individual members in the years 1998–2001. Since the number of candidates is smaller than the number of seats to be attributed, all candidates are declared elected, without the need for a ballot:

CASTELLET, Manuel, Barcelona, Spain  
JAIANI, George, Tbilisi, Georgia  
MARCHISIO, Marina R., Torino, Italy  
MICHOR, Peter, Vienna, Austria  
MILMAN, Vitali, Ramat-Aviv, Israel  
SLOVAK, Jan, Brno, Czech Republic

The biographical information as well as the statements provided by the candidates are printed below.

### CASTELLET, Manuel

Professor, Universitat Autònoma de Barcelona,  
Centre de Recerca Matemàtica,  
Apartat 50; E-08193 Bellaterra, Spain

*Proposer:* Dr. Sebastia Xambo (Universita Politecnica Catalunya)

*Seconder:* Sir Michael Atiyah (University of Edinburgh)

#### *Biography:*

Manuel Castellet born in Barcelona in 1943, Ph. D. studies at the ETH Zürich, Professor of Mathematics at the Universitat Autònoma de Barcelona since 1976, President of the Catalan Mathematical Society (1979–1983), Director of the Centre de Recerca Matemàtica since 1984, Member of the Institut d'Estudis Catalans (the Catalan National Academy of Sciences) since 1982 and President of the Institut d'Estudis Catalans since 1995.

Council delegate representing individual members of the European Mathematical Society since 1994, Member of the Societat Catalana de Matemàtiques, the Schweizerische Mathematische Gesellschaft, the Deutsche Mathematiker-Vereinigung, the European Mathematical Society, the American Mathematical Society and Member of the Committee ERCOM (European Research Centres on Mathematics).

Research on Algebraic Topology, a field strongly developed in the universities of Barcelona under his leadership. President of the organizing committee of the Barcelona Conferences on Algebraic Topology in 1982, 1986, 1990 and 1994, one of the most prestigious conferences in this field.

#### *Statement:*

As a director of a research institute for visitors (CRM) and at present president of the Academy (IEC) I am in a position to promote more joint activities among the European mathematical community, especially at graduate and postdoctoral levels. Moreover in the last few years Barcelona has played an important role in the development of mathematics and the city will host the 3rd European Congress of Mathematics.

### JAIANI, George, Professor, Dr.

Vekua Institute of Applied Mathematics of  
Tbilisi State University,  
University St. 2, 380043 Tbilisi 43, Republic  
of Georgia

*Proposer:* R. Bochorishvili, Prof. Dr. Head of Department of Vekua Institute of Applied Mathematics of Tbilisi State University

*Seconder:* A. Shapatava, Dr. Assistant-Professor of Tbilisi State University

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

#### *Biography:*

Born on June 19, 1945, in Tbilisi, Georgia, graduated from the Tbilisi State University for Mathematics and Mechanics, January 1968, Diploma in Mechanics. Ph.D. (Candidate of Sci.) in Mechanics of Deformable Bodies, Razmadze Institute of Mathematics, 1974. Thesis: "Some Problems for Prismatic Shells with Cusp Edge", under supervision of Academician, Professor Ilya Vekua. Dr. Hab. (Full Professor) in Differential Equations and Mathematical Physics, Razmadze Institute of Mathematics, 1986. Since 1987 Deputy Director, Vekua Institute of Applied Mathematics, since 1989 Professor of Tbilisi State University. Member of Council of Georgian Mathematical Union (GMU) and delegation of GMU at the inaugural meeting of the EMS. Member of the Georgian Academy of Natural Sciences. EMS Council delegate of individual members (1994–1997). Fields of interest: Differential Equations, Mechanics of Solids. Visiting positions, research stays and participation in Congresses, conferences and symposia in Germany, Italy, France, Greece, Switzerland, Hungary, Poland, Czech Republic, former Soviet Union and USA. Author of 2 monographs and about 50 papers.

*Statement:*

According to my statement for elections for 1994–1997, the Tbilisi International Centre of Mathematics and Informatics (TICMI) have been founded by support of EMS (about activities of TICMI see BULLETIN of TICMI, vol. 1, 1997 or Website: [www.viam.hepi.edu.ge](http://www.viam.hepi.edu.ge)). If re-elected, as Chairman of International Scientific Committee of TICMI, I could contribute to the efforts of EMS to encourage quality research and teaching in mathematics in Transcaucasia and adjacent region.

**MARCHISIO, Marina R., Dr.**

Via Primula, 20; I-12012 Boves (CN); Italy

*Proposer:* Professor A. Conte

*Secunder:* Professor G. Anichini

*Biography:*

*Born:* Cuneo (Italy), 20th December 1969.

*Title:* Laurea in Matematica, 110/110 e lode, Università degli Studi di Torino, 4th July 1994.

*Present Position:* 4th year Ph. D. student, Università degli Studi di Torino (advisor: Professor A. Conte). I am also acting as assistant to the President of the Unione Matematica Italiana and editorial secretary for the Bollettino dell'Unione Matematica Italiana. I was a member of the Italian Delegation at the EMS Council Meeting which was held in Budapest in July 1996.

*Research interests:* I am working in Algebraic Geometry and published already two papers on abelian surfaces and on a special congruence of lines of  $P^3$ . I am now working on my Ph. D. thesis on "Smooth unirational quartic threefolds". I am expecting to defend at the end of 1998.

*Statement:*

If I shall be elected inside the Council of EMS, I shall do my best in order to strengthen the action of the Society to solve the problems of Ph. D. students and to enlarge the number of jobs positions available for them.

**MICHOR, Peter, Prof. Dr.**

Institut für Mathematik, Universität Wien, Strudlhofgasse 4, A-1090 Wien, Austria

*Proposer:* Max Karoubi

*Secunder:* Jan Slovak

*Biography:*

For my vita see my home page:

<http://radon.mat.univie.ac.at/~michor>

*Statement:*

I was delegate of individual members to the EMS council 1994–1997, and serve as elected

secretary of the EMS 1995–1998. My main contribution to the EMS was the conception and (together with Bernd Wegner) implementation of the electronic server EMIS and its electronic library for mathematics. I am willing to continue to work for EMIS for some more years.

**MILMAN, Vitali, Professor of Mathematics**

School of Mathematics, Tel-Aviv University, Ramat-Aviv, Israel

*Proposer:* Lawrence Zalcman

*Secunder:* Mina Teicher

*Born:* 1939

*Education:* Ph.D. 1965, Institute for Low Temperature Physics, Kharkov; D.Sc. 1970, Institute for Low Temperature Physics, Kharkov

*Specialization:* Functional Analysis and Convexity

*Publications:* has published over 100 papers and edited 7 books

*Journals:* Editor of Geometric and Functional Analysis

*Invited Addresses:* ICM 1986 and 1998; EMC 1996

*Statement:*

I view the EMS as potentially the most important body representing and lobbying for mathematics in a united Europe. In the past, various national mathematical societies have had strong connections with the scientific ministries of their respective countries, leading in many cases to strong support for research in mathematics at the national level. In the current era of a united Europe, scientific funding will depend increasingly on the decisions of a supranational bureaucracy that is not easily accessible via national societies. Maintaining and enlarging support for mathematics within Europe will require vigorous lobbying efforts on the part of a body that can speak clearly and forcefully for the European mathematical community as a whole. The only credible candidate for this important role is the EMS.

On the international level, I see the EMS as providing a useful and healthy balance to other groups within the International Mathematical Union which can serve to further the interests of European mathematics and mathematicians within that body.

Finally, as a professional society, the EMS must continue and expand its activities in support of joint European mathematical conferences, scientific exchange, and the easy movement of mathematicians between the countries of Europe.

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**SLOVAK, Jan**, Doc. Dr.

Department of Algebra and Geometry,  
Masaryk University, Janačková n. 2a, 662 95  
Brno, Czech Republic

*Proposer:* Peter Michor

*Secunder:* Vladimír Souček

*Biography:*

*Education and degrees:* RNDr. (MSc) - 1983, Mathematical Analysis, Masaryk University in Brno, Czech Republic; CSc. (PhD) - 1990, Masaryk University in Brno, Czech Republic; Doc. (Associated Professor) - 1993, Masaryk University in Brno, Czech Republic

*Positions:* 1983–91 Research Fellow, Mathematical Institute of the Academy of Science, Brno, Czech Republic; 1991–92 Visiting Professor, University of Vienna, Austria; 1992–93 Assistant Professor, Masaryk University, Brno, Czech Republic; 1993– Associate Professor, Masaryk Uni-

versity, Brno, Czech Republic; (1996–97 ARC Senior Research Fellow, University of Adelaide, South Australia);

*Research:* I am interested mainly in differential geometry and its interaction with representation theory (cf. Slovak & Michor & Kolar: Natural operations in differential geometry, Springer, 1993; Slovak: Invariant operations on a manifold with connection or metric, J. Diff. Geom., 36 (1992), 633–650; Eastwood & Slovak: Semiholonomic Verma modules, Journal of Algebra, 197 (1997), 424–448)

*Statement:*

As a Council Delegate, I would like to follow the importance of electronic publishing and the close relations between all European countries, across the border of the European Community. Also I would focus on specific problems of small language groups.

### Delegates for 1996–1999

Anichini, Giuseppe, Modena, Italy  
Bolondi, Giorgio, Sassari, Italy  
Branner, Bodil, Lyngby, Denmark  
Deshouillers, Jean-Marc, Bordeaux, France  
Habetha, Klaus, Aachen, Germany  
Karoubi, Max, Paris, France

Kuusalo, Tapani, Jyväskylä, Finland  
Lahtinen, Aatos, Helsinki, Finland  
Márki, László, Budapest, Hungary  
Piccinini, Renzo, Milano, Italy  
Puppe, Dieter, Heidelberg, Germany

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## EMS AGENDA

### 1998

*March, 21st-22nd*

Executive Committee Meeting in Helsinki (Finland)

*May, 15th*

Deadline for submission of information or papers to the June issue of EMS Newsletter

(Contact: Martin Speller, msp@gcal.ac.uk)

*May, 31st*

**Deadline for submission of proposals for the 1999 EMS Summer Schools**

(Contact: Giovanni Monegato, monegato@polito.it)

*June, 5-6th*

**Third Diderot Mathematical Forum, "Mathematics as a force of cultural evolution" in Berlin (Germany), Florence (Italy) and Krakow (Poland)**

(Contact: Mireille Chaleyat-Maurel, mcm@ccr.jussieu.fr)

*June, 20th - July, 10th*

**EMS Summer School in Orsay (France) in Applied Mathematics**

"Wavelets and their applications". **Organiser: A. Cohen (University Paris 6, France)**

*July, 27th - August, 14th*

**EMS Summer School in CLUJ (Romania) in Pure Mathematics**

"Singularities in Geometry". **Organiser: N. Teleman (Ancona, Italy)**

*August, 15th*

Deadline for submission of information or papers to the September issue of EMS Newsletter

(Contact: Martin Speller, msp@gcal.ac.uk)

*August 18-27th*

EMS booth at the International Congress (ICM98) in Berlin (Germany)

**Launching of JEMS (the Journal of EMS) at ICM98**

*August 28-29th*

**EMS Council in Berlin (Germany)** hosted by the Deutsche Mathematiker Vereinigung

Election of the President, a Vice-President, the Treasurer, the Secretary, EC members.

*November, 15th*

Deadline for submission of information or papers to the December issue of EMS Newsletter

(Contact: Martin Speller, msp@gcal.ac.uk)

### 1999

*Autumn*

**DMF "Mathematics and Music" in Lisbon (Portugal), Paris (France)**

(Contact: Mireille Chaleyat-Maurel, mcm@ccr.jussieu.fr)

### 2000

*July 10-14*

**Third European Congress of Mathematics (3ECM) in Barcelona (Spain)**

(Contact: S. Xambo-Descamps, sxd@grec.upc.es)

# DIDEROT MATHEMATICAL FORUMS

## Committee

Jochen Brüning (Berlin, Germany)  
Mireille Chaleyat-Maurel (Paris, France)  
Alberto Conte (Torino, Italy) (Chair)

## Format

This cycle of conferences, launched in September 1996, with a forum in London, Moscow and Zurich, on the theme of "Mathematics and Finance", features two conferences a year taking place simultaneously in three European cities exchanging information by telecommunication and addressing in their programmes three different aspects : fundamental mathematics, applications of mathematics and their relation to society (e.g., ethical and epistemological dimensions).

**The second Diderot Mathematical Forum  
"MATHEMATICS AND ENVIRONMENT"  
December 19-20, 1997 Amsterdam, Madrid,  
Venice**

## Organizers

*Amsterdam* : Prof. Michael KEANE (Centrum voor Wiskunde en Informatica, CWI)

*Madrid* : Prof. Jesus-Ildefonso DIAZ (Universidad Complutense, Madrid)

*Venice* : Prof. Elio CANESTRELLI (Universita Ca' Foscari, Venice)

The second Diderot Mathematical Forum was held in Amsterdam, Madrid and Venice on the more focused theme of "problems related to water" under the general heading of "Mathematics and Environment".

This meeting was supported by the European Commission (DG XII D). The use of sophisticated telecommunication devices was made possible thanks to the support of Telecom Italia.

The local organizers had made proper arrangements for the success of the conference, in particular selected excellent speakers. The programme was very interesting.

Telecommunication means, provided by Telecom Italia, functioned well but we are still learning how to make the most out of these new media. All the teleconference has been recorded.

*FRIDAY, DECEMBER 19, 1997*

**International programme in teleconference  
provided by Telecom Italia**

## I. Opening Ceremony

With, successively, Jean-Pierre Bourguignon (EMS President) in Madrid, Michael Keane (Professor in CWI) in Amsterdam and Gianni Mattioli (Vice-Minister of Italian Public Work) in Roma.

## II. Scientific Conferences

With, successively, C.J. Van Duijn, CWI, (*Salt water intrusion*) in Amsterdam, A. Bermudez de Castro, University of Santiago de Compostela, (*Mathematical modelling and optimal control methods in a waste water*) in Madrid and A. Quarteroni, I. Politecnico di Milano and CRS4 of Cagliari, (*Physical-numerical modelling of environmental processes*) in Venice.

## Local programme

### *Amsterdam*

B.H. Gilding, University of Twente, (*On the wetting front, transport of moisture in soil*), M. de Gee, Landbouw Universiteit Wageningen, (*Semi-numerical methods for groundwater contaminant transport*) and B. Sommeijer, CWI, (*Numerical modeling of Three-Dimensional Bio-Chemical Transport in Shallow Seas*)

### *Madrid*

J. Carrera, Universidad Politecnica de Catalunya, (*Underground water mathematical models*), R. Bermejo, Universidad Complutense de Madrid, (*A comparison between semi-Lagrangian and Eulerian schemes for ocean circulation*) and J. I. Diaz/ J.L. Lions, UCM/Collège de France, (*Mathematical treatment of a model arising in lake pollution problems*).

### *Venice*

G. Gambolati, Universita de Padova, (*Il modello matematico del sottosuolo di Venezia*) and A. Speranza, Ministry of Environment in Roma, (*I presupposti della previsione idro-meteo marina nell'alto Adriatico: storia, attualità, proiezioni future*).

## International programme

Round Table "*The role of mathematics in Environment: the point of view of Industrials and Mathematicians*"

With M. Knaap (Shell Research), D. Maslen, S. Verdun Lunel (Vrije Universiteit van Amsterdam) in Amsterdam; T. Estrella (Ministerio de Industria), R. Llamas (Real Academia de Ciencias de Madrid), G. Parrilla (Istituto Spagna de Oceanografica) in Madrid and V. Casulli (Universita de Trento), G. Gambolati (Universita de Padova), G. Italiano

(Universita de Venezia), A. Quarteroni (I. Politecnico di Milano and CRS4 de Cagliari), A. Speranza (Ministry of Environment, Roma) in Venice.

SATURDAY, DECEMBER 20, 1997

### International programme between Amsterdam and Madrid

With R.D. Gill, Rijksuniversiteit Utrecht, (*Lies, damned lies, or statistics of the environment; use and abuse of statistics in environmental issues*) in Amsterdam and C. Pares, Universidad de Malaga, (*Numerical simulation of the Alboean sea and the Gibraltar circulation*) in Madrid.

### Local programme

#### Amsterdam

A. Stein, Landbouw Universiteit Wageningen, (*Point processes, random sets, and geostatics for analyzing patterns of methylene blue coloured soil*), L. de Haan, Erasmus Universiteit Rotterdam, (*Sea and Wind : Multivariate Extremes at work*) and R.M. Cooke, Technische Universiteit Delft, (*Expert Judgement and the theory of dry water*).

#### Madrid

J. Samper, Universidad de La Coruna, (*Ground-water pollution modelling: a challenge for the next century*), G. Winter/J. Betancor and G. Montero, Universidad de Las Palmas de Gran Canarias, (*3D-simulations in the lower troposphere: dispersion of air pollutants from industrial emissions of Sulfure and Nitrogen Oxides with field mades in connection to meteorology*) and F.J. Elorza, Universidad Politecnica de Madrid ; (*Transport of pollutants in ground water and low permeability rocks*).

#### Venice

V. Casulli, Universita de Trento, (*Un modello matematico per la Laguna di Venezia*), A. Bergamasco, Universita de Venezia, (*Modello numerico d'interazione tra Laguna di Venezia e Mare Nord-Adriatico*), A. Marani, Universita de Venezia, (*Controllo di qualite dei dati con reti neurali*) and

A. Cecchini, Universita de Venezia, (*Ambiente e Territorio; alcuni modelli di facile uso (e di molte implicazioni) realizzati con gli automi cellulari*).

### International programme between Amsterdam and Madrid

Round Table "*The role of Mathematics in Environment : the point of view of Public Institutions and Mathematicians*"

With M. van Calmthout (Journalist "de Volkskrant"), M. Keane (CWI) in Amsterdam and M. Ruiz de Elvira (Diario El Pais), Manuel Toharia (Corespondent of the European Union of Scientific Journalists), A. Ribera (Diario El Pais), J.I. Diaz (UCM) in Madrid.

### IN PREPARATION

**Third Diderot Mathematical Forum "MATHEMATICS AS A CULTURAL FORCE OF EVOLUTION"** June 5-6, 1998 Berlin, Florence, Krakow

#### Organizers

Berlin : Prof. Jochen BRÜNING (Humboldt University, Berlin)

Florence : Prof. Enrico GIUSTI (University of Florence)

Krakow : Prof. Andrzej PELCZAR (Jagellonian University, Krakow)

**Diderot Mathematical Forum "MATHEMATICS AND MUSIC"** Autumn 1999 Lisbon, Paris and a third town yet to be determined

#### Organizers

Lisbon : Prof. José-Francisco RODRIGUES (University of Lisbon)

Paris : Dr. Gérard ASSAYAG (IRCAM) and Prof. Laurent MAZLIAK (University Paris 6)



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# WORLD MATHEMATICAL YEAR 2000

A world event at the initiative of the  
International Mathematical Union (IMU)

## ◊ Sponsorship of UNESCO

In its November 11, 1997 plenary meeting, the UNESCO General Conference followed the recommendations of Commission III and approved draft resolution 29 C/DR126 related to the World Mathematical Year 2000, allocating US \$20,000 to this series of events.

The following 15 countries co-sponsored the draft resolution: Belgium, Benin, Brazil, Colombia, Cote d'Ivoire, Denmark, France, Ireland, Luxembourg, Philippines, Netherlands, Russian Federation, Spain, Thailand, Uzbekistan.

## The UNESCO resolution

### *The General Conference*

*Considering the central importance of mathematics and its applications in today's world with regard to science, technology, communications, economics and numerous other fields,*

*Aware that mathematics has deep roots in many cultures and that the most outstanding thinkers over several thousand years contributed significantly to their development, and numerous other fields,*

*Aware that the language and the values of mathematics are universal, thus encouraging and making it ideally suited for international cooperation,*

*Stressing the key role of mathematics education, in particular at primary and secondary school level, both for the understanding of basic mathematical concepts and for the development of rational thinking,*

*Welcomes the initiative of the International Mathematical Union (IMU) to declare the year 2000 the World Mathematical Year and carry out, within this framework, activities to promote Mathematics at all levels world-wide,*

*Decides to support the World Mathematical Year 2000 initiative,*

*Requests the Director General to collaborate with the international mathematics community in planning the World Mathematical Year 2000 and to contribute during 1998-1999 funds of £ 20.000 from the*

*Regular Programme and Budget in support of preparatory activities.*

## ◊ IMU Committee for the Year 2000 / UNESCO

This Committee has been set up to coordinate plans for WMY 2000 with UNESCO. The following have agreed to serve on the committee:

A. Ashour (Egypt), M. Chaleyat-Maurel, chair (France), M.S. Narasimhan (India-Italy), M. Niss (Denmark), R. Rebolledo (Chile), A. Sierpiska (Canada) and G. Tronel (France).

## ◊ Projects for the Year 2000

Many mathematical societies and countries are preparing the WMY 2000 with various projects. Plans of EMS for this operation have been described by V.L. Hansen in the 25th issue of the EMS Newsletter (September 1997).

A preliminary Agenda for Year 2000 can be found in the 5th issue of the WMY 2000 Newsletter.

For more details, please contact Mireille Chaleyat-Maurel [mcm@ccr.jussieu.fr](mailto:mcm@ccr.jussieu.fr).

## ◊ WMY 2000 Newsletter

Five issues of the WMY 2000 Newsletter have been published and worldwide distributed to all IMU affiliated institutions.

For a printed version, please send a request to WMY 2000 Newsletter, Institut Henri Poincaré, 11, rue Pierre et Marie Curie, F-75005 Paris (France).

The five issues are available on the Web at the site [www.math.jussieu.fr](http://www.math.jussieu.fr) with links to the servers of IMU, EMS, AMS, and the French societies, SMF and SMAI.

## ◊ WMY 2000 booth at ICM98

The operation "WMY 2000" will be presented at the International Congress of Mathematicians in Berlin (ICM98) via a booth where documents on all projects will be available. The objective is to make the operation known through various components of the mathematical community and to convince people to cooperate for the organization of this event.

## EUROPEAN NEWS: Country by Country

### CZECH REPUBLIC

#### Conference:

#### “Partial Differential Equations – Theory and Numerical Solutions”

The conference “Partial Differential Equations – Theory and Numerical Solutions” will be held in Prague (Czech Republic) in August, 10-16, 1998 as a satellite conference to the International Congress of Mathematics (ICM'98) under the auspices of the Charles University of Prague and Ruprecht-Karls University in Heidelberg. It is organized in the framework of the 650-th anniversary of the foundation of the Charles University.

#### Organising committee

W. Jäger, J. Nečas (chairmen), M. Feistauer, O. John, R. Rannacher, J. Stará

#### Programme Committee

H. Berestycki, M. Feistauer, A. Friedman, H. Gajewski, M. Golubitsky, J. Haslinger, G. C. Hsiao, T. J. R. Hughes, J. Kačur, D. Kröner, J. M. Morel, R. Rannacher, M. Renardy, I. Vrkoč

#### Important Information

The number of participants is limited by the capacity of lecture halls to 250. Registration form as well as further details can be found on

<http://kma14.karlin.mff.cuni.cz/pdeconf>

Deadline for registration forms and abstracts is 15 March 1998. The registration fee is 450 US\$ including accommodation in a double room and breakfasts and lunches.

#### Contact Address

Jana Stará, KMA MFF UK, Sokolovská 83, 18675 Praha 8, Czech Republic

e-mail: [pde98@karlin.mff.cuni.cz](mailto:pde98@karlin.mff.cuni.cz)

web address:

<http://kma14.karlin.mff.cuni.cz/pdeconf>

### 36th International Symposium on Functional Equations

Hotel Santon, Brno-Bystrc, Czech Republic

May 24–30, 1998

Scientific Committee: J. Aczél (Waterloo, Canada), W. Benz (Hamburg), R. Ger (Katowice), J. Raetz (Bern), L. Reich (Graz), A. Sklar (Chicago)

Local Organisers: J. Chvalina (Masaryk University, Brno), F. Neuman and J. Šimša (Math. Inst. Acad. Sci. Brno)

Information: Participation is by invitation only. Those who wish to attend should write to

36th ISFE

Math. Inst. Acad. Sci

Zizkova 22

616 62 Brno

Czech Republic

Fax ++420-5-41218657

E-mail: [math@ipm.cz](mailto:math@ipm.cz)

### FRANCE

#### XXVIIIth Probability Summer School Saint-Flour (Cantal)

17th August – 2nd September, 1998

#### INVITED SPEAKERS

- Michel EMERY, Directeur de Recherches C.N.R.S.  
“Martingales continues dans les variétés différentiables”
- Arkadi NEMIROVSKI, Professeur, Technion-Israel Institute of Technology  
“Topics in Non-parametric Statistics”
- Dan VOICULESCU, Professeur, University of California, Berkeley  
“Lectures on Free Probability Theory”

For further information, please contact P. BERNARD

Université Blaise pascal

Mathématiques Appliquées

F63177 AUBIERE CEDEX

Tél. 04.73.40.70.52 ou 04.73.40.70.50

Telefax 04.73.40.70.64

E-mail [bernard@ucfma.univ-bpclermont.fr](mailto:bernard@ucfma.univ-bpclermont.fr)

### GERMANY

An International Conference devoted to

**Representation Theory of Algebras**

will be held from August 31 - September 5, 1998 at the University of Bielefeld.

The scientific organisation lies in the hands of Dieter Happel (Chemnitz) Helmut Lenzing (Paderborn) Claus Michael Ringel (Bielefeld) Klaus W. Roggenkamp (Stuttgart).

**Programme**

There will be 18 one-hour lectures on important recent developments in the subject and on decisive relations to other parts of mathematics. The following mathematicians have accepted our invitation for such a lecture:

- Hans Joachim Baues (Bonn, Germany)
- Raymundo Bautista (UNAM, Mexico)
- Jon Carlson (Athens, USA)
- William Crawley-Boevey (Leeds, England)
- Gordon James (London, England)
- Mikhail Kapranov (Boston, USA)
- Olivier Mathieu (Strasbourg, France)
- Sergei Ovsienko (Kiev, Ukraine)
- Idun Reiten (Trondheim, Norway)
- Andrzej Skowroński (Toruń, Poland)
- Katsuhiko Uno (Osaka University, Japan)
- Michel Van den Bergh (Hasselt, Belgium)
- Jie Xiao (Beijing, China)

The remaining one-hour lectures and additional twenty-minutes lectures (in parallel sessions) will be arranged on the basis of abstracts provided by participants.

On Tuesday evening (September 1) there will be a presentation of computer algebra packages which handle problems in representation theory, organised by Peter Dräxler (Bielefeld). The final programme will be available July 31, 1998 in the internet.

**Abstracts**

The deadline for the submission of an abstract is June 30, 1998. Such an abstract should be no longer than one page and should clearly state the result to be presented. The abstracts obtained in time will be distributed to all participants.

Further information concerning the meeting (including a registration form) is available in the internet under:

<http://www.mathematik.uni-bielefeld.de/sek/98rep.html>

or you may contact

- Ms. H. Scharsche,
- Fakultät für Mathematik, Universität,
- POBox 100 131, D-33501 Bielefeld, Germany.
- Fax: (+49) 521 106-4743,
- E-mail: [scharsch@mathematik.uni-bielefeld.de](mailto:scharsch@mathematik.uni-bielefeld.de)

A Euroconference on

**Infinite Length Modules**

will be held from September 7 - 11, 1998 at the University of Bielefeld (starting on September 7 at 9:00 am and ending on September 11 at 17:00 pm).

The scientific organisation lies in the hands of

Ken Brown (Edinburgh), Paul M. Cohn (London), Idun Reiten (Trondheim) and Claus Michael Ringel (Bielefeld).

**Programme**

The aim of the conference is to provide a survey of methods and results concerning modules of infinite length (in comparison to the well-known properties of finite length modules). A detailed program will be available by the end of February 1998.

**Financial Support**

The Euroconference is financially supported by the TMR-program of the European Union. Special funds are available for allowing young researchers from member states of the European Union to participate.

Further information concerning the Euroconference (including a registration form) is available in the internet under:

<http://www.mathematik.uni-bielefeld.de/sek/E-C-BIE.html>

or you may contact

- Ms. H. Scharsche,
- Fakultät für Mathematik, Universität,
- POBox 100 131, D-33501 Bielefeld, Germany.
- Fax: (+49) 521 106-4743,
- E-mail: [scharsch@mathematik.uni-bielefeld.de](mailto:scharsch@mathematik.uni-bielefeld.de)

**6th International Conference on Evolution Equations and their Applications in Physical and Life Sciences**

**September 14 – 19, 1998**

Topics range from functional-analytic methods for partial differential equations to the modelling of physical and biological processes by evolution equations, with particular emphasis on non-linear evolution equations, (e.g. reaction-diffusion equations, Hamilton-Jacobi equations), semigroups and PDEs, stochastic evolution equations, mathematical physics (e.g. fluid mechanics, quantum physics, statistical mechanics), and mathematical biology (e.g. population dynamics, spreading of epidemics).

Besides survey talks and individual lectures, there will also be workshop discussions dedicated to these subjects.

Scientific Committee: S. Albeverio (Bonn), H. Amann (Zürich), W. Arendt (Ulm), G. Da Prato (Pisa), G. Lumer (Mons), J. Prüß(Halle), L. Weis (Karlsruhe)

Lecturers include: S. Albeverio, H. Amann, I. Antoniou, W. Arendt, P. Auscher, C.J. Batty, Ph. Bénilan, J. v. Below, I. Cioranescu, Ph. Clément, M.G. Crandall, T. Coulhon, G. Da Prato, E.B. Davies, M. Demuth, O. Diekmann, K.-J. Engel, J. Escher, A.Favini, G. Goldstein, J. Goldstein, M. Gyllenberg, K.P. Hadeler, M. Hieber, M. Iannelli, W. Jäger, N. Jacob, A. Lasota, Y. Latushkin, R. de Laubenfels, P.-L. Lions, S.-O. Londen, G. Lumer, A. Lunardi, V.P. Maslov, S. Monniaux, R. Nagel, J. van Neerven, S. Nicaise, S. Oharu, I. Prigogine, J. Prüß, F. Rübiger, S. Romanelli, M. Röckner, W. Rueß, B.-W. Schulze, G. Simonett, J. Sprekels, Th. Sturm, K. Taira, A. Venni, Q-Ph. Vu, W. v. wahl, V. Wrobel, J. Zabczyk

Sponsors: Deutsche Forschungsgemeinschaft (DFG), Landesregierung Bade-Württemberg, Universität Karlsruhe. Furthermore, the organisers are hopeful that the European Union will grant additional funds destined specifically to support the participation of a number of highly promising young researchers.

Information: For more details contact:

L. Weis  
 Conf. on Evolution Eq.  
 Mathematisches Institut I  
 Universität Karlsruhe  
 76128 Karlsruhe  
 Germany  
 Fax: +49-(0)721-608-6177  
 E-mail: Conf-Evolve98@math.uni-Karlsruhe.de

Updates of this information will be given on WWW:  
<http://malserw.mathematik.uni-Karlsruhe.de/c.html>

## In memoriam, Walter Andrejewski

The Andrejewski Foundation and the Max-Planck-Institute for Mathematics in the Sciences (MIS) announce an outstanding interdisciplinary symposium

## *"Mathematics in the Sciences"*

from June 19 until June 23, 1998 in Leipzig. The goal of this symposium is to promote the flow of ideas between mathematics and the sciences in both directions and to open new perspectives for the future.

The following scientists have agreed to give one-hour lectures:

Abhay Ashtekar (Penn State University)  
 Sir Michael Atiyah (University of Cambridge)  
 John Ball (University of Oxford)  
 Randolph Bank (Supercomputer Center San Diego)  
 Alain Connes (IHES Bures-sur-Yvette)  
 Sir Sam Edwards (University of Cambridge)  
 Manfred Eigen (MPI for Biophysical Chemistry Göttingen)  
 Mikhail Gromov (IHES Bures-sur-Yvette)  
 Helmut Hofer (Courant Institute)  
 Richard James (University of Minnesota)  
 Anatole Katok (Penn State University)  
 Elliot Lieb (Princeton University)  
 Bernard Frederik Schutz (MPI for Gravitational Physics Potsdam)  
 Yakov Sinai (Princeton University)  
 Luc Tartar (Carnegie Mellon University/MIS Leipzig)  
 Srinivasa Varadhan (Courant Institute)  
 Julius Wess (MPI for Physics München)  
 Shing-Tung Yau (Harvard University)  
 The symposium will be opened by  
 Friedrich Hirzebruch (MPI for Mathematics Bonn).  
 The organizing committee consists of Jürgen Jost, Stefan Müller, Eberhard Zeidler (MIS Leipzig), and representing the Andrejewski Foundation, Bodo Geyer (Leipzig University) and Dietmar Lüst (Humboldt University Berlin).

To encourage students and young scientists to attend, no participation fee will be charged. More information (hotel reservations etc.) can be found on the home page

[www.mis.mpg.de/conferences/symp98](http://www.mis.mpg.de/conferences/symp98)

Any interested person should send an empty email to: [symp98@mis.mpg.de](mailto:symp98@mis.mpg.de)

A registration form will be sent back.

The deadline for applications is April 30, 1998.

## ITALY

### International Mathematical Summer Centre

#### Fondazione C.I.M.E.

#### Centro Internazionale Matematico Estivo

##### Courses for 1998

C.I.M.E. activity 1998 consist in five courses: the first course is jointly organised by C.I.M.E. and C.I.M. (Centro Internacional de Matematica, Coimbra) in Portugal; other four courses will take place at Cetraro (Cosenza), in Italy.

##### FIRST C.I.M.E. – C.I.M. COURSE

*“Optimal Shape Design”*

in Troia (Portugal) from 1 to 6 June, 1998.

Scientific Direction:

Prof. Arrigo CELLINA (Università di Milano)

Prof. Antonio ORNELAS (University of Evora)

##### Courses

(4 lectures in English for each course)

a) Some nonconvex optimal shape problems, Prof. Bernd Kawohl (Univ. Koeln, Germania)

b) Shape Control and Optimal Shape Design, Prof. Olivier Pironneau, Analyse Numerique, Paris 6. c) Homogenisation methods in Optimal Design, Prof. Luc Tartar, Carnegie Mellon University

d) Explicit solutions in Elastic Optimisation, Prof. Piero Villaggio, Università di Pisa.

e) Optimal Shape Design: Theory, Modelling and numerical algorithms, Prof. Jean Paul Zolesio, CNRS, Sophia Antipolis.

##### Applications

A registration fee of 9 000 Portuguese Escudos (approximately 50 US \$). Those who want to attend the Session should fill in an application that can be obtained by e-mail at the address [shape98@hermite.cii.fc.ul.pt](mailto:shape98@hermite.cii.fc.ul.pt) **not later than April 15, 1998**. Further information can be obtained through internet at the address <http://www.cim.pt>

##### SECOND C.I.M.E. COURSE

*“Dynamical Systems and Small Divisors”*

at Grand Hotel San Michele, Cetraro (Cosenza), from 13 to 20 June, 1998.

Scientific Direction:

Prof. STEFANO MARMI (Università di Firenze) and

Prof. JEAN-CHRISTOPHE YOCCOZ (Université de Paris Sud, Orsay)

##### Courses

a) KAM-Theory for Linear Quasi-Periodic Systems (8 lectures in English), Prof. L. Hakan ELIASSON (KTH, Stockholm)

b) Invariant Tori (8 lectures in English), Prof. Michael HERMAN (Université de Paris 7, Ecole Polytechnique)

c) Geometrical Methods in Small Divisors Problems (8 lectures in English), Prof. Jean-Christopher YOCCOZ (Université de Paris-Sud, Orsay)

##### Applications

Those who wish to attend the Session should fill in an application to the Director of C.I.M.E at the address below, **not later than April 15, 1998**.

##### THIRD C.I.M.E. COURSE

*“Mathematical Problems in Semiconductor Physics”* at Grand Hotel San Michele, Cetraro (Cosenza), from 15 to 22 July, 1998.

Scientific Direction:

Prof. MARCELLO ANILE (Università di Catania), Prof. PIERRE DEGOND (Université Paul Sabatier, Toulouse) and

Prof. PETER A. MARKOWICH (TU, Berlin)

##### Courses

a) Drift Diffusion Equations and Applications (6 lectures in English), Prof. Walter ALLEGRETTO (Univ. of Alberta, Canada)

b) An Introduction to Kinetic Theory (6 lectures in English), Prof. David LEVERMORE (University of Arizona, Tucson)

c) Transport Modelling in Semiconductors (6 lectures in English), Prof. Frederick POUPAUD (Université de Nice)

d) Foundations of Mathematical Models for Semiconductor (5 lectures in English), Prof. Christian RINGHOFER (Arizona State University, Tempe)

##### Applications

Those who want to attend the Session should fill in an application to the Director of C.I.M.E at the address below, **not later than April 30, 1998**.

**FOURTH C.I.M.E. COURSE**

*"Filtration in Porous Media and Industrial Applications"*

at Grand Hotel San Michele, Cetraro, from August 24 to September 1, 1998.

Scientific Direction:

Prof. ANTONIO FASANO (Università di Firenze) and

Prof. HANS VAN DUIJN (University of Amsterdam)

**Courses**

a) Mathematical Models for Oil Reservoirs Engineering (6 lectures in English), Prof. Magne S. ESPEDAL (University of Bergen)

b) Filtration Processes in Various Industrial Problems (4 lectures in English), Prof. Antonio FASANO (Università di Firenze)

c) Reactive Transport Processes in Porous Media (3 lectures in English), Prof. P. KNABER (Universität Erlangen-Nürnberg)

d) Homogenisation Theory and Applications to Filtration Processes (6 lectures in English), Prof. A. MIKELIC (Université Lyon I)

e) Some Nonlinear Models Arising in Subsurface Transport (3 lectures in English), Prof. Hans VAN DUIJN (Delft University of Technology)

**Applications**

Those who want to attend the Session should fill in an application to the Director of C.I.M.E at the address below, **not later than May 15, 1998.**

**FIFTH C.I.M.E. COURSE**

*"Stochastic PDEs and Kolmogorov Equations in Infinite Dimensions"*

at Grand Hotel San Michele, Cetraro, from August 24 to September 1, 1998.

Scientific Direction:

Prof. GIUSEPPE DA PRATO (S. N. S., Pisa)

**Courses**

a) Kolmogorov equations (8 lectures in English), Prof. N. V. KRYLOV (University of Minnesota, Minneapolis)

b)  $L^p$ -analysis of finite and infinite dimensional diffusion operators (8 lectures in English), Prof. M. RÖCKNER (Universität Bielefeld)

c) Kolmogorov equations with infinite numbers of variables (8 lectures in English), Prof. J. ZABCZYK (Polskiej Akademii Nauk, Warszawa)

**Applications**

Those who want to attend the Session should fill in an application to the Director of C.I.M.E at the address below, **not later than May 15, 1998.**

Further information:

Fondazione C.I.M.E. c/o Dipartimento di Matematica "U. Dini"

Viale Morgagni, 67/A - 50134 FIRENZE (ITALY)

Tel. +39-55-434975 / +39-55-4237123

FAX +39-55-434975 / +39-55-422695

E-mail CIME@UDINI.MATH.UNIFI.IT

Information on CIME can be obtained on the system World-Wide-Web on the file

<http://www.math.unifi.it/CIME/welcome.to.CIME>

The CIME Foundation is sponsored by Consiglio Nazionale delle Ricerche (C.N.R.), Ministero dell'Università e della Ricerca Scientifica e Tecnologica (M.U.R.S.T.) and European Community.

**SCUOLA MATEMATICA INTERUNIVERSITARIA****SUMMER COURSE IN MATHEMATICS - PERUGIA 1998**

In Summer 1998 graduate courses in mathematics will be organized under the sponsorship of the Italian National Research Council and MURST, at the University of Perugia, Perugia (Italy); the courses will take place between July 26 and August 29, 1998.

The courses are directed towards young graduates wishing to study mathematics at a graduate level.

The list of courses offered is attached. Each participant is required to choose two courses for a total of 10 hours a week of lectures in addition to problem sessions. Daily attendance is compulsory for participants. Although written tests will be given by the lecturers, no certification of proficiency will be issued.

Ten fellowships, of 570.000 Italian lire each, will be available to foreign participants to help cover their living expenses during the course. All the participants will be lodged, at no cost, in the Casa dello Studente. Text books, lecture notes and photocopies will be provided by the School.

**NO TRAVEL EXPENSES WILL BE REIMBURSED**

Applications should be sent by mail to the following address :

Professor Graziano GENTILI  
 Scuola Matematica Interuniversitaria  
 Summer Course in Mathematics  
 Via S. Marta 13/A  
 50139 - Firenze, Italy

and should reach this address before April 30, 1998. A selection committee will meet shortly afterwards and all admitted foreign applicants will be notified of the result in due time. Applications should contain the titles of three courses the applicant would like to attend to (in order of preference) a brief curriculum vitae and a DETAILED CURRICULUM STUDIORUM (including a certificate with the list of university courses taken and corresponding grades). Applicants are requested to state if their participation is conditioned by the allotment of a fellowship. They should indicate very clearly the exact address to which all correspondence concerning the Summer Course should be mailed.

**Information** - Programmes and further information can be found on the WEB page of SMI at the address:

<http://www.iaga.fi.cnr.it/SMI/index.html>

or can be obtained by e-mail at:

[smi@iaga.fi.cnr.it](mailto:smi@iaga.fi.cnr.it)

Programmes and further information can also be required by fax at +39-55-475915 or by mail at the address of the Scuola Matematica Interuniversitaria (see above).

The Chairman of S.M.I.  
 (Prof. Graziano Gentili)

**LIST OF COURSES – Perugia 1998**

- ALGEBRA Prof.M. Gutierrez, Tufts Univ.  
(lectures in English)
- COMPLEX ANALYSIS Prof. T. Gamelin, UCLA  
(lectures in English)
- FUNCTIONAL ANALYSIS Prof. L. De Michele,  
Univ. Milano  
(lectures in Italian)
- NUMERICAL ANALYSIS Prof. C. Lubich, Univ.  
Tubingen  
(lectures in English)
- DIFFERENTIAL EQUATIONS OF Prof. K.  
Oddson, Univ.Calif. Riverside  
MATHEMATICAL PHYSICS (lectures in English)
- ALGEBRAIC GEOMETRY Lecturer to be  
confirmed

-DIFFERENTIAL GEOMETRY Prof. E. Musso,  
Univ. de L'Aquila

(lectures in Italian or English)

-INTRODUCTION TO PROGRAMMING Prof.  
J.R. Hindley, Univ. Wales-UK

AND COMPUTER SCIENCE (lectures in English)

-PROBABILITY Prof. H. Teicher, Rutgers Univ.

(lectures in English)

-MATHEMATICAL STATISTICS Prof. E.  
Regazzini, Univ. "L. Bocconi"

(lectures in Italian)

-ALGEBRAIC TOPOLOGY Prof. K. Johnson,  
Dalhousie Univ.

(lectures in English)

**SCUOLA MATEMATICA INTERUNI-  
VERSITARIA**

**SUMMER COURSE IN MATHEMATICS -  
CORTONA 1998**

During Summer 1998 several graduate courses in mathematics will be held, under the sponsorship of the National Research Council and MURST, in Cortona at the Scuola Normale Superiore. The courses will take place during the periods June 28-July 11, 1998; July 12-August 1, 1998 and August 2-August 15,1998.

The courses are directed towards young graduates who would like to engage in research in one of the following fields :

June 28 - July 11

-COMBINATORIAL GEOMETRY Prof. G.-C.  
Rota (MIT-Cambridge) - Prof. A. Beutelspacher  
(Univ. Giessen)

- DIFFERENTIAL GEOMETRY Prof. S. Salamon  
(Oxford Univ.) - Prof. P. de Bartolomeis (Univ.  
Firenze)

July 12 - August 1

-ALGEBRA Prof. L. Di Martino (Univ. Milano) -  
Prof. A.E. Zalesskii (Univ. East Anglia)

- ELLIPTIC DIFFERENTIAL EQUATIONS

(Lecturers to be confirmed)

August 2 - August 15

- OPERATIONS RESEARCH Prof.D. Bertsekas  
(MIT-Cambridge) - Prof. P. Hansen (Univ.  
Montreal)

Each participant is required to choose one topic for a total of 12 hours a week of lectures.

In addition, the participants themselves will be asked to participate in the problem sessions and in the seminars that will be organised in the afternoons.

Six fellowships, of the duration of two or three weeks (each consisting of 90.000 Italian lire per week) will be available to foreign participants to help cover their living expenses. The participants will be lodged at no cost in the Palazzone or nearby hotels; furthermore breakfast and lunch (the latter only from Monday through Saturday) will be offered by the organization. The School will also provide texts books, lecture notes and photocopies.

#### **NO TRAVEL EXPENSES WILL BE REIMBURSED**

Applications should be sent by mail to the following address:

Professor Graziano GENTILI  
Scuola Matematica Interuniversitaria  
Summer Course in Mathematics  
Via S. Marta 13/A  
50139 - Firenze, Italy

Applications for the courses of the first and second period should reach this address before April 15, 1998; for the third period before May 15, 1998.

A selection committee will meet shortly afterwards and all accepted foreign applicants will be notified of the result in due time.

Applications should contain a BRIEF CURRICULUM VITAE and a DETAILED CURRICULUM STUDIORUM and should indicate which course the candidate would like to follow. Applicants are requested to state if their participations is conditioned by the allotment of a fellowship. The exact address to which all correspondence concerning the Summer courses has to be mailed should be clearly stated.

**Information** - Programmes and further information can be found on the WEB page of SMI at the address:

<http://www.iaga.fi.cnr.it/SMI/index.html>

or can be obtained by e-mail at:  
[smi@iaga.fi.cnr.it](mailto:smi@iaga.fi.cnr.it)

Programmes and further information can also be required by fax at n. +39-55-475915 or by mail at the address of the Scuola Matematica Interuniversitaria (see above).

The Chairman of S.M.I.  
(Prof. Graziano Gentili)

## PORTUGAL

### International Conference on Combinatorial Methods in Mathematics

#### II Meeting of the project Algebra, Geometria e Combinatoria

(Praxis 2/2.1/MAT/63/94)

9 - 11 JULY, 1998

Faculdade de Ciencias da Universidade do Porto (Portugal)

The Conference aims to bring together mathematicians working in Combinatorics and mathematicians that use combinatorial methods as a tool in their research.

There will be one hour invited lectures given by the following speakers:

- ANDERS BJOERNER ( University of Stockholm, Sweden) (to be confirmed)
- RAUL CORDOVIL (Technical University of Lisbon, Portugal)
- KOMEI FUKUDA (Institute for Operations Research, ETH Zentrum, Switserzland)
- JOHN MEAKIN (University of Nebraska-Lincoln, USA)
- CHRISTOPHE REUTENAUER (University of Québec at Montréal, Canada)
- GRANT WALKER (University of Manchester, United Kingdom)

The programme of the Conference will also include sessions for SHORTER COMMUNICATIONS (30 minutes). Participants wishing to present a communication are asked to SUBMIT A SUMMARY of no more than two A4 pages (12 point fonts) by 15th MAY.

Please complete and RETURN THE FOLLOWING FORM, preferably by email, before 30th APRIL.

The second announcement should be available in May.

THERE IS ALSO INFORMATION AT THE FOLLOWING ADDRESS:

<http://www.fc.up.pt/agc98.htm>

The meeting will be held at the Faculty of Sciences of University of Porto, near the historical part of the town. The city of Porto, standing in the northern coast of Portugal, is over one thousand years old and the word "Portugal" derives from "Porto" and its neighbour town Gaia, which used to be called "Cale". Its history is so intrinsically linked to that



of port wine trade that the wine got its name from Porto. Recently, the city of Porto has been appointed by UNESCO a World Heritage.

For MORE INFORMATION about the meeting, CONTACT the Organizing Committee at [agc98@fc.up.pt](mailto:agc98@fc.up.pt)

Organising Committee:

Maria Leonor Moreira, Maria do Rosario Pinto, Jose Carlos Santos.

The organisation would appreciate YOUR FORWARDING THIS MESSAGE TO ANYONE WHO MAY BE INTERESTED IN PARTICIPATING.

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**International Conference on Combinatorial Methods in Mathematics  
II Meeting of the project Algebra, Geometria e Combinatoria  
9 -11 July, 1998  
Faculdade de Ciencias da Universidade do Porto (Portugal)**

NAME:

Address:

Institution:

Country:

E. MAIL:

FAX:

DO YOU PLAN TO PRESENT A SHORT COMMUNICATION?

Date:

Signature:

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## RUSSIA

### **Euler International Mathematical Institute at St.Petersburg**

**A.Vershik, Yu.Matijasevich (St.Petersburg, Russia)**

In this article we describe for the readers of EMS Newsletters history, activities, and plans of EIMI: Euler International Mathematical Institute at St.Petersburg. More up-to-date information can always be found at

URL: <http://www.pdmi.ras.ru/EIMI>

#### **I. History**

Euler International Mathematical Institute (EIMI)

is one of the several international institutes like IHES (France), Max Planck Institute (Germany), Banach Center (Poland), Newton Institute (UK).

The decision of the Academy of Sciences to create EIMI was first announced in 1988 in recognition of the high contribution of the Russian mathematical School to international mathematics.

The creation of the Euler Institute was made possible by the support of the Academy of Sciences as well as assistance from some international organizations including UNESCO, JEC FUND, Japan Association for Mathematical Science, Society for the Support of the Euler Institute (Berlin).

The main purpose of the EIMI is to serve as a meeting place for leading scientists of the former

---

Soviet Union and their foreign colleagues. The activity of the EIMI consists in the organization and running of scientific programmes, conferences and workshops on concrete mathematical problems of fundamental importance for mathematics and its applications.

The scientific activity of the EIMI began in October, 1990 on the premises of the Leningrad Branch of the V.A.Steklov Mathematical Institute (LOMI). It was continued at the present, renovated building after its official inauguration in September 1992.

The decision to unite the activities of the Euler Institute and the St.Petersburg Branch of the Steklov Mathematical Institute of Russian Academy of Science was taken for some reasons in 1995. Now the reorganization is complete, and the Euler Institute is ready to receive new guests.

## II. EIMI Completed Programmes

Two main forms of the work of the Institute are:

- 1) organisation of international meetings;
- 2) individual invitations of scientists for collaboration with Russian colleagues (program "Tete-a-tete in Russia", see below).

The following long-term programmes and conferences have already taken place:

1990-1995

1. Quantum Groups (1990)
2. Methods of Approximation Theory in Complex Analysis and Mathematical Physics (1991)
3. Mathematical Models in Environmental Sciences (1991)
4. Dynamical Systems (1991)
5. Lobachevsky Geometry (1992)
6. Kolmogorov Probability and Statistics (1993)
7. Kolmogorov and Modern Mathematics (1993)
8. Spectral Theory and the Theory of Wave Propagation (1993)
9. Networking Project (1994)
10. Selected Topics in Modern Mathematical Physics (1994)
11. Complex Analysis and Free Boundary Problems (1994)
12. Complex Analysis: Methods of Potential Theory and Their Applications to Approximation Theory (1994)
13. Galois Theory of Local and Global Fields (1994)
14. Complex Analysis: Geometric Methods in Several Variables (1994)
15. Nonlinear Analysis and Extremal Problems (Theory and Applications) (1995)
16. Nonlinear PDEs (1995)

1996

1. Petersburg Workshop on Perturbative QCD
2. Boundary Control and Inverse Problems
3. Free Boundaries with Viscous Flows
4. British-Russian Workshop in Functional Analysis
5. Galois Groups of Local and Global Fields
6. Project INTAS-93-1702 "Efficient Symbolic Computing" Working Meeting
7. Experience in realization of joint projects INTAS/NIS

1997

1. 2nd POMI-Florence workshop on integrable systems and quantum groups
2. International meeting "14th DAYS ON WEAK ARITHMETICS"
3. Annual International Seminar "DIFFRACTION DAYS - 97"
4. International meeting "New Asymptotic and Numerical Methods in Diffraction"
5. The First International Conference on Problems of Dynamic Objects Logic-Linguistic Control DOLLC'97
6. VI St.Petersburg Summer Analysis Meeting
7. International Algebraic Conference dedicated to D.K.FADDEEV
8. Russian-German Geometry Meeting dedicated to the 85th birthday of A.D.Alexandrov

## III. More detailed information about the recent meetings:

June 14-28, 1996

"Petersburg Workshop on Perturbative QCD"

Co-chairmen: B.Ernolaev (Ioffe Institute) and Yu.Dokshitzer (St.Peterburg Nuclear Physics Institute)

16 participants, including 7 foreigners

July 29 - August 10, 1996

"Boundary Controls and Inverse Problems"

Co-chairmen: C.Bardos (University Paris 7, France) and M.Belishev (PDMI RAS)

31 participants, including 19 foreigners

September 4-7, 1996

"Free Boundaries with Viscous Flows"

Chairman: V.Pukhnachev (Novosibirsk, Lavrent'ev Institute)

49 participants, including 19 foreigners

October 13-17, 1996

"British-Russian Workshop in Functional Analysis"

Co-chairmen: N.Young (Lancaster University, UK) and V.Vasyunin (PDMI RAS)

31 participants, including 16 foreigners

October 18-22, 1996

"Galois Groups of Local and Global Fields"

Co-chairmen: H.Koch (Max-Planck Institute, Germany), A.Parshin (Steklov Institute RAS), S.Vostokov (St.Petersburg State University)

39 participants, including 17 foreigners

October 24-26, 1996

"Efficient Symbolic Computing"

Co-chairmen: Jean-Marie Jacquet (Namur, Belgium) and E.Dantsin (PDMI RAS)

31 participants, including 14 foreigners

December 13-14, 1996

"Experience in realization of joint projects INTAS/NIS"

Co-chairmen: A.Zizcenko (RAS, Moscow) and Yu.Teterin (PDMI RAS)

25 participants, including 4 foreigners.

May 19-24, 1997

"2nd POMI-Florence workshop on integrable systems and quantum groups"

Chairman: Anatoly Izergin (Steklov Institute of Mathematics in St.Petersburg)

27 participants, including 7 foreigners

May 22-24, 1997

"14th Days on Weak Arithmetics"

Chairman: Yuri Matiyasevich (Steklov Institute of Mathematics in St.Petersburg)

32 participants, including 17 foreigners

June 3-5, 1997

Annual International Seminar "DIFFRACTION DAYS - 97"

Co-chairmen: V.Babich (Steklov Institute of Mathematics in St.Petersburg) and V.Buldyrev (St.Petersburg State University)

60 participants, including 8 foreigners

June 6-7, 1997

International meeting "New Asymptotic and Numerical Methods in Diffraction"

Chairman: Vasily Babich (Steklov Institute of Mathematics in St.Petersburg)

15 participants, including 5 foreigners

June 16 - 20, 1997

(participation in organization)

The First International Conference on Problems of Dynamic Objects Logic-Linguistic Control DOLLC'97

Co-chairmen: N.Lyashenko (USA), L.Reznik (Australia), A.Gorodetsky (St.Petersburg, Russia)

50 participants, including 5 foreigners

June 23 - 24, 1997

VI St.Petersburg Summer Analysis Meeting

Co-chairman: N.Nikolski, S.Kisliakov, V.Vasyunin (Steklov Institute of Mathematics in St.Petersburg)

35 participants, including 9 foreigners

June 24 - 30, 1997

(participation in organization)

International Algebraic Conference dedicated to D.K.FADDEEV

Chairman: A.Yakovlev (St.Petersburg State University)

233 participants, including 67 foreigners

September 22-27, 1997

Russian-German Geometry Meeting dedicated to the 85th birthday of A.D.Alexandrov

Chairmen: W.Ballmann (Mathematisches Institut, Bonn), Yu.Burago (Steklov Institute of Mathematics in St.Petersburg), Yu.Reshetnyak (Sobolev Institute of Mathematics, Novosibirsk)

71 participants, including 38 foreigners

#### IV. Programme of the personal visits of Euler Institute

EIMI runs an ongoing program of scientific collaboration:

##### TETE-A-TETE in RUSSIA

The goal of this program is to provide facilities for western and Russian mathematicians (not necessary from St.Petersburg) to meet for joint work. Such a meeting of two or more colleagues could last from a couple of days to several months.

In view of the present difficult economic situation, it is assumed that visitors will find the required funds from other sources. For its part, EIMI will provide offices, (modest) computer facilities (including TeX and INTERNET connection), and access to the libraries of EIMI and PDMI. Visitors are welcome to participate in the regular mathematical seminars of PDMI and the UNIVERSITY as well as in the meetings of the St. Petersburg Mathematical Society. EIMI will issue invitations as required for obtaining Russian visas and will help in finding (reasonably inexpensive) accommodation.

If you and your colleague(s) in Russia are interested in participating in this programme, please fill in the attached form and e-mail it (with any questions you may have) to

admin@euler.pdmi.ras.ru

Acceptance of the application is subject to demand and to events in other EIMI programmes.

Application for participation in the EIMI programme TETE-A-TETE IN RUSSIA: The form can also be downloaded from

<http://www.pdmi.ras.ru/EIMI/imitet.html>

**I. Western participant(s)**

- 1) last name
- 2) given name(s)
- 3) citizenship
- 4) degree, title(s)
- 5) affiliation
- 6) position
- 7) mailing address
- 8) e-mail address
- 9) phone number
- 10) FAX number

If visa is required, the following fields should be filled in too:

- 11) Date of bith
- 12) Passport number

**II. Russian participant(s)**

- 1) family name
- 2) given name
- 3) patronymic
- 4) degree, title(s)
- 5) affiliation
- 6) position
- 7) mailing address
- 8) e-mail address
- 9) phone number
- 10) FAX number

**III. Subject and form of proposed joint work (a few phrases)**

**IV. Desired duration ..... days/weeks/months**

**in the period from ..... to .....**

The following researchers have visited EIMI in 1996-1997 in the framework of the programme "Tete-a-tete in Russia":

Prof. Wilfrid Hodges, Great Britain;  
 Prof. Denis Richard, France;  
 Prof. William S.Hatcher, Canada;  
 Prof. Valerio Tognetti, Italy;  
 Prof. Francois Englert, Belgium;  
 Prof. Mikhael Balabane, France;  
 Prof. Roland Gillard, France;  
 Prof. Nicholas Young, Great Britain;  
 Prof. Francois Cuvelier, France;  
 Prof. Alberto Tesei, Italy;  
 Prof. Paolo Emilio Ricci, Italy;  
 Dr. Paolo Aschieri, Italy;  
 Prof. Johann Makowsky, Israel;  
 Prof. Herbert Koch, Germany;  
 Prof. Ruediger Goebel, Germany;  
 Prof. Anca Muscholl, Germany;  
 Olivier Teytaud, France;  
 Prof. Laura Anderson, USA;  
 Prof. Richard Bishop, USA;  
 Prof. Françoise Blanchard, France;  
 Prof. Zhou Chaochen, China;  
 Prof. Bruno Courcelle, France;  
 Prof. Victor Donnay, USA;  
 Dr. Thomas Dunker, Germany;  
 Prof. Emmanuel Fontain, France;  
 Prof. Leonid Fukshansky, Germany;  
 Prof. Franco Garrani, Italy;  
 Prof. Jose Gonzalez Llorente, Spain;  
 Prof. James Lawry, UK;  
 Prof. Vladimir Lifschitz, USA;  
 Prof. Jean Michel Maillet, France;  
 Prof. Grigori Mints, USA;  
 Prof. Manuel Ojanguren, Switzerland;  
 Prof. Regimantas Pliuskevicius, Lithuania;  
 Prof. Jose Francisco Rodrigues, Portugal;  
 Prof. Zigmund Rogoff, UK;  
 Prof. Vesa Ruuska, Finland;  
 Prof. Stefan Wabnitz, Italy;  
 Prof. Maciej Wojtkowski, USA.

You can find opinions of visitors to Euler IMI on <http://www.pdmi.ras.ru/EIMI/imioplst.html>

#### VI. Contact with UNESCO.

In April 1997 the Institute was visited by Academician Chaochen ZHOU from International Institute for Software Technology of United Nations University. Besides scientific lecture "An

Introduction to Duration Calculus", he gave a detailed description of this institute and outlined possible forms of cooperation with it.

In January 1997 the following Agreement was signed with UNESCO.

#### AGREEMENT BETWEEN

The United Nations Educational Scientific and Cultural Organisation and

The EULER International Mathematical Institute

Whereas the United Nations Educational, Scientific and Cultural Organisation (hereinafter referred to as "UNESCO") is a specialised agency in the area of co-operation in all branches of intellectual activity and especially in international scientific relations,

Whereas the Euler International Mathematical Institute (hereinafter referred to as the "EIMI") at the Steklov Mathematical Institute of the Russian Academy of Sciences is directed to promote research and the advanced training of researchers and university teaching staff in various areas of fundamental and applied mathematics and mathematical physics, and

Whereas the EIMI and UNESCO wish to establish an entity to be known as the Euler International Mathematical Institute associated with UNESCO and acting under the auspices of the Steklov Mathematical Institute of the Russian Academy of Sciences, which will specifically:

- \* promote international cooperation in mathematical research in modern branches of mathematics such as mathematical logic, including foundations of mathematics and computing science, number theory, algebra, geometry, topology, differential equations, functional analysis, theory of probability and statistics, and mathematical aspects of theoretical physics;

- \* provide advanced training in mathematical sciences for specialists from developing and industrialized countries through the organization, in the framework of thematic trimesters, of international workshops, ad-hoc training groups and advanced schools;

- \* promote the sharing of knowledge in mathematical sciences through electronic publishing, via INTERNET and WWW, of research results and training materials available at the EIMI;

- \* promote women's careers in mathematical research and university education.

Whereas within the framework of their terms of reference UNESCO and the EIMI may co-operate with other specialised scientific organisations and institutions with whose goals their own are in accord.

UNESCO and the EIMI agree on the following:

ARTICLE I

1. The parties will exchange on a regular basis information on their activities in the framework of mutual co-operation.

2. At the request of either party, UNESCO and the EIMI will mutually facilitate participation in their meetings and provide each other with advice on the area in which they are competent, especially regarding the joint organization of projects in the area of mathematical research and training and aid to assist activities undertaken by UNESCO or by the EIMI that could be of interest to the other party.

3. The EIMI takes full responsibility for organizing activities (scientific research, workshops, seminars, selection and hosting of leading scientists for participation in programme activities, etc.) organized in the framework of mutual agreements.

4. Both organizations will promote specific programmes aimed at sharing advanced scientific knowledge, and the preservation of traditions, and further integration, in world science, of Russian scientific schools, particularly those of the Stekirov Mathematical Institute and its affiliated institutions.

5. UNESCO and the EIMI will also promote the participation of women in the advancement of mathematical research and education.

ARTICLE II

UNESCO and the EIMI will be empowered to conclude any further arrangements necessary for the execution of this agreement.

ARTICLE III

This agreement may be terminated by one of the participating parties by one year's written notice. It may be reviewed as mutually determined between UNESCO and the Institute.

VII. Euler International Mathematical Institute plans:

\*April 20-24, 1998

Computer Algebra in Scientific Computing

\*May 16-18, 1998

Final meeting of INTAS project EmNet (Phase II)

\*June 2-4, 1998

Annual International Seminar DIFFRACTION DAYS'98

\*June 17-20, 1998

Seventh Summer St.Petersburg meeting in Mathematical Analysis

\*June 24-28, 1998

Probability Theory and Mathematical Statistics Asymptotic Methods

\*July 6-15, 1998

Small-x Physics and Light Front Dynamics in QCD

\*August 24-29, 1998

Dynamical Inverse Problems

1999:

\*May (First week), 1999

3rd International Workshop PDMI-Florence on Quantum Groups and Integrable Systems

We are ready to consider your proposals about conferences, workshops, summer schools etc. at the EIMI. Your suggestions could be addressed to [admin@euler.pdmi.ras.ru](mailto:admin@euler.pdmi.ras.ru)

UNITED KINGDOM

CONFERENCE ON COMMUTATIVE ALGEBRA

in Honour of David Rees's 80th Year

Exeter, England, 13 - 16 August 1998

Organisers : P. Vámos (Exeter, local organiser), R.Y. Sharp (Sheffield)

Location : Exeter is a city in South West England, about 250 kilometres from London.

Provisional list of invited speakers : Among those who have already accepted invitations to speak are C. Huneke (Purdue), D. Katz (Kansas), D.Kirby (Southampton), L. O'Carroll (Edinburgh), N.V. Trung (Hanoi), G.Valla (Genoa) and J.K. Verma (Bombay).

Scope of the conference : The conference, which is open to all interested mathematicians, is expected to concentrate on recent and current research in aspects of commutative algebra related to the work of David Rees, including reductions and integral closures of ideals, Rees rings and algebras, uniform Artin-Rees Theorems, mixed multiplicities and Hilbert functions. Participants from developed countries will be expected to pay a Registration Fee of £35.

Financial support : The conference is supported financially by a grant from the London Mathematical Society: this will be used to cover part of the costs of attendance by the invited speakers and some graduate students.

Further information : Those interested in further information should send an e-mail message to [car-meet@maths.ex.ac.uk](mailto:car-meet@maths.ex.ac.uk) or visit the web site [http://www.maths.ex.ac.uk/conf\\_rees.html](http://www.maths.ex.ac.uk/conf_rees.html)

## ICMI Study

# On the Teaching and Learning of Mathematics at University Level

The purpose of this Discussion Document is to raise important issues related to the study of the teaching and learning of mathematics at university level and to stimulate discussion and research on these topics as background for a conference to be held in Singapore in December 1998. After this conference, a publication covering the fundamental areas of the topic will be published in the ICMI Study Series. The main aspects of the Study will also be presented at ICME-9 in Makuhari, Japan in the year 2000. It is anticipated that the Study will be of interest to those concerned with the teaching of mathematics at university level, to mathematics educators undertaking research in related areas, and to many other people with an interest in university level mathematics. The conference and publication related to this Study are likely to have a positive influence on the understanding and practice of the teaching and learning of mathematics at university level in the early years of the 21st century.

### 1. Why a Study on the Teaching and Learning of Mathematics at University Level?

A number of changes have taken place in recent years which have profoundly affected the teaching of mathematics at university level. Five changes, which are still having considerable influence, are

- (i) the increase in the number of students now attending tertiary institutions;
- (ii) major pedagogical and curriculum changes that have taken place at pre-university level;
- (iii) the increasing differences between secondary and tertiary mathematics education regarding the purposes, goals, teaching approaches and methods;
- (iv) the rapid development of technology; and
- (v) demands on universities to be publicly accountable.

Of course, all of these changes are general and have had their influence on other disciplines. However, because of its pivotal position in education generally, and its compulsory nature for many students, it could be argued that these changes have had a greater influence on mathematics than perhaps on any other discipline.

There is no doubt that, in many countries, significantly more students are now entering university and taking mathematics courses than was the case ten years or so ago. On the

other hand, an increasingly smaller percentage of students appears to be opting for studies which require substantial amounts of mathematics. Thus university departments are faced with a double challenge. On the one hand, they have to cope with the influx of students whose preparation, background knowledge and even attitudes are quite different from those of past students. On the other hand, they have to attract students to pursue studies in mathematics, where employment opportunities and well-paying jobs appear not to be as certain as in some other disciplines.

Some new developments in the teaching and learning of mathematics attempt to come to grips with these issues. For example, alternative approaches to calculus and linear algebra in the United States reflect, in part, attempts to make these subjects more engaging and meaningful for the majority of students. There have also been content changes, with increased emphases in some universities on applications and modelling, history and philosophy of mathematics, and so on. But a general perception remains in some quarters that the teaching of mathematics at the undergraduate level has not to date made sufficient effort to deal with the backgrounds and needs of present-day students.

There is also often perceived to be a discontinuity between mathematics education in secondary schools and mathematics education in universities. Certainly the levels of ambition and demand placed on students are increased at the tertiary level. There is not the same attention paid to learning theories in the delivery of university mathematics as there is in the teaching of the subject at lower levels. University teaching methods tend to be more conservative. Often university teachers have joint responsibility for research and teaching. This is clearly beneficial but it can cause more emphasis to be placed on mathematical research in places where that is the main criterion for promotion.

Teachers of university mathematics courses, on the whole, have not been trained to, and do not often, consider educational, didactic or pedagogical issues beyond the determination of the syllabus; few have been provided with incentives or encouragement to seek out the results of mathematics education. In days gone by, responsibility was placed largely on students' shoulders: it was assumed that faculty's responsibilities were primarily to present

material clearly, and that 'good' students would pass and 'poor' ones fail. The climate today is that academic staff are considered to have greater overall responsibility for students' learning. The role of instruction (specifically, of lectures) and staff accountability are both being reconsidered.

Worldwide, increasing use is also being made of computers and calculators in mathematics instruction. Much mathematical software and many teaching packages are available for a range of curriculum topics. This, of course, raises such issues as what such software and packages offer to the teaching and learning of the subject, and what potential problems for understanding and reasoning they might generate. It would be good to collect examples of the use of information technology and software which enrich students' experience of mathematics and result in better understanding and learning.

Many academic mathematicians are aware of changes occurring around them, and of experimentation with different teaching approaches, but they have limited opportunities to embrace change owing to faculty structures and organisation. Further, the relationships between mathematicians in mathematics departments and their colleagues in mathematics education are often strained, with less productive dialogue between them than there might be. The same can be said of relationships between mathematicians and engineers, economists, etc., even though mathematics service teaching to students in other disciplines is an enormous enterprise. These general factors tend to work against, or delay, improvements in the teaching and learning of mathematics, particularly for those students whose main interests are in other disciplines.

As a result of the changing world scene, ICMI feels that there is a need to examine both the current and future states of the teaching and learning of mathematics at university level. The primary aim of this ICMI Study is therefore to pave the way for improvements in the teaching and learning of mathematics at university level for all students.

To achieve this aim it is important for the professionals involved to

- \* exchange views and experiences from a wide variety of places and backgrounds;
- \* report about developments and projects that have taken place;
- \* consider the contributions from theory and research, and identify areas still to be investigated.

More specifically the Study will cover the following and related points:

- \* to identify, review, encourage and disseminate, research in educational matters at the tertiary level;
- \* to identify and describe major approaches to tertiary mathematics teaching within different cultures and traditions;
- \* to identify obstacles which might prevent the learning of mathematics;
- \* to discuss equity and other issues relating to mathematics education at university level;
- \* to discuss the goals of teaching mathematics to a range of students with different backgrounds and needs, and who should be responsible for that teaching;
- \* to find ways to meet changing needs without compromising the integrity of the subject;
- \* to identify, publicise, and expose to scrutiny, new teaching methods and the positive use of technology;
- \* to discuss the transition and the relations between secondary school and university;
- \* to consider ways to improve the preparation of teachers of mathematics at university level.

Leading up to and during the Conference relating to this Study, it is expected that there will be debate as to why mathematics is taught and what mathematics education is at university level. In addition, consideration will be given as to what is the current teaching and learning situation in universities, what it is believed that the situation should be, and how desired changes can be effected.

## 2. Themes and Issues Pertaining to Research on the Teaching and Learning of Mathematics at University Level.

Most academic mathematicians know little about the research that has been undertaken in mathematics education in general, or at the tertiary level in particular. Generally speaking, they are unaware of the methods used by researchers in education. One of the most valuable aspects of the current study is that it could collect together the major findings of mathematics education research, review them, and make them readily accessible to a wide audience. The potential usefulness and limitations of this research should then be considered in the light of the practice of teaching. At the same time, it would be valuable to determine research areas which have not yet been explored and to encourage work in them.

The following questions are of particular interest for the Study.

What is mathematical understanding and learning, and how are these achieved? What are the



underlying theories behind these and how do they relate to teaching at university level?

What research methods are employed in mathematics education? What are the major research findings of mathematics education? What are the obstacles to having teaching practice become informed/influenced by research findings?

Might insights into the nature of the learning process play out differently at different grade levels? Are the theories that are relevant at school level, relevant at university level as well? Is there a need for theories that are specific to university level?

What research has there been into traditional and alternative methods of teaching and what do the results of such research tell us?

In what ways can teaching change to take into account the different background, abilities and interests of the learner? What methods are effective for teaching large classes?

What do we know about the learning and teaching of specific topics such as calculus and linear algebra? Are there characteristics which are relevant to specific topics? Are there characteristics which are pertinent to a number of topics?

What alternative forms of assessment exist? How can assessment be used to promote better learning and understanding?

What are the mathematical competences that are required in the different professions?

What are students' attitudes and beliefs concerning mathematics? What causes them to change? How do these affect their enrolments and success in courses with substantial mathematical components?

What are the effects of the use of technology in the teaching and learning of mathematics? In what ways can technology be used to enhance understanding?

What important issues are under-represented in the research literature and how can researchers be encouraged to work in these areas?

### 3. Themes and Issues Pertaining to Practice

We divide this section into four parts: Clientele, Curriculum, Student Activity and Pedagogy.

#### Clientele

The students who are of interest for this Study include all those students who are taught mathematics at university level, whether as mathematics majors, as students of other subjects

using mathematics as a service course, as prospective mathematics teachers, or as recipients of some form of general 'mathematics appreciation' course. Hence we are addressing the needs of not only future research mathematicians but also other categories of future mathematics professionals as well as graduates in other disciplines who require varying amounts of mathematical knowledge, skill or insight.

For several reasons, in many countries there has been a move to mass education at university level. As a result many mathematics departments are providing courses for a much wider range of ability and needs than was formerly the case. Simultaneously with this increase in student numbers, there has been a change in the kind of student preparation in secondary schools as well as in students' interests and motivation. Consequently many students have not met material which was in most secondary school curricula of the 1970s. In addition they may have been taught by an approach which places more emphasis on the intuitive and pragmatic. Some university mathematics departments have been slow in recognising these changes in their student intake. Others have developed new courses to cope for the range of content needs but have made few pedagogical concessions.

There are a number of special groups of students including potential teachers of school mathematics, scientists, engineers. What should the interaction between mathematical and professional knowledge be? To what extent do these groups need specially designed courses?

#### Curriculum

By curriculum we mean matters pertaining to the purposes, goals and content of mathematics education. Current curricula may need to be reconsidered for at least two reasons. There are the different student needs that were mentioned above and there are the developments in mathematics itself.

As far as the changing clientele is concerned, it is not clear that its constitution or its needs have been adequately considered. What are the professional aspirations of our student population? Will they go on to be teachers, to work in industry, to be academics, etc.? How should the curriculum be shaped to meet the needs of these groups?

What changes are, or should be, taking place in the curriculum? Some mathematical subject areas are on the decline while others are in the ascendancy. What is the rationale for the changes? Are some content areas now less important and should other areas take their place?

Mathematics as a rapidly developing research field is continuously undergoing changes with new fields arising, changes of emphasis, and so on. At present we notice strong interactions between different branches, an increasing interest in applications, the development of an experimental approach, etc. To what extent is and should this evolution be reflected in the teaching of the subject at undergraduate level?

### Student Activity

Here we wish to discuss the various ways in which students might be induced to interact with mathematical content, both inside and outside the classroom. What forms of study and what activities are currently used in the teaching of mathematics? Do different forms of engagement (e.g., in "mathematics labs" where students explore families of mathematical objects using computers) have the potential to result in better learning in different subjects?

Two of the central issues here are the role of the student and the attitude towards the subject. Under what circumstances should the student's role be to receive information and when should it be to interact with the content in more dynamic ways (including exchanges with their teachers and with other students)? Under what circumstances should the subject be presented as a set of skills (algorithms), as a set of processes or as a combination of these? The attitude of the teacher will require different reactions and actions from students.

### Pedagogy

By pedagogy we mean the teachers' orchestration of teaching and learning environments and situations, examined both from the descriptive/analytic position (what is the case?) and the normative position (what ought to be the case?).

Some areas of mathematics are met by students before they enter university and the approaches they have met in school may well be quite different from those which are common in universities. Mathematics majors, for example, have to meet a more formal approach to calculus/analysis. What are the best ways to effect this change of approach? But, given the changes in clientele referred to earlier, it is likely that the transition to university teaching poses problems for all students. How can the transition from school to university be best accomplished?

This raises the issue of the philosophical approach to the subject. Many courses appear to concentrate on content knowledge. The emphasis seems to be on learning certain algorithms or theorems and

applying them in controlled situations. This hides the creative and problem solving aspects of the subject. Should more emphasis be placed on the way that mathematicians think and create? Should there be more emphasis on students' problem solving capabilities as opposed to their learning the results the subject produces? How can the impact of problem-based lectures, the use of computers, project work and so on, be assessed?

One of the issues that requires discussion is the importance placed upon teaching by universities generally. In many universities, promotion is based largely on research output, with teaching having a minor role. In such places, there is little incentive for academics to put more emphasis on their teaching. There are, of course, many academics who put quite a lot of work into their teaching. Should the profession through its national bodies, show that it recognises the importance of teaching at the university level?

Another relevant issue is, where and how do academics learn to teach? Some universities have courses for their staff but these often do not go into any great depth in particular subject areas. Should more formal instruction be given and, if so, by whom and of what type?

Now that there is relatively ready access to computers, graphical calculators and calculators, it is worth examining to what extent we can release our students from some of the drudgery experienced by past generations. How has the new technology changed the content and philosophy of the curriculum? How can mathematics majors benefit from using computer technology? How can majors in other subjects benefit? Should existing programmes be delivered in the same way as in the past or can technology assist in the development of higher order skills or other more important skills?

## 4. Themes and Issues Relating to Policy

Policy issues naturally fall into two groups: those relating to society at large and those which are the concern of a specific university or university department.

### Society

The amount of control that society, through its government, takes over its universities, varies considerably from country to country. In most countries, government provides the majority of the financial support for its universities. Hence, at least indirectly, government's policies will affect individual departments. How are these policies formed? What influence can and should

mathematicians and mathematics educators have on them?

The previously mentioned increasing number of students at the university level has, in many nations, occurred either explicitly or implicitly as the result of government policy. Is there cause for satisfaction with the result of this policy or is there a need to change or modify it in some way?

The mathematical community is convinced of the importance of mathematics both for its own sake and for the contribution that it ultimately makes to society. It is not clear that society in general also holds this position. Perhaps it does not realise what it takes to generate the contribution mathematics can make. What does the mathematical community need to do to make society aware of the mathematical requirements of society and how these can be achieved? What does the mathematical community need to do to make mathematics more visible in a competitive environment? In what ways should society provide its citizens with the basic ideas and philosophy of mathematics and its impact on our lives, both from a philosophical and practical point of view?

### University

In some countries the difference between universities and other tertiary institutions is the fact that research takes place in universities. In such countries, universities have a research culture in which it is assumed that most lecturers will engage in research. To what extent should the teaching of mathematics be delivered by lecturers who are engaged in some form of research?

In some countries, university degrees are of a general nature and cover a range of topics. In other countries, there are more directed programmes for students to follow. What is more, some of the more applicable areas of mathematics may be taught outside a mathematics department by engineers, statisticians, physicists, etc. To what extent should courses be general and to what extent should they be specific to each user group? To what extent should courses be taught by mathematicians and to what extent should they be taught by experts from other appropriate fields?

What then is the role of a department of mathematics at the end of the twentieth century, given that there is a tendency for non-mathematics departments to teach their own mathematics? (This is not only for bureaucratic reasons but also because these departments are often dissatisfied with the gap between the content and approach they require and the content and approach of

mathematics departments.) Should departments of mathematics be responsible for all of the students taking mathematics at its university or should it concentrate on its traditional clientele, the mathematics majors? Will departments which do not teach a range of students remain viable in an environment where a balanced budget, rather than education, is the main concern of administrators? What cooperation can there be with other disciplines for whom mathematics is a service course? In some cases there is an overlap in the material being taught in courses by a mathematics department and a service department. Are there good reasons for continuing this practice?

Clearly no university department can teach all branches of mathematics. Are there fundamental branches of the subject which should be in all programmes? How should the balance be struck between suitable major components?

How strongly are incoming students influenced by career prospects in mathematics? How should this affect the courses offered and the advice given to prospective students?

### 5. Call for Reactions

The work of this Study will take place in two parts. The first consists of a conference which is to be held in Singapore from December 8 to 12, 1998. *English will be the language of the conference.* The conference will be a working one where every participant will be expected to be active. Current planning is for a limited attendance of about 75 persons.

Given the style of the conference, we anticipate a variety of types of contributions that will be presented in plenary sessions, working groups, panels and short presentations. Presentations may include position papers, discussion papers, surveys of relevant areas, reports of projects, or research papers of an educational nature.

We invite you to make a submission for consideration by the International Programme Committee no later than 1 May 1998. Submissions should be up to three pages in length and may be emailed, faxed or sent as hard copy. They should be related to the problems and issues identified in this document but need not be limited to these alone. You might also draw to the attention of the Committee, the names of other people whom you feel ought to be invited, stating the type of the contribution they might make. We would appreciate knowing the nature and results of related studies in this area.

Participation in the conference is by invitation only. Invitations to those whose submissions have been

accepted will be made in July 1998. At the same time invitees will be asked to produce a longer version of their submission for publication in the pre-conference proceedings. The Study organisers are seeking funds to provide partial support to enable participants from non-affluent countries to attend the conference but it is unlikely that full support will be available for any one individual.

All contributions and suggestions concerning the content of the study and the conference programme should be sent to

Derek HOLTON, Chair, IPC, ICMI Study, Department of Mathematics and Statistics, University of Otago, P O Box 56, Dunedin, New Zealand  
 email: dholton@maths.otago.ac.nz  
 fax: (+64-3) 479 8427

The second part of the Study is a publication which will appear in the ICMI Study Series. This publication will be based both on the contributions requested above and the outcomes of the conference working group and panel deliberations. The exact format of the publication has not yet been decided but it is expected to be an edited, coherent book which it is hoped will be a standard reference in this field for some time.

The planned timetable for the Study is as follows:

**1 May 1998:** Deadline for worldwide reaction to this Discussion Document.

**July 1998:** The Study conference programme and the list of invitees to be finalised.

**8-12 December 1998:** Study conference, Singapore.

**1 March 1999:** Deadline for the submission of papers to the study publication.

**31 July-7 August 2000\*:** Presentation of main considerations and findings, ICME-9, Makuhari, Japan

**1999-2001:** The editors produce the study volume.

(\*Actual dates to be confirmed.)

The members of the International Programme Committee are:

Nestor AGUILERA, Pema/INTEC, Guemes 3450, 3000 Santa Fe, Argentina  
 email: aguilera@fermat.arcrude.edu.ar  
 fax: (+54) 42 550 944

Michele ARTIGUE, Equipe DIDIREM, Case 7018, Universite Paris 7, 2 place Jussieu, F- 75251 Paris Cedex 05, France

email: artigue@mathp7.jussieu.fr  
 fax: (+33) 1 4427 5608

Frank BARRINGTON, Department of Mathematics and Statistics, University of Melbourne, Parkville, Victoria 3052, Australia  
 email: frankb@ms.unimelb.edu.au  
 fax: (+61) 3 9344 4599

Mohamed E A EL TOM, Department of Mathematics, University of Qatar, Doha, Qatar  
 email: ssc@africanmail.com  
 fax: (+20-2) 578 7142 (+20-2) 242 8789

Joel HILLEL, Department of Mathematics and Statistics, Concordia University, 7141 Sherbrooke St W., Montreal, QC H4B 1R6, Canada  
 email: jhillel@vax2.concordia.ca  
 fax: (+1) 514848 2831

Urs KIRCHGRABER, Mathematik, ETH-Zentrum, CH-8092 Zuerich, Switzerland  
 email: kirchgra@math.ethz.ch  
 fax: (+41) 1632 1085

LEE Peng Yee, Division of Mathematics, National Institute of Education, Nanyang Technological University, 649 Bukit Timah Road, Singapore 259756, Singapore  
 email: leepy@am.nie.ac.sg  
 fax: (+65) 469 8952

Alan SCHOENFELD, Education, EMST, Tolman Hall # 1670, University of California, Berkeley CA 94720-1670, USA  
 email: alans@socrates.berkeley.edu  
 fax: (+1) 510-642-3769

Hans WALLIN, Department of Mathematics, Umeaa (Umea) University, S-901 87 Umeaa, Sweden  
 email: hans.wallin@mathdept.umu.se  
 fax: (+46) 90 7865 222

YE Qi-xiao, Department of Applied Mathematics, Beijing Institute of Technology, P O Box 327, Beijing 100081, People's Republic of China  
 email: yeqx@sun.ihep.ac.cn  
 fax: (+86) 10 684 12889

Mogens NISS, ex officio, IMFUFA, Roskilde University, PO Box 260, DK-4000 Roskilde, Denmark  
 email: mn@mmf.ruc.dk  
 fax: (+ 45) 46743020

## Mathematics from K to 12 : about consistency and continuity

Nicolas Rouche

This paper presents a study, carried out in Belgium, is likely to be of some interest to people in other countries facing the difficulty of teaching mathematics coherently throughout elementary and secondary schools. This study has some antecedents also worth reporting.

In 1988, Yvan Ylieff, the Minister of Education for the French-speaking part of Belgium, set up a commission to study the difficulties of mathematical teaching. This commission has been named after its president as: "la Commission Danblon". We shall concentrate here on two contributions of the report<sup>1</sup> submitted to the Minister in 1990.

The first contribution we choose to emphasize is the remark that, in the French-speaking Community of Belgium (Communauté Française de Belgique), mathematical education is traditionally conceived on a very strong basis of horizontal divisions. These divisions are present in three sectors of the school system.

Firstly, the curricula for Kindergarten, elementary and secondary schools (three levels) are elaborated by distinct commissions, with few coordination efforts. Secondly, the future teachers for Kindergarten, elementary schools, junior and senior high schools (four levels) are trained in different institutions, without communication.

At last, as far as research on mathematical learning is concerned, it is taken in charge mostly at the K and elementary levels by the psychology and pedagogy departments of the universities, without substantial contacts with mathematicians, and at the high school level by the mathematics departments, often without substantial knowledge or even concern about what happens at the elementary level.

These multiple divisions crossing the system horizontally result, among other deficiencies, in a lack of coordination of the subjects taught at the various levels, with severe difficulties of adaptation for the students.

The second contribution we want to emphasize is in close connection with the first. It is a recommendation to create in Belgium a centre for research in mathematics education. During the new math period, we had the well known C.B.P.M. ("Centre Belge pour la Pédagogie de la Mathématique") chaired by Georges Papy. But the Government had ceased to fund it a number of years ago, and the Commission considered that the Belgian school system needed the support of a strong research group similar to the IREMs in France or the Freudenthal Institute in the Netherlands. Such a group should include researchers familiar with all the levels of mathematics education, as well as professional mathematicians with a strong interest in teaching questions.

About this recommendation, the Minister did nothing. That is why a group of colleagues originating from all French-speaking universities of Belgium (some of them former members of the "Commission Danblon") created in 1993 a nonprofit-making organisation called the CREM ("Centre de Recherche sur l'Enseignement des Mathématiques").

By the autumn of 1993, the CREM had a board of trustees composed of representatives of all school levels, but had no money; it had only energy and good will. It applied to the Minister of Education, Elio Di Rupo, for an initial research grant. The Minister accepted, but imposed the research subject: we had to develop a general plan for mathematical education from K to 12 in 10 months. We thought it was a joke. But it wasn't and our choice was to accept it or disappear. We accepted and it took just over two years. The rest of this paper is a presentation of the book which resulted from this

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<sup>1</sup>*Perspectives sur l'enseignement des mathématiques dans la Communauté française de Belgique* premier rapport de la Commission scientifique sur l'enseignement des mathématiques et des sciences, présenté à Monsieur le Ministre Yvan Ylieff, le 7 juin 1990, Ministère de l'Éducation et de la Formation, Bruxelles, Belgique. This report is still available upon request to the CREM, see address at footnote 2.

research<sup>2</sup>. It is an attempt to partially bridge the multiple gaps mentioned above<sup>3</sup>. Its authors are Bernard Honclaire, Marisa Kryszynska, Nicolas Rouche, Françoise Van Dieren and Marie-Françoise Van Troeye, with the indispensable collaboration (on a voluntary basis) of a dozen teachers and professors of all levels.

Needless to say that the leitmotiv is : mathematical education has absolutely to be conceived in its natural continuity from the prime to the adult age.

The study begins with three chapters of a general character.

The first one analyses the idea of ability (*compétence* in French), a very popular notion nowadays. It intends to show that (at least in the mathematical field) every ability is a capacity to put *some knowledge* to work. Considering abilities in the abstract, apart from the knowledges, would be nonsensical.

The second chapter entitles *Teaching mathematics today* : it is a critical survey of which topics to drop from the curriculum and which ones to introduce. It further explains the main trends and ideologies in mathematical education today : the autonomy of thought, the construction of knowledge, the problem-solving approach, the learning "in spiral".

The third chapter outlines what might be a minimal curriculum for today's citizens, not those bound to advanced mathematics, but the future consumers, voters, readers of enquiries, reports and statistics, holders of insurance policies, Lotto players, etc.

The rest of the book consists in six chapters, all structured alike, successively devoted to magnitudes, numbers, geometry, algebra, data processing with statistics and probability, and at last analysis. To explain the common structure of these chapters, let us take geometry as an example (in what follows, *geometry* can be replaced by *magnitudes*, or *algebra*, etc.)

The chapter consists of two parts, and the first part of six sections. The first section explains what is *geometry at the basic level* (an expression borrowed from Freudenthal<sup>4</sup>) : in other words, it highlights the everyday phenomena which appear to be in need of a geometrical explanation, which mobilise geometrical thinking. The title of the second section is *The construction of geometry* : it *outlines* (nothing more) a plausible content for the learning of geometry from K to 12. Then comes, as a third section, a glimpse at what geometry is at college and university levels, as well as its place and role *in today's research*. The fourth section is of particular importance : it tries to explain what geometry is as a *form of thought*, with distinct traits as compared to arithmetic thought, algebraic thought, stochastic thought, etc. The most relevant *applications of geometry* are outlined in the fifth section. The sixth and last section explains to some extent what geometry is or has been *in history, philosophy and culture*. In each of these sections, an effort is made to convey the essentials, of course within a small number of pages.

The second part of the chapter consists of three sections : geometry from K to 6, then from 6 to about 9, and lastly from 9 to 12. No one of these sections proposes detailed topics to teach. Each one develops and discusses a few principles which are thought to be appropriate for teaching and learning geometry during the corresponding years. The principles are illustrated by some typical problematic situations. A kind of continuity is made apparent in the evolution of the principles from one age to the next.

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<sup>2</sup>Bernard Honclaire et al. *Les mathématiques de la maternelle jusqu'à 18 ans [Mathematics from K to 12]*, Centre de Recherche sur l'Enseignement des Mathématiques (CREM), Nivelles, 1995, 327 pages, available at CREM, 5 rue Émile Vandervelde, B-1400 Nivelles, Belgium ; price : FEB 300 (about \$8) ; not available in bookshops.

<sup>3</sup>Another document, written in an analogous intention, is the well-known *Curriculum and Evaluation Standards for School Mathematics*, National Council of Teachers of Mathematics, Reston, 1987. It seems however that the vertical continuity of the Standards could still be improved since, according to Gail Burril, president of the NCTM, "there is a need to build stronger articulation between the grade-level bands." (See Interview with Gail Burril (conducted by Allyn Jackson), *Notices of the Am. Math. Soc.* **45** (1998), 87-90.

<sup>4</sup>Hans Freudenthal, *Mathematics as an Educational Task*, D. Reidel, Dordrecht, 1973.

Let us repeat that similarly structured chapters are devoted to magnitudes, arithmetic, algebra, statistics and analysis.

No doubt this list of subjects will appear natural, or even necessary, except probably for magnitudes. Why magnitudes ? In a few words, although magnitudes disappeared from 20th Century mathematics, they are present by necessity, *before being measured*, already in the lives of small children, and *along with their measures*, in the lives of everybody, not to mention all the natural sciences. Allowing room for magnitudes in the mathematical curriculum is merely recognizing their presence at the roots of mathematical thinking. Further, it is a contribution to reducing a harmful gap between mathematics and physics teachers.

Another question : why did the authors deal with each subject from K to 12, and not, as in the NCTM Standards, with all subjects from K to 4, followed by all subjects from 5 to 8, and then all subjects from 9 to 12 ? The only but important reason is that they wanted to emphasize the continuity of each subject through the entire school period.

Considering each subject throughout the entire childhood and adolescence resulted for the authors in a strong conscience that teaching is not about putting science *as it is* into the mind of the pupil, but about working with the pupil *as he or she is*, while aiming in the long run at science *as it is*. A conspicuous example is orientation : for a baby, it concerns distinguishing above and below, before and behind, left and right, the clockwise sense, etc. But there is a continuous thread from these questions to the orientation of the bases in a vector space.

What is the expected readership of this study ? Written as far as possible in straightforward language, a large part of it should be accessible to the reader without any particular mathematical training. The authors *hope* that it will allow

- (1) each teacher to recognize her situation and role between those before her and those after;
- (2) each future teacher -- at any level -- to appreciate the scope of the matters they have to learn;
- (3) the teachers of other disciplines to clarify their relation to mathematics and the role of mathematics in general education;
- (4) the parents to realize where their children come from and in which direction they are moving;
- (5) the students of a certain age and maturity to understand the meaning of their efforts;
- (6) the curriculum commissions and textbook authors to coordinate their contributions with the preceding and following ones;
- (7) the managers of education and the politicians to better appreciate the scope and some global implications of their decisions.

On the first page of the book, one reads : "This work was conceived as a source of ideas and a basis for discussion : let us hope that nobody will receive it as a dogma."

But the question may be asked : to which extent will the school system be improved as a consequence of this publication ? It is hard to say. One of the authors of the report has already been consulted as an expert for the curricula coordination. The schools for teachers preparation will certainly not be coordinated in the near future, but some of the professors read the report. At last, as far as research is concerned, there is now a group in Belgium (the CREM) where teachers of all levels and mathematicians collaborate closely all the year round. There is some hope.

All this however may appear overambitious ! But remember the scope of the study was imposed by the Minister. He received the report rather well : 5000 copies were disseminated in the French-speaking school system of Belgium. All criticisms will, of course, be welcomed.

Nicolas Rouche,  
Emeritus Professor,  
University of Louvain,  
Belgium

## Proposing Problems is a Practical Art...

### The Vlaamse Wiskunde Olympiade (Part III)

A familiar 'face' is honouring the Corner for the third time: The Vlaamse Wiskunde Olympiade (VWO). My thanks go to Prof. Dr **Paul Igodt**, Katholieke Universiteit Leuven, Campus Kortrijk, Belgium, the Executive Secretary of the Flanders competition who has provided me with the annual reports on the VWO as regular as clockwork. Consequently, this Belgian mathematics contest is almost part of the furniture of the Problem Corner. The latest dispatch received presents the problems of the 11th and 12th editions of the VWO together with an overview of some statistics related to these events.

The competition has broken its fetters. New, in comparison to earlier issues, is the fact that the Vlaamse Wiskunde Olympiade now provides two complete sets of 30 multiple choice problems annually, whereas in former years the second round was shared with the American High School Mathematics Examination (AHSME). Each correct answer yields five marks, a blank answer is credited with one point and no scores can be made with wrong answers. The Olympiad demands mathematical power of the contestants and is to be done in three hours.

I have sketched out the structure and the course of the VWO in Newsletter no. 19 ; therefore we can deal today with another two pillars of this regional Olympiad. Each of these supports has not been in place for very long; no mention of them is made only in the original Dutch report, but not in the English-language version which is half as thick. Now I'm stretched by this: it is truly a European chore putting Dutch passages into English wording whilst bound to a German desk. We'll see what will come of it!

One support leg which is firmly established in the VWO is

#### **De Universitaire Wiskunde Competitie**

In conjunction with the neighbouring Netherlands, the organising committee of the VWO runs a parallel mathematics contest open to all undergraduate students who are registered at either a Dutch or a Flemish university, respectively. Teamwork is allowed. The main purpose of this counterpart of the VWO is to promote learning in how to handle mathematics, in every sense of the word.

*De Universitaire Wiskunde Competitie* includes 10 questions that range over a wide spectrum of areas of undergraduate mathematics and levels of difficulty. Sometimes there are problems or parts of problems (generally marked with an asterisk) for which the problem-selection committee itself does not know the solution (see for instance Question 91 which is taken from the set of problems proposed for the competition in the recent year). Each student intending to engage in the competition is issued with problem-papers through local contacts appointed specifically for this purpose (and at the same time they canvass potential customers for the contest in their local Alma Mater). The table shows all those persons responsible for implementing the competition at Belgian Universities in accordance with regulations:

K.U.Leuven

Prof. Roger Holvoet  
 Departement Wiskunde  
 Celestijnenlaan 200 B  
 3001 Heverlee  
 E-mail:  
 Roger.Holvoet@wis.kuleuven.ac.be

K.U.Leuven  
 Campus Kortrijk

Prof. Paul Igodt  
 Faculteit Wetenschappen  
 Universitaire Campus,  
 E. Sabbelaan 53  
 8500 Kortrijk  
 E-mail: Paul.Igodt@kulak.ac.be



## PROBLEM CORNER

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Limburgs Universitair  
Centrum

Prof. Noel Veraverbeke  
Departement Wiskunde  
Universitaire Campus  
3590 Diepenbeek  
E-mail: nveraver@luc.ac.be

Universiteit Antwerpen

Prof. Jan van Casteren  
Departement Wiskunde  
Universiteitsplein 1  
2610 Wilrijk  
E-mail: vcaster@uia.ac.be

Universiteit Gent

Prof. Frank de Clerck  
Vakgroep Fundamentele en  
Computergerichte Wiskunde  
Galglaan 2  
9000 Gent  
E-mail: fdc@cage.rug.ac.be

Vrije Universiteit Brussel

Prof. Francine Grandsard  
Departement Wiskunde  
Pleinlaan 2  
1050 Brussel  
E-mail: fgrands@vnet3.vub.ac.be

Only these cited lecturers have the authority to permit participation in the contest.

Students who are involved in the competition are normally allowed 6 to 7 weeks for solving the questions, and while brooding over them they are allowed to consult reference or textbooks. The appropriate faculty member additionally watches carefully to ensure that students meet the deadline and he or she collects all 'preparations' and forwards them to the committee for assessment. Stress is explicitly laid on the fact that participants are not expected to crack all questions set: complete solutions of one problem (or more) are always worth entry.

### A praiseworthy search for problems

Towards the end of the 12th year of VWO (1996-97) the organising committee decided to renovate the competition in order to enhance its attraction. One cannot equate a mathematics contest solely with problem solving but a competition often requires to come up with new questions. Anyone concerned with conducting a national or even regional mathematics competition can tell you a thing or two about that: it's a hard way to earn your living stocking up each year on unfamiliar but appealing and challenging problems. Fortunately, the need for new problem proposals was not so serious as at first thought. Nevertheless, the organisers from Flanders have made a virtue out of necessity. As a further stimulant for the lure of the VWO, they have established another new contest around it: the 'Zoekerswedstrijd Fernand Goethals' and its purpose is to help 'invent' new sets of problems. The jury will vet and rank all submitted proposals against well-established criteria (such as authenticity, clarity). Finally, the best submissions will be awarded prizes in a formal ceremony. Of course, members of the jury are prohibited from submitting questions.

The executive committee of the VWO wants to make use of the Corner to repeat its call for problems from all interested colleagues, teachers, professional or amateur creators of Olympiad-like problems, but students at school and their parents are warmly invited to proffer home-made teasers, too. The problem selection committee accepts everything from multiple choice problems to unsettled questions. Yet there is one stringent restriction imposed on all proposals: they have to be set down in plain words and should be suitable for students (of average ability) in years 11 and 12.

The selection committee would welcome written questions which become progressively difficult until they are a serious challenge even for those students in the Belgian team at the IMO. Each submission should be accompanied by a solution (multiple choice questions must offer five possible answers each).

The board of organisation has deliberately set no deadline for submitting problems; the Fernand Goethals Contest runs continuously. Proposals which are not adopted, for whatever reason, are still eligible for a prize.

The contest year 1996-97 brought the problem selection committee a reasonable number of nice questions. However, there was no use for some of them because they drifted in too belatedly to be considered for the competition about to appear. Such being the case, it is sometimes convenient to be able to fall back on previous proposals and the organisers have been re-assessing them; they also cherish hopes that more than a sprinkling of colleagues will engage in 'inventing' questions helpful to the competition. Possibly enthusiasts of puzzles, in addition, might submit their own problems to the committee so that a stock of problems can be accumulated.

There are very many mathematical competitions, at many levels, being given around the world each year. As a consequence of these numerous competitions, there have been quite a number of duplications of the problems, either inadvertently or in some cases by direct copying. Also, many contest problems have appeared previously in well known books and journals. In view of all this, competition examination committees now have to be much more vigilant than ever before in setting their competitions. They must now continually keep abreast of problems set in other competitions, and they have to be very careful about duplicating problems from books and journal problem sections. Even if the book or journal used is not so well known, the problems used could have already been cloned in other compendia and journals that are widely known. To play safe, problems should either be new or else based on some nice result from some non-recent mathematical paper. This brings us back to the theme of the heading, "Problem Proposing is a Practical Art.....".

In creating problems it is certainly quite helpful to have a good memory and to be observant. The guru of inventing new problems, *George Polya*, made the analogy of finding a precious uncut stone on the shore and tossing it away as it is not recognised as being valuable. One has to do a certain amount of cutting and polishing before the value of the stone is acknowledged, although an expert usually can get away with just a careful examination. So, to become proficient in problem creating, as in other non-trivial activity, one must have lots of practice. For example, at the U.S.A Mathematical Olympiad, students in training sessions were required not only to solve challenging problems but also to submit original, reasonable, proposals for problems. As most of these students had had little or no practice in problem-creation, their first efforts were usually poor. The next quotation acknowledges this deficiency; it is a fragment from a famous saying coined by George Polya: "*Proposing problems is a practical art like, swimming or skiing, or playing the piano: you can learn it only by imitation and practice ... If you wish to learn swimming you have to go into the water, and if you wish to become a problem proposer you have to propose problems*".

In closing I should like to give the address where your artful ideas will be received with open arms:

Vlaamse Wiskunde Olympiade  
 Zoekerswedstrijd Fernand Goethals  
 Algemeen Secretariat  
 Universitaire Campus  
 Etienne Sabbelaan 53  
 8500 Kortrijk

The distress signal from Flanders is no isolated occurrence. Even on a world-wide scale (the IMO for example) organisers are sorely in need of fresh ideas. And I am not affected, too. Ideally, one needs to have a huge 'Problem Bank' with enough variety of materials, from relatively easy to moderately difficult. Fortunately, I am not yet at the point of having to declare bankruptcy, for I am fortunately able to take advantage of numerous collections of problems that I have laid in. Nevertheless, the constant struggle to feature a healthy mix of interesting problems in the Problem Corner is becoming more and more arduous. I really need your help!

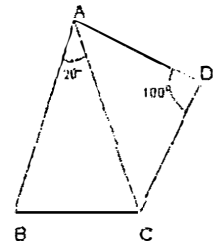
Before the next cycle of seasons with problems commences, I would like to express my thanks to all readers for their every good wish for the Problem Corner. I hope that you all had a wonderful year, and that 1998 will bring you even more joy and happiness - and that the problem section in the Newsletter will continue to be a great source of amusement for you.

**PROBLEM CORNER**

Q. 86 Consider the triangle with vertices  $(-6, 0)$ ,  $(0, 12)$  and  $(16, 0)$ . How many points with integer coordinates lie on the sides of the triangle and form together with the points  $(0, 0)$  and  $(5, 0)$  an obtuse triangle? (VWO, 1996-97, First Round)

Q. 87 Let  $a$ ,  $b$  and  $c$  be the lengths of the medians of a right-angled triangle, such that  $a \geq b \geq c$ . Find the numerical value of  $\frac{a^2 + b^2}{c^2}$ . (VWO, 1996-97, Second Round)

Q. 88  $ABC$  and  $DAC$  are two isosceles triangles with  $\widehat{BAC} = 20^\circ$  and  $\widehat{ADC} = 100^\circ$  (see figure). Prove that  $\overline{AB} = \overline{BC} + \overline{CD}$ . (Final Round, 1995-96)



Q. 89 The number 1997 is expressed as the sum of some natural numbers, not necessarily different from one another. What is the greatest possible value of the sum? (Final Round, 1996-97)

Q. 90 With respect to an orthonormal basis, we consider the curves determined by the equations

$$x^2 + y^2 = r^2 \quad (r \geq 0, \quad r \in \mathbf{R}) \quad \text{and} \quad (x, y)^2 = 1.$$

Let  $F_r$  denote the convex polygon having the intersection points of these curves as vertices (assuming that they exist).

- (a) Find an expression  $f(r)$  which describes the area of the polygon  $F_r$ .
- (b) For which values of  $r$  is  $F_r$  a regular polygon?

(Final Round, 1996-97)

Q. 91 Prove that for any positive numbers  $n \geq 4$  and any positive real numbers  $a_1, a_2, \dots, a_n$  the following inequality holds:

$$\frac{1}{a_1 + a_2} + \frac{1}{a_2 + a_3} + \dots + \frac{1}{a_{n-1} + a_n} + \frac{1}{a_n + a_1} > \frac{4}{3} \left( \frac{1}{a_1 + a_2 + a_3} + \frac{1}{a_2 + a_3 + a_4} + \dots + \frac{1}{a_{n-1} + a_n + a_1} + \frac{1}{a_n + a_1 + a_2} \right).$$

Please note: there was a printing mistake in Q.85 (Newsletter 26). The quantity in small brackets in the second term of the final expression should be the scalar product of vectors  $\mathbf{v}$  and  $\mathbf{F}$ , namely  $(\mathbf{v} \cdot \mathbf{F})$ , rather than their difference. We apologise for this mistake.

Now we are going to proceed to solve the problems given in issues 25 and 26. But before then I am able to greet some new and inquisitive guests who dared to sniff at this corner for the first time. It is to be wished that they have acquired a taste for it.

Q. 74 At the beginning of a month a shop has 10 different products for sale, each with equal prices. Every day the price of each product is either doubled or trebled. By the beginning of the following month all the prices have become different. Prove that the ratio *maximal price/minimal price* is greater than 27.

Solution (Eoin Coleman, King's College, London)

The price of a product at the beginning of the following month is determined by an ordered  $n$ -tuple  $\mathbf{x}$  in which each component is 2 or 3. Since multiplication is commutative, it does not alter the price if we permute the components (pushing the 3s to the left of the vector), so that, without loss of generality, we may assume  $x_{i+1} \leq x_i$  for  $1 \leq i < n$ . If  $\mathbf{x}$  and  $\mathbf{y}$  are the  $n$ -tuples of two products with terminal prices  $X$  and  $Y$  where  $X < Y$ , then for some least  $k = k(X, Y)$  for every  $r > k$  we must have  $2 = x_k < y_k = 3$  and  $x_r \leq y_r$ . Suppose now that  $X = X_1 < \dots < X_{10} = Y$  are the different terminal prices of the ten items. Then

$\frac{3^9}{2^9} \leq \frac{Y}{X}$ , as  $k(X, X_2) < k(X_2, X_3) < \dots < k(X_9, Y)$ . Since  $\frac{3^9}{2^9} = \left(\frac{27}{8}\right)^3 > 3^3 = 27$ , the result follows.

Q. 75 A sequence  $a_n$  is determined by the rules  $a_0 = 9$  and for any non-negative  $k$ ,

$$a_{k+1} = 3a_k^4 + 4a_k^3.$$

Prove that  $a_{10}$  contains more than 1000 nines in decimal notation.

Solution (Dr J N Lillington, Winfrith Technology Centre, Dorchester)

Computing the first term we find  $a_1 = 3(10 - 1)^4 + 4(10 - 1)^3$  and expanding it by the binomial theorem gives that the coefficient of 10 vanishes (for  $-3\binom{4}{1} + 4\binom{3}{1} = 0$ ).

Hence we can write  $a_1$  in the form  $a_1 = c_1 \cdot 10^2 + 10^2 - 1$ , where  $c_1$  is an integer. Number  $a_1$  has the last two terms in its decimal representation as 99.

Similarly,

$$\begin{aligned} a_2 &= 3(c_1 \cdot 10^2 + (10^2 - 1))^4 + 4(c_1 \cdot 10^2 + (10^2 - 1))^3 \\ &= 3((c_1 + 1) \cdot 10^2 - 1)^4 + 4((c_1 + 1) \cdot 10^2 - 1)^3 \end{aligned}$$

has the property that the coefficient of  $(c_1 + 1) \cdot 10^2$  vanishes when expanded by the binomial theorem. Hence we can write  $a_2 = c_2 \cdot 10^4 + 10^4 - 1$ , where  $c_2$  is an integer.

Proceeding inductively,  $a_n = c_n \cdot 10^{2^n} + 10^{2^n} - 1$  for all integers  $n$ .

Specifically, for  $n = 10$ ,  $2^{10} = 1024$  and  $a_{10} = c_{10} \cdot 10^{1024} + 10^{1024} - 1$  with the last 1024 terms in its decimal representation equal to 9.

Q. 77 Fifteen elephants stand in a row. Their weights are expressed by integer numbers of kilograms. The sum of the weight of each elephant (except the one on the extreme right) and the doubled weight of its right neighbour is exactly 15 tonnes. Determine the weight of each elephant.

Solution (Dr J N Lillington)

Let the weights be  $n_1, \dots, n_{15}$ . Then  $n_i + 2n_{i+1} = 15$ ,  $1 \leq i < 15$ . (\*)

it follows from (\*) that  $n_i$  is odd for each  $i$ ,  $1 \leq i < 15$ . Then

$$n_1 = 1 \implies n_2 = 7 \implies n_3 = 4, \text{ which contradicts (*)}$$

$$n_1 = 3 \implies n_2 = 6, \text{ which contradicts (*)}$$

$$n_1 = 5 \implies n_i = 5 \text{ for } 2 \leq i < 15$$

$$n_1 = 7 \implies n_2 = 4, \text{ which contradicts (*)}$$

$$n_1 = 9 \implies n_2 = 3 \implies n_3 = 6, \text{ which contradicts (*)}$$

$$n_1 = 11 \implies n_2 = 2, \text{ which contradicts (*)}$$

$$n_1 = 13 \implies n_2 = 1 \implies n_3 = 7 \implies n_4 = 4, \text{ which contradicts (*) again}$$

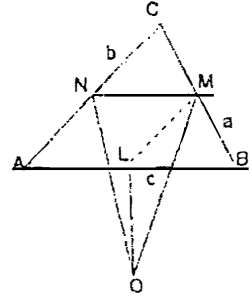
The weight of the first 14 elephants is 5 tonnes. It is not possible to deduce the weight of the elephant on the far right.

Q. 79 A square is constructed on the side  $AB$  of triangle  $ABC$  (outside the triangle).  $O$  is the centre of the square.  $M$  and  $N$  are the midpoints of the sides  $BC$  and  $AC$ . The lengths of these sides are  $a$  and  $b$  respectively. Find the maximal possible value of the sum  $OM + ON$  (when the angle at  $C$  changes).

**PROBLEM CORNER**

Solution (Dr J N Lillington, *slightly modified by the editor*)

Let  $L$  be the foot of the perpendicular through  $O$  on  $AB$ .  $L$  is the midpoint of side  $AB$ . Put  $AB = c$ . Then  $LM = \frac{c}{2}$  and  $\widehat{OLM} = A + \frac{\pi}{2}$ . Applying the cosine law to triangle  $OLM \implies$



$$OM^2 = LM^2 + OL^2 - 2LM \cdot OL \cdot \cos \widehat{OLM} = \frac{b^2}{4} + \frac{bc \sin A}{2} + \frac{c^2}{4} \text{ for } \cos(A + \frac{\pi}{2}) = -\sin A.$$

By sine rule on triangle  $ABC$ ,  $c \sin A = a \sin C$ .

By cosine rule on triangle  $ABC$ ,  $c^2 = a^2 + b^2 - 2ab \cos C$ . Hence,

$$OM^2 = \frac{b^2}{4} + \frac{ab \sin C}{2} + \frac{a^2}{4} + \frac{b^2}{4} - \frac{ab \cos C}{2} = \frac{a^2}{4} + \frac{b^2}{2} + \frac{ab}{2} (\sin C - \cos C).$$

Now,  $\frac{\sin C - \cos C}{\sqrt{2}} = \sin C \cos \frac{\pi}{4} - \cos C \sin \frac{\pi}{4} = \sin(C - \frac{\pi}{4})$  attains its maximum value of 1 at  $C - \frac{\pi}{4} = \frac{\pi}{2}$  or  $C = \frac{3\pi}{4}$ . Hence the maximum value of  $\sin C - \cos C$  is  $\sqrt{2}$ .

It follows that the maximum value of  $OM^2 = \frac{a^2}{4} + \frac{b^2}{2} + \frac{ab}{\sqrt{2}} = (\frac{a}{2} + \frac{b}{\sqrt{2}})^2$  and therefore  $OM = \frac{a}{2} + \frac{b}{\sqrt{2}}$ . Similarly,  $ON = \frac{b}{2} + \frac{a}{\sqrt{2}} \implies OM + ON = \frac{1}{2}(\sqrt{2} + 1) \cdot (a + b)$ .

Q. 80 How many positive integers  $n$  with  $1 \leq n \leq 1996$  exist that solve the equation

$$\left[ \frac{n}{2} \right] + \left[ \frac{n}{3} \right] + \left[ \frac{n}{4} \right] = \frac{n}{2} + \frac{n}{3} + \frac{n}{4}?$$

( $[x]$  is the greatest integer not exceeding  $x$ .)

Solution (Niels Bejlegaard, Stavanger, Norway)

Since  $[x] \leq x$  with equality only when  $x$  is an integer, the given equation has only solutions when  $n = 12q$ ,  $q$  an integer as well as  $n$  (or  $n \equiv 0 \pmod{12}$ ). With  $1996 = 12 \cdot 166 + 4$  there are 166 positive integers  $n$ ,  $1 \leq n \leq 1996$  satisfying the equation.

Also solved by Dr J.N. Lillington

Q. 81 Let  $a$  and  $b$  be non-negative real numbers. Determine all sets of solutions  $\{x_1, x_2, \dots, x_{96}\}$  of the following systems of equation (all  $x_i$  non-negative integers):

$$\begin{aligned} x_1 - ax_3 &= b \\ x_2 - ax_4 &= b \\ &\vdots \\ x_{94} - ax_{96} &= b \\ -ax_1 + x_{95} &= b \\ -ax_2 + x_{96} &= b \\ x_1 + x_2 + \dots + x_{96} &= 96 \end{aligned} \tag{*}$$

Solution (Niels Bejlegaard)

(*Ed.* I have to make an apology for a misprint in the last row of the system. Instead of  $b$  there must come the integer 96. Owing to this mishap, the solution has become trivial.)

Addition of all rows but the last one gives

$$\sum_{i=1}^{96} x_i - a \sum_{i=1}^{96} x_i = 96b \implies b(1-a) = 96b \quad (**).$$

If  $b \neq 0$  we arrive at  $a = -95$  in contradiction with  $a \geq 0$ . Therefore  $b = 0$ .

Since  $\sum_{i=1}^{96} x_i = b$ , we have  $\sum_{i=1}^{96} x_i = 0$ , but  $x_i \geq 0$  means that the only solution is  $x_1 = x_2 = \dots = x_{96} = 0$  irrespective of  $a$ . There is no solution when  $b \neq 0$  under the given restrictions.

(Ed. Thus far *Bejlegaard*. I want to complete his reasoning. From (\*\*) we can deduce that  $a$  and  $b$  must satisfy the relation  $1 = a + b$ . Then obviously  $(x_1, x_2, \dots, x_{96}) = (1, 1, \dots, 1)$  is a solution of the system of simultaneous equations (for  $x_i \in \mathbb{N}$ ). Otherwise the set of solutions is empty.

*Rider*. The solution of system (\*) turns out to be more difficult if we alter the domain of the  $x_i$ 's. So one can reformulate question 81 as follows: *Determine all real roots of system (\*) if  $x_i, 1 \leq i \leq 96$ , are non-negative real numbers*. I'm keen on your new solutions!

That completes the Corner for this issue. Send me your nice solutions and contest materials.

Finally, you are invited to propose problems for which readers will send in solutions. Proposals should, whenever possible, be accompanied by a solution, references, and other insights which are likely to be of help for the editor. They can be anything from elementary to advanced, from easy to difficult. Original problems are particularly sought.

So, please submit any interesting problems you come across, especially those from (problem) books and contests that are not easily accessible. But other interesting problems may also be acceptable provided they are not too well known and references are given as to their provenance. I hereby invite my readers to share them with their colleagues and students.

I welcome your input, most especially problem sets and solutions for future use!

## Oberwolfach Prize for Young European Scientists

Verein zur Förderung des Mathematischen Forschungsinstituts Oberwolfach (Friends of Oberwolfach) and Gesellschaft für mathematische Forschung are awarding a prize for excellent achievements in

### Stochastics

The prize amounts to DM 10,000. Candidates must be nominated, come from Europe and be under the age of 35. All European senior scientists in Stochastics are requested to submit proposals by 31 May 1998 to:

Matthias Kreck  
Mathematisches Forschungsinstitut Oberwolfach  
Schwarzwaldstr. 9 – 11, 77709 Oberwolfach

## BRIEF REVIEWS

*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.*

**M. Giaquinta, S. Hildebrandt: Calculus of Variations II. The Hamiltonian Formalism**, Grundlehren der mathematischen Wissenschaften 311, Springer-Verlag, Berlin, 1996, xxix+652 pp., 82 fig., DM 198.00, ISBN 3-540-57961-3

The second volume of this excellent survey of the calculus of variations consists of two parts, Part III "Canonical Formalism and Parametric Variational Problems" and Part IV "Hamilton Jacobi Theory and Canonical Transformations", and they are covered by Chapters 7 - 10 of the book. In Chapter 7 the authors describe an important involutory transformation, which is used to derive a dual picture of the Euler-Lagrange formalism and the so-called canonical formalism of field theory. It forms a part of Hamilton-Jacobi theory presented in Chapter 9 together with a brief introduction to symplectic geometry. The connection between canonical (or symplectic) transformations and Lie's theory of contact transformations is discussed in Chapter 10, where relations between Fermat's and Huygens principles are also investigated. Cauchy's method of integrating partial differential equations of first order by the method of characteristics is described, and connections of this technique with Lie's theory are also illustrated here. The field theory for parametric integrals corresponding to Weierstrass field theory for non-parametric variational problems considered in Chapter 6 is presented in Chapter 8. As in the first volume, the reader can find here detailed introductions to each chapter and section of the book, many examples, historical references and comments. Beside the vast bibliography the authors completed the book with a useful overview of textbooks on the classical calculus of variations. Both broad and deeply rooted contents and remarkably clear style of presentation make the book highly recommended for all analysts. (jsta)

**W. Filter, K. Weber: Integration Theory**, Chapman & Hall Mathematics Series, Chapman & Hall, London, 1997, xii+294 pp., GBP 35.00, ISBN 0-412-57680-5

A Daniell space is a triple consisting of a set  $X$ , a vector lattice  $L$  of real-valued functions on  $X$  and a null-continuous positive linear functional on  $L$ . Unlike the traditional approach, the book presents an extension of a Daniell space in two steps. The second extension gives nothing new in the  $\sigma$ -finite case. However, there are examples showing a weakness of the classical construction which stops after introducing the closure and a justification for

another extension is explained. The book relies on the notion of a vector lattice and the corresponding theory is developed in order to describe property spaces of integrable functions and spaces of measures as well. Extension of Daniell space is the main method for constructing an integral. However, a measure theoretic approach is compared with the Daniell-type method. The context of the theory, as treated in the book, makes it possible to develop a nice measure theory on Hausdorff topological spaces. Two chapters deal with  $L^p$  spaces. Spaces of signed measures are also studied, the main tool being a vector lattice approach. Elements of the theory of functions of bounded variation and absolutely continuous functions are included in the last chapter. The book is well written and contains a large number of exercises. It can be used as a textbook for a university course in integration. The book is recommended to mathematics teachers as well as students and can also serve for a second reading to those who have already studied integration based on another approach. (in)

**A. W. Knap: Lie Groups Beyond and Introduction**, Progress in Mathematics, vol.140, Birkhäuser, Basel, 1996, 656 pp., sFr 78.00, ISBN 3-764-33926-8

The theory of Lie groups, Lie algebras and their representations have had an important influence on all fields of mathematics and theoretical physics during the last century. The classification of complex semisimple Lie algebras and of their finite dimensional representations has already become a standard part of a good mathematical education. There is a certain number of well written textbooks available on this subject. A study of infinite dimensional representations of reductive Lie groups is much more difficult, although a huge amount of important results has been accumulated after a half century of intensive research. Prerequisites necessary for an understanding of these results are Cartan's structure theory of real semisimple Lie algebras and groups and various forms of decompositions of reductive Lie groups. However these topics cannot be found (with one exception) in standard textbooks on Lie algebras and Lie groups. The important feature of the present book is that it starts from the beginning (with only a very modest knowledge assumed) and covers all mentioned important topics - the connection between Lie groups and Lie algebras; complex semisimple Lie algebras, their universal enveloping algebras and their finite dimensional representations; compact Lie groups and their represen-

tations; Cartan and Iwasawa decompositions, Vogan diagrams and classification of simple real Lie algebras; reductive Lie groups,  $KAK$  and Bruhat decompositions, parabolic subgroups and Harish-Chandra decomposition, the Weyl integration formula for reductive Lie groups. So the reader has at his disposal a systematic treatment of all basic ingredients needed for a study of infinite dimensional representations. The book is very carefully organized, and each chapter has an abstract explaining its contents and ends with a list of problems (hints for solutions can be found at the end of the book). The methods used are both algebraic and analytic, and examples are stressed everywhere. The book ends with 20 pages of useful historical comments. Such a comprehensive and carefully written treatment of fundamentals of the theory will certainly be a basic reference and text book in the future. (vs)

**J.H.Dorfman: Bayesian Economics Through Numerical Methods. A Guide to Econometrics and Decision-Making with Prior Information,** Springer-Verlag, New York, 1997, vii+110 pp., DM 90.00, ISBN 0-387-98233-7

The author has written the book with two goals. First he tries to convince the reader of the usefulness and advantages of Bayesian statistics relative to the classical sampling approach. Therefore, after a "quick course in Bayesian statistics and decision theory" in Chapter 2, he presents new numerical methods developed in the last 30 years that have expanded the range of problems to which Bayesian methods can be applied without simplifying assumptions (e.g. Monte Carlo sampling, antithetic replication, importance sampling, Gibbs sampling). Secondly, the author examines a variety of applied economic questions emphasizing problems that are best solved, in his opinion, just with numerical Bayesian methods. This involves, for example, imposing economic theory (restricted parameter spaces, a profit function application), studying parameters of interest (estimating welfare measures, elasticities, dynamic properties), unit root and cointegration tests (application to efficient market tests, Bayesian approaches to cointegration tests, applications to the extended Nelson-Plosser data), model specification uncertainty (uncertain lag lengths, uncertain right-hand-side variable choice, uncertainty with partial information), forecasting (turning point forecasting, full and partial information approach, composite qualitative forecasting), decision theory applications (land allocation, optimal decisions for dynamic problems). A very positive feature of the book is that an extensive bibliography, grouped by category, is included. (tc)

**I.Mareels, J.W.Polderman: Adaptive Systems. An Introduction,** Systems & Control: Foundations

& Applications, Birkhäuser, Boston, 1996, xvii+339 pp., DM 108.00, ISBN 3-764-33877-6, ISBN 0-817-63877-6

In spite of many common features with robust control, the theory of adaptive systems differs in its "raison d'être". Roughly speaking, an adaptive control changes the strategy of the controller according to the actual state of the system. The book is based on graduate courses taught by both authors and is intended as a text-book. Therefore it is self contained and only basic knowledge of linear algebra and ordinary differential equations is needed. The first three chapters are preparatory and they contain examples of adaptive systems (not in terms of transfer functions but with a behavioural approach based on the notion of trajectory) and identification algorithms. The main part of the book consists of Chapters 4-6 which are devoted to adaptive pole placement, model reference adaptive control and theory of universal controllers. These six chapters cover the basic theory of adaptive systems and can be used for a one trimester course. The rest of the book is more advanced and discusses the validity of assumptions which are rather restrictive and were used in previous chapters. The second aim is to study the behaviour of algorithms in situations for which they were not designed. The book is accompanied by many solved and unsolved exercises, two Maple procedures and a large bibliography. (jmil)

**M.Audin: Spinning Tops,** Cambridge Studies in Advanced Mathematics, vol.51, Cambridge University Press, Cambridge, 1996, vi+139 pp., GBP 25.00, ISBN 0-521-56129-9

This book has several remarkable features. The subject itself is exceptional - rigid bodies in classical mechanics have been studied for more than two centuries and still they form a very active field of research nowadays with many different parts of mathematics being used together in their description. The best way to grasp quickly the main lines of a theory is by studying and understanding a certain number of well chosen typical examples. The book by M.Audine takes this fact into account perfectly. The themes discussed in the book are integrable systems, their description using methods of algebraic geometry (curves and their Jacobians) and especially topological questions arising in these problems. The main cases studied in the book are the free rigid body, a heavy rigid body fixed at the centre of mass, the Lagrange symmetric spinning top, Kowalewski top as well as a variant of the periodic Toda lattice. The overall organization of the book is nonstandard but useful. The core of the book (Chapters I - V) consists of a detailed treatment of the afore-mentioned examples. The



book starts with a very nicely written introduction explaining basic facts about integrable systems in general as well as specific features and aims of the book. In the Appendices, the reader can find a summary of facts used in the book (Poisson structures, the AKS theorem, complex curves and their Jacobians, Prym varieties). This small book has very rich contents which can be recommended to any mathematician or physicist interested in the subject. (vs)

**A.Krause, M.Olson: The Basic of S and S-Plus, Statistics and Computing, Springer-Verlag, New York, 1997, xiv+242 pp., 34 fig., DM 48.00, ISBN 0-387-94985-2**

S is a powerful tool for interactive data examination, creation of graphs and implementation of customized routines based on the S language. This book gives a solid but quick introduction to the S environment. If you have never used S before, this book will get you up to speed quickly, as it is full of examples and insights into how S works. Although the book is primarily intended for the S novice, the material covered extends to more advanced topics and contains many hints beneficial also to those who already have some knowledge of S or are not aware of the many enhancements that have been made to the system over the past few years. The structure of the book, with its detailed exercises and solutions at the end of each chapter, reflects its origin from lecture notes and homework exercises. The best way to use the book is to read it while sitting at the computer and repeat all of the examples. As the authors state, for getting an overview two days of reading would be sufficient, while working through the examples will take surely much more time. Using the book to lay the foundations, the reader will be able to use S with all its basic capabilities. (jan)

**P.Ribenboim: The New Book of Prime Number Records. 3rd ed., Springer-Verlag, New York, 1996, xxiv+541 pp., DM 88.00, ISBN 0-387-94457-5**

The book is an extension and an improved version of the 2nd edition of "The book of prime number records" published in 1989. In six chapters and on more than 500 pages, almost all problems which were studied in connection with prime numbers are discussed in detail. The author carefully describes the historical evolution of the problems, including last results obtained using computer techniques. The book contains almost 70 pages of a carefully compiled bibliography, index, as well as 53 tables in text. It is a nicely readable book which will be useful both for students and specialists. (bn)

**E.T.Whittaker, G.N.Watson: A Course of Modern Analysis. Fourth Edition, Cambridge Mathematical Library, Cambridge University Press, Cambridge, 1996, 608 pp., GBP 29.95, ISBN 0-521-58807-3**

This a paperback classic dating back to 1927 and reprinted many times since! Nevertheless, it is still very valuable book containing essential facts of analysis (basics of real analysis and of complex function theory, asymptotic expansions, Fourier series, ordinary differential equations in the complex domain and integral equations) in a short, condensed and precise form approved by years of practical use. The second part of the book describes in detail the main special functions used in applications and mathematical physics (Gamma function, zeta function, hypergeometric functions, Legendre, Bessel, Mathieu and Lamé functions, elliptic and theta functions). A wealth of mathematical ideas with a touch of old times make this book a pleasure to read. (vs)

**B.Hughes, A.Ranicki: Ends of Complexes, Cambridge Tracts in Mathematics, vol.123, Cambridge University Press, Cambridge, 1996, xxv+353 pp., GBP 45.00, ISBN 0-521-57625-3**

This is a highly specialized monograph which is very clearly written and made as accessible for the reader as possible. Its short title not specifying the notion of complex comprises two aspects of the theory: namely, the complex means here either a CW-complex in topology or a chain complex in algebra. Accordingly, we meet ends of CW-complexes and ends of chain complexes which represent the algebraic counterpart of the topological situation. The authors have succeeded in presenting practically a complete theory of ends of all kinds and their interrelations which are relevant to the topology of high dimensional manifolds. The book contains a great amount of information, many new results and also new approaches. It is absolutely indispensable for any specialist in the field. The authors declare that they are assuming some familiarity with high dimensional manifold theory and with the standard applications of algebraic K- and L- theory to manifolds. But beyond these prerequisites they introduce and explain almost all necessary notions. In the text are to be found many historical remarks that clarify the development of the theory of ends and help in their understanding. At the end of the book there are also short appendices describing the history of end spaces and the history of wrapping up. The references extend to 170 items. (jva)

**J.Casey: Exploring Curvature, Friedrich Vieweg & Sohn, Braunschweig, 1996, xv+291 pp., 141 fig., \$ 49.00, ISBN 3-528-06475-7**

It is easy to use a formula to compute the curvature of an analytically given curve. Nevertheless, what is the geometrical meaning of the curvature and how is it obtained by measurements? Likewise, in the case of a surface - how can we estimate the curvature of a surface if we only have its model? We get the length of a curve from the length of broken lines by

a limiting process; the case of the surface area is more difficult. What is the deformation of a surface and how does one demonstrate it? Such problems are dealt with in this book. The author shows how, with help of experiments and measurements, we can obtain an understanding of the geometrical meaning of several notions of elementary differential geometry. Physics helps us in the case of minimal surfaces. The author presents the well-known "soap solution" of Plateau's problem: there is a surface with a minimal possible area among all surfaces with boundary equal to a fixed closed curve. In the reviewer's opinion, it is important to show a relationship with physical reality both to motivate mathematical assumptions and to present questions from which theorems arise. The book is very useful, especially for teachers, and serves to make their students acquainted with the interrelations between mathematical ideas and real things. The only drawback of the book is a certain number of incorrect figures (e.g. on pp.158, 161) - they are false from the point of descriptive geometry. On the other hand, the reader will appreciate many historical comments. Special chapters are devoted to C.F.Gauss, B.Riemann and T.Levi-Civita. (lbo)

**T.Jech: Set Theory. Second Corrected Edition,** Perspectives in Mathematical Logic, Springer-Verlag, Berlin, 1997, xiv+634 pp., DM 168.00, ISBN 3-540-63048-1

The monograph is devoted to a detailed study of axiomatic set theory. It contains comprehensive material about all main topics. Chapter 1 is about axiomatic set theory with a detailed description and explanation of the basic notions in the set theory (axioms, ordinal and cardinal numbers, real numbers, the axiom of choice, cardinal arithmetics, filters and ideals, singular integral, axiom of regularity). The main topic of Chapter 2 are transitive models of set theory including transitive models of ZF, constructible sets, consistency of the axiom of choice and the generalized continuum hypothesis, relative constructibility and ordinal definability. Forcing and generic models are introduced in Chapter 3 (complete Boolean algebras, Boolean-valued models, independence of continuum hypothesis and the axiom of choice, symmetric submodels of generic models). In Chapter 4 the forcing is applied to several problems (Suslin's problem, Martin's axiom, iterated forcing, complete Boolean algebras). Chapter 5 concerns measurable cardinals (the measure problem, ultrapowers, elementary embeddings, infinitary combinatorics, silver indiscernibles). Chapter 6 is devoted to the study of other large cardinals. Final Chapter 7 deals with the real line. The descriptive set theory is studied (Borel and analytic sets, Baire space, projective sets, constructible universe, the

axiom of determinacy, applications of forcing). The monograph contains both useful and interesting historical notes and a guide to the bibliography. The book covers major areas of modern set theory: cardinal arithmetic, constructible sets, forcing and Boolean-valued models, large cardinals and descriptive set theory. It contains results on various topics, including properties of the reals, infinitary combinatorics, ultrapowers, Suslin's Problem and Martin's Axiom, measurable cardinals, axiom of determinacy and many others. The book is aimed primarily at graduate students and researchers in set theory. It can be used as a textbook for a graduate course in set theory and also can serve as a reference book. (pp)

**H.McKean, V.Moll: Elliptic Curves: Function Theory, Geometry, Arithmetic,** Cambridge University Press, Cambridge, 1997, xiii+280 pp., GBP 40.00, ISBN 0-521-58228-8

This book is a full and sufficiently detailed introduction to the theory of elliptic curves the beauty of which has bewitched mathematicians at least since the last century. The book is divided into seven chapters: 1. First ideas: complex manifolds, Riemann surfaces, and projective curves; 2. Elliptic integrals and functions; 3. Theta functions; 4. Modular groups and modular functions; 5. Ikosaeder and the quintic; 6. Imaginary quadratic number fields; 7. Arithmetic of elliptic curves. This indicates that all three pillars, complex function theory, geometry and arithmetic, on which the theory of elliptic curves rests are represented in a proper proportion. A reading of the book requires only a basic knowledge of fundamentals of these three disciplines. The text includes many references and comments concerning the further developments of the presented results and ideas, as well as many exercises which are very helpful for understanding the whole theory and supporting the spirit of the original discoveries. The book is a welcome extension of the existing literature about this important topic which in view of its extensive development has often been an obstacle to the novice's progress. It is recommended to students of mathematics and physics interested in the applications of the theory and the theory itself. (šp)

**D.M.Salopek: American Put Options,** Pitman Monographs and Surveys in Pure and Applied Mathematics, vol.84, Addison Wesley Longman, Harlow, 1997, 116 pp., ISBN 0-582-31594-8

The book provides an overview of both theoretical and computational approaches to American put options, starting with early ideas of Bachelier, through the Black-Scholes model, and up to recent developments in the numerical analysis of such American put options. Unfortunately, this useful

survey is spoiled by a completely wrong numbering of references. (jd)

**A.van der Poorten: Notes on Fermat's Last Theorem**, Canadian Mathematical Society Series of Monographs and Advanced Texts, J.Wiley & Sons, Inc., New York, 1996, xv+222 pp., GBP 35.00, ISBN 0-471-06261-8

Based on the author's lecture series at Macquarie University in Sydney, the book covers, in its 17 chapters, the history of the solution of Fermat's last theorem from first results, through Kummer's work, up to the proof of the theorem worked out by A.Wiles. This is a very attractively written publication containing extended remarks, comments and stories that complement every chapter, illustrate the evolution of the problem and are often more interesting (for beginners as well as specialists) than the contents themselves. The book is very warmly recommended to everybody. (bn)

**J.Stoyanov: Counterexamples in Probability. Second Edition**, Wiley Series in Probability and Statistics, J. Wiley & Sons, Inc., Chichester, 1997, xxviii+342 pp., GBP 55.00, ISBN 0-471-96538-3

The author started to collect counterexamples in 1970. The first edition of this book which appeared in 1987, has become very popular and today it is a classic reference work. In the second edition, some examples are replaced by more attractive ones and new examples are included. The book contains 25 sections grouped into the following parts: 1. Classes of random events and probabilities. 2. Random variables and basic characteristics. 3. Limit theorems. 4. Stochastic processes. Undoubtedly, every teacher needs examples to clarify that some sufficient conditions are not necessary, that some necessary conditions are not sufficient, and that the converse to a statement is not true. This book is a very important source of such examples in probability theory. (ja)

**J.Elstrodt: Maß- und Integrationstheorie**, Grundwissen Mathematik, Springer-Verlag, Berlin, 1996, xvi+398 pp., DM 58.00, ISBN 3-540-15307-1

This is a carefully written textbook which covers in detail the most important topics in measure theory and integration. The contents are more or less standard: set systems (including semirings, monotone classes, Dynkin systems), set functions (content, premeasure, measure, outer measure), extension theorems, uniqueness, Lebesgue and Hausdorff measure, measurable functions, abstract Lebesgue integral, product measure, change of variables, Fourier transform,  $L^p$ -spaces, convergence of sequences of measurable functions, absolute continuity (measures, functions), measures on topological spaces (regularity, Kisiński extension theorem, Riesz representation theorems, Haar measure on locally compact topological groups).

A large number of exercises accompanies each chapter. Besides the main text, additional material is often included in order to provide the reader with further results or information. A nice feature of the book is the inclusion of historical notes and comments giving a competent historical perspective of the subject. There are also many original quotations from important work on measure and integration, and short biographies of the most important personalities are also included (e.g. Borel, Radon, Carathéodory, Hausdorff, Vitali, Levi, Young, Fatou, Lebesgue, Fubini and Tonelli, F.Riesz, Fischer, Jegorov, Hahn, Nikodým, Lusin, Haar). The textbook can be recommended to mathematics students and also to teachers of mathematical analysis who will appreciate an access to facts not easily available in such a form in traditional textbooks on the subject. (in)

**J.R.Schott: Matrix Analysis for Statistics**, Wiley Series in Probability and Statistics, J. Wiley & Sons, Inc., New York, 1997, xii+426 pp., GBP 50.00, ISBN 0-471-15409-1

Matrix methods are among to the most important tools used in statistics. Their role in statistical theory has been even more enhanced by the use of computers in data analysis. The book under review brings an accessible and modern background in matrix analysis required by statisticians. Introductory chapters review elementary matrix algebra and vector spaces. Further topics are eigenvalues, eigenvectors, matrix factorizations, and matrix norm. The chapter about generalized inverses is mostly devoted to the Moore-Penrose generalized inverse. The chapter devoted to systems of linear equations is oriented to the least squares method. Then the author deals with Kronecker product, vec operator; Toeplitz matrices, matrix derivatives and some other subjects. The last chapter describes some properties of quadratic forms which are useful in statistics. Some theorems are stated with a reference substituting the proof (e.g., Theorem 3.12, which is then used as a tool for proving continuity of eigenvalues). Each chapter contains a section with problems. The book can be used as a course of matrix theory for students of statistics. (ja)

**R.B.Bapat, T.E.S. Raghavan: Nonnegative Matrices and Applications**, Encyclopedia of Mathematics and Its Applications, vol.64, Cambridge University Press, Cambridge, 1997, xiii+336 pp., GBP 45.00, ISBN 0-521-57167-7

An integrated treatment of the theory of nonnegative matrices with the emphasis on its applications to game theory, combinatorics, optimization and mathematical economics. About half of the material in the book presents standard topics in a novel fashion. The remaining portion brings many

new results in matrix theory. The book is divided into seven chapters. The material begins with the basics of the subject such as Perron-Frobenius theory and shows the connections with game theory, M-matrices and the theory of finite Markov chains. Doubly stochastic matrices are treated in the second chapter. Some matrix inequalities as for instance information inequalities, further Hadamard, Fiedler-Oppenheim, Levinger-Kingman inequalities and some related problems are studied in the third chapter of the book. Chapter 4 is devoted to some results concerning conditionally positive matrices and chapter 5 contains some topics in combinatorial matrix theory (e.g. matroids, a new proof of Alexandroff inequality, Coxeter graphs, matrices over the max-algebra, Boolean matrices). Some scaling problems and their applications are surveyed in Chapter 6. The last chapter investigates the application of special matrices in economic models. The Perron-Frobenius theorem is used to explain both the Leontief and Sraffa system; further, the linear expanding economy and the behaviour of market prices are investigated. The treatment of the material is rigorous and almost all the results are completely proved. The book is aimed at first year graduate students and researchers with a minimal background in linear algebra and advanced calculus, although familiarity with the basics of linear programming and statistics will be helpful in understanding some of its sections. (kz)

**W.N.Venables, B.D.Ripley: Modern Applied Statistics with S-Plus. Second Edition,** Statistics and Computing, Springer-Verlag, New York, 1997, xvii+548 pp., 144 fig., DM 88.00, ISBN 0-387-98214-0

S is a powerful tool for interactive data examination, creation of graphs and implementation of customized routines based on the S language. Since the first edition of this book in 1994, S has continued to grow in popularity, due also to the fact that its Windows version now offers equivalent capabilities to the versions running on UNIX workstations. The second edition of the book is designed for users of S 3.3 and later. It was written whilst S for MS Windows was under development, and covers what the authors see as the most exciting new features. This is not a text in statistical theory, but does cover modern statistical methodology. After the introduction to the S language and the system itself, there are twelve chapters, each of them covering one part of modern statistical methodology. Each chapter summarizes the method discussed, in order to set out the notation and the precise method implemented in S. However, the main aim is rather to show how to analyse datasets using S. In doing that, the authors show how the availability of a powerful and graphical system has altered the way people ap-

proach data analysis and offered the possibility to perform penetrating analyses routinely. The book is intended both for would-be users of S as an introductory guide and for class use. The level of a course for which it is suitable ranges from the upper years of an undergraduate course to the Master's level. Full exercises are provided only for Chapters 2-5. Generally, this book shows its reader how to extend S, and uses this facility to discuss the procedures not implemented in S, thereby providing fairly extensive examples of how this might be done. Throughout, the emphasis is on presenting practical problems and full analyses of real data sets. Many of the methods discussed are state-of-art approaches to topics such as linear and non-linear regression models, robust and smooth regression methods, survival analysis, multivariate analysis, tree-based methods, time series, spatial statistics and classification. (jan)

**P.Hilton, D.Holton, J.Pedersen: Mathematical Reflections. In a Room with Many Mirrors,** Undergraduate Texts in Mathematics, Springer-Verlag, New York, 1997, xvi+351 pp., 134 fig., DM 49.00, ISBN 0-387-94770-1

Fibonacci, Fermat and Mersenne numbers are well-known; not so much Euler and Lucas ones. The book under review deals with all these numbers but this is not its main purpose. As explained in the preface, the authors want to show what mathematics is, what it is about, and how it is done. Mathematics must be taught so that students understand how and why mathematics is done by those who do it with success. The authors present a picture of mathematics as an exciting, stimulating activity not as a set of procedures set in stone. They use several topics to illustrate their ideas (number theory, fractal geometry - Koch snowflake, decorative geometry - frieze and wallpaper patterns, cardinality - pigeon-hole principle, Schröder-Bernstein theorem). From time to time you find a BREAK to test your understanding of the matter just presented. At the end of some chapters there is a FINAL BREAK which is followed by a list of references and answers. The last chapter is quite different from the preceding ones. The authors formulate here certain principles of mathematical pedagogy. E.g. "Never be pedantic but sometimes be precise" or "Geometry plays a special role in mathematics". (lbo)

**R.R.Hocking: Methods and Applications of Linear Models. Regression and the Analysis of Variance,** Wiley Series in Probability and Statistics, J. Wiley & Sons, Inc., New York, 1996, xxii+731 pp., GBP 70.00, ISBN 0-471-59282-X

This book provides a thorough presentation of linear model analysis. In the first part the author defines the essential distributions encountered in linear model analysis and derives their basic properties. The methods of simultaneous inference are then

explained. The second part is concerned with regression models and gives a detailed description of building regression models, estimating the parameters, testing for violations of a model, transforming data, dealing with outliers, influential observations and collinearity. Calibration, robust regression and nonlinear regression are also briefly mentioned. The theory is accompanied by deeply analysed real-data examples illustrating the problems commonly met in practice. The third part is devoted to the analysis of variance models. The fixed effects models are studied, including one-way classification, two-way classification with and without interactions, and with balanced or unbalanced data, and nested models. The remainder of the book develops mixed effects models and describes the AVE method for variance component estimation. I consider this book invaluable for graduate students in statistics and applied statisticians for its comprehensive explanation of the basic methodologies and the presentation of examples which help to avoid common misinterpretations of the data. (sk)

**B.Flury: A First Course in Multivariate Statistics**, Springer Texts in Statistics, Springer-Verlag, New York, 1997, xiii+713 pp., 141 fig., DM 148.00, ISBN 0-387-98206-X

This book gives a thorough introduction into the area of multivariate statistics at an intermediate level. After reviewing basic statistical concepts, the author introduces the multidimensional normal distribution and spherical and elliptical distributions. The methods of parameter estimation are explained, concentrating mainly on maximum likelihood estimation, and the EM algorithm for incomplete data is also presented. The central topics of the book are discriminant analysis and classification, including logistic regression. The problem of statistical inference for means is approached via maximum likelihood, the union-intersection principle, and bootstrapping. The linear principal component analysis is presented using self-consistency principle. The final chapter gives an introduction to finite mixture analysis. Factor analysis and cluster analysis are not presented in the book. The book contains many exercises, real-data examples, and the data files and the software instructions files written in S-PLUS and GAUSS are available via ftp. The book is suitable for advanced undergraduate students in statistics and for a broad class of researchers in other fields. (sk)

**W.C.Winnie Li: Number Theory with Applications**, Series on University Mathematics, vol.7, World Scientific, Singapore, 1996, x+229 pp., GBP 39.00, ISBN 9-810-22226-2

Edmund Landau said that the number theory is immortal because it provides an inexhaustible

source for Ph.D. theses. The present book shows that there are also some other reasons based on real life problems supporting the importance of this fundamental branch of mathematics. Motivating the reader by the construction of the so-called Ramanujan graphs appearing in network communications, the author moves on to several important branches of number theory in a concise form. These parts taken by itself are usually considered "only" of theoretical importance. Chapter 1 recapitulates basics about finite fields, and Chapter 2 is devoted to the Weil conjectures on zeta functions of projective varieties over finite fields. In Chapter 3, the reader is introduced to local and global fields and adèlic language. In Chapter 4 the Riemann-Roch theorem is proved, and Bombieri's approach to counting points on curves over finite fields is presented. Analytic behaviour of the zeta and  $L$ -functions attached to idèle class characters is proved in Chapter 5 based on the philosophy of Tate's thesis using Fourier analysis on the adèlic groups. Chapter 6 is devoted to estimates of various character sums needed for construction of Ramanujan graphs based on estimates of roots of  $L$ -functions attached to character of the idèle class group of a function field. Chapter 7 summarizes classical modular forms, including Hecke operators,  $L$ -functions, and the theory of newforms. The reader finds here how Hasse conjecture implies Taniyama-Shimura conjecture. The content of the last two chapters is characterized by the author as follows: "Automorphic forms and representations are discussed in Chapter 8. There we give an adèlic interpretation of the classical modular forms, which naturally leads to the adèlic definition of automorphic forms and representations for  $GL(2)$ . Then we survey the Jacquet-Laglands theory of local and global representation for  $GL(2)$  and quaternions groups. ..." In Chapter 9 we apply what we learned to give explicit constructions of Ramanujan graphs; on the other hand, we obtain some information on the distribution of eigenvalues of a Hecke operator using the limit of the measure attached to certain family of graphs arising from quaternion groups. (šp)

**A.C.Zaanen: Introduction to Operator Theory in Riesz Spaces**, Springer-Verlag, Berlin, 1997, xi+312 pp., DM 98.00, ISBN 3-540-61989-5

This is an excellent detailed textbook dealing with ordered spaces and operators in these spaces. Assuming only a knowledge of basic notions in functional analysis and measure theory, the author starts with algebraic theory of Riesz spaces (chapters on Lattices and Boolean algebras, Riesz spaces, Ideals and bands, Archimedean spaces, Projections and Dedekind completeness), and continues with normed Riesz spaces. A major part of the book

is devoted to linear operators on Riesz spaces. Here are some highlights: order bounded and order continuous operators, order duals and biduals, the Radon-Nikodym theorem, Freudenthal's spectral theorem, functional calculus, the Hahn-Banach theorem in normed Riesz spaces, the Krein-Rutman theorem, a spectral theory of positive operators. The textbook includes exercises (many with a hint for the proof) and a short list of other books on the subject. This book is warmly recommended to both graduate students and experts in the field. (jl)

**P.-L.Lions: Mathematical Topics in Fluid Mechanics. Volume I. Incompressible Models**, Oxford Lecture Series in Mathematics and its Applications, Oxford University Press, Oxford, 1996, x+237 pp., GBP 29.95, ISBN 0-198-51487-5

Various continuum mechanics models of complex motions of incompressible and compressible fluids prove to be a neverending source of deep mathematical problems. Treatment by P.L. Lions in two volumes deals with essentially three fundamental questions: (i) global existence of (weak, renormalized) solution, (ii) its uniqueness and (iii) regularity. The attention is focussed on evolutionary equations, for which three kinds of 'boundary problems' are investigated: (i) the Cauchy problem, (ii) the space periodic problem, and (iii) the Dirichlet problem. The first volume summarises and proves significant results relating to various incompressible models. The book starts with the density-dependent Navier-Stokes equations; the scheme of presentation is inspired by Leray's famous paper on the Navier-Stokes equations (having the density constant). The next chapter provides a survey of known results on classical Navier-Stokes equations, with the emphasis on (i) second derivatives estimates, and (ii) fine improvements obtained by an application of Hardy spaces. The final chapter deals with ideal fluids, i.e., Euler equations, density-dependent Euler equations, and hydrostatic approximations. The volume is completed by five appendices interesting on their own. Everybody who is interested in studying mathematical questions arising in fluid mechanics should read this book. (jona)

**Y.Motohashi: Spectral Theory of the Riemann Zeta-Function**, Cambridge Tracts in Mathematics, vol.127, Cambridge University Press, Cambridge, 1997, ix+228 pp., GBP 29.95, ISBN 0-521-44520-5

The aims of the book are perhaps best described by a quotation from the author's preface: "Ever since Riemann's use of the theta transformation formula in one of his proofs of the functional equation for the zeta-function, number-theoretists have been fascinated by various interactions between the zeta-function and automorphic forms. These experiences, however, have remained episodic like rare glimpses

of crests, for most of them ensued from apparently spontaneous relations of the zeta-function with a variety of Eisenstein series. Nevertheless such glimpses are highly suggestive of a grand view over and far beyond the Eisenstein ridge, and bring forth the notion of a *kamuy-mintar* where the entire collection of automorphic forms contribute to the formation of the zeta-function. My aim in the present monograph is to try to substantiate this belief by demonstrating that the zeta-function has indeed a structure tightly supported by all automorphic forms. The story begins with an unabridged treatment of the spectral resolution of the non-Euclidean Laplacian, and continues to a theory of trace formulas. The fundamental means thus readied are subsequently mustered up for the guest to find an explicit formula for the fourth power moment of the zeta-values. Then the zeta-function emerges as a magnificent peak embracing infinitely many gems called automorphic  $L$ -functions representing the spectrum." Some experience with integrals involving transcendental functions will help the reader, and as the author says "ample knowledge" of the properties of the zeta-functions is also welcomed. The first three chapters of the book (1. Non-Euclidean harmonic; 2. Trace formulas, and 3. Automorphic  $L$ -functions) are intended as an introduction to the subject. The fourth chapter "An explicit formula" is devoted to the theory of the power moments  $Z_k(g) = 3D \int_{-\infty}^{\infty} |\zeta(1/2 + it)|^{2k} g(t) dt$  where  $g$  is of rapid decay and  $k = 3D1$  and 2. In the fifth chapter "Asymptotics" some quantitative information about the zeta-functions are deduced to the explicit formulae of the previous chapter. Every chapter ends with detailed notes and comments explaining the historical background and showing connections to other results. (šp)

**N.Ja.Vilenkin, A.U.Klimyk: Representation of Lie Groups and Special Functions**, Mathematics and Its Applications, vol.316, Kluwer Academic Publishers, Dordrecht, 1995, xvi+497 pp., GBP 151.50, ISBN 0-792-33210-5

Both authors published a comprehensive three volume treatise with the same title and in the same series over the period 1991-93. A continuation of this series describing recent results is presented here. While reading this book, it is often necessary to have the previous volumes nearby. The subject is the same - a description of many fundamental facts in the theory of various special functions from the point of view of representation theory. This is a very natural and efficient way of systematically explaining various properties of different classes of special functions. A very interesting part of the book discusses in detail the properties of decomposition of the tensor product of two irreducible representation of a compact group into

irreducible parts, and related Clebsch-Gordan and Racah coefficients. A substantial part of the book contains a discussion of various generalizations of hypergeometric functions. The connection of hypergeometric functions on Grassmanians to the Radon transform on  $k$ -dimensional subspaces in  $R^n$  is described at the end of the book. Various recent generalizations of symmetric polynomials and the so called  $h$ -harmonic polynomials (where  $h$  is a suitable function depending on a choice of a Coxeter group  $G$ ) are other topics described in the book. There is an extensive bibliography (450 items) and bibliographic comments. The book includes recent results and will be useful for both mathematicians and physicists interested in the theory of applications of special functions. (jbu)

**J.J.Kinney: Probability. An Introduction with Statistical Applications**, J. Wiley & Sons, Inc., New York, 1997, xiv+513 pp., GBP 21.55, ISBN 0-471-12210-6

This live textbook has some remarkable features that could differentiate it from other introductory courses on probability theory. Though the readers are assumed to have some background in algebra and calculus, computational aspects are relieved by using modern computer algebra system like Mathematica and the readability and the meaning of results are emphasized. Various applications to manufacturing processes, especially to the quality control and quality production appear in the text. Headlines are as follows: Sample spaces and random variables, Discrete random variables and probability distributions, Continuous random variables and probability distributions, Functions of random variables, generating functions and statistical applications, Bivariate probability distributions, Recursions and Markov chains. Topics from statistics, like acceptance sampling, reliability, confidence intervals and hypotheses testing as well as simple linear regression are integrated throughout the book. Each chapter is followed by a summary and exercises and problems at various level of difficulty; the readers with an access to Mathematica computer system will find very useful appendix with commands and hints how to use this system to solve examples and graph the pictures appeared in the text. (zp)

**A.Visintin: Models of Phase Transitions**, Progress in Nonlinear Differential Equations and Their Applications, vol.= 28, Birkhäuser, Boston, 1996, vii+322 pp., DM 138.00, ISBN 3-764-33768-0, ISBN 0-817-63768-0

The volume presents mathematical analysis of various macroscopic, mesoscopic, and two-scale models of phase transitions based on nonlinear partial differential equations and inequalities. Starting from a (possibly degenerate) parabolic inclu-

sion  $\partial\alpha(u)/\partial t - \Delta u \ni f$ , a doubly nonlinear parabolic problems of the type  $\partial\alpha(u)/\partial t - \operatorname{div}\gamma(\nabla u) \ni f$ ,  $\alpha(\partial u/\partial t) - \operatorname{div}\gamma(\nabla u) \ni f$ , or even more general ones, are investigated. The book continues with the classical Stefan problem and its generalizations considering undercooling or superheating, with Muskat and Hele-Shaw problems, a phase-field model, nucleation and growth, mean curvature flow, Stefan-Gibbs-Thomson problem, micromagnetics, etc. The main ingredients are both mathematical (Sobolev spaces, weak solutions, monotonicity method and its generalizations) and physical (continuum mechanics, equilibrium and non-equilibrium thermodynamics). Basic mathematical tools are summarized in appendices, which makes the book self-contained in this respect. This clearly written monograph will be found useful by applied mathematicians, both experts and advanced students, and mathematically oriented physicists and engineers working in continuum mechanics and thermodynamics. (trou)

**B.Fine, G.Rosenberger: The Fundamental Theorem of Algebra**, Undergraduate Texts in Mathematics, Springer-Verlag, Berlin, 1997, xi+208 pp., DM 59.00, ISBN 0-387-94657-8

As explained in preface, the book is based on two courses delivered to the upper level undergraduates in US and to a class of potential (gymnasium  $\approx$  high school) teachers. It contains a description of six proofs of the theorem (calculus of functions of two variables, complex function theory, algebra and topology form the background for it) in nine chapters and other five (two based on complex function theory and three topological proofs) are described in Appendices; also the first of four Gauss' proofs is included. The book brings a good portion of a non-trivial mathematics ranging from Cauchy-Goursat theorem to Galois theory and Brower fixed point theorem, of course more in a form of account and sometimes even in very simplified version. Inaccuracies in standard terminology: (*region* is any subset of  $C$ , *domain* is a connected open region where connected means arcwise-connected versus compact domain and continuity in a region (pp. 36-7), definition (5.1.1) (p. 53), Morera's theorem (p. 71) to name a few) and seldom used "proofs" can assure prospective teachers that mathematics could be also a vague talk about it. This is illustrated by a "proof" of the Cauchy integral formula (p. 66). A version of Cauchy theorem for Star (=  $3D$  starlike) domains is presented in one of Appendices but it barely corrects the overall view. The choice of the central theme is rewarding and the book in hands of an experienced teacher will do a good job but for a beginner could do a disservice. (jve)

**F.Smithies: Cauchy and the Creation of Complex Function Theory**, Cambridge University Press, Cambridge, 1997, 216 pp., GBP 35.00, ISBN 0-521-

59278-X

A nicely written book which brings more detailed information and sometimes corrections to a part of the history of holomorphic (analytic) function theory like the one presented by Markushevich. The book closes the activity in research of Cauchy's works performed by the author during past 20 years. More than 140 references (45 to Cauchy's works) show the care which was given to the book and make it a unique source not only for the historians of mathematics but to all who are fascinated by the beauty of the complex function theory. The author does not omit the description of the blind paths and hence helps to the reader really understand its development. Analysis of the Cauchy's activity in this field in the period 1814 - 1831 and his way to some versions of statements nowadays called Cauchy-Goursat theorem and theorem on residues. (jve)

**L.A.Kime, J.Clark: Explorations in College Algebra. Preliminary Edition,** J.Wiley & Sons, Inc., New York, 1997, xv+694 pp., GBP 16.99, ISBN 0-471-10699-2

This book represents a new approach to the teaching and learning of the college algebra (in fact, it is meant to be a course on this subject). A simple enumeration of the topics covered by the text could be misleading (linear and quadratic functions, exponential functions, logarithms, polynomials, ...). Some quotations from the first pages of the book will quickly correct such judgements: "... This book has been developed by a consortium of schools ... The course materials have now been tested in fifteen different schools ... The text has been developed and refined over the last three years by *experts from many different disciplines.*" Teachers and their pupils can find interesting problems "... that require you to reason critically ...". Some examples: *How to find models to describe data* (e.g. the relationship between the life expectancy and per capita gross domestic product (p. 83) where one uses the data from 114 different countries (see the table on pages 510-512)), *estimating linear models for data, deep time and deep space* (e.g. Hubble's Law holds true across the known universe, p. 312), *modeling epidemics: an iterative approach to exponential functions* (e.g. "... Is this a realistic model? Can a disease spread this fast? The bubonic plague ... called the black death ... killed about 14% of the population of London ... We still have concerns about epidemics today, like the AIDS and Ebola virus ..."). At the end of the book one can find *Anthology of Readings* (a sample: Two articles "A Fragmented War on Cancer" and "Promote Cancer Treatment, Not Cancer Phobia" from the New York Times (May 29, 1996). These articles are related to Exercise 27 (p. 48): What questions are raised [in the first article] about the claim that we are on

the verge of a cancer epidemic?... ) and also some valuable indications concerning the corresponding *software* (e.g. Power Functions on the TI-82 or TI-83: Graphing Calculator Techniques for Chapter 9). There are some minor points in the book which one could criticise: The letters in the figures on pages 554 and 555 are too small to be clearly legible and "taking the square root of  $4a^2$ " (p. 461) might deserve some explanation. The reader will find many refreshing and non-traditional moments in the book (like the title Algebra Aerobics (used many times) or exercises like "Read the chapter entitled "The Cosmic Calendar" from Carl Sagan's book *The Dragons of Eden* (p. 317)). The "Explorations in College Algebra" are written very well, contain an unbelievable quantity of problems and ideas from the *real* world and I would like to emphasize that they are written with a visible love for the subject. And also with a good taste: "Mathematics is a filter, a way of looking at the world. Just as musical training increases your awareness of sounds, or knowledge of history gives a deeper perspective on the present, mathematics heightens your perception of underlying order and systematic patterns in numerical information." (p. xi). I think that you would also sign these words and I am nearly sure that you would surely accept such a course of college algebra for your own children. (lbe)

**A.J.Chorin: Vorticity and Turbulence,** Applied Mathematical Sciences, vol.103, Springer-Verlag, New York, 1994, 174 pp., 45 fig., DM 76.00, ISBN 0-387-94197-5, ISBN 3-540-94197-5

This is an interesting textbook on the mathematical theory of turbulence, reflecting both classical Kolmogorov theory and its revision based on the author's original contributions. The book starts with the equations of incompressible fluid mechanics, and representation formulas for the energy and velocity in terms of vorticity, while Chapter 2 provides an introduction to probability and random flows. After introducing the appropriate tools, a discussion of the Kolmogorov qualitative theory is presented. This theory can capture basic properties of fully developed turbulence, but there are many detailed properties of turbulent flows due to intermittency that are inconsistent with Kolmogorov's theory. The remaining chapters are devoted to the vortex dynamics of turbulence with the aim to building a theory consistent both with the Kolmogorov prediction and with intermittency. Chapter 4 concentrates on two dimensional case (serving here more as an illustrative example of an application of statistical theory in fluid mechanics), while the three-dimensional vortex motions are studied in the following chapter; the main difference comes from vortex stretching, and non-conservation of



vorticity and entropy. In Chapter 6, further tools of statistical mechanics of polymers, percolation, real-space renormalization, and self-avoiding random walks are introduced to be deployed in the analysis of vortex equilibria in three dimensions. This analysis is presented in the last chapter where the connection with Kolmogorov theory is explained. (joma)

**S.Gong: Integrals of Cauchy Type on the Ball. Volume I**, International Press, Cambridge, 1993, iii+304 pp., ISBN 1-571-46005-5

Various types of kernels (Cauchy-Fantappiè, Cauchy-Szegö), the corresponding singular integrals and singular integral equations have been extensively studied in the theory of several complex variables during last decades. Due to historical circumstances, the study of these problems in China was developed in sixties and seventies independently, without a close contact with the rest of world. This book collects results obtained there during that period; they have a minimal overlap with other results. Two chapters of the book are devoted to the study of certain systems of singular integral equations, an attempt to generalise Hadamard's 'parties finies'. The subsequent two chapters contain study of the Cauchy-Szegö integral on certain Cartan domains of a higher rank; kernels considered here have higher dimensional singularities. The book contains interesting new results. (vs)

**P.Arabie, L.J.Hubert, D.De Soete (Eds.): Clustering and Classification**, World Scientific, Singapore, 1996, ix+490 pp., GBP 44.00, ISBN 9-810-21354-9, ISBN 9-810-21287-9

This book is a collection of ten papers on cluster analysis, problems of classification and multidimensional scaling. The papers included in the volume are written by outstanding contributors to the field; they are organized in such a way that they provide a compendious scholarly review of it. The volume begins with an introduction (J.A.Hartigan) explaining its scope and organization. The following four chapters are devoted to combinatorial data analysis (P.Arabie, L.J.Hubert), hierarchical classifications (A.D.Gordon), theory and methods of a hierarchical classes model with some applications (S.Rosenberg, I. van Rosenberg, P. de Boecke) and tree models for proximity data (G. de Soete, J.D.Carrol). The next chapter brings an analysis of computational aspects of the application of different algorithms. Then there is a chapter on neural networks for clustering (F.Murtagh), an alternative approach to the problem. Two chapters that follow treat the development and advances of clustering and classification methods in two countries: Japan (Akinori Akada) and Russia (B.G.Mirkein, J.Muchnik). The penultimate chapter is devoted to clustering validation by simulation (G.W.Milligan). The volume ends

by a chapter on probabilistic and statistical aspects of cluster analysis (H.-H.Bock). There is a wealth of bibliographical data, more than 1500 papers or books quoted. The book is just what it was intended for: a thorough survey of up to date state of art of classification and clustering. (jmac)

**B.Kutzler: Improving Mathematics Teaching with DERIVE. A Guide for Teachers**, Chartwell-Bratt, Bromley, 1996, 185 pp., sFr 14.50, ISBN 0-862-38422-2

This book, a subtitle of which is "A Guide for Teachers", is an introduction to using the computer algebra system DERIVE for teaching mathematics. The text consists of several parts. In one of them the author explains how DERIVE can be used for teaching mathematics alongside traditional curricula. In other one he thinks about future and develops a new concept of teaching mathematics, in which a computer algebra system plays an important rôle. Besides these more theoretical parts the book contains a chapter, in which the author shows practically how it is possible to use DERIVE for teaching of several topics of mathematics. There is an interesting and useful chapter Tips and Tricks too. No a priori knowledge of DERIVE is required because the first chapter is devoted to an introduction to this computer algebra system. At the end of the book we can also find a chapter which provides a look "inside" computer algebra systems. The book is very nicely written and recommended to every mathematics teacher. (ml)

**T.O.Moore, E.H.Hadlock: Complex Analysis**, Series in Pure Mathematics, vol.9, World Scientific, Singapore, 1991, x+391 pp., GBP 23.00, ISBN 9-810-20246-6, ISBN 9-810-20247-4

As explained in the preface the text was written to serve both undergraduate and graduate students in engineering, physics, and mathematics. The style of Definition — Theorem — Proof is used and proofs are carefully presented in details. The content of the book is more or less standard and includes also approx. 100 pages on conformal mapping and the Riemann Mapping Theorem. Harmonic functions are treated in about 40 pages. The style is clear, the authors try to choose the most economical path to arrive at results, providing readers with all details which must be omitted when the allocated time for the course is not sufficient. A lot of examples are solved in the text; a good number of exercises presented in the text will help students to apply the material explained. Weak points of the book are those parts where the dependence on the intuition is too high (e.g. a counter clock oriented contour is the one for which its interior remains on the left while the parameter varies from  $a$  to  $b$ ); the winding number (index) should be defined more precisely. A mixed approach to treatment of curves

(a subset  $K$  of  $\mathbf{C}$  is a simple closed (Jordan) curve iff there is a parametrization  $f : [a, b] \rightarrow K$  which is continuous, one-to-one on  $[a, b)$  and  $f(a) = 3Df(b)$ ) sometimes introduces unnecessary complication in the exposition. Nevertheless, it is a good *multi-purpose* book on complex analysis to have in the library. For a course with higher aspirations, this book must be supplemented by additional material which can be found elsewhere. (jve)

**L.C.G.Rogers, D.Talay (Eds.): Numerical Methods in Finance**, Publications of the Newton Institute, Cambridge University Press, Cambridge, 1997, x+326 pp., GBP 35.00, ISBN 0-521-57354-8

This book contains 16 papers written by specialists in financial mathematics, probability theory, and numerical analysis. The papers are based on lectures given at the session 'Numerical Methods in Finance' at the Isaac Newton Institute in 1995. The reader should have a basic knowledge of the theory of stochastic processes and finance. The reader approaching the book from the numerical point of view will find numerical solutions to both partial differential equations (PDE's) and stochastic differential equations (SDE's) usually used in finance; that is, finite difference methods, viscosity solutions of PDE's, Monte Carlo methods, lattice methods, etc. Most of the papers present a large variety of numerical methods used for the computation of option prices (European, lookback, Asian (also called option on the average) and, especially, American) with various modifications (with or without continuous dividends, with constant or stochastic volatility etc.) and numerical solutions to portfolio management strategies. Three papers are devoted to backward SDE's, their applications in finance, and numerical solutions to them. The reader will also find statistical procedures, identification of models or simulation of the market in other papers. The articles cover both mathematical matters and practical issues in numerical problems. Thus the book can be strongly recommended to economists, probabilists, and applied mathematicians working in finance. (mk)

**Jian-Ke Lu: Boundary Value Problems for Analytic Functions**, Series in Pure Mathematics, vol.16, World Scientific, Singapore, 1993, xiii+466 pp., GBP 54.00, ISBN 9-810-21020-5

This book is the English version of the original book which was published in Chinese, Shanghai, 1987. Theory of boundary problems for analytic functions and the related theory of singular integral equations belong to important branches of complex analysis and have many applications in mechanics, physics and engineering (fracture problems). The famous monographs of Muskhelishvili and Gakhov have collected results of the Georgian and Russian

school up to the 70's. The book under review presents contributions of the Chinese school, based on articles published mostly in Chinese language up to 1990. The book can easily be used (and was used) in one-year course for seniors or graduate students, it covers the main parts of the theory: Cauchy-type integrals, Hölder spaces, Plemelj formulas, singular integral equations for closed contours, Riemann, Hilbert and mixed boundary problems, periodic, doubly periodic and quasi-periodic problems, boundary value problems for systems of functions and systems of singular integral equations, and boundary problems with shift. The mathematics underlying the presentation is classical. Small part of the book is devoted to numerical approximations of singular kernels and to the weighted quadrature formulas for Cauchy-type integrals and it is only the first step to the numerical solution of boundary problems. (zv)

**E.B.Saff, V.Totik: Logarithmic Potentials with External Fields**, Grundlehren der mathematischen Wissenschaften, vol.316, Springer-Verlag, Berlin, 1997, xv+505 pp., 18 fig., DM 158.00, ISBN 3-540-57078-0

The book studies the extension of classical logarithmic potential theory to the case when there is a weight (external field) present. The book is a self-contained introduction to the "weighted" potential theory as well as to its numerous applications. As a by-product the classical theory of logarithmic potential is fully developed. The external field problem has its origin in the work of C.F. Gauss, and is sometimes referred to as the Gauss variational problem. The book presents a comprehensive treatment of the Gauss variational problem in the plane. The review of properties of harmonic functions is contained in the Chapter 0. Chapter I on weighted potentials presents a detailed treatment of Frostman type for the existence and uniqueness of the extremal measure (including the weight function on an unbounded set, the energy problem, the minimum principle, the Dirichlet problem, the extremal measure, the equilibrium potential, the fine topology and the continuity of equilibrium potentials, the weighted capacity). Chapter II on recovery of measures, Green functions and balayage includes the problem of recovering a measure from its potential, the unicity theorem, the Riesz decomposition theorem and the principle of domination, Green's functions and the balayage measures, and Green's potential. Motivations and detailed proofs for many of the basic results from potential theory are provided. Chapter III on weighted polynomials presents weighted Fekete points and weighted Chebychev polynomials. Chapter IV on determination of the extremal measure uses the random matrix techniques (some

problems from physics included). Chapter V uses the extremal point method for solving some problems (Dirichlet problem, determination of Green's function and conformal maps). Chapter VI deals with weights on the real line (with different weights). Chapter VII contains some applications concerning orthogonal polynomials. The last Chapter VIII is about signed measures. Appendix A contains studies of the Dirichlet problem and harmonic measures (regularity, Poisson formula). Appendix B deals with weighted approximation in the multidimensional case (extending the external field to the pluripotential setting). All chapters are provided with clear notes and historical references to help reader to trace the development of the field. The book is very well written and can be recommended to anyone interested in logarithmic potentials with external fields. (pp)

**M.Machover: Set Theory, Logic and their Limitations**, Cambridge University Press, Cambridge, 1996, ix+288 pp., GBP 14.95, ISBN 0-521-47493-0, ISBN 0-521-47998-3

This book arose from two of the author's courses on the subject for undergraduate students of philosophy and students of mathematics interested in philosophy. Hence the book can be understood as a general introduction. But being written by an excellent mathematician, there are no misunderstandings or omissions of justifications of assertions which are common in many popular books. After a short discussion concerning mathematical induction, a course of axiomatic theory is developed. Then the course of mathematical logic with the standard contents (propositional calculus, first order logic, recursion theory and limitative/Gödel's/ results) is presented. I very much like the way the author explains things, especially the description of recursion using the intuitive concept of computability followed by exact description using Matiyasvič theorem ( $n$ -ary domain /or natural numbers/ is recursively enumerable iff it is the projection / $m$ -ary domain/ of an  $n + m$ -ary relation described by the equality of two polynomials) seem to me to be very efficient for the mentioned type of students. (kč)

**L.M.Batten: Combinatorics of Finite Geometries. Second Edition**, Cambridge University Press, Cambridge, 1997, xiv+193 pp., GBP 16.95, ISBN 0-521-59014-0, ISBN 0-521-59993-8

This is a second edition of an introductory text on the combinatorial theory of finite geometries. This second edition contains completely new chapter on the so called blocking sets in linear spaces with indications of their application in game theory, testing of statistical sampling of surveys and cryptography. The reading of the book requires only a basic experience with set theory and linear

algebra, and a sound geometrical imagination. The exposition of the book turns around the notion of the so called connection number in a near-linear space (or partial plane in M.Hall's terminology). Thus in the first chapters the combinatorial theory of finite geometries is built up, based on finite sets of points and lines. Then the basic theory of affine and projective spaces is developed. The second half of the book is devoted to structures which have been introduced in the recent past. The heading of the chapters here are Polar spaces, Generalized quadrangles, Partial geometries, and the final chapter Blocking sets, as already indicated. Every chapter is accompanied by up to fifty examples which either can serve to consolidation of the reader knowledge, or contains additional related material. The book is written in a very lively and readable style, and must be recommended as the first reading for everybody interested in this area of combinatorics and geometry. (šp)

**A.S.Fokas, I.M.Gelfand (Eds.): Algebraic Aspects of Integrable Systems. In Memory of Irene Dorfman**, Progress in Nonlinear Differential Equations and Their Applications, vol.26, Birkhäuser, Boston, 1996, viii+350 pp., DM 168.00, ISBN 3-764-33835-0, ISBN 0-817-63835-0

This is a collection of papers on various problems in the theory of integrable systems. The majority of contributions deal with algebraic problems connected with such systems. Among topics discussed are multi-Hamiltonian structures, the Sato's method of  $\tau$ -function for matrix hierarchies, WDVV system of the associativity equations, the correspondence between classical modular forms and  $\Psi$ -functions, billiard solutions on Riemannian manifolds, master symmetries, discrete integrable systems, asymptotic integrability, invariance under Laplace-Darboux-type transformations, nonultralocal Poisson brackets, trace formulas and canonical 1-forms. Most of these contributions are related to work of Irene Dorfman who died recently. The whole volume is dedicated to her. (jbu)

**H.-M.Krolzig: Markov-Switching Vector Autoregressions. Modelling, Statistical Inference, and Application to Business Cycle Analysis**, Lecture Notes in Economics and Mathematical Systems, vol.454, Springer-Verlag, Berlin, 1997, xiv+357 pp., 49 fig., DM 106.00, ISBN 3-540-63073-2

Univariate autoregression and vector autoregression (VAR) models are standard tools in time series analysis. A new class of models is based on the assumption that the parameters of the model depend on an unobservable regime variable. In Markov-switching (MS) models the regime is generated by a discrete-state homogeneous Markov chain. The book is a revised version of author's dissertation. It contains a description of MS-VAR

model, its state-space representation, methods for forecasting, filtering, and smoothing, maximum-likelihood estimation, procedures for model selection and model checking, and other topics. The author presents results of application of MS models to the German, global, and international business cycles. The last part of the book is devoted to cointegration analysis of VAR models with Markovian shifts in regime. Univariate MS models were analyzed in several papers and monographs. The reviewed book provides a systematic approach to the modelling of dynamic systems based on vector MS models, from which solutions for special problems are derived. (ja)

**M.Hazewinkel (Ed.): Handbook of Algebra. Volume 1**, North-Holland, Amsterdam, 1996, xix+915 pp., \$ 187.50, ISBN 0-444-82212-7

The first volume of the intended multi-volume Handbook consists of 8 more or less randomly chosen Sections (Linear Algebra; Linear (In)dependence; Fields, Galois Theory and Algebraic Number Theory; Generalizations of Fields and Related Objects; Category Theory; Homological Algebra, Cohomology, Cohomological Methods in Algebra, Homotopical Algebra; Commutative Rings and Algebras; Associative Rings and Algebras) and of 24 Articles (Van der Waerden conjecture and applications; Random matrices; Matrix equations, Factorization of matrix polynomials; Matrix functions; Matroids; Higher derivation Galois theory of inseparable field extensions; Complete discrete valuation fields, Abelian local class field theories; Infinite Galois theory; Finite fields and their applications; Global class field theory; Finite fields and error correcting codes; Semi-rings and semi-fields; Near-rings and near-fields; Topos Theory; Categorical structures; The cohomology of groups; Relative homological algebra, Cohomology of categories, posets and coalgebras; Homotopy and homotopical algebra; Derived categories and their uses; Ideals and modules; Polynomial and power series rings, Free algebras, firs and semifirs; Simple, prime and semi-prime rings; Algebraic microlocalization and modules with regular singularities over filtered rings; Frobenius rings). This means that the articles are published as they arrive from the authors. In some cases, the level is almost undergraduate, but basically a graduate-level background is needed. To understand well the topics covered, a reader is assumed to be acquainted with the material of an opulent textbook of Algebra. The Handbook will certainly provide professional mathematicians with sufficient information on the particular parts of Algebra contained in the first Volume (and hopefully in the other ones to come). Unfortunately, only a few topics from the Subsections mentioned above are

followed by a satisfactory list of references. (tk)

**D.Acheson: From Calculus to Chaos. An Introduction to Dynamics**, Oxford University Press, Oxford, 1997, ix+269 pp., GBP 25.00, ISBN 0-198-50077-7, ISBN 0-198-50257-5

The book is intended as an introduction to elementary calculus built on applications of the classical calculus. Using carefully selected examples, from the time of Newton to the present day, the author demonstrates in a highly readable form what we usually call the mathematization of physical problems. These are mainly of the dynamical nature as the title and subtitle indicate. This selection simultaneously opens the door for computer orientated readers to start their own experimentation with modelling of real processes. The first two chapters recapitulate some basic results from the elementary calculus and its application to particle motion. The third chapter is devoted to the first and second order linear and nonlinear differential equations. The simple methods for their solution are demonstrated, among others, on an epidemic model or harmonic oscillators. The fourth chapter centres on the Newton method for solution of differential equations. However, the reader finds here an improvement towards Runge-Kutta method. In the fifth chapter the reader encounters various forms of pendulum, oscillations and the notion of the linearization. The sixth chapter is devoted to the planetary motion and the two and three-body problem. The reader is introduced to the partial differential equations through waves and diffusions in the seventh chapter. The following chapter "The best of all possible worlds" revolves around the calculus of variations. In the chapter "Fluid flow" fundamentals of the theory of viscous flow are developed. The chapter "Instability and catastrophe" is based on the previous one with the linear stability theory and bifurcations. The eleventh chapter "Nonlinear oscillations and chaos" demonstrates the *sensitivity to initial conditions*. The reader finds here among others, the van der Pol and the forced Duffing equation, or description of the Poincaré-Bendixon theorem. The last chapter is devoted to some wider aspects of the pendulum motion. It includes the author's own research on the inverted pendulum. The book ends with recommendations for further reading, with Appendix A on elementary programming in QBasic. Appendix B contains listings of ten programs related to themes dealt with in this book. The industrious reader will find answers to the exercises following each chapter at the end of the book. (sp)

**W.Neutsch: Coordinates**, Walter de Gruyter, Berlin, 1996, xiii+1365 pp., DM 398.00, ISBN 3-110-14852-8

The main purpose of this huge book (more than 1300 pages) is to offer a comprehensive description of the most useful and practical coordinate systems in low dimensions. The theoretical description and the corresponding tables form the last two parts of the book. For each set of coordinates, the reader can find in the tables key information (singularities, coordinate surfaces, volume element, metric tensor, Christoffel symbols) and formulae for the most important operators (gradient, divergence and the Laplace operator). The first six parts of the book contain a summary of mathematics needed in the later theoretical description and in some practical applications to problems of efficient numerical integration on spheres. The largest

part (more than 500 pages) contains a systematic review of differential, Riemannian and projective geometry and complex analysis; various descriptions of the group of rotations by means of quaternions, octonions, or more generally Clifford algebras; and a description of the theory of Coxeter and Weyl groups. The chapter on lattices contains a discussion of elliptic functions and modular forms, theta functions, lattices and linear codes, and the chapter on spheres describes harmonic and spherical functions and presents two special numerical integration methods. The whole book is clearly meant for practical use and should be of value mainly to engineers, physicists and applied mathematicians. (jbu)

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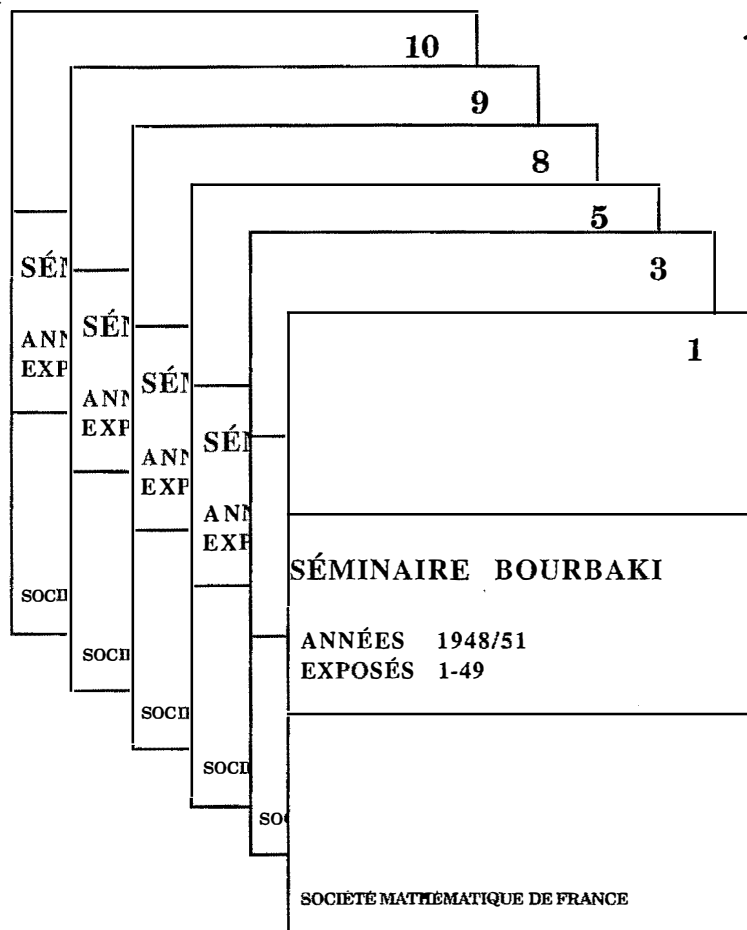
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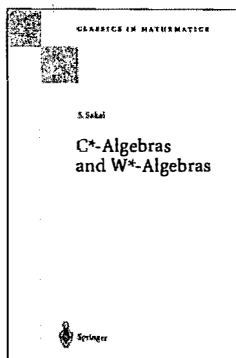
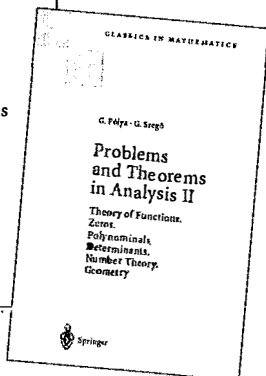
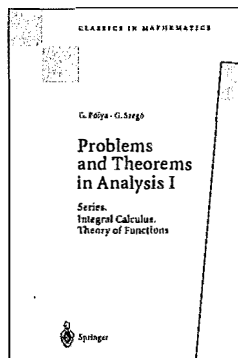
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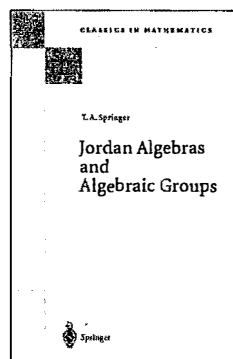
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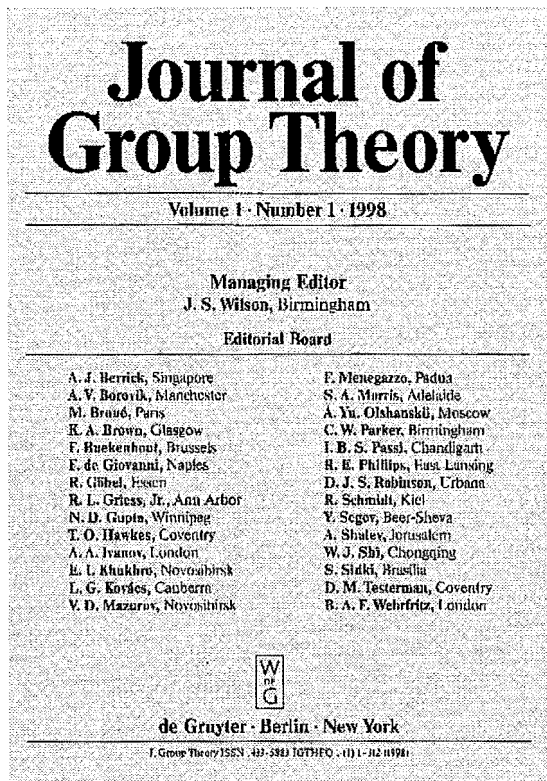
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