EUROPEAN MATHEMATICAL SOCIETY

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NOTICE FOR MATHEMATICAL SOCIETIES

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

INSTITUTIONAL SUBSCRIPTIONS FOR THE EMS NEWSLETTER

Institutes and libraries can order the EMS Newsletter by mail from the EMS Secretariat, Department of Mathematics, P. O. Box 4, FI-00014 University of Helsinki, Finland, or by e-mail: Please include the name and full address (with postal code), telephone and fax number (with country code) and e-mail address. The annual subscription fee (including mailing) is 60 euros; an invoice will be sent with a sample copy of the Newsletter.

EMS News: Committee and Agenda

EMS Agenda
1999

30 September
Deadline for submission of proposals for the *2001 EMS Summer Schools*
contact: David Brannan, *e-mail: d.a.brannan@open.ac.uk*

9 - 10 October
Executive Committee Meeting, hosted by the Swiss Mathematical Society and ETH, Zurich (Switzerland)

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

December
Second announcement of the *Third European Congress of Mathematics (3ecm)*, Barcelona (Spain)
contact: S. Xambó-Descamps, *e-mail: sxd@grec.upc.es*
website: www.iec.es/3ecm/

3 - 4 December
Fourth Diderot Mathematical Forum, on *Mathematics and Music*, in Lisbon (Portugal), Paris (France) and Vienna (Austria)
contact: Mireille Chaleyat-Maurel, *e-mail: mcm@ccr.jussieu.fr*

2000

31 January
Nominations to the Secretariat for delegates of individual members (details to appear in the December *Newsletter*)
contact: EMS Secretariat, *e-mail: makelain@cc.helsinki.fi*

February - March
Voting for delegates of individual members
contact: EMS Secretariat, *e-mail: makelain@cc.helsinki.fi*

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

25 - 26 March
Executive Committee Meeting, hosted by the Polish Mathematical Society and the Institute of Mathematics of the Polish Academy of Sciences, Bedlevo, near Pozñan (Poland)

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

3 – 7 July
ALHAMBRA 2000: a joint mathematical European-Arabic conference in Granada (Spain), promoted by the European Mathematical Society and the Spanish Royal Mathematical Society
contact: Ceferino Ruiz, e-mail: *ruiz@ugr.es*
website: www.ugr.es/~ruiz/

7 – 8 July
Council Meeting in Barcelona (Spain)
contact: EMS Secretariat, *e-mail: makelain@cc.helsinki.fi*

10 – 14 July
Third European Congress of Mathematics (3ecm) in Barcelona (Spain)
contact: S. Xambó-Descamps, *e-mail: sxd@grec.upc.es*
website: www.iec.es/3ecm/

24 July – 3 August
EMS Summer School in Edinburgh (Scotland): *New analytic and geometric methods in inverse problems*
organiser and contact: Erkki Somersalo (Otaniemo, Finland), *e-mail: Erkki.Somersalo@hut.fi*

17 August – 2 September
EMS Summer School at Saint-Flour, Cantal (France): *Probability theory*
organiser and contact: Pierre Bernard (Clermont-Ferrand, France), *e-mail: bernard@ucfma.univ.bpclermont.fr*

Editorial by EMS Vice-President

Andrzej Pelczar (Kraków)

In October 2000 the European Mathematical Society celebrates the tenth anniversary of its creation. Looking back on the past nine years we can try to evaluate the achievements of the EMS, counting its successes, pointing out possible mistakes or unrealised plans while concentrating on projects for the future. Such an anniversary provides a good occasion for a discussion on some problems concerning the general shape of the Society and of its activities, as for instance its role in the preparation of European Congresses of Mathematics and the Diderot Mathematical Forums, the patronage offered to scientific conferences, and so on. Important aspects of the *EMS*'s activity, and more generally of the presence of the Society on the European scientific and cultural platform, concern the use of European financial sources; compare, for instance, Luc Lemaire's Editorial in the June issue (*EMS Newsletter* 32).

It would be practically impossible and superfluous – in view of Rolf Jeltsch's Editorial in the March issue (*EMS Newsletter* 31) – to present here all the forms of *EMS* activity related to research in mathematics and its applications (with all its interdisciplinary aspects), international cooperation of mathematicians and national societies (including, but not restricted to, support for young mathematicians from countries facing financial difficulties) and everything that has been done, according to the general mission of the Society, for the popularisation of mathematics, with special attention to the role of mathematics in the evolution of culture, technology and civilisation. It would also be useless to try to describe all the present and future problems of the Society and the *EMS*'s role in the scientific and cultural life of Europe; such a task would be too ambitious and beyond the author's competence. I will thus limit myself to a few of them, selected in a quite arbitrary and subjective way.

The first group of problems concerns the members of the *EMS*. Everyone knows that the membership is very heterogeneous with its three categories of members. National societies, as corporate founder members, created the Society in M¹dralin (Poland) in October 1990. Expecting a rapid growth in the number of individual members, these societies decided that the *EMS* statutes should be rediscussed, revised and then 'stabilised', in some sense, as soon as the number of individual members became large enough; for details, see the *EMS* statutes. Since the growth in the individual membership has been slower than expected, this decision is still to be implemented; one can say that at that time the process of building up and shaping the Society will be barely completed. Such an

Photo by Stefan Ciechan
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opinion is not based on an official interpretation of the statutes and need not be shared by everyone; on the other hand, it is not totally unacceptable, and is formulated here as 'intellectual provocation' in order to point out that the most important question concerning individual members is: how do we increase their number?

On the quantitative development of the *EMS* we have to think about the possible impact of the growth in the individual membership on the future shape of the Society. The *EMS* can be briefly characterised as a scientific society that is also concerned with the popularisation of mathematics as well as its applications and (at least implicitly) with the teaching of mathematics, stressing to the public the role played by mathematics in science, culture, technology and civilisation in general. It is natural that these tasks and goals were first realised by researchers and teachers in higher education institutions; at present the individual members come almost exclusively from these categories. However, since the membership of several national mathematical societies (corporate members of the *EMS*) also includes schoolteachers and other mathematical 'alumni' not working as scientists or academics, we must expect that some of them will become future members of the *EMS* – we should welcome them warmly. In the long run this should change the future image of the Society. I think that the main impact would be a stronger interest by the *EMS* in the teaching of mathematics (at all levels, including elementary and secondary). Even now the Society should extend its interest in mathematical education in the 'European dimension', especially with respect to a general reform of educational systems (including fundamental reforms in mathematics teaching) in several Central and Eastern European countries, in order to be aware of what has already been done and what we can expect in that area in the near future.

Returning to the question of membership, let me add a historical remark about the Polish Mathematical Society. During its foundation meeting in Kraków in April 1919 (see the Societies section in the June issue), two founder members, Stanis³aw Zaremba and Stefan Banach, decided after discussion that the Society should have a purely scientific character; all suggestions proposing the popularisation of mathematics and other not strictly scientific activities were officially rejected. Eventually, after some decades, the Society changed its identity and became an association that included in its mission the popularisation of mathematics and (later) the teaching of mathematics. The membership rules now allow schoolteachers to be members of the Polish Mathematical Society.

The above remarks are of minor importance with respect to membership of the *EMS*, but they raise a more important problem, that of understanding the word *mathematician*. This seems to be important for numerous reasons; let me mention only one – statistical data indicating the numbers of mathematicians in European countries. In Poland we have two so-called 'professional titles', *licencjat* and *magister*, equivalent to a B.Sc. and an M.Sc. in English or American terminology. *Licencjat* is purely a 'professional' title, while *magister* is the first step in an academic career: everyone wishing to get a Ph.D. must have the 'title' *magister*. In official (administrative) terminology everybody who gets the professional title of *licencjat* in mathematics (or, of course, the higher one: *magister*) is counted in the statistical data as a mathematician. In all databases concerning higher education only mathematicians with an M.Sc. are counted as members of staff of a higher education institution. It is probable that future databases for higher education will indicate only those members of academic staff with a Ph.D. Thus, in the future, from a 'statistical point of view', mathematicians in higher education institutions in Poland will all be doctors in mathematics. (I think that the terminology varies from country to country.)

It would be very useful to obtain more precise terminology on a European scale. It would be valuable in particular to continue the extremely interesting panel discussion on 'Demography of mathematicians' at the Second European Congress of Mathematics (Budapest, 1996). Maybe the *EMS* should suggest something along those lines to stimulate some clarification. The first step would be to compare the terminology in various countries.

The next question I regard as important since it touches on one form of activity that makes the Society visible. Among several interesting problems discussed by mem-

bers of the *EMS* Council at the Budapest meeting, one concerned a fundamental question: is the organisation of large and 'non-specialised' conferences, such as International Congresses of Mathematicians or the European Congresses of Mathematics, really reasonable and fruitful? A 'weaker' version of this problem questioned the need to organise European Congresses in view of the fact that an ICM is organised every four years – or (almost equivalently) the need to organise great and expensive international meetings every two years. The arguments (presented here in simplified form) were of two kinds:

(1) real scientific gain is now obtained mostly by participating in specialised conferences on specific topics, rather than in 'everything-touching' big conferences;
(2) great meetings (congresses) are expensive, and the ratio of scientific gain to cost seems to be too small.

Radical options presented during this discussion (and repeated a few times since then) described huge congresses as 'relics of the past'. Such radical opinions were (and are) not shared by many mathematicians, but they should be noted.

Presenting the opposite point of view, we notice that there is a growing trend towards specialisation and a tendency to organise specialised conferences and so-called workshops, and it is thus reasonable and necessary to bring together mathematicians working in distinct areas of mathematics and give them opportunities to exchange ideas and enable interdisciplinary discussions. It is also important to build interpersonal relations, so that mathematicians can meet each other as friends and not only as scientific partners.

There are other important, and probably deeper, reasons that make large and regular congresses very fruitful. Each such congress summarises (in some sense) what has been achieved in mathematics during the last few years and identifies the most important results obtained since the preceding congress. This is realised by the prestigious prizes awarded to the authors of the most spectacular achievements and by the selection of the invited talks. Lists of invited lectures (both plenary and sectional) indicate the most important fields – not necessarily those with the most important and spectacular results! Thus, the major international and prestigious congresses both summarise the past and stimulate the future, at least until the next congress.

Accepting the above arguments, one might say that the International Congresses of Mathematicians are sufficient and that the European Congresses should be abolished. However, analysing the results and opinions from the first two European Congresses, we can see that they were well placed between the ICMs, and that their format ensures that the above aspirations are realised and help to motivate the next congress. We also note that the European Congresses do not duplicate the ICMs; in particular, the European Congresses present prizes to young mathematicians, and there are round table discussions on special topics. We note finally that progress in mathematics, and the growth in numbers of researchers and mathematical scientific centres – 'density in the time scale' of mathematically important events – make it reasonable to organise large and prestigious congresses independently of the ICMs. European Congresses play a proper role in that respect. We add that the acceptance of the idea of the European Congresses has been emphasised in spectacular form by the strong competition for permission to organise the Third European Congress of Mathematics; Barcelona was the winner of that competition. I am sure that the Third Congress will be fully successful and will dismiss all doubts concerning the organisation of European Congresses.

Fourth Diderot Mathematical Forum

Mathematics and Music

L. Mazliak (Paris)

On 3-4 December 1999 the Fourth Diderot Mathematical Forum, on *Mathematics and Music*, will be held in Lisbon, Paris and Vienna. As for all events in this series, each city has selected a specific subtheme on which the meeting will focus. These subthemes are:
Lisbon: A historical study of the connection between the two domains;
Paris: The problems around the formal systems for composition in the 20th century;
Vienna: The mathematics of sound.
A round table between the three sites is scheduled for Friday afternoon on the theme: *Is the link between mathematics and music a cultural or a natural one?* Details of the programmes and local arrangements can be found on the web site: *www.emis.de*, with links to other sites.

The connections between mathematics and music are among the classical themes studied by philosophers. One of the main sources for this interest can be found in the Pythagorean system that connects with elementary arithmetic the fundamental components of sounds (such as those emitted by a vibrating string) and all parts of the universe such as planets and stars. For centuries this vision of the world, inherited from the ancient Greeks, was spread by the Church-dominated Western scientific culture. It had the great advantage of providing a unified system of the World, ruled by simple laws that could be regarded as a proof of God's rationality; all the teaching of medieval Christian science could be summarised as 'Reason is God's part in Man'. With the help of reasoning, Man could tear the hidden order of Creation from the appearing chaos of the world.

On the beautiful allegorical rose of Laon cathedral in the north of France, the artists of the Middle Ages have represented theology surrounded by its court: arithmetic, geometry and music are members of it. However, early in history (even in Greek times), serious fractures began to appear in a system that was too perfect and too rigid: slowly, but inevitably, mathematics and music have followed separate ways. However, the weight of the cultural heritage was so great that its effects were still present many centuries after musicians had ceased to have a strong connection with pure science. It is impressive that great scientists, such as Kepler, Euler and Lagrange, have been interested in music at a scientific level and have looked for formal systems.

Attempts to find unified scientific explanations for music in the 19th century quickly miscarried: some of them were clever, but most were quite wretched, as described in Fichet's 'Musical theories of music in the XIXth and XXth centuries'. In a sense, the twelve-tone system of Schönberg and the Vienna school may be seen as another attempt to obtain a unified system; when reading Webern's cycle of conferences in 1932 (Path to the new music), it is surprising how much energy the author spends in 'proving' (through a careful choice of examples!) that the twelve-tone system embodies all the previous music.

The attempt was doomed to failure. However, the twelve-tone system marked a real turn in modern music: as an 'official' ending of tonality, it opened the door to the idea that composers were free to choose their own compositional systems. And here, mathematics returned to offer a platform on which artists may base their personal language. Also, new importance was given to the mathematical study of the particular physical phenomenon we call 'musical sound', in order to obtain a better understanding of it and to develop new technology (such as new instruments) that can be used as a resource for composers.

At the turn of the 21st century, the Diderot Forum can be seen as an attempt to take stock of the millenial history of the lively connections between the two domains.

Introducing the Editorial Team : part 1

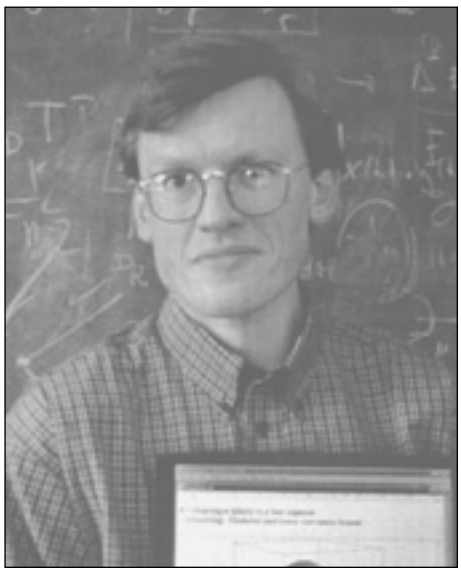
Robin Wilson *(Editor-in-Chief)* is a Senior Lecturer in Mathematics at the Open University, UK, where he has been since 1972. He is also a Fellow of Keble College, Oxford University, and a frequent Visiting Professor at Colorado College, USA. He received his Ph.D. from the University of Pennsylvania in 1968 for a thesis in number theory.

His mathematical interests lie mainly in graph theory and the history of mathematics. In the former he has been particularly involved with graph colourings and in the latter his concerns are mainly British mathematics, particularly of the late 19th and early 20th centuries, and the history of combinatorics. He has written and edited over twenty books in these areas, and won the Mathematical Association of America's Lester Ford award for outstanding expository writing. He has served on the British Combinatorial Committee and the committee of the British Society for the History of Mathematics.

He is actively involved with the popularisation of mathematics and enjoys lecturing to school and college students and to adults interested in mathematics.

Krzysztof Ciesielski (*Associate editor and Societies editor*) works in the Mathematics Institute of the Jagiellonian University, Kraków, from which he obtained his Ph.D. in 1986. His mathematical interests include dynamical systems, topology and analysis. He has been a Correspondent of *The Mathematical Intelligencer* since 1987. His wife Danuta is also a mathematician, who is interested in classical geometry and complex analytic geometry.

He and his friend Zdzislaw Pogoda have co-authored about 100 articles presenting mathematics to a general audience. They have been given several awards, including the Dickstein Prize (1995) which is given once every few years by the Polish Mathematical Society for an outstanding contribution to mathematical culture; they are the youngest ever recipients of this prize. They have written two popular books: *Boundlessness of Mathematical Imagination* (1995) and *Mathematical Diamonds* (1997). Both of these books were best-sellers in Poland.



Steen Markvorsen (*Associate editor and Interviews editor*) received his Ph.D. from the Technical University of Denmark in 1983. His main mathematical interest is in differential (and distance-) geometry. In particular he is concerned with the geometric synthesis between curvature, form and function, including its applications to a spectrum of topics ranging from general relativity to biology. Together with a group of researchers he is currently exploring the role and potential of computer experimentation in mathematical research, in particular within the area of curvature geometry.

He has been a member of the board of the Danish Mathematical Society and is actively promoting and disseminating mathematics inside and outside university circles.

Kathleen Quinn (*Associate editor and Conferences editor*) is a Lecturer in Mathematics at the Open University, UK. She obtained her Ph.D. in 1991 from London University. Her research interests lie mainly in design theory and the applications of combinatorics to cryptography. She was a lecturer in London (at the Roehampton Institute) from 1991 to 1995, and then a research fellow at the Open University for four years.

June Barrow-Green (*Anniversaries editor*) is a Research Fellow in the History of Mathematics at the Open University, UK. She graduated from King's College, London, and received her doctorate from the Open University. Her research interests include 19th- and 20th-century British and European mathematics (in particular, the work of Henri Poincaré). She is also working on the use of databases and the use of the World Wide Web as research tools in the history of mathematics.

A former secretary of the British Society for the History of Mathematics (BSHM), she is currently a member of the BSHM Council.

Meeting of the EMS Council

7-8 July 2000, Barcelona
First announcement

The *EMS* Council meets every second year. The next meeting will be held in Barcelona on 7-8 July 2000, before the 3rd European Congress of Mathematics. The exact location will be announced later.

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

(a) Full Members: Full Members are national mathematical societies, which elect 1, 2 or 3 delegates according to their size and resources. Each society is responsible for the election of its delegates. Each society should notify the Secretariat of the *EMS* in Helsinki of the names and addresses of its delegate(s) no later than 10 March 2000. As of 1 July 1999, there were 47 such societies – which could designate a maximum of 69 delegates.

(b) Associate Members: There are two associate members, namely the Gesellschaft für Mathematische Forschung and the European Mathematical Trust. Their current common delegate is elected until 1999, so their delegate has to be elected in 2000. According to the Statutes, 'delegates representing associate members shall be elected by a ballot organised by the Executive Committee from a list of candidates who have been nominated and seconded, and have agreed to serve.'

(c) Institutional Members: There are three institutional members, Institut Non-Lineare de Nice, the Moldovian Academy of Sciences and the Mathematical Institute of the Serbian Academy of Sciences and Arts. Their common delegate is elected till 1999, so their delegate has to be elected in 2000. According to the Statutes, 'delegates representing institutional members shall be elected by a ballot organised by the Executive Committee from a list of candidates who have been nominated and seconded, and have agreed to serve.'

(d) Individual Members: A person becomes an individual member either through a corporate member, by paying an extra fee, or by direct membership. On 30 June 1999, there were some 1900 individual members and, according to our statutes, these members will be represented by 19-20 delegates. The final count of individual members for these elections will be made on 1 November 1999.

The mandates of 11 of the present 17 delegates end on 31 December 1999, and so elections must be held for their positions. They are: G. Anichini, G. Bolondi, B. Branner, J.-M. Deshouillers, K. Habetha, M. Karoubi, T. Kuusalo, A. Lahtinen, L. Màrki, R. Piccinini, and D. Puppe. Of the eleven, B. Branner, J.-M. Deshouillers and M. Karoubi cannot be re-elected because they have served in this capacity for eight years.

Nomination papers for these elections will appear in the December issue of the *Newsletter*. Six delegates were elected for the term 1998-2001, so they will continue unless they inform the Secretariat to the contrary by 31 December 1999.

The Executive Committee is responsible for preparing the matters to be discussed at Council meetings. Items for the agenda of this meeting of the Council should be sent as soon as possible – and no later than 10 March 2000 – to the *EMS* Secretariat in Helsinki.

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

President
Professor Rolf Jeltsch (1999-2002)
Vice-Presidents
Professor Andrzej Pelczar (1997-2000)
Professor Luc Lemaire (1999-2002)
Secretary
Professor David Brannan (1999-2002)
Treasurer
Professor Olli Martio (1999-2002)
Members
Professor Bodil Branner (1997-2000)
Professor Marta Sanz-Solé (1997-2000)
Professor Anatoly Vershik (1997-2000)
Professor Doina Cioranescu (1999-2002)
Professor Renzo Piccinini (1999-2002)

Under Article 7 of the Statutes, members of the Executive Committee shall be elected for a period of four years. Committee members may be re-elected, provided that consecutive service shall not exceed eight years. Andrzej Pelczar has served on the Executive Committee for eight years, so he cannot be re-elected.

It would be convenient if potential nominations for office in the Executive Committee, duly signed and seconded, could reach the Secretariat by 10 March 2000. It is strongly recommended that a statement of intention or policy is enclosed with each nomination. If the nomination comes from the floor during the Council meeting there must be a written declaration of the willingness of the person to serve, or his/her oral statement must be secured by the Chair of the Nominating Committee (if there is such) or by the President. It is recommended that a statement of policy of the candidates nominated from the floor should be available.

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

Delegates to the Council meeting, who are planning to attend the European Congress of Mathematics, are advised that their accommodation arrangements should be made through the *ECM*. For delegates to the Council who are not attending the *ECM*, an address for accommodation arrangements will be provided later.

Secretariat: Ms. Tuulikki Mäkeläinen
Department of Mathematics
P.O. Box 4, FIN-00014
University of Helsinki, Finland

David Brannan
Secretary of the EMS

Annex : Timetable for the Council Meeting

September 1999: Letters are sent to full, associate and institutional members as well as delegates giving information on the Council meeting. Specifically, points for the agenda and suggestions for future members of the Executive Committee are invited. (Delegates are kindly requested to keep the Secretariat informed of their correct and up-to-date addresses.)

1 November 1999: Following the by-laws, the number of individual members is recorded to determine the number of their delegates.

December 1999 ***Newsletter***: Information on the Council meeting is printed again. A nominating slip for the delegates of the individual members is given and suggestions for Executive Committee members are invited.

31 January 2000: Deadline for nominations for delegates of individual members.

February 2000: The ballots for delegates of individual members are sent to individual members.

March 2000 ***Newsletter***: Candidates for delegates of individual members are announced. The venue and meeting times of the Council meeting are repeated.

April 2000: A letter is sent to each delegate, containing the agenda of the Council meeting.

June 2000 ***Newsletter:*** The results of the elections for delegates of individual members are announced. The venue, the meeting times, and the agenda of the Council meeting are given.

June 2000: Material for the Council meeting is sent to the delegates.

Oxford doctorate for Andrew Wiles

In June Andrew Wiles received an honorary doctorate from his alma mater, Oxford University. For those readers who wish to try out their Latin, the citation by the Public Orator Jasper Griffin was as follows; a translation appears below. We thank Jasper Griffin for permission to reprint his citation.

Professor ANDREW WILES, FRS, Eugene Higgins Professor of Mathematics, Princeton University.

Neminem, credo, in hac hominum litteratissimorum frequentia reppereris quin mecum hanc formulam conceptis verbis concinere possit: Nullam in infinitum ultra quadratum potestatem in duas eiusdem nominis fas esse dividere. Haud ita pridem res aliter se habebat, nos plerique Ciceroni ipsi adsensi eos dixissemus qui mathematici vocentur non solum recondita in arte et multiplici subtilique sed etiam in magna rerum obscuritate versari; sed hodie et Pythagorae arcana vulgi aures titillant, et homines devia illa mathematicorum latibula visitant ita indocti ut nihilominus curiositate ducantur. itaque quisquis famam sibi adpetit huius quem produco vitam contemplatus ne eruditum geometrarum pulverum aspernetur. hic enim cum diu in intimis rei algebraicae medullis habitarit, tam primum nobiscum quam postea apud Cantabrigienses et postremo apud Princetonienses, tam insignem denique consecutus est gloriam ut etiam ab insciis neque isti studiorum generi adscriptis agnoscatur. qui usque a primis aetatis suae annis austera numerorum scientia delectatus notissimum illud Petri Fermati theorema, a tot tamque nobilibus mathematicis CCC ferme annos frustra temptatum, sibi proposuit probandum; quod quidem firmata iam aetate post alia egregia facinora rationibus exquisitissimis summoque acuminis firmamento usus tandem firmissime elaboravit. longum sit si spinosissimas istius incepti difficultates, ingeniosissima huius artificia, singillatim percensere coner, praesertim cum L, tantum homines esse dicantur qui quantum hic perfecerit animo recte aestimare possint, quorum in numero me non esse confiteor atque concedo. erant homines quibus hic nimis audax videbatur, qui tantae claritudinis problema solus aggrederetur; erat tempus quo ipse paene desperarat, cum theorema illud, devictum iam, ut videbatur, atque superatum, tamen tanquam Hydra illa Lernaea insperatas difficultates subito protulit atque produxit. sed res bene vortit: vicit tandem vivida vis animi, invenit Sphinx Oedipodem suum, cui ita plauserunt universi mathematici ut dolerent quidam sibi ademptas esse haud ingratas frustra ratiocinandi molestias, solutum denique esse venerabile istud aenigma.

Preasento temporum nostrorum Archimeden, numerorum magistrum singularem, theorematis ultimi enodatorem incomparabilem, Andream Wiles, Societatis Regiae Sodalem, Collegi Mertonensis Socium honoris causa ad scitum, ut admittatur honoris causa ad gradum Doctoris in Scientia.

Admission by the Chancellor

Mathematicorum princeps ingeniosissime, qui quaestionem perdifficilem deficientibus ceteris vi cogitationis devicisti, ego auctoritate mea et totius Universitatis admitto te ad gradum Doctoris in Scientia honoris causa.

Paraphrase in English

I do not imagine that there is anybody in this learned company who could not recite in unison with me the formula: There is no whole-number solution to the equation $x^n + y^n = z^n$, where n is greater than 2. That is a very new state of things. Until recently most of us would have agreed with Cicero, who said that mathematicians concern themselves with a subject matter which is not only various and rarified but also obscure; but now discoveries in mathematics appeal to the ears of the unlearned, and quite ordinary people feel an interest, even if not a well informed one, in its most abstruse areas. Anyone who is interested in becoming famous should consider the career of Professor Andrew Wiles and think twice about passing up a mathematical career. After spending many years at number theory, first here, then at Cambridge, and most recently in Princeton, he has attained such celebrity that he has become recognisable to laymen and to those with no professional interest in the subject. At a very early age he was attracted by algebraic number theory and decided that he would try to produce a proof of the last theorem of Pierre Fermat, that classic problem which over the last three hundred years had been attempted without success by so many eminent mathematicians. In his maturity he crowned his many other achievements by producing a definitive proof, by means of procedures of extraordinary subtlety and intellectual range. It would take far too long if I were to try to explain his achievement in detail, with its perplexing difficulties and Professor Wiles's most ingenious solutions; especially as there are said to be only fifty people in the world who fully understand it, and I freely confess that I am not one of them. There was a time when people were inclined to criticise him for overconfidence, in taking on such a problem single-handed; there was a time when he came close to despair, as the theorem, which had appeared to be defeated, suddenly put forth new and unexpected difficulties. But all was well: his intellectual power prevailed, like an Oedipus he solved the riddle of the Sphinx. His achievement has been greeted with universal applause by the mathematical community, although some of them view with regret the disappearance of a venerable puzzle, and the loss of the mingled pleasure and pain of inconclusive mathematical endeavour.

I present the Archimedes of our time, the outstanding master of numbers, the incomparable unriddler of the Last Theorem, Professor Andrew Wiles, FRS, Honorary Fellow of Merton College, for admission to the honorary degree of Doctor of Science.

Admission by the Chancellor

You are a prince among mathematicians: by your intellectual power you have solved a most intractable problem where others have failed. Acting on my own authority and that of the whole University, I admit you to the honorary degree of Doctor of Science.

European Women in Mathematics

The video *Women and Mathematics across Cultures*, is available from the EWM office in Helsinki. It was shown at the ICM98 in Berlin after the panel on women and mathematics.

The video explores the impact of cultural differences of the female condition allowing four women mathematicians who have studied and worked in Europe and North and South America to tell their stories. Following a five-minute introduction to EWM, including some surprising statistics about women mathematicians in Europe, the four women recount their personal experiences. The length of the video is 25 minutes, and was directed by Marjatta Näätänen in collaboration with Bodil Branner, Kari Hag and Caroline Series in 1996.

The cassettes are in VHS and the prices are as follows:

	PAL	*SECAM/NTSC*
in Europe	200 FIM	250 FIM
outside Europe	220 FIM	270 FIM

(6 FIM is approximately 1 euro)

SECAM and *NTSC* cassettes are not equipped with English subtitles, but the video is in English and a written text of the interviews is provided.

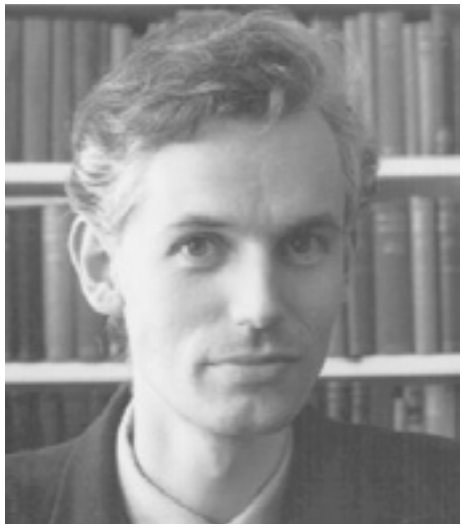
Please send your order via e-mail to Riitta.Ulmanen@helsinki.fi stating which system you want. After we receive your payment, the cassette will be mailed to you. Please, pay to 'Euroopan naismatemaatikot', account number 800017-702454141 with Leonia Bank plc, Helsinki, Finland, with swift code PSPBFIHH via Euro Netting System or via Eurogiro. The telex of Leonia Bank is 121 698. Personal checks cause us a lot of work and expense, so they cannot be used; neither can we accept credit cards.

Mailing address: Riitta Ulmanen, Department of Mathematics, P.O.Box 4, FIN-00014 University of Helsinki, Finland.

Interview with Tim Gowers (Cambridge)

Fields Medallist 1998

interviewer: Tom Körner



You come from a distinguished intellectual family with Cambridge connections?
Well, I would not put it that strongly, but my great-great-grandfather was a famous neurophysiologist in his day, and his name is still very much known to some of my colleagues at Trinity College in that area. My great-grandfather was a civil servant who is best known for editing Fowler's *Modern English Usage*, and for a book he wrote called *Plain Words*. This was originally commissioned as a guide to good writing style for civil servants, but it turned out to have a much broader appeal and is still in print today. My father is a composer, which is a highly cerebral occupation even if it is not usually classified as an intellectual one. He and I are often struck by similarities between his working methods when writing a piece of music and mine when tackling a complicated mathematics problem. My father, grandfather and great-grandfather all studied at Cambridge, and so did several relatives on my mother's side. Although my parents lived in London, I boarded at King's College School, Cambridge, where I was a chorister.

I believe that Andrew Wiles also went to the same school?
Yes, ten years before me so we had teachers in common. Mary Briggs, the wife of the headmaster at the time, had graduated in mathematics from Girton College, where she was taught by Mary Cartwright, and during my last year or so she gave me some individual teaching. I was very lucky to be taught by her, and by my later teachers as well.

Thanks to Mrs Briggs I got a scholarship to Eton and there I had another inspirational teacher, Norman Routledge, who had been a fellow of King's. He did not allow himself to be limited to the syllabus but ranged far more widely. In my last two years at Eton, the mathematics specialists were given a weekly sheet of challenging problems which were only loosely based on the syllabus, if at all. Of course, boys being boys, we tended to do nothing for five days and then rush at them for two days, but even so it was a very valuable experience. Such a thing was rare then and I am afraid it is even rarer now in the days of school league tables and the like.

Then I got into Trinity and fell under the spell of Dr Bollobás – another believer in hard questions off the syllabus. So throughout my education I always had strong and good influences.

You had an excellent but not an outstanding undergraduate career?
That would be a fair summary.

How did you choose your subject for research?
In my third year I did pure mathematics and I gradually narrowed down my preferences to analysis rather than algebra or geometry. The course in Part III (the Cambridge fourth year) which I enjoyed most was in the geometry of Banach spaces, given by Dr Bollobás, and the thought of being supervised by him appealed to me very much anyway. Looking back it is amusing to remember how little idea I had of what research in different areas would be like when I made such an important choice. But I was lucky and found myself in an area that suited me very well, and with an excellent supervisor.

Just as I was finishing my Ph.D., Pete Casazza visited Cambridge for a year. I had a bit of a lean patch for eighteen months or so around that time, but had a boost to my morale in the middle of it when, encouraged by him, I solved a problem in the finite-dimensional theory. He used to carry around a list of unsolved problems in Banach space theory, mostly infinite-dimensional, working up enthusiasm for them. At the time, the received wisdom amongst Banach space theorists was that the infinite-dimensional theory had stagnated, with the interesting problems being inaccessible. He very definitely felt otherwise, and had a surprisingly prescient view of how things might work out.

The next year I made my main infinite-dimensional breakthrough, solving the so-called unconditional basic sequence problem, which was also solved independently by Bernard Maurey, and for some time my research programme was obvious – many questions in the infinite-dimensional theory (including several on Casazza's list) suddenly looked possible with the new techniques and ideas that had been introduced, and over the next couple of years or so, many of them fell, to me and to others. Towards the end I obtained my dichotomy result. This needed different techniques, based on results in Ramsey theory, though the problem itself was closely related to my other work. I was particularly pleased because it was a positive result, and I had felt that I was getting a reputation as a 'counter-examples mathematician'. Incidentally, many of my counter-examples have resulted from trying to prove positive results – it's just that there's not much you can do about it when one of these turns out to be false.

I think Maurey is the only mathematician with whom you have collaborated to the extent of writing a joint paper?
Yes he is, and even that collaboration arose out of the accident of our solving the same problem at the same time. Although it was initially a shock (for both of us) to discover that we had to share the result, which was much more important than anything I had previously done, I am now very glad to have collaborated with Maurey, and proud of our two joint papers. The second of these grew out of the first, and I would definitely not have been able to do it on my own.

In general, although I have nothing against joint work and sometimes resolve to do more of it, I think I work more naturally on my own. When I discuss mathematics with other people, I often find that either I don't understand what they are saying, or they provoke some idea in me which I want to think about alone and free of distractions. This is probably just a sign of inexperience on my part.

How did you decide to change subject?
Despite appearances, I haven't exactly changed subject, because my Banach spaces results and what I have done more recently both fall under a general heading of what might be called applied combinatorics. That said, I did make a fairly conscious decision to apply what combinatorial skill I had in areas other than Banach space theory, for several reasons. First, given that I have only one life, I don't want to spend twenty years of it in a single area of mathematics, and I can't understand those who do. Secondly, I felt under a certain amount of external pressure to show that I could do more than churn out results on Banach spaces (not that I myself regarded the process as churning out). Thirdly, and most importantly, I always had a side interest in combinatorics (not surprisingly, given my research supervisor) and wanted to solve one or more of the beautiful problems that I had known about for years.

My general approach to research is to try problems with a reputation for being difficult, but, in order to avoid the danger of wasting years getting nowhere, I like to have several on the go at once, spending a month or two here, a month or two there, until one of them reveals a soft underbelly. This procedure increases the chances of happy accidents. For example, I built up my understanding of infinite-dimensional Banach spaces by trying and failing to solve the so-called distortion problem, later solved by Odell and Schlumprecht. Without that, I would not have seen how to do the other problems.

More recently, I decided to think about the Kakeya problem, starting completely from scratch, because I had been told that it was very important. I hadn't been going long when I realised (what I now know is an absolutely standard observation) that it was basically a combinatorial problem about arithmetic progressions, which caused me to think, by no means for the first time, about Szemerédi's theorem. I then had an idea for how to tackle the special case of arithmetic progressions of length 3, and found that I had reinvented Roth's original proof for this case. However, this spurred me on to think about progressions of length 4, and a month or two later I came up with a complete proof for the general case. I wrote it out as a finished paper, with all the details. I then discovered that a seemingly unimportant lemma was false, and the hole, like a hole in a piece of knitting, expanded to the point where I realised that the main lemma on which my

proof was based was also false. This was a crushing blow, but by now I was hooked on the problem. Bollobás was very encouraging at this point and said there must surely be something in the ideas I had had. In the end I managed, after a big struggle, to get a new proof of the general result. I don't think I would have had the stamina for it if it had not been for the earlier disappointment. The whole thing occupied me for two years and has led on to another clear research programme which should keep me going for some time. Meanwhile, I still have no idea how to solve the Kakeya problem.

Does it bother you that the things you work on are unfashionable?

Not from a personal point of view, because it has not impeded my career, but I have been lucky. There are others in my sort of area who are bothered, and with some justification. I do think it is good to have to work hard to interest other mathematicians – the situation becomes unhealthy when it is either impossible to do so because one's area is completely out of favour, or too easy because it is the latest craze.

The unfashionability of combinatorics is partly a result of the familiar contrast between elementary methods and big machinery. Twentieth-century mathematics has seen many triumphs of the latter, and this has naturally influenced people's opinions. I think also that if you get used to big machinery, then problems which can be stated to a schoolchild begin to seem babyish. The standard answer of a combinatorialist to such an attitude would be "Why not have a go at solving one?", but this does not convince everybody.

Combinatorics has a reputation for being rather isolated, with few applications to the rest of mathematics, or at least important mathematics. I think this view rests on a misapprehension. Combinatorics does not contain many powerful and difficult general results like the Atiyah-Singer index theorem, which can be directly applied over and over again. However, over the years, combinatorialists have built up a considerable expertise in solving certain types of problems which would have been hopeless a generation ago and which can be used in many external fields. Although progress in mathematics can be a result of truly understanding difficult concepts until the proofs write themselves, I believe that it is not sufficiently recognised that many problems are at heart combinatorial, and in the end if you want to solve them you simply have to get your hands dirty.

What is your attitude to teaching?

I enjoy teaching, not all the time of course, but I find it sufficiently rewarding to wish to go on doing it. I enjoy the process of working out why something that I understand causes difficulty to a student. (Unfortunately, the answer is often boring – they just haven't learnt the relevant definitions or something like that.) I am fortunate enough to supervise a number of the very best undergraduates in the country, who are sometimes better than I am at what I am supposed to be teaching them.

I find that lecturing can be directly beneficial to my research, because I have to understand even quite elementary material much better if I am going to stand in front of two hundred intelligent people and explain it to them. Bollobás brings up his students not to use notes, which I think improves lectures immeasurably. As he puts it, how can we expect our audience to learn several courses for an examination if we, who are supposed to be experts, cannot even learn a small fraction of one? It is hard work, but there is nothing quite like the feeling of having successfully given a complicated lecture from memory.

Teaching is of course very important, since our future audience depends on it. It irritates me that many writers seem to treat books and papers more as an opportunity to display their own knowledge and achievement than as a genuine attempt to convey it to their readers – that is, to teach it. In particular, it is very common for proofs to be presented over-neatly, so that, although one can see that the steps are correct, one has to work much harder to understand how anybody could have thought of them. Just a few well-placed remarks can make an enormous difference ("Actually, this is a natural thing to do because ...") but they are surprisingly rare. Many papers, or chapters in books, could do with much longer introductions, setting the scene, explaining why the results are interesting and explaining the difficulties to be overcome. But I am not the first to air these complaints. I firmly believe that one should aim not just at a specialist audience, but also at those who would prefer to skim a paper and get some idea of what is happening without worrying about the technical details.

We have tended to talk about Cambridge. What about your time elsewhere?

Although my heart has always been in Cambridge, I had a very happy and productive four years at University College London, and am glad to have experienced life elsewhere (though never a life without cloisters). The department suited me well, as there were several people there – David Preiss, Keith Ball, David Larman, Ambrose Rogers – with interests similar to mine. I used to commute from Cambridge, and found the train a congenial place to work, making at least one genuine breakthrough on it.

When did you first think that you might win a Fields medal?

Initially, I assumed that it was impossible to get one for work in Banach spaces, which at least saved me the bother of thinking about it. However, about two years before the last International Congress I started getting mysterious e-mail messages asking for lists of publications, copies of papers, and so on. The messages were usually labelled urgent, but did not explain why they were urgent. Even then, it was a long time before I dared to wonder whether I was being considered.

When did you realise that you wanted to be a mathematician?

It was a gradual process. It was the subject I enjoyed most at school, partly because I found it easiest. The system laid out a series of hurdles in one's path and to some extent I just found that I had jumped the hurdles rather than being forced to find another job. I became certain that I would like to be a professional mathematician some time when I was an undergraduate – though, even then, I had little idea of what this meant.

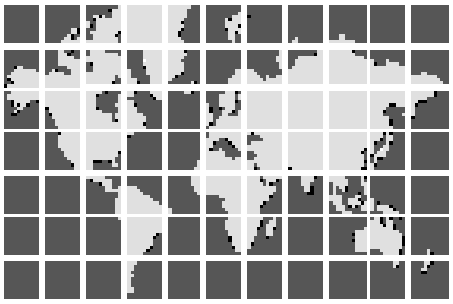
And when did you feel that you had become a mathematician?

Several times. At almost every hurdle, in fact. When I became a research student. When I got a research fellowship. But when I solved the unconditional basic sequence problem, which was a problem with a name, which others had tried, then I felt for the first time that I had truly fulfilled a boyhood ambition.

We thank the London Mathematical Society for permission to reproduce these photographs

Seven Fields Medallists at the opening of De Morgan House, the new headquarters of the London Mathematical Society (see EMS Newsletter 31). From left to right: Tim Gowers, Klaus Roth, Simon Donaldson, Sir Michael Atiyah, Alan Baker, Richard Borcherds and Daniel Quillen.

ICIAM 99



in Edinburgh
5 – 9 July 1999

Rolf Jeltsch

(President of EMS)

More than 1500 applied mathematicians gathered from all over the world for a week in Edinburgh. They came to attend the *4th International Congress on Industrial and Applied Mathematics*. *ICIAM99* followed the traditions of its successful predecessors in Paris (1987), Washington (1995) and Hamburg (1995).

The opening ceremony was held in the beautiful McEwan Hall, a semicircular arena with fantastic paintings on the ceiling of the half dome. Unfortunately, H.R.H. Prince Philip, Duke of Edinburgh, a Joint Patron of the Congress, couldn't attend the opening as he was attending a ceremony to honour the late King Hussein of Jordan. Instead, a message from him was read and he was able to join the congress dinner in the Playfair Library at the Old College of the University of Edinburgh. Sir Michael Atiyah, Chair of *ICIAM99*, responded to the opening speech and Lord Sainsbury, UK Minister of State responsible for Science, welcomed the delegates. The Celtic Brass opened the ceremony which announced the four new *CICIAM* prizes, created since *ICIAM95* in Hamburg. The president of *CICIAM*, Reinhard Mennicken, presented the prizes to the winners.

Jacques-Louis Lions was awarded the Lagrange prize in recognition of his exceptional contributions to applied and industrial mathematics throughout his career. He was cited as one of the most distinguished and influential scientists of this century in the domain of applied and industrial mathematics. A few of his outstanding contributions to our science and his famous books were mentioned. Lions founded and developed an important school of applied mathematics in France which has had a strong influence in many other countries. He has participated in many industrial programmes. With the choice of Jacques-Louis Lions the prize committee has set an extremely high standard for future winners. The Lagrange prize is a gift of the Société des Mathématiques Appliquées et Industrielles (*SMAI*), the Sociedad Espanola de Mathematica Aplicada (*SEMA*) and the Societa Italiana di Mathematica Applicata e Industriale (*SIAMAI*).

The Collatz prize 1999, awarded to a scientist under 42 years of age, went to *Stefan Mueller* for his highly original and profound contributions to applied mathematics, the calculus of variations and non-linear partial differential equations, the mechanics of continua, and mathematical material sciences. Mueller, born in 1962, studied mathematics and physics in Bonn, Edinburgh and Paris. He became full professor at the University of Freiburg at the age of 32, and shortly after, Vice-Director of the famous mathematical Research Centre at Oberwolfach. After a brief appointment at ETH Zurich, he became one of the three directors of the Max Planck Institute for Mathematics in the Sciences in Leipzig in 1996. Stefan Mueller is one of the very few young mathematicians in the world who combine high-quality mathematical skills with a feeling for real world problems. The Collatz prize was sponsored by the Gesellschaft für Angewandte Mathematik und Mechanik (*GAMM*).

The *CICIAM* Pioneer prize was awarded to *Ronald R. Coifman* of Yale University and *Helmut Neunzert* of the University of Kaiserslautern for very different contributions to applied mathematics. Coifman was honoured for his pioneering work in exploiting harmonics, and especially wavelet analysis, to provide computational methods and algorithms in a wide variety of important contexts involving signal and image processing. Applications have included FBI data files for fingerprints and many other problems involving compression and/or restoration of images and sound. Who has not seen, when clicking on a webpage, how the images on the page are built up from large scale wavelets to fine scales in seconds? Neunzert was honoured for his work over the last twenty years in developing 'technomathematics', both as a scientific discipline and as a curriculum now offered at more than twenty-five universities, and in developing the specialisation of industrial mathematics through active consulting and modelling, playing a leading role in the European Consortium for Mathematics in Industry, and for founding and directing the Frauenhofer Institute for Techno- and Econo-mathematics at Kaiserslautern. [You can read more about Helmut Neunzert in an interview he gave to Heinz Engl in the June 1999 issue of the *EMS Newsletter*.] The Pioneer prize is funded by the Society for Industrial and Applied Mathematics *(SIAM)*, and is given for pioneering work introducing applied mathematical methods and scientific computing techniques to an industrial problem area or a new scientific field of applications.

Grigory Issakovic Barenblatt was awarded the *CICIAM* Maxwell prize in recognition of outstanding originality in his work in applied mathematics. He is one of the most distinguished Russian applied mathematicians, and is well known for his important contributions to the mathematical theory of fluid motion, solid structure, non-linear waves, scaling and asymptotics. He constructed a deep connection between non-linear waves and general scaling arguments. Among the many applications of this highly original and amazing theory are the scaling of turbulence, the analysis of failure in solids, the dynamics of reservoirs and the analysis of stratification in geophysical fluid mechanics. The Maxwell prize is sponsored by the Institute of Mathematics and its Applications (*IMA*) and the James Clerk Maxwell Foundation, to provide international recognition to a mathematician who has demonstrated originality in applied mathematics.

These prizes will be presented every four years at the *ICIAM*. Clearly, more than through their official descriptions, the world standing of their first winners will set the level of achievement for future winners. The presentation of these prizes concluded the opening ceremony.

The conference was one of superlatives – and not only with respect to these prizes and their winners. In one week there were 33 plenary speakers and about 210 mini-symposia (usually consisting of 3-4 lectures, but some running up to 26 lectures), and about 1100 contributed papers were presented. Everything ran in parallel, even the plenary sessions, and sometimes 28 mini-symposia were running simultaneously, so you cannot expect your correspondent to tell you all the highlights; it was simply impossible to attend and absorb all that was presented. The few lectures I did attend were selected by personal interest, curiosity, or just by chance. But the proportion of excellent lectures was extremely high. The two Schlumberger lectures I attended by F. P. Kelly on *Mathematical modelling of the internet* and S. Popescu on *What is quantum computation?* were real eye-openers for me. Margaret Wright's lecture on *What, if anything, is new in optimization?* and James A. Sethians' presentation on *Fast marching methods and level set methods: evolving interfaces in fluid mechanics, computational geometry and material sciences* really surpassed their usual (already fascinating) performances. Among the mini-symposia, I would like to single out the one on *Computational science and engineering: How to organize? How to teach?*, because this new curriculum will have to be discussed in the near future by many mathematics departments.

For those with insatiable appetites who found the presented material insufficient, there were additional scientific events like the *Symposium on mathematics and the law* and a meeting on *Maxwellian themes* with topics like 'Testing Einstein in space: a marriage of physics and technology' or 'A Maxwellian approach to modern cosmology'. *ICIAM99* really covered all the fields one could imagine – and even ones one couldn't.

Three additional prizes were awarded in the McEwan Hall, between two morning plenary lectures.

The Dahlquist prize, established by *SIAM* in 1995, was awarded to Linda

Jacques-Louis Lions, winner of the Lagrange prize, at the 1994 ICM.

Petzold for her important contribution to effective numerical methodology for differential equations, especially the analysis of methods for differential algebraic equations, the construction of effective techniques for their solution, and the integration of these and other techniques into robust software, thus making possible the reliable solution of large classes of ordinary and partial differential equations arising from engineering and science applications. This prize is awarded on a biannual basis.

Germund Dahlquist received the newly established Henrici prize. He was cited for his outstanding research and leadership in numerical analysis. Dahlquist created the fundamental concepts of stability, *A*-stability and the non-linear *G*-stability for the numerical solution of ordinary differential equations. He succeeded, in an extraordinary way, in relating stability concepts to accuracy and proved the deep results that are nowadays called the first and second Dahlquist barriers. His interests, like Henrici's, are broad, and he has contributed significantly to many parts of numerical analysis. As a human being and scientist, he gives freely of his talent and knowledge to others and will remain a model for many generations to come. This was the official citation; I wish to add that I myself benefited a lot from his generosity. The Henrici prize is jointly sponsored by *SIAM* and The Swiss Federal Institute of Technology, ETH Zurich.

Matteo Frigo and Steven Johnson of the Massachusetts Institute of Technology received the Wilkinson Prize for *FFTW*, 'the fastest Fourier transform in the West', a C library for the computation of the discrete Fourier transform that automatically tunes the computation for any particular hardware in order to produce efficient code. The Wilkinson prize for numerical software was established in honour of the outstanding contributions of James Hardy Wilkinson to the field of numerical software. This prize is jointly sponsored by Argonne National Laboratory, the National Physical Laboratory, and the Numerical Algorithms Group (*NAG*).

You can find more information on all prizes, the exact citations, the prize committees and the whole scientific programme of *ICIAM99* on the webpage: *http://www.ma.hw.ac.uk/iciam99/*.

Finally, I should add that the *EMS* was present at *ICIAM99* with a booth, jointly with *Zentralblatt MATH*. It gave the Chair of the Applications Committee (Heinz Engl) and myself a good opportunity to meet member societies and their representatives as well as other societies; you will be reading about some of the results from these talks in future Newsletters. One effect can be noted in this issue: *SIAM* and *EMS* are planning a cooperation agreement and you will find an article by the *SIAM* president, Gil Strang below. A corresponding article by myself will appear in the September issue of *SIAM News*.

On Saturday the Committee for International Conferences on Industrial and Applied Mathematics (*CICAM*) had a business meeting. It prepared the election of the new president, to be done by mail this autumn. It also established new statutes. We shall report on these new developments in the next *Newsletter*.

We look forward to the next *ICIAM*, to be held from 7-11 July 2003, in Sydney, Australia.

SIAM and *EMS* joint conference on Computational Science

Gil Strang, *SIAM* President

I am writing to introduce *SIAM*, the Society for Industrial and Applied Mathematics. This is an especially good time to add new connections between *SIAM* and the *EMS*, because our two societies are planning a joint conference. It will be the first major conference for *SIAM* in Europe and the first big conference on Computational science for the *EMS*. Rolf Jeltsch, *EMS* President, is preparing a similar column for *SIAM* News, to introduce the *EMS* to members of *SIAM*.

I hope you have seen *SIAM* News, which goes to all members and is very widely read – and above all the *SIAM* journals which are at the centre of our work. There are now eleven journals covering a wide range, from classical problems in analysis to discrete mathematics and optimisation. Maybe this is an important point about *SIAM* – it has a very broad view of what applied mathematics really is.

Another important point about *SIAM* is that it is truly international, as mathematics is. More than a third of our members live and work outside North America. I am personally very happy about that, and am working in my two years as president to do everything possible for applied mathematics worldwide. So much of the best research is joint work – we are already working together! I have had total encouragement in this cooperation from inside and outside *SIAM*.

Let me mention some new directions for the society? One is to establish an activity group in the life sciences. Biology, medicine and pharmacology are areas of tremendous scientific growth, and the mathematical and computational parts are increasingly important. The activity groups in *SIAM* are responsible for focussed conferences every two years and I believe that this new group will grow quickly. The environment is also a part of their interest. The linear algebra group has been particularly active in Europe, and I anticipate a new group in 2000 on imaging science.

May I call your attention to our web page: *www.siam.org*. It has much more information about the society than I can give here. You can see the calendar of conferences, and how to join *SIAM*, and the editorial boards of all the journals (which now come electronically before the printed editions). I am happy to give my own email *(gs@math.mit.edu)* for anything I can do.

One more word about our joint conference. The first discussion was with Rolf Jeltsch and Heinz Engl. The whole topic of computational science and engineering is coming into prominence for students too. The key is to know about the science as well as the mathematics (and the computation). I am convinced that the conference will be a success.

A universal mathematical resources locator?

Alain Damlamian

Past-President Société de Mathématiques Appliquées et Industrielles (SMAI)

Late last June, an electronic message with a similar title was sent to the presidents of all the member societies of the *EMS*. It was signed by Rolf Jeltsch, president of the *EMS*, as well as by the presidents of the two French Mathematical Societies, the *SMF* and the *SMAI*. Its purpose was to present a new French initiative for World Mathematical Year 2000, and to urge all mathematicians in Europe and outside to use this new service. Insofar as such a tool is useful only if it is used by many, and as its usefulness increases exponentially with the number of sites it indexes, we present it in the columns of the *EMS Newsletter* and urge all *EMS* members to take a look at it.

What is *ACM/UMRL*?

The original name of this service is 'Agenda des Conférences Matématiques' (*ACM* for short, not to be confused with other *ACMs* on the web); its web address is <http://*acm*.emath.fr>. It was created eighteen months ago at the initiative of Stephane Cordier, a Maitre de Conferences at the University of Paris 6 and an active member of the *SMAI*, to cover France. *ACM* has been supported from its onset by a small grant from the French Ministry of Research, with the understanding that it should be made freely available everywhere. Its success in France has been such that the idea of extending it to the whole of Europe and elsewhere has become realistic, and this is what the *EMS*, the *SMAI* and the *SMF* are supporting for the year 2000. Since the acronym *ACM* has many meanings (among others, the Association for Computing Machinery), the following web name is proposed: *ACM/UMRL*, or even *UMRL*, which could stand for 'Universal Mathematics Resources Locator'.

At the core of *ACM/UMRL* is a database of seminar series, conferences and colloquia in mathematics, including dates and times, locations, titles, speakers, and (optionally) key words, *MSC2000* codes, etc. We present it here from the end-user's point of view, and from that of the organiser of a series of lectures or a conference.

***ACM/UMRL* for the end-user**

On the user's side, *UMRL* appears as the interface for a search engine. It can be queried in English and French (this can be extended to other languages with help from native speakers). It can be customised to each user's profile(s), which can be saved as Bookmarks or Favorites and re-used at will. Simple and complex searches are possible, including geographical regions and time periods. Although setting up a profile can be lengthy the first time (*), it is worth while because once bookmarked it performs new searches in a single step (and keeps the date as relative, not absolute). The result of a search is a list of all the seminar talks, symposia talks and conferences in the database which satisfy the search criteria, with their titles and links to their web sites (abstracts, directions, etc.). One can even ask for a timely e-mail reminder.

At present, some sixteen geographical areas are used, as well as ten general subfields of mathematics that can be selected for a focused search. Each talk can also present a list of key words and *MSC2000* codes that can be used in the searches.

The database includes information on mathematical conferences, congresses, workshops and colloquia from the conference calendar maintained by the Atlas of Mathematical Conference Abstracts (*AMCA*) at http://at.yorku.ca/amca/. It also includes the information located on the EMIS conference board. We suggest that you give it a try at http://acm.emath.fr. *ACM/UMRL* has been expanding regularly in Europe (Austria, Germany, Italy, the Netherlands) and North America, and a simple query can certainly be instructive. One can easily imagine the many uses that such a large database can have. But how is the *ACM/UMRL* database maintained?

***ACM/UMRL* for the organiser of a conference, colloquium or seminar series**

Here is the key concept: the *ACM/UMRL* database gets created and maintained automatically, using a web-engine that queries the web pages of all seminar series, conferences or colloquia registered with *ACM/UMRL*. This requires the active cooperation of the organisers of these events, but that is straightforward: the *URL's* of the announcement web pages have to be indicated to the *ACM/UMRL*-master and these pages must include some very simple tags that the *ACM/UMRL* engine can recognise and retrieve. Another advantage of this procedure is that the database always remains up-to-date. Detailed explanations are available on the *ACM/UMRL* server <http://*acm*.emath.fr> in English, German, Italian, Spanish and French (so far!).

How can *ACM/UMRL* grow?

ACM has recently been expanding to countries other than France. Its user interface has been translated into several languages and it is hoped that more will be included. National and regional correspondents are also needed; some are already in place, from France, Austria, Belgium, Germany, Italy, the Netherlands and Canada. Mirrors will also be most welcome from everywhere possible; a mirror is planned on the EMIS servers.

For those locations that have no web page, it will be possible in France to post announcements on a special web-site that will automatically be queried by the *ACM/UMRL* robot. This type of procedure should be considered at country level, possibly by the national mathematical Society. As the geographical coverage increases, more numerous and focused regions will be included. If the need arises, more subfields of Mathematics can be defined, but the searches can always be made via keywords and *MSC2000* codes.

Obviously, *ACM/UMRL* is an evolving project and we hope that by being a common tool for the mathematical community it can evolve to satisfy the needs of all and to help foster the sense of a global mathematical community.

One final note: *ACM/UMRL* does not intend to compete with other sites that propose similar information. On the contrary, it is willing to incorporate all information that resides on these sites, with direct reciprocal links with them. An example of such an existing cooperation is with ACMA, as indicated above.

(*) At present, a bug in the way Netscape v.4.6 handles long URLs (and the bookmarks created by *ACM/UMRL* are long indeed) appears to corrupt bookmarks when one tries to rename them. If this happens to you, try not to rename the bookmark. This was only noted on the Mac platform.

1999 Anniversaries

Caspar Wessel on representing complex numbers (1799)

Bodil Branner

The Norwegian surveyor Caspar Wessel is now recognised as the first to have given a geometrical interpretation of complex numbers and their rules of composition. This year we celebrate the bicentenary of his paper in *Det Kongelige Danske Videnskabernes Selskabs Skrifter, Nye Samling, V, Kiøbenhavn*, 1799, pp. 469-518 [the collected papers of The Royal Danish Academy of Sciences and Letters]. Although his work was ignored and had no influence on later mathematical developments, his story is worth telling.

In 1796 Wessel completed the triangulation of Denmark and Schleswig that, together with astronomical observations, formed the basis of the first real cartography of Denmark; this work was done under the auspices of the Academy. In the same year Wessel wrote a mathematical treatise entitled *Om Directionens analytiske Betegning, et Forsøg anvendt fornemmelig til plane og sphæriske Polygoners Opløsning* (On the analytical representation of directions; an attempt applied chiefly to solving plane and spherical polygons). Its first part deals with directions in a plane, and the second, less well-known, part deals with directions in space. The treatise was presented at a meeting on 10 March 1797 to the Academy and accepted for publication. From the start (1742) the Academy had decided to publish articles written by members in Danish, not Latin. The statute of the Academy was relaxed in 1796 to allow non-members to submit articles and Wessel's treatise became the first of this kind to be published.

At the end of the 18th century there was nobody around who could understand or appreciate the scope of Wessel's work. If there had been, the paper would probably have been translated into Latin or German as other important publications were. There were many people of German origin in Copenhagen at the time, such as J. N. Tetens, who had come to Copenhagen from a professorship at Kiel University in philosophy and mathematics. He encouraged Wessel to write his results down and, as the leader of the mathematical class of the Academy, he presented Wessel's work at the meeting. Wessel himself was not present.

Soon after, Wessel's treatise seems to have been completely forgotten. It was rediscovered about a century later when Sophus A. Christensen mentioned it in his doctoral thesis (*On the development of mathematics in Denmark and Norway in the 18th century*). The three opponents at his defence were professors at Copenhagen University, two official (H.-G. Zeuthen and Julius Petersen) and one from the audience (T.-N. Thiele). Immediately after, Christian Juel, docent at the Technical University, called attention to Wessel's achievement by publishing a short paper (in Danish) about it and Sophus Lie reprinted Wessel's paper in the *Archiv for Mathematik og Naturvidenskab* in 1895. The Academy honoured Wessel by publishing a French translation of his treatise by H.-G. Zeuthen in 1897. Last year the Academy held a Wessel Symposium organised by Jesper Lützen, and this year a complete English translation of Wessel's treatise will appear (for the first time) in the proceedings [1], together with a Wessel biography and a paper on the history of complex numbers.

Caspar Wessel was born in 1745 in Vestby in Norway, south-east of Christiania (now Oslo). He was the sixth child (of 14) of the curate Jonas Wessel and his wife Helene Marie Schumacher. When he was 12 years old he was sent to the Cathedral School in Christiania with two of his elder brothers. There was no university in Norway, so the three brothers moved to Copenhagen, the capital of the dual monarchy Denmark-Norway, to study at the university there, the elder brothers Johan Herman and Ole Christopher in 1761 and Caspar in 1763. They all had some financial support from home to start out with, but it soon became necessary to find extra income. Both Ole Christopher and Caspar became involved with surveying for the Academy. Ole Christopher earned his living this way while he was a student; after taking a degree in law in 1770 he embarked on a successful legal career, attaining one of the highest positions in Norway. For Caspar surveying became an engagement for life although, like his brother, he completed a degree in law. Their brother Johan Herman Wessel became a poet. Although he was not very productive and died rather young, many of his poems are still remembered in Norway and Denmark; they have a special humour and are hard to translate.

The first plan for a modern topographical measurement of Denmark was proposed to the King in 1757 by a student, Peder de Koefoed. The plan was approved and Koefoed started to work, but unfortunately he died three years later having accomplished little. But the time was ripe and the way prepared for a more ambitious plan put to the Academy by Christen Hee, professor in mathematics, and Thomas Bugge (1740-1815), Koefoed's assistant. The plan involved both topographical surveying and the method of triangulation to determine geographical coordinates. This long-term project of great national (and international) interest became essential for the development and strengthening of the young Academy.

Om

Directionens analytiske Betegning,

et Forsøg,

anvendt fornemmelig

til

plane og sphæriske Polygoners Opløsning.

Af

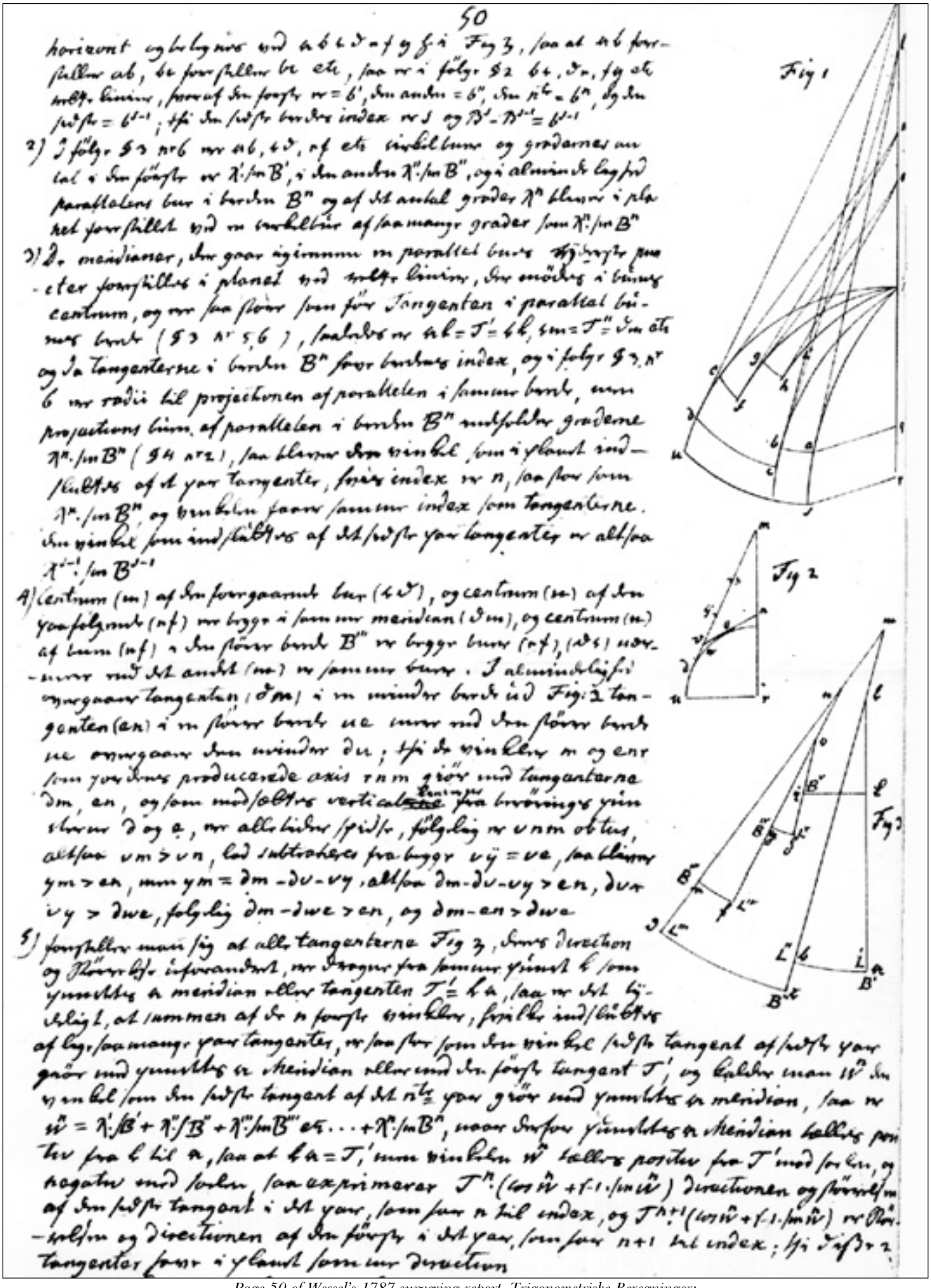
Caspar Wessel, Landmaaler.

Nærværende Forsøg angaaer det Spørgsmaal, hvorledes Directionen analytisk bør betegnes, eller hvorledes rette Linier burde udtrykkes, naar af een eneste Ligning mellem een ubekiendt og andre givne Linier skulde kunne findes et Udtryk, der forestillede baade den ubekiendtes Længde og dens Direction.

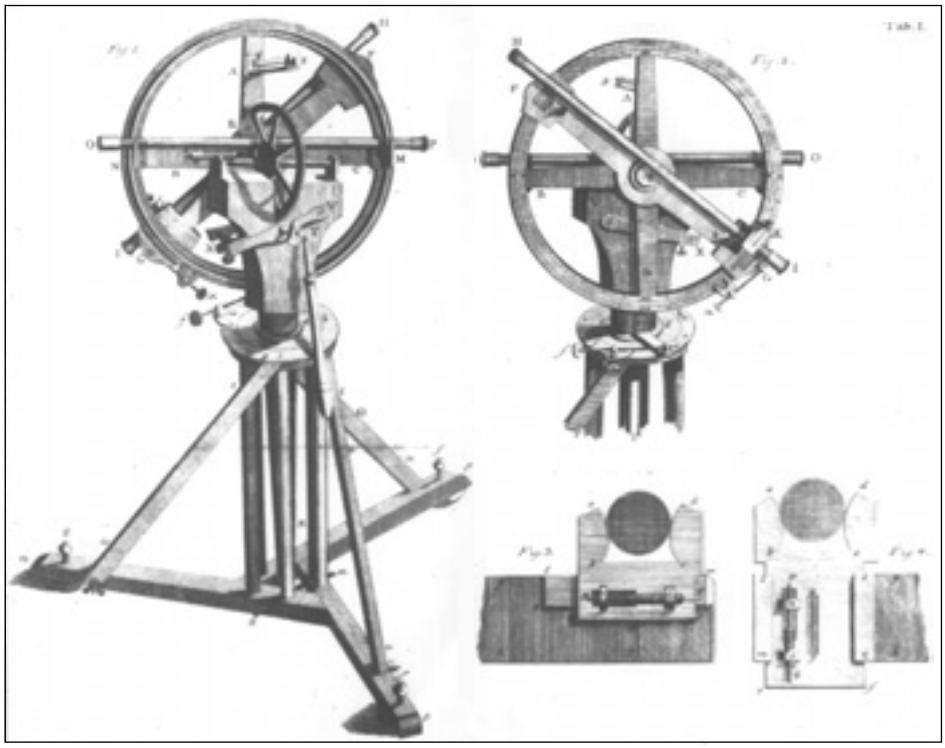
For nogenledes at kunne besvare dette Spørgsmaal, lægger jeg til Grundvold to Sætninger, der synes mig unegtelige. Den første er: at den Directionens Forandring, der ved algebraiske Operationer kan frembringes, ogsaa bør ved deres Tegn at forestilles. Den anden: at Direction er ingen Størrelse for Algebra, uden for saavidt den ved algebraiske Operationer kan forandres. Men da den ved disse ei kan forandres (i det mindste efter den sædvanlige Forklaring), uden til den modsatte, eller fra positiv til privativ, og omvendt: saa skulde disse to Directioner alene kunne betegnes paa den bekiendte Maade, og i Hensigt til de øvrige Problemer være uopløseligt. Dette er vel

Doo 2 ogsaa

Title page of Wessel's 1799 treatise.



Page 50 of Wessel's 1787 surveying report, Trigonometriske Beregninger;
in Section 5 he expresses the direction of the nth tangent vector in Fig. 3 by $T^n.(\cos w^n + \sqrt{-1}.\sin w^n)$.



The geographical instrument shown in vertical position, from Thomas Bugge's Beskrivelse over den Opmaalings Maade som er brugt ved de Danske geografiske Karter, Kiøbenhavn, 1779.

Hee and Bugge educated the two first surveyors, one of whom was Ole Christopher Wessel, and the work started in 1762. Two years later Ole Christopher needed an assistant and chose Caspar. At first Bugge was responsible for everything including the trigonometrical measurements (the triangulation), the most theoretical part of the surveying, but Ole Christopher Wessel soon took over this responsibility as well. However, his salary as an assistant was so low that Caspar could not survive on it alone, and he asked the Academy for a rise if he took on the drawing of maps in addition to his surveying. He was granted increased pay and made responsible for the construction, reduction and drawing of maps based on the geographical and trigonometrical surveying, then presenting the model from which the coppersmith would make plates and produce the final prints. A test map had already appeared, representing the County of Copenhagen; officially it had been drawn by Ole Christopher Wessel, but from the surveying diary we know that Caspar had drawn part of it.

From May to September or October, the surveying took place in the countryside from early morning to late evening (weather permitting) every day except Sundays. A fair copy of the surveying diary had to be sent to the Academy, together with the topographical maps measured that summer, marking the locations of towns, churches, castles, mills and woods, the courses of roads and streams, and the positions of coastlines and islands. During the winter there should then be time for study, but for Caspar Wessel this proved difficult since he was then working on the reduction of maps. By 1778 he had became so desperate that he asked for a sabbatical year with full salary. This was not popular since he had just accepted responsibility for the trigonometrical surveying, to succeed the successor of Ole Christopher. Nevertheless, Hee wrote a supporting letter: *'None of the surveyors has been more useful to us than he has, during the summers he has been surveying and in the winter time he has been working as a designator, which in the fourteen years he has stayed with the surveying has ruined his health and been an obstacle to his studies in such a way, that if he once again has to interrupt his studies he is perdu and will never pick them up again. Last winter when he nolens volens had to draw the general map of Zealand he was once more distracted in his studies, and then I promised him never again to disturb his circles.'* The sabbatical was granted and Wessel finished his degree in law. No trigonometrical surveying took place that year.

From 1779 to 1796 he worked as a trigonometrical surveyor, still spending his summers in the countryside measuring. During the winters he was occupied with trigonometrical calculations based on the collected data, judging the validity of the measurements, and constructing and drawing the resulting triangular maps. His reports also contained shorter articles describing the methods behind the measurements and cartography. His work required both practical and theoretical skills, as well as accuracy, patience and a breadth of outlook.

The purpose of the trigonometrical surveying was to establish a network of trigonometrical points, to determine their triangular net, and to supplement this with an astronomical determination of the latitude and longitude of some of the points and of the direction of the meridian through such points. One distance, a base line, between two neighbouring points in the triangular net had to be measured with great care; all angles of all triangles in the net were measured several times and from these data the rest of the distances were calculated. Angles were measured by the so-called *geographical instrument* or *Ekström's circle*. For trigonometrical surveying the instrument was used with the circle in horizontal position and placed above one trigonometrical point of a triangle, with one telescope pointing towards one of the other points in the chosen triangle and the other telescope in the direction of the third point in the triangle. The instrument was also used for astronomical measurements with the circle in vertical position, measuring the height of the sun or certain stars.

The origin of the triangular net had been chosen as the Royal Observatory in Copenhagen placed in the Round Tower. The building of the Round Tower was started in 1637 and the observatory was established by Longomontanus, a pupil and former assistant of Tycho Brahe (1546-1601). Brahe had been the first to use a triangular net in surveying, to determine the position of his observatory Uraniborg on the island Ven relative to the coastlines of Sweden and Denmark. The method was later pioneered by the French Abbé Jean Picard who visited Denmark in 1671-72 in order to compare the longitudes of the new Paris Observatory and Uraniborg and the Round Tower. When the trigonometrical surveying of Denmark started in 1762, that of France had already been completed, forming the basis of the famous Cassini-maps.

From May 1782 to the summer of 1785 Wessel was again on leave from the Academy, but this time with its recommendation. He was made responsible for the complete trigonometrical surveying of the duchy Oldenburg West of Bremen. In a letter of recommendation, Bugge wrote in 1781, '*He possess a lot of theoretical knowledge of algebra, trigonometry and mathematical geometry, and as far as the last point is concerned, he has come up with some new and beautiful solutions to the most difficult problems in geographical surveying*'. The Oldenburg area was later (around 1824) re-triangulated by Gauss; his instrument and part of his triangular net can be seen on German 10 DM notes.

In the 1779 surveying report Wessel explained how a map of an ellipsoid can be obtained by projecting points of the ellipsoid onto a cone and unfolding. The cone he used for Denmark was formed by the tangents to the meridians through points with the same latitude as the Observatory. When he returned from Oldenburg he elaborated on this method and in his 1787 report he described how he came closer to the actual measurements by using several cones, each one over points of a fixed latitude; in the unfolding he pieced the different cones together along tangents to a common meridian. In his description of how to calculate the coordinates of a point in the unfolding, he expressed a direction in the plane by $T(\cos w + \sqrt{-1}.\sin w)$. So at least as early as 1787 he had the geometric interpretation of complex numbers as directions in a plane. There is no trace of the product rule in this report. But knowing that he was a master in handling trigonometrical formulas and noticing how

he wished to change from a direction given by $(\cos w^n + \sqrt{-1}.\sin w^n)$ to one given by $(\cos w^{n+1} + \sqrt{-1}.\sin w^{n+1})$ through a turn of the angle of $(w^{n+1} - w^n)$, it is possible that he obtained the geometrical interpretation of the product rule by pursuing this further.

As already explained, he wrote his one and only mathematical treatise in 1796. It was clearly inspired by his work as surveyor, but there is no reference to this, and the results he obtained did not simplify the trigonometrical calculations in the surveying. In part two of his treatise he expressed directions in space by refering to two orthogonal complex planes with the real axis in common. Although his notation may look rather clumsy and the results seem to drown in pages of symbols, there is an underlying simple and elegant geometrical idea which enabled him to obtain a 'universal formula' from which he derived all the spherical trigonometrical formulas.

In 1805 Wessel resigned. But he still worked for the Academy when they needed his help; for instance, in 1808 he drew a triangular map of the duchies Schleswig-Holstein and added some explanations in French, since the maps were requested by the French Emperor Napoleon and sent to Dépôt général de la Guerre in Paris. In 1815 he was made a knight of the Dannebrog in recognition of his exceptional contribution to surveying. He died in 1818.

Acknowledgement: This article is based on joint work with Nils Voje Johansen; our Wessel biography in [1] contains a list of the material used.

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Bodil Branner teaches in the Department of Mathematics, Technical University of Denmark.

E.C. Titchmarsh (b. 1899)

Robin Wilson

On 1 June, around 100 people came to the Mathematical Institute in Oxford to commemorate the 100th anniversary of the birth of Edward ('Ted') Charles Titchmarsh (1899-1963). This gathering, organised by David Edwards, included many of his former colleagues and four generations of his family, including two of his three daughters. Talks were given on his life (Robin Wilson) and his work in the areas of Fourier analysis (David Edwards), the Riemann zeta-function (Roger Heath-Brown) and eigenfunctions (Norrie Everitt).

Early Years

The Titchmarsh family can be traced back many centuries, in the area to the south-west of Cambridge. There is a village called Titchmarsh in Northamptonshire – but it was around Royston that E. C. Titchmarsh's forebears lived as local traders. Titchmarsh's grandfather ran a grocery shop, but Titchmarsh's father entered the church and became a Congregational Minister – first in Newbury, Berkshire, and later in Sheffield (Yorkshire).

Ted Titchmarsh was born in Newbury, the second of four children. In Sheffield he attended King Edward VII School, where he performed well in most subjects. He later wrote: 'The first occasion on which I distinguished myself was when I was in one of the fourth forms. The headmaster for some unknown reason made the whole upper school do an arithmetic paper, the same for all forms. The mathematical specialists in the sixth form came out top, and I came next . . . At this point one had to choose either classical or modern subjects: I was put on the classical side. I learnt enough Latin to pass and enough Greek to fail. It had become clear that mathematics was my real subject, and I began to specialise in it.'

In December 1916 Titchmarsh won the Open Mathematical Scholarship to Balliol College, Oxford, going up in October 1917 for a term. However, he then went away for almost two years on war service, as Second Lieutenant in the Royal Engineers (Signals), going to France from August 1918. He became a dispatch rider, on horse and then motorcycle. He returned to Oxford in October 1919, being tutored by J. W. Russell. Mary Cartwright has written: 'At Russell's first lecture the room was packed to the doors, and Russell said: "Ah, there's my clever pupil Mr Titchmarsh – he knows it all, he can go away." Russell dictated his lectures word for word and examples were handed out – and then, if necessary, solution to examples. Some of Titchmarsh's solutions replaced the official ones.' Certainly his student career was very successful, and he gained a First Class Honours Degree and won the Junior and Senior mathematical scholarships. Later,

E.C. Titchmarsh as a young lecturer

One of Titchmarsh's favourite occupations was playing criket

Ted Titchmarsh was to write: 'I was however principally influenced by G. H. Hardy. From him I learned what mathematical analysis is, and at his suggestion I devoted myself to research in pure mathematics.'

Oxford in the 1920's

His most important contemporary in the 1920s was indeed Hardy, who had left Cambridge in 1920 to succeed William Esson (former deputy to J. J. Sylvester) as Savilian Professor of Geometry in Oxford. Hardy was the founder of the Oxford research school in analysis, a tradition that Titchmarsh followed ten years later when he succeeded Hardy as Savilian professor. Other Oxford contemporaries included Edwin Elliott, the first holder of the Waynflete Chair in pure mathematics, who wrote important books on invariant theory but had 'no sympathy with foreign modern methods'; W. L. Ferrar later described Elliott: 'a man who has written books which have put the works of his rivals on the bookshelves is the worst lecturer who ever picked up chalk', Elliott retired in 1921, being replaced by Alfred Lee Dixon who made few mathematical innovations but knew some 'very pretty things in 19th-century geometry'; Dixon, a keen sportsman, was so strong that he could break a walnut in the crook of his arm. On the applied side, the Sedleian Chair of Natural Philosophy was held for over forty years by Augustus Love, who worked in continuum mechanics and electrodynamics and wrote a classic book on elasticity. In addition, the new Rouse Ball Chair of Mathematics was founded in 1928 and the first holder was E. A. Milne.

But in pure mathematics, Hardy was the main influence. He invited many foreign mathematicians to Oxford, such as the number-theorist Edmund Landau, the Russian emigré Abram Besicovitch, and Georg Pólya, the first Rockefeller Fellow. Hardy's weekly evening mathematical gatherings were of great interest to Titchmarsh, Mary Cartwright and others, as were the meetings of the Oxford Mathematical and Physical Society, found-

Hardy leads a criket team of Oxford mathematicians during a British Association meeting in 1926; Titchmarsh is fourth from the right. Hardy dubbed this photograph "Mathematicians v The Rest of the World".

ed by Sylvester in 1888 and celebrating its 200th meeting in 1925. Hardy's influence also extended beyond mathematics; his regular cricket matches frequently involved Titchmarsh, who had a passion for the game – indeed, his uncle was a professional cricketer.

The 1920s were important years for Titchmarsh. In 1923 he was appointed to a Senior Lectureship at University College, London, giving undergraduate lectures, supervising postgraduates, and starting to publish his research in major journals. Also in 1923 he became a Prize Fellow by examination at Magdalen College, Oxford, awarded to graduates of outstanding merit; he held this position for seven years, and was thereby able to keep in touch with Oxford mathematics. Meanwhile, his father had become a church minister in Essex and Titchmarsh fell in love with Kathleen, the Church Secretary's daughter. Kathleen called him 'Oxford's most B. M. [brilliant mathematician]. They married in 1925 and had three daughters.

In 1929 he was appointed Professor of Pure Mathematics at Liverpool University, succeeding Charles Burkill. While there, he was elected a Fellow of the Royal Society, became President of the Liverpool Mathematical Society, and wrote his first book, a Cambridge tract on the Riemann zeta-function.

Titchmarsh receiving an honorary degree from Sheffield University in 1953

In 1931 Hardy returned to Cambridge to take up the Sadleirian Chair vacated on the resignation of E. W. Hobson. By chance, Titchmarsh was visiting Oxford to examine a doctorate and bumped into Ferrar who asked him whether he'd applied for Hardy's vacant Oxford Chair. Titchmarsh said no, but (encouraged by Ferrar) thought that he might. He sent in an application on a single sheet saying that he wished to apply for the geometry Chair but could not undertake to lecture on geometry as Hardy had done. Two days later he was appointed and the statutes were soon changed to say that the Savilian Professor of Geometry no longer had to lecture on geometry. Writing to Oswald Veblen about the appointment, Hardy said: 'I fancy Littlewood [one of the electors] would have preferred Besicovitch; but I expected the electors, with the opportunity of taking a genuinely first rate Oxford product, to do so. The man I am unhappy about is Mordell: first cut out from Cambridge by my decision to stand there, and then here by the Oxford candidate'. The Chair was associated with New College, where he held a number of college positions.

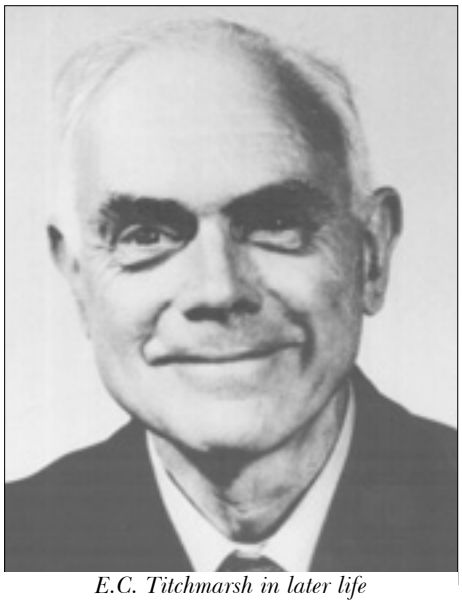
Savilian Professor of Geometry

During his remaining thirty years in Oxford his research publications continued to appear at a great rate, gradually shifting from number theory and trigonometrical series to Fourier transforms, eigenfunction expansions, analysis for physicists, and the theoretical background to relativistic quantum mechanics. It was also during this time that he wrote his best-known textbooks. His tract on the Riemann zeta-function had been written in Liverpool, but was much developed and rewritten twenty years later in Oxford. His first major book, The Theory of Functions was later described as ' the rebellion of a young, widely read professor against the narrow range to which mathematical analysis was then so often confined'. Later writings included classic texts on Fourier integrals and eigenfunction expansions associated with second-order differential equations. His method of writing them was interesting; after researching on a topic for a couple of years he would 'sign off' with a book representing the synthesis of his own discoveries. He also wrote a popular Mathematics for the General Reader.

His achievements became widely recognised. He was President of the London Mathematical Society from 1945 to 1947 and received its highest honours – the De Morgan Medal and the Berwick Prize. Sheffield University awarded him an honorary doctorate in 1953 and he was a plenary speaker at the Amsterdam International Congress the next year. The Royal Society awarded him their Sylvester Medal in 1955.

On a personal basis, he was a man of few words, but his silences were 'benevolent and never oppressive'. While in Oxford he became Curator of the Mathematical Institute, issuing keys to new graduate students. Sir Michael Atiyah recalls that on arrival in Oxford as a graduate student 'I was duly ushered into his big room, where he was sitting at his desk. I sat down and he handed over the key, and I then expected a speech of welcome or some words of advice, but we just sat in silence. After five minutes I left.'

In January 1963, suddenly and completely unexpectedly, he died in his armchair at home. There were many tributes, as everyone was very fond of him. His colleague Charles Coulson wrote: 'There were many things about Ted that I have always much admired – his utter humility, which never betrayed anything but the greatest simplicity; his complete integrity ... and his kindness to me when I arrived first; to his students (who worshipped him) and to everyone'. But perhaps the final tribute can be given in the words of a young visitor to his house who, on being told later that he had been playing dominoes with a great mathematician, remarked: 'Well, he didn't seem like it.'



E.C. Titchmarsh in later life

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We thank Jennifer Andrews for supplying these photographs.

Societies Corner

Societies Corner is a column concerning the mathematical societies in European countries. The articles in this column could describe the history of a particular society or discuss some event connected with the society. If you feel that your society would interest others, please contact the column editor, Krzysztof Ciesielski (e-mail: ciesiels@im.uj.edu.pl) in the first instance.

Swiss Mathematical Society

Urs Stammbach

The Swiss Mathematical Society was founded in 1910, fairly late in comparison with similar societies in other European countries. There were, however, earlier organisations that, at least partially, served the needs of Swiss mathematicians. We first look briefly at these forerunners.

Forerunner Organisations

Before 1800 there were few academic institutions in Switzerland, but two had already achieved European renown in mathematics by the 18th century. One of these was the University of Basle which was founded in 1460 and which, mainly due to the various members of the Bernoulli family, became one of the mathematical centres of Europe in the 18th century. The other one was the Académie de Genève which was founded in 1559. It too achieved European renown in mathematics, due to people like G. Cramer (1704-52) and J.-L. Calandini (1703-58).

When the other universities in Switzerland were founded in the 19th century, mathematics did not, apparently, take high priority. All that was expected of the discipline at that time was the education of specialist teachers in the subject. This is somewhat surprising in view of the fact that, at the time, there were Swiss mathematicians of international importance. Ch. F. Sturm (1803-55) from Geneva was professor at the Ecole Polytechnique and the Sorbonne in Paris and Jakob Steiner (1796-1863) from Berne was at the University of Berlin. Mention must also be made of Steiner's friend, Ludwig Schläfli (1814-95); although he was employed as a lecturer at the University of Berne, his pay was so low that he could not make a living out of his work. Eventually, in 1853, he was made a professor, albeit with a small salary.

Only at the Polytechnicum in Zurich, founded in 1855, was the situation for mathematicians somewhat better. As a basic scientific discipline within the curriculum of a technical education, mathematics enjoyed a high priority status right from the beginning. In addition, in the very early years, and mainly due to the activity of E. B. Christoffel, a school for specialist teachers was established, where scientific mathematics could also be pursued within the framework of a mathematical seminar. The Polytechnicum quickly made a name for itself as a technical school throughout German-speaking Europe, and this especially applied to the area of mathematics. It attracted excellent young mathematicians from Germany who spent the first years of their scientific careers in Zurich: R. Dedekind, E. B. Christoffel, H. A. Schwarz, H. Weber, G. F. Frobenius, A. Hurwitz and H. Minkowski – all stayed for shorter or longer periods. One of the great drawbacks for the Polytechnicum in those days was the fact that it did not have the right to confer doctoral degrees. This became possible in 1909, and in 1911 the name was changed to the *Eidgenössische Technische Hochschule* (Federal Institute of Technology) or, to give it its German acronym, *ETH*.

In keeping with the spirit of the times, scientific societies opened their doors in many university towns. In accordance with the spirit of the enlightenment, their aim was to bring new knowledge to interested parties and circles, by organising gatherings and producing regular publications. The *Naturforschende Gesellschaft* (Scientific Research Society) of Zurich was founded in 1746, and was one of the first such organisations in Europe. Its quarterly publication was of great importance to the mathematical community; until well into the 20th century, numerous mathematical essays were published in it by, for example, E. B. Christoffel, R. Dedekind, H. A. Schwarz, G. F. Frobenius and L. Schläfli, and also by H. Weyl and H. Hopf. A national *Naturforschende Gesellschaft* did not come into being until 1815. Within this body, an informal mathematical section was set up and H. A. Schwarz, who was at the *ETH*, became its first president. The activities of the section petered out, however, after Schwarz was called to Göttingen in 1875.

First International Congress of Mathematicians, 1897

The first International Congress of Mathematicians took place in Zurich in 1897. One might be tempted to assume that this event would have led to the founding of a national mathematical society, but strangely this was not the case. Under the supervision of C. F. Geiser, the congress was jointly organised by mathematicians from the *ETH* and the University of Zurich. Other Swiss universities were not involved in the organisation, nor were many of the participants from other Swiss universities. This was undoubtedly due to the

The three founding members of the Swiss Mathematical Society.
From left to right, R. Fueter (1880-1950), H. Fehr (1870-1954) and M. Grossmann (1878-1936).

The frontispiece of the Proceedings of the First International Congress of Mathematicians, Zurich 1897; the mathematicians featured are (top) Daniel, Jakob and Johann Bernoulli; (bottom) Leonhard Euler and Jakob Steiner

splintered situation and lack of cohesion in the area of mathematics in Switzerland at the time.

Euler's *Complete Works*

During the congress, F. Rudio brought up the idea of publishing the complete works of Leonard Euler. The decision to do so led indirectly – a few years later – to the founding of the Swiss Mathematical Society. It was clear to everyone involved in this project that the publication of Euler's complete works would take many years and require considerable sums of money, and it was clearly necessary that the project be supported by a wide scientific community. At the celebrations for the 200th anniversary of Euler's birth in Basle, F. Rudio and C. F. Geiser, amongst others, submitted a corresponding proposal to *Schweizerische Naturforschende Gesellschaft*. Both Rudio and Geiser were at the *ETH*; the former was director of the library and had wide-ranging historical interests, while the latter was a talented organiser with good connections in political circles. The so-called 'Euler Commission', charged with preparing the publication of Euler's complete works, was founded in the very same year, in 1907. Under the presidency of Rudio, the commission worked swiftly and had soon clarified the financial and scientific aspects of the project. Following the commission's positive report, the project of bringing out Euler's complete works in the original was started. The first volume appeared in 1911, and today more than seventy volumes have been published. It is expected that the project will be completed within the next few years.

Founding of the Swiss Mathematical Society

During the preparations for the publication of Euler's works, the people involved had to fall back on improvisation time and again and sorely felt the need of a national mathematics body in Switzerland: a mathematical organisation was needed to coordinate and realise an undertaking of these dimensions and to secure funding. This is why the publication of Euler's works led indirectly to the founding of the Swiss Mathematical Society. On 4 September 1910 the *SMG/SMS (Schweizer Mathematische Gesellschaft*, its German name, and *Société Mathématique Suisse*, its French one) was founded as a section of the *Schweizerische Naturforschende Gesellschaft* (today, the Swiss Academy of Natural Science). "The advancement of pure mathematics should stand in the foreground and its promotion within a national and international framework" is what Rudolf Fueter, a founding member and the first president of the society, wrote in an article in the *Neue Zürcher Zeitung* on 26 June 1960, on the occasion of the 50th anniversary of the *SMG*.

The founding of the society in 1910 was greeted with great interest by Swiss mathematicians: in its first year the society numbered 100 members. The annual meetings, which took place jointly with the *Schweizerische Naturforschende Gesellschaft* at different venues in Switzerland, were very well attended and undoubtedly helped to create and strengthen the contact and communication between mathematicians from the different (language) regions. That this had been one of the main aims at the founding of the society can be seen by the fact that, from the start, the choice of the president took the various universities of the German and French-speaking regions into consideration, taking care that neither region should dominate the other; the first president, R. Fueter, was at the University of Basle, the second, H. Fehr at the University of Geneva and the third, M. Grossmann at the *ETH* Zurich. It was, incidentally, mainly due to the initiative of these three men that the society came to be founded. Having mathematics embedded in a truly national society became especially important during the first World War as the belligerent actions between Germany and France threatened to poison the atmosphere between the French-speaking Swiss and their German-speaking counterparts.

Commentarii Mathematici Helvetici

Scientific demands on mathematics continued to grow, and with these growing expectations the lack of a Swiss periodical for the publication of scientific mathematical works became painfully apparent. A plan was devised during the 1920s to establish such a journal. The preparation was carried out by H. Fehr, together with some of the former presidents of the society. Faced with the 'multi-lingualarity' of Switzerland, it was clear from the beginning that neither a French or German title would serve; for this reason a Latin name was decided on, and *Commentarii Mathematici Helvetici* was chosen from three suggestions.

The journal was formally founded at the *SMG* meeting of 20 May 1928, and R. Fueter was elected as its first editor-in-chief. In those early years, practically only articles from mathematicians working in Switzerland were published, in order, as Fueter said in the above-mentioned *NZZ* article, "to give as complete a picture as possible of what our country has to offer in the way of mathematics". In the following years the contributions published in the *Commentarii Mathematici Helvetici* became more and more international. Even though the journal filled a void and sold well from the beginning - it had 140 subscribers in its first year of publication - it could not be financed by sales of subscriptions alone. Further funds were needed. In 1929 the *SMG* therefore decided to create a *Stiftung zur Förderung der mathematischen Wissenschaften* in order to attract money from the private sector. Eventually, this foundation was also entrusted with other tasks, and today it still supports specifically targeted projects in teaching and research.

zürich m94

The 1994 International Congress logo and a Swiss postage stamp issued to commemorate the Congress. The stamp features a portrait of Jakob Bernoulli, painted by his brother Nicholas, together with his law of large numbers.

International Congress of Mathematicians, 1932

In 1932 the ICM took place in Zurich for the second time. R. Fueter from the University of Zurich and M. Plancherel from the *ETH* had received a request in Bologna that the next ICM take place in Zurich. The preparations were very different from those for the 1897 congress. Care was taken to carry them out under the patronage of the *SMG* and that the organising committee should include people from universities from other parts of Switzerland. In a far greater measure than in 1897, this congress was organised with the mutual participation of the entire Swiss mathematical community. R. Fueter from the University of Zurich served as president and there were two vice-presidents, M. Plancherel from the *ETH* and H. Fehr from the University of Geneva.

The Steiner and Schläfli Archives

As early as 1930 the *SMG* had laid the foundation for a Steiner archive and formed a responsible committee. The archive was to preserve and manage J. Steiner's scientific legacy; his *Complete Works* had been published by Weierstrass in 1881-82. In 1937 the task of the committee was extended to include "sifting through the legacies of the two great Swiss mathematicians Steiner and Schläfli and making their work accessible". Schläfli's work was eventually published in 1956 in three volumes.

International Contacts

The meetings of the *SMG* brought many opportunities to invite renowned foreign mathematicians to Switzerland to give lectures. For the smaller Swiss universities, these invitations provided among the few opportunities – until well into the 1940s – for making international contacts. Furthering international relations thus remained an especially important task of the *SMG*. With this in mind, the society created numerous honorary memberships for foreign mathematicians with whom it wished to foster relations. These included, amongst others, R. Dedekind, D. Hilbert, H. Weyl, R. Nevanlinna, G. Pólya, H. Whitney and J. Leray, as well as worthy Swiss mathematicians (we name only deceased colleagues) R. Fueter, C. F. Geiser, H. Hopf, A. M. Ostrowski, A. Pfluger, M. Plancherel, G. de Rham, W. Saxer and B. L. van der Waerden.

The ever stronger relationship between Switzerland and the International Mathematical Union must be mentioned in this context. H. Hopf was president from 1955-58, while B. Eckmann served as secretary. Later presidents of the IMU from Swiss universities were G. de Rham from the universities of Geneva and Lausanne, and K. Chandrasekharan and J. Moser from the *ETH* Zurich. Recently, the relationship with the European Mathematical Society has included a prominent position: the current president, Rolf Jeltsch from the *ETH*, is also a member of the *SMG* board.

Elemente der Mathematik

In 1946 L. Locher-Ernst started publication of the journal *Elemente der Mathematik*, quite independent of the *SMG*. It was aimed at a readership consisting mostly of teachers of higher education, although it dealt primarily with mathematics as science and not didactics. In this, *Elemente der Mathematik* was following aims similar to those of *L'Enseignement Mathématique*, the journal set up in 1899 by H. Fehr and Ch. Laisant at Geneva. In 1975 ownership of *Elemente der Mathematik* was transferred to the *SMG* and the Society has been charged with its publication ever since.

International Congress of Mathematicians, 1994

Searching for a venue for the 1994 International Congress of Mathematicians, the IMU again turned to the *SMG* with the request that it take place in Switzerland. After a short location assessment, Zurich was chosen, for the third time, as the most suitable place. Once again, as in 1932, a committee was put together under the patronage of the SMG, made up of mathematicians from all over Switzerland. H. Carnal from the University of Berne served as president and Chr. Blatter from the *ETH* Zurich was secretary. This congress provided a welcome opportunity to steer the interests of the general public towards mathematics and elucidate its role in today's technological society. At the opening address, the Federal Minister of Home Affairs, Ruth Dreifuss, picked up on this very point: 'It is the task of the scientific community to tell the public why science matters. It is your task and mine.' The role of our scientific society towards society as a whole cannot be better expressed.

Urs Stammbach is Professor of Mathematics at the ETH Zurich. *He wishes to thank Dr. F. Lanini from the Wissenschaftshistorische Sammlungen der ETH Bibliothek for her critical proof reading of this manuscript and for many useful suggestions.*

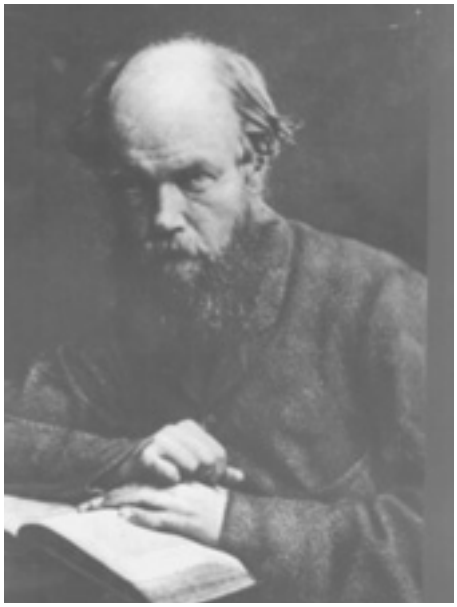
Edinburgh Mathematical Society

Philip Heywood

The Edinburgh Mathematical Society was formed at a meeting in the mathematics classroom of Edinburgh University on Friday 2 February 1883, following the circulation of a letter from A. J. G. Barclay, A. Y. Fraser and C. G. Knott to 'Gentlemen in Edinburgh, in Cambridge, and throughout Scotland generally whom they deemed likely to take an interest in such a Society.' The letter proposed the establishment, in connection with the University, of a society for the mutual improvement of its members in the mathematical sciences, pure and applied. Methods suggested for the attainment of this object were reviews of work, both British and foreign, historical notes, discussion of new problems or new solutions, and comparisons of the various systems of teaching in different countries.

It is interesting that schoolteachers took a leading part in the foundation of the Society. Mr Barclay and Mr Fraser were teachers at George Watson's College in Edinburgh, while Cargill Knott, who took the chair at the inaugural meeting, was assistant to the professor of natural philosophy in the University of Edinburgh, Peter Guthrie Tait. At the first meeting, Professor Tait and George Chrystal, the professor of mathematics at Edinburgh, were elected honorary members. Professor Chrystal gave an address on 'Present fields of mathematical research', and 51 people joined as ordinary members. J. S. Mackay, chief mathematics master at the Edinburgh Academy, was elected as first president of the Society, with Dr Knott as both secretary and treasurer. Mr Fraser succeeded Dr Knott in these offices from the autumn of 1883, when the latter left to become professor of physics at the Imperial University of Japan; Cargill Knott was an authority on magnetism and seismology, and was responsible for conducting the magnetic survey of Japan. After his return to a lectureship in mathematics at Edinburgh in 1891, he served twice as the Society's president, in 1893-94 and in 1918-19. His name is known to many thousands, including the present writer,

Professor Ian Sneddon of Glasgow University and Professor Emeritus W. L. Edge of Edinburgh University enjoy a joke at the Society's centenary dinner in February 1983.



George Chrystal and Peter Guthrie Tait, the first honorary members of the Society.

who were school pupils before the age of calculators, through the publication of his booklet of four-figure mathematical tables.

Prominent and faithful early members of the Society included George Alexander Gibson, president of the Society in 1888-89, professor of mathematics at the Glasgow and West of Scotland Technical College from 1895-1909 and at Glasgow University from 1909-27, and Robert Franklin Muirhead, president in 1899-1900.

With the growth in size of university departments, the Society gradually came more under their influence and paid more attention to mathematical research. Sir Edmund Whittaker, professor of mathematics at the University of Edinburgh from 1912-46, was responsible for the first mathematical colloquium sponsored by the Society, in 1913. A second colloquium was held in Edinburgh in 1914, before the outbreak of war. After the war, colloquia were resumed at St Andrews in 1926, largely through the enthusiasm of H. W. Turnbull, who succeeded to the Regius Chair of mathematics there in 1921, and colloquia have been held in St Andrews regularly ever since. The Society is now firmly established as the principal mathematical society for the university community in Scotland. Its membership, which exceeds 400, is drawn from the Scottish universities and other educational institutions, as well as from mathematicians in industry and commerce both at home and overseas.

The first meeting outside Edinburgh was held in Glasgow in March 1900 during Muirhead's Presidency. Regular meetings in Glasgow followed, and the Society began to meet annually in St Andrews in 1922. The first meetings in Dundee and Aberdeen were held in 1930 and 1937, respectively. At present, the Society meets regularly in ten different universities. Eight ordinary meetings are held in each Session, from October to June, three at the University of Edinburgh, and the remainder in other Scottish universities. Meetings are normally on Friday afternoons, and are open to all who are interested. Speakers are chosen to cover a wide range of topics in pure and applied mathematics. From time to time, the Society organises joint meetings with the London Mathematical Society, and regularly hosts in Scotland that Society's Popular Lectures, intended for senior school pupils and other non-professional mathematicians.

Each year the Society holds a meeting of postgraduate students at the Burn at Edzell, and every four years it holds the St Andrews Colloquium, a major conference held for a week in July, at which three or four distinguished international speakers give short courses of lectures; the next such colloquium will be in 2001.

The *Proceedings of the Edinburgh Mathematical Society* have been published by the Society since 1884. Three issues are published each year, containing research papers covering a wide range of topics in pure and applied mathematics. The *Proceedings* has an international board of consulting editors and has a world-wide circulation.

The Society is conscious that its declared objective, "the promotion and extension of the Mathematical Sciences", is sometimes best achieved through the support of activities planned and instigated by others. It therefore has schemes for awarding grants for mathematical activities, and it joins with other Societies in supporting various initiatives at national and international level through subscriptions, donations and the sending of representatives.

Membership of the Society is open to all who are interested. Prospective members are nominated at one of the Society's meetings and elected at the following meeting. Currently membership costs 11 pounds sterling per year, or 20 pounds including an individual subscription to the *Proceedings*. Further information is available from the Honorary Secretary, Department of Mathematics and Statistics, James Clerk Maxwell Building, Mayfield Road, Edinburgh EH9 3JZ, Scotland, or on the internet at *http://www.maths.ed.ac.uk /~chris/ems*. The Society has reciprocity agreements with a number of overseas mathematical societies, through which membership of one society enables one to join others at a reduced subscription. Postgraduate students at Scottish universities are offered free membership of the Society for up to three years to encourage them to take part in the Society's activities.

The Society's library is housed in the James Clerk Maxwell Building at the University of Edinburgh, and consists mainly of periodicals obtained by exchange with other learned societies throughout the world. Members may consult or borrow books from the Society's library, and are also entitled to use the Edinburgh University Library.

Each year since 1983, the Society has set aside a sum of money, known as the Centenary Fund, to give financial support to a variety of mathematical activities, including research visits, conferences and publications. Any member of the Society may apply for a grant or guarantee from this fund. Awards are normally paid to an applicant's institution rather than to the applicant personally, and a key feature in the consideration of an application is the perceived benefit to the wider mathematical community. Part of the Centenary Fund each year is earmarked for applications from members resident overseas. The Society also sets aside each year a sum of money known as the Education Fund, to give financial support to educational activities of a mathematical nature. As with the Centenary Fund, applications may be made by members of the Society, but additionally the Education Committee itself actively seeks out projects worthy of support. In addition to the Centenary and Education Fund schemes, the General Committee of the Society from time to time makes special grants. Sometimes these are major grants for the support of large international conferences, but equally they may be small grants for worthy mathematical purposes that do not fall within the remits of the two schemes.

Acknowledgement I have drawn freely on the history of the Society, "The First Hundred Years 1883-1983", *Proc. Edinburgh Math. Soc.* **26** (1983), 135-150, by Robert Rankin, formerly professor of mathematics at Glasgow University, President of the Society from 1957-58, and currently an Honorary Member, and also on the Annual Report for 1997-98 by the present Honorary Treasurer, Neil Dickson of Glasgow University.

Philip Heywood teaches in the Department of Mathematics and Statistics at the University of Edinburgh.

Forthcoming conferences

compiled by
Kathleen A S Quinn

Please e-mail announcements of European conferences, workshops and mathematical meetings of interest to EMS members, to k.a.s.quinn@open.ac.uk. Announcements should be written in a style similar to those below, and sent as text files (but not as TeX input files). Space permitting, each announcement will appear in detail in the next issue of the Newsletter to go to press, and thereafter will be briefly noted in each new issue until the meeting takes place, with a reference to the issue in which the detailed announcement appeared. The present issue includes conferences up to September 2000.

October 1999

4-8: International Workshop on General Topological Algebras, Tartu, Estonia
Information:
e-mail: abel@math.ut.ee

4-8: ParaOpt VI, 6th International Conference on Parametric Optimization and Related Topics, Dubrovnik, Croatia
Information:
URL:
http://www.math.hr/dubrovnik/index.htm

4-15: Isaac Newton Institute Workshop, Defect Mechanics and Non-locality, Cambridge, UK
Information:
URL: http://www.newton.cam.ac.uk/programs/

5-9: Géométrie des équations differentielles, Luminy, France
Information: contact J.-P. Francois, Equipe «Géométrie différentielle, Systèmes dynamiques, applications, UFR 920, Mathématiques, B.C. 172, Tour 46, 5ème étage, Université P.-M. Curie, Paris VI 75252, Paris, France; fax: +33-1-442-5345
e-mail: jpf@ccr.jussieu.fr
[For details, see EMS Newsletter 32]

6-9: New Trends in the Calculus of Variations, Lisbon, Portugal
Information: Contact CMAF/Univ. Lisboa, Av. Prof. Gama Pinto 2, 1649-003 Lisboa, Portugal
e-mail: ntcv99@math.ist.utl.pt
URL: http://www.math.ist.utl.pt/~ntcv99/
[For details, see EMS Newsletter 32]

15-16: Two-day LMS meeting, New Applications of Twistor Theory, London, UK
Speakers: K.P. Tod (Oxford), M.G. Eastwood (Adelaide), N.J. Hitchin (Oxford), S. Merkulov (Glasgow), L.J. Mason (Oxford), Sir Roger Penrose (Oxford)
Grants: apply to lms@lms.ac.uk
Deadline: to book reserved accommodation, 1 October 1999
Information:
e-mail: oakes@lms.ac.uk

21-26: Foundation Workshop on Stochastics and Quantum Physics, Aarhus, Denmark
Aim: to foster fruitful discussions and collaboration on the role and use of stochastics in quantum physics, by bringing together leading physicists and mathematicians having an active interest in the themes of the workshop
Main themes: (confirmed key-note speakers in parentheses) laser physics/quantum optics (F. Bardou, H. Carmichael, G. Mahler), quantum stochastic processes (A. Barchielli, V.P. Belavkin, G. Lindblad), Wick products, white noise analysis and Malliavin calculus (B. Øksendal), the role of generalised measurements and quantum statistical inference (R. Gill, S. Massar, H. Wiseman), quantum information (A.S. Holevo, P. Høyer, A. Peres, S. Popescu)
Programme: during the first two days, B. Øksendal will give a short course on Wick products, Malliavin calculus and their applications in physics
Organisers: O.E. Barndorff-Nielsen (Aarhus), K. Molmer (Aarhus)
Fee: the registration fee is DKK600, to cover lunches, coffee during breaks and the conference dinner. Those who participate only in the short course need not pay the registration fee
Site: University of Aarhus
Deadlines: for registration, already passed
Information:
URL:
http://www.maphysto.dk/events/QuantumStoc99/index.html

November 1999

1-12: Isaac Newton Institute Workshop, Models of Fracture, Cambridge, UK
Information:
URL: http://www.newton.cam.ac.uk/programs/

2-5: Workshop on Hilbert's 10th problem, relations to arithmetic and algebraic geometry
Information: contact Jan Van Geel or Karim Zahidi, University of Gent, Department of Pure Mathematics, Galglaan 2, B-9000 Gent, Belgium; fax. +32-9-264-49 93
e-mail: hilbrt10@cage.rug.ac.be
URL:
http://cage.rug.ac.be/~hilbrt10/hilbert10.html
[For details, see EMS Newsletter 32]

25-26: XXème Rencontre Franco-Belge de Statisticiens, Brussels, Belgium
Topic: factor models. In a factor model, one tries to explain the correlation between several random variables using a limited number of factors. This conference aims to present the latest developments as well as the numerous applications of factor models
Programme committee: Christophe Croux, Alois Kneip, Lucrezia Reichlin, Eric Renault, Bas Werker
Organisers: Institut de Statistique et de Recherche Opérationelle, European Center for Advanced Research in Economics and Statistics
Site: Universite Libre de Bruxelles, Brussels
Deadline: for submission of papers, already passed
Information: contact RFBS99, Institut de Statistique, CP210, ULB, B-1050 Bruxelles, Belgium; tel/fax: +32-2-650-5899
e-mail: RFBS99@ulb.ac.be
URL: http://isro.ulb.ac.be

December 1999

2-4: Conference on Mathematical and Computational Methods in Music, Vienna
[Part of the EMS Diderot Forum series]
Aim: to bring together mathematicians interested in or working on subjects of relevance to music, and musicians who make use of computational methods; to raise public awareness of the role of mathematics in our society, in particular by showing the multiple connections and mutual influences which exist between music and mathematics
Topics: synthesis of musical sounds, analysis of musical sounds (transcription digital data - MIDI, time-frequency methods, quantitative analysis of instruments and musical interpretation), restoration and improvement of old recordings and mathematical algorithms, 'instrument optimisation' (instrumental parameter identification), coding strategies for musical information, mathematical models for musical sound or rhythm
Invited speakers: (confirmed) W. Fitzgerald (Cambridge), G. DePoli (Padua), X. Serra (Barcelona), G. Wakefield (Ann Arbor, Michigan)
Scientific committee: Werner A. Deutsch (Austrian Acadademy of Science, Kommission für Schallforschung), Hans G. Feichtinger (Institut für Mathematik, University of Vienna, main organizer), Christian Krattenthaler (Institut für Mathematik, University of Vienna), Erich Neuwirth (Institut für Statistik, University of Vienna), Gregor Widholm (Institut für Wiener Klangstil, University of Music and Dramatic Arts, Vienna), Gerhard Widmer (Austrian Research Institute for Artificial Intelligence, Vienna)
Local organising committee: Monika Dörfler, Hans G. Feichtinger, Christian Krattenthaler, Stefan Thurner
Supporting institutions: Universität Wien, EMS (European Mathematical Society), OEMG (Austrian Mathematical Society), Mathematischer Zirkel der Universität Wien, OECG (Austrian Computer Society), Bank Austria
Proceedings: to be published in a special issue of the OECG series (Austrian Computer Society)
Site: Kleiner Festsaal der Universität Wien, main building of the University of Vienna

Accommodation: participants should make their own arrangements; the organisers may be consulted
Social event: a concert with contributions from participants is planned
Deadline: for submission, already passed
Information: contact Hans G. Feichtinger, Institut für Mathematik, Universität Wien, Strudlhofgasse 4, A-1090 Vienna
tel: +43-1-4277-50696; fax: +43-1-4277-50620
e-mail: diderot@tyche.mat.univie.ac.at
URL: http://tyche.mat.univie.ac.at/~diderot/

20-22: Seventh IMA International Conference on Cryptography and Coding, Cirencester, UK
Information:
e-mail: conferences@ima.org.uk
URL: http://www.ima.org.uk/mathematics/conferences.htm
[For details, see EMS Newsletter 32]

January 2000

17-22: Workshop on Computational Stochastics, Aarhus
Information: contact Eva B. Vedel Jensen, Department of Mathematical Sciences, University of Aarhus, Ny Munkegade, DK-8000 Aarhus C
e-mail: eva@imf.au.dk
URL:http://www.maphysto.dk/events/CompStoc2000/
[For details, see EMS Newsletter 32]

February 2000

3-5: Mathematics Today, Trondheim, Norway
Note: primarily intended for a Scandinavian audience
Information:
URL: http://www.math.ntnu.no/talltiltusen/

28-3 March: Eighth International Conference on Hyperbolic Problems, Magdeburg, Germany
Topic: theory, numerics and applications of hyperbolic conservation laws and related fields
Plenary speakers: Yann Brenier (Paris), Thomas Hou (Pasadena), Shuichi Kawashima (Fukuoka), Ingo Mueller (Berlin), Alfio Quarteroni (Lausanne), Phil Roe (Ann Arbor), Giovanni Russo (L'aquila), Steve Schochet (Tel Aviv), Joel Smoller (Ann Arbor), Michael Struwe (Zuerich), Kevin Zumbrun (Bloomington)
Invited Speakers: Francois Bouchut (Orleans), Suncica Canic (Houston), Pierre Degond (Toulouse), Eduard Feireisl (Prague), Emmanuel Grenier (Lyon), David Hoff (Bloomington), Shi Jin (Atlanta), Kenneth H. Karlsen (Bergen), Smadar Karni (New York), Claus-Dieter Munz (Stuttgart), Benedetto Piccoli (Salerno), Bradley Plohr (Stony Brook), Ed Seidel (Potsdam), Tao Tang (Hong Kong), Eleuterio Toro (Manchester), Cheng-Chin Wu (Los Angeles), Tong Yang (Hong Kong), Shi-Hsien Yu (Osaka)
Scientific committee: J. Ballmann, A. Bressan, C. Dafermos, B. Engquist, M. Feistauer, H. Freistühler, J. Glimm, L. Hsiao, R. Jeltsch, P. Lax, T.-P. Liu, P. Marcati, D. Marchesin, K.W. Morton, B. Perthame, D. Serre, E. Tadmor, A. Tveito, and G. Warnecke.
Organisers: G. Warnecke, H. Freistueühler.
Call for papers: abstracts for contributed papers may be submitted immediately
Site: Otto-von-Guericke University, Magdeburg
Information: contact HYP-2000 c/o Institut für Analysis und Numerik Otto-von-Guericke-Universität Magdeburg PSF 4120, D-39016 Magdeburg, Germany; fax: HYP-2000 at +49-391-67-18073
e-mail: hyp2000@mathematik.uni-magdeburg.de
URL: http://rubens.math.uni-magdeburg.de/~hyp2000

March 2000

11-12: School Mathematics 2000, Helsinki, Finland
Information:
e-mail: petri.graeffe@maol.fi

April 2000

11-14: Workshop on Harmonic Maps and Curvature Properties of Submanifolds 2, Leeds, UK
Aim: to stimulate cooperation between researchers working in harmonic maps and those working in submanifold theory
Speakers: (expected plenary speakers) F. Burstall, T.E. Cecil, M.A. Guest, F. Helein, Y. Ohnita, F. Pedit, U. Pinkall, G. Thorbergsson
Programme committee: S. Carter, J.C. Wood.
Information: contact J.C. Wood, School of Mathematics, University of Leeds, Leeds LS2 9JT, UK
e-mail: j.c.wood@leeds.ac.uk
URL: http://www.amsta.leeds.ac.uk/pure/geometry/leeds2000.html

17-20: 52nd British Mathematical Colloquium, Leeds, UK
Scope: the annual meeting of (pure) mathematicians in the UK; all mathematicians are welcome
Plenary speakers: Sir Michael Atiyah (Edinburgh), Simon Donaldson (Imperial College), Vaughan Jones (Berkeley), Harvey Friedman (Ohio), Jens Jantzen (Aarhus); also 14 main speakers, mostly based in the UK
Special sessions: harmonic maps and minimal surfaces; operator algebras
Splinter groups: number theory, mathematical logic, algebraic topology, mathematical education, functional analysis, algebra, and integrable systems
Organisers: H.G. Dales and H.D. Macpherson, Leeds
Site: University of Leeds
Registration: forms will be available in early 2000; they will be circulated with the London Mathematical Society Newsletter, and sent to all UK Departments of Mathematics; to obtain a form, please contact H.D. Macpherson at the e-mail address below
Accommodation: available on the campus of the University of Leeds
Satellite conferences: 11-14 April, Harmonic maps and curvature properties of submanifolds, Leeds; 14-17 April, Mathematical methods of regular dynamics - dedicated to the 150th anniversary of Sonja Kowalevski, Leeds; 16-17 April, British topology meeting, Sheffield; 17 April, Model theory, Leeds
Information:
e-mail: h.d.macpherson@leeds.ac.uk
URL: http://www.amsta.leeds.ac.uk/bmc/

26-28: Mathematical Education of Engineers, Loughborough, UK
Aim: to reflect the progress and experiences of initiatives within the teaching of mathematics to engineers in recent years, to debate areas of known concern and to learn together from current best practice; to examine collectively as mathematicians, academic engineers and engineers in industry the engineering mathematics provision for the future
Programme: invited speakers, contributed papers (or posters), workshop sessions and a forum
Organising committee: Leslie Mustoe (Loughborough), Stephen Hibberd (Nottingham), Trevor Easingwood (IMA), Duncan Lawson (Coventry); Heather Liddell (London), John McWhirter (DERA), Stephen Reid (UMIST), Ralph Smith (Jaguar)
Proceedings: to be published by the Institute of Mathematics
Sponsors: The Institution of Civil Engineers and The Institution of Chemical Engineers
Site: Loughborough University
Deadline: for abstracts, 3 December
Information:
URL: http://www.ima.org.uk/mathematics/conferences.htm

May 2000

29-9 June: Foliations: Geometry and Dynamics Revisited, Banach Centre, Warsaw, Poland
Aim: the exchange of scientific information among specialists in the theory of foliation and related topics, in particular in the area of relations between this theory, differential geometry, dynamical systems and ergodic theory

June 2000

13-16: First AMS-Scandinavian International Mathematics Meeting, XXIII Scandinavian Congress of Mathematicians, Odense, Denmark
Speakers: Tobias Colding (New York), Nigel J. Hitchin (Oxford), Elliott Lieb (Princeton) Pertti Mattila (Jyväskylä), Curtis McMullen (Harvard), Alexei Rudakov (Trondheim), Dan-Virgil Voiculescu (Berkeley), Johan Hostad (Stockholm)
Special sessions: (to run in parallel) algebraic groups/representation theory, complex analysis in higher dimensions, differential geometry, discrete mathematics, dynamical systems, geometric analysis/PDE, K-theory and operator algebras, linear spaces of holomorphic functions, mathematical physics, mathematics education, stochastic DE and financial

mathematics, joint EWM and AWM session
Information: contact Hans J. Munkholm, Odense University, Campusvej 55, DK 5230 Odense M, Denmark
tel: +45-6557-2309/+45-6593-2691
e-mail: hjm@imada.ou.dk
URL:http://www.imada.ou.dk/~hjm/AMS.Scand.2000.html

14-17: International Workshop for Operator Theory and Applications (IWOTA), Bordeaux, France
Aim: to bring together mathematicians and engineers interested in operator theory and its applications to related fields
Scope: operator theory and related topics in mathematics and its applications: differential operators, reproducing kernel spaces, harmonic analysis, control theory, system theory and signal processing
Invited speakers: (confirmed) V.M. Adamyan, D. Alpay, A. Böttcher, L de Branges, R.F. Curtain, K. Davidson, C. Foias, I. Gohberg, W. Helton, R. Kaashoek, A. Megretski, Y. Meyer, S.N. Naboko, J. Partington, G. Pisier, C. Sadosky, E.B. Saff, K. Seip, O. Staffans, S. Treil, S. Verduyn Lunel
Organising committee: L. Baratchart (Sophia-Antipolis), A. Borichev (Bordeaux), G. Cassier (Lyon), J. Esterle (Bordeaux), N. Nikolski, chairman (Bordeaux and St.Petersburg), V.-H. Vasilescu (Lille)
President of the steering committee: I. Gohberg (Tel Aviv)
Site: University of Bordeaux-1
Information:
e-mail: iwota@math.u-bordeaux.fr
URL: http://www.math.u-bordeaux.fr/~iwota/

18-21: International Conference on Monte Carlo Simulation, Monte Carlo, Monaco
Aim: to provide an opportunity for engineers, mathematicians and other professionals who are interested in the theoretical and practical aspects of Monte Carlo simulation to exchange ideas on the status of MCS procedures
Topics: include algorithms for random number generation, methods for solutions (spectral simulation, solving the PDEs directly, numerics of PDEs), algorithms (evolutionary, genetic), practical engineering applications
Deadline: for abstracts, 12 December
Information:
URL:
http://www.uibk.ac.at/c/c8/c810/conf/mcs_2000.html

18-24: Perspectives of Mathematics, Goslar, Germany
[World Mathematical Year event]
Aim: to bring together senior and younger mathematicians to discuss the perspectives of mathematics at the turn of the century
Speakers: (confirmed) V. Arnold (Paris and Moscow), M. Gromov (Bures sur Yvette), R. James (Minnesota), J.P. Morel (Cachan), G.C. Papanicolaou (Stanford), A. Schrijver (Amsterdam), D. Zagier (Bonn)
Scientific committee: J.-P. Bourguignon (Paris), F. Hirzebruch (Bonn), K.-H. Hoffmann (Bonn), S. Müller (Leipzig).
Local organiser: K. Hulek
Note: the number of junior participants is limited to 50. The workshop is aimed at younger mathematicians, that is, those who have had a PhD for at least one year and have done research beyond their thesis, but do not yet hold a senior tenured position
Deadline: for applications, 31 January
Information: contact K. Hulek, Institut für Mathematik, Universität Hannover, Postfach 6009, D-30060 Hannover, Germany
e-mail: Hulek@math.uni-hannover.de
URL: http://www-ifm.math.uni-hannover.de/info/perspectives.html

26-30: POISSON 2000, France
Information:
e-mail: dufourj@darboux.math.univ-montp2.fr

28-1 July: First World Congress of the Bachelier Finance Society, Paris, France
Information:
e-mail: geman@dauphine.fr

29-3 July: International Workshop on Nonlinear Spectral Theory, Würzburg, Germany
Topic: state-of-the-art of spectral and eigenvalue theory for nonlinear operators
Scope: to bring together experts on nonlinear analysis to discuss recent developments and open problems in the theory, methods, and applications of spectra of nonlinear operators
Programme: 15 invited one-hour lectures, short communications, informal discussion
Lecturers: R. Chiappinelli (Siena), G. Conti (Florence), E. De Pascale (Cosenza), W. Feng (Toronto), M. Furi (Florence), M. Martelli (Fullerton), M.Z. Nashed (Newark), T. Riedrich (Dresden), P. Santucci (Rome), C.A. Stuart (Lausanne), V.A. Trenogin (Moscow), M. Vath (Wurzburg), A. Vignoli (Rome), J.R.L. Webb (Glasgow), P.P. Zabrejko (Minsk)
Sponsor: Deutsche Forschungsgemeinschaft (DFG), Bonn
Site: Department of Mathematics, University of Würzburg (Franconia)
Information: contact Jurgen Appell, Department of Mathematics, University of Würzburg, Am Hubland, D-97074 Würzburg, Germany
tel: +49-931-8885017; fax: +49-931-8885599
e-mail: appell@mathematik.uni-wuerzburg.de
URL: www.mathematik.uni-wuerzburg.de/~appell/nlst.html

July 2000

3-7: ALHAMBRA 2000, Granada, Spain
Information:
e-mail: ruiz@ugr.es

3-7: Functional Analysis Valencia 2000, Spain
[satellite conference to the Third European Congress of Mathematics in Barcelona, 10-14 July]
Information: contact: K.D. Bierstedt or J. Bonet, Univ. Paderborn, FB 17, Math., D-33095 Paderborn, Germany or Universidad Politècnica de Valencia, Departamento de Matemática Aplicada, E-46071 Valencia, Spain
e-mail: VLC2000@uni-paderborn.de
URL: http://math-www.uni-paderborn.de/VLC2000
[For details, see EMS Newsletter 32]

3-7: Sixth International Conference on p-Adic Analysis, Ioannina, Greece
Information:
e-mail: akatsar@cc.uoi.gr

4-7: Second International Conference on Mathematical Methods in Reliability, Bordeaux, France
Information:
e-mail: Nikolaos.Limnios@utc.fr

10-14: IUTAM Symposium on Free Surface Flows, Birmingham, UK
Topics: axisymmetric free surface flows, moving contact lines, non-linear water waves, collapsing bubbles
Scientific committee: J.R. Blake, J.B. Keller, A.C. King, W. Lauterborn, D.H. Peregrine, A. Prosperetti, E.O. Tuck, L. van Wijngaarden
Local organising committee: J.R. Blake (co-chair), A.C. King (co-chair), J. Billingham, S.P. Decent, Y.D. Shikhmurzaev, J.R. King, J.R.A. Pearson, E.J. Hinch, J.M. Vanden-Broeck
Site: University of Birmingham
Related meetings: 17-20 July, IUTAM Symposium 2000/10 Diffraction and Scattering in Fluid Mechanics and Elasticity, Manchester; 17 July-4 August, Free Boundary Problems in Industry, Isaac Newton Institute, Cambridge, UK
Deadline: for abstracts, 1 January
Information:
URL:
http://www.mat.bham.ac.uk/research/iutam.htm

10-14: Third European Congress of Mathematics, Barcelona
Information: contact Societat Catalana de Matemátiques, Carrer del Carme, 47, E-08001 Barcelona
tel: +343-270-16-26; fax: +343-270-11-80
e-mail: 3ecm@iec.es
URL: http://www.iec.es/3ecm/
[For details, including satellite conferences, see First Announcement in EMS Newsletter 31]

17-20: IUTAM Symposium 2000/10 Diffraction and Scattering in Fluid Mechanics and Elasticity, Manchester, UK
Aim: to bring together researchers from a range of different subject disciplines and industrial focuses, who employ common techniques and approaches, to examine the ways that the various subjects have developed and to stimulate cross-fertilisation of the theoretical ideas and methodologies.
Themes: elastic waves, acoustic phenomena in stationary fluids, aeroacoustics, diffraction of free surface and other geophysical waves
Organisers: hosted jointly by the Departments of Mathematics, University of Manchester and Keele University
Local organising committee: I. David

Abrahams (Manchester, chair), C. John Chapman (Keele), Paul A. Martin (Manchester), Mike J. Simon (Manchester). Graham Wilks (Keele), Andrew J. Willmott (Keele)
Proceedings: will be published
Site: University of Manchester
Related conference: IUTAM Symposium on Free Surface Flows, 10-14 July 2000
Deadline: for abstracts, 31 January
Information: contact Professor David Abrahams, Department of Mathematics, University of Manchester, Oxford Road, Manchester M13 9PL, UK
tel: +44-161-275-5901, fax: +44-161-275-5819
e-mail: i.d.abrahams@ma.man.ac.uk
URL: http://www.keele.ac.uk/depts/ma/iutam/

17-22: Colloquium on Lie Theory and Applications, Vigo, Spain
[Satellite Activity of the Third European Congress of Mathematics]
Programme: three courses of three hours each, eleven invited lectures and several short communications
Courses: D.V. Alekseevsky, Semisimple Lie algebras, Dynkin diagramms and geometry of flag manifolds; A.T. Fomenko, Lie groups and integrable Hamiltonian systems; M. Scheunert
Speakers: S. Benayadi, M. Bordemann, V. Cortés, A. González-López, Yu.B. Hakimjanov, E. Koelink, M. de León, E. Macías-Virgós, A. Medina, C. Moreno, K-H. Neeb
Scientific committee: D.V. Alekseevsky (Germany), S. Benayadi (France), M. Bordemann (Freiburg), V. Cortés (Bonn), A.T. Fomenko (Moscow), A. González-López (Madrid), Yu.B. Hakimjanov (France), K.H. Hofmann (USA), E. Koelink (Netherlands), M. de León (Spain), E. Macías-Virgós (Santiago), A. Medina (France), C. Moreno (Bourgogne and Madrid), K-H. Neeb (Germany), M. Scheunert (Bonn)
Organising committee: N. Alonso, I. Bajo, R. González, A. Martín and E. Sanmartín (Vigo)
Languages: English, Spanish and French; English is recommended in abstracts and in the written version of the communications
Registration: possible from 1 February to 30 April
Deadline: for abstracts, 30 November
Note: first of a series of conferences devoted to all aspects of lie theory to be held in different locations biannually
Information: contact I Colloquium on Lie Theory and Applications, E.T.S.I. Telecomunicación, Universidad de Vigo, 36280 Vigo, Spain;
tel: +86-81-21-52 // +86-81-24-45; fax: +86-81-21-16 // +86-81-24-01
e-mail: clieta@dma.uvigo.es
URL: http://www.dma.uvigo.es/~clieta/

17-22: International Congress of Mathematical Physics, London, UK
Information:
URL: http://icmp2000.ma.ic.ac.uk/

23-31: ASL European Summer Meeting (Logic Colloquium 2000), Paris, France
Main themes: proof theory and logical foundations of computer science, set theory, model theory, computability and complexity theory, history of 20th-century logic, philosophy, applications of logic to cognitive sciences
Programme: 24 plenary talks, four three-hour tutorials, parallel sessions of contributed talks.
Programme committee: Daniel Andler (Paris), Chantal Berline (Paris), Barry Cooper (Leeds), Akihiro Kanamori (Boston), Charles Parsons (Harvard), Alexander Razborov (Moscow), Helmut Schwichtenberg (Munich), John Steel (Berkeley), Stevo Todorcevic (Paris), Dirk van Dalen (Utrecht), Alex Wilkie (Oxford), Carol Wood (Chairperson, Wesleyan University)
Organising committee: Chantal Berline (Paris), Zoé Chatzidakis (Paris), René Cori (Chairman, Paris), Maximo Dickmann (Paris), Jacques Dubucs (Paris), Jean-Baptiste Joinet (Paris), Daniel Lascar (Paris), Yves Legrandgérard (Paris), Jean Mosconi (Paris), Marie-Hélène Mourgues (IUFM de Créteil), Catherine Muhlrad-Greif (Paris), Leszek Pacholski (Wroclaw), Jean-Pierre Ressayre (Paris), Boban Velickovic (Paris), Francoise Ville (Paris)
Site: the Sorbonne (Université Paris 1)
Deadline: for abstracts, 31 March
Information: to receive the congress announcements, send a request by e-mail to lc2000-robot@logique.jussieu.fr with subject get-announcement, or by fax to +33-1-44-27-61-48 (from abroad) and 01-44-27-61-48 (from France), or by letter to LC2000, UFR de Mathématiques, case 7012, Université Paris 7-Denis Diderot, 2 place Jussieu, 75251 Paris Cédex 05, France.
e-mail: asl@math.uiuc.edu
URL: http://lc2000.logique.jussieu.fr

31-3 August: Third Conference of Balkan Society of Geometers, Bucharest, Romania
Topics: Riemannian geometry, symplectic geometry, submanifolds theory, Chen invariants, harmonic maps, spectral geometry, Finsler-Lagrange-Hamilton geometry, geometry of PDEs, critical point theory and its applications, convexity and optimisation on Riemannian manifolds, electromagnetic dynamical systems, numerical integrator of dynamical systems
Programme: 30-minute lectures and 15-minute papers; a workshop engaging Masters and Ph.D. students in geometry, and an open forum of the Balkan Society of Geometers
Conference chairs: R. Miron (Romania), Gr. Tsagas (Greece), C. Udriste (Romania)
Programme committee: M. Anastasiei (Romania), D. Andrica (Romania), P.L. Antonelli (Canada), Gh. Atanasiu (Romania), D. Blair (USA), N. Blazic (Yugoslavia), V. Boskoff (Romania), K. Buchner (Germany), B.Y. Chen (USA), V. Cruceanu (Romania), D. Hrimiuc (Canada), S. Ianus (Romania), L. Nicolescu (Romania), D. Opris (Romania), D. Papuc (Romania), Gh. Pitis (Romania), P. Popescu (Romania), M. Puta (Romania), H. Shimada (Japan), P. Stavrinos (Greece), L. Tamassy (Hungary), K. Trencevski (Macedonia), I. Vaisman (Israel), L. Vanhecke (Belgium), L. Verstraelen (Belgium), E. Vassiliou (Greece)
Organiser: C. Udriste
Proceedings: selected papers will be published in the Balkan Journal of Geometry and its Applications
Site: University Politehnica of Bucharest, Splaiul Independentei Street 313, Bucharest, RO-77206
Deadline: for registration, 15 April
Information: contact V. Balan, University Politehnica of Bucharest, Department of Mathematics I, Splaiul Independentei 313, RO-77206, Bucharest, Romania
fax: +401-411-53-65
e-mail: vbalan@mathem.pub.ro

August 2000

8-12: XVIII Nevanlinna Colloquium, Helsinki, Finland
[World Mathematical Year event]
Scope: the emphasis will be on subjects in some way connected to analysis, especially geometric aspects
Speakers: include A. Baernstein (St. Louis), J. Cheeger (New York), W. Bergweiler (Kiel), P. Mattila (Jyväskylä), C. Bishop (Stony Brook), C. McMullen (Berkeley), B. Bowditch (Southampton), Yu. Reshetnyak (Novosibirsk), L. Carleson (Stockholm)
Programme: about 45 invited talks
Organising committee: Peter Buser (Lausanne), Seppo Rickman (Helsinki), Ilpo Laine (Joensuu), Kurt Strebel (Zürich), Olli Lehto (Helsinki),.Pekka Tukia (Helsinki), Olli Martio (Helsinki), Matti Vuorinen (Helsinki)
Site: University of Helsinki
Information: to receive the second announcement, send e-mail to RNC2000@www.math.helsinki.fi or write to Riitta Ulmanen, Department of Mathematics, P.O. Box 4 (Yliopistonkatu 5), FIN-00014 University of Helsinki, Finland
e-mail: pekka.tukia@helsinki.fi
URL: http://www.math.helsinki.fi/~analysis/NevanlinnaColloquium/

21-25: IMACS 2000, Lausanne, Switzerland
[International Association for Mathematics and Computers World Congress]
Information: contact Prof. Robert Owens, IMACS Congress 2000, DGM-IMHEF-LMF, Swiss Federal Institute of Technology, CH-1015 Lausanne, Switzerland
tel: +41-21-693-35-89; fax: +41-21-693-36-46
e-mail: robert.owens@epfl.ch
URL: http://imacs2000.epfl.ch
[For details, see EMS Newsletter 32]

30-2 September: Innovations in Higher Education 2000, Helsinki, Finland
Theme: higher education in general (not just mathematics)
Information:
e-mail: sari.lindblom-ylanne@helsinki.fi
URL: http://www.helsinki.fi/inno2000

Recent books

edited by Ivan Netuka and Vladimír Souèek

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

S. K. Berberian, *Fundamentals of Analysis*, *Universitext, Springer, New York, 1999, 479 pp., DM99, ISBN 0-387-98480-1*
This book is essentially a record of a course on functions of a real variable for first-year graduate students in mathematics, offered at the University of Texas at Austin.

The foundational material includes construction of the reals, cardinal and ordinal numbers, Zorn's lemma and transfinite induction. Chapter 2 is devoted to Lebesgue measure on R introduced via Carathéodory outer measure, and Chapter 3 presents a short introduction to metric and topological spaces. Chapter 4 deals with abstract Lebesgue integral, including convergence theorems, finite signed measures and the Radon-Nikodym theorem. Chapter 5, *Differentiation*, includes absolutely continuous functions, functions of bounded variation, F. Riesz's Rising Sun Lemma, indefinite integrals, Lebesgue's Fundamental theorem of calculus, Lebesgue decomposition of a function of bounded variation and a criterion for Riemann-integrability. The Stone-Weierstrass approximation theorem, L^p-spaces and real and complex measures are studied in Chapter 6. Product measures and Fubini-Tonelli theorem are covered in Chapter 7. Chapter 8 deals with Picard's and Peano's existence theorems for $y' = f(x, y)$. Additional topics in measure and integration (Jordan-Hahn decomposition of a signed measure, the Radon-Nikodym theorem for σ-finite measures, Lebesgue decomposition of measures, convolution) are included in Chapter 9.

The material is well chosen, the presentation nice, the balance between special and general is reasonable, and each section is accompanied by exercises. This textbook will surely find many readers among both students and teachers interested in mathematical analysis. (in)

C. Blatter, *Wavelets. A Primer*, *A. K. Peters Ltd., Natick, 1998, 202 pp., £24, ISBN 1-56881-095-4*
This excellent book is intended as an introduction to the wavelet transform for students in mathematics. It provides a solid, yet accessible, mathematical foundation for those interested in learning about wavelets and pursuing the broad range of applications for which the wavelet transform has proved successful.

The book is divided into six chapters. The introductory Chapter 1 presents a *tour d'horizon* over various ways of signal representation. Chapter 2 serves primarily as a tutorial on Fourier analysis. The continuous wavelet transform is treated in Chapter 3, while Chapter 4, *Frames*, decribes a general framework that allows one to handle the continuous and the discrete wavelet transforms in a uniform way. Multi-resolution analysis with its fast algorithms is presented in Chapter 5. The construction of orthonormal wavelets with compact support is given in Chapter 6, and the book ends with a brief treatment of spline wavelets in Section 6.4.

Numerous illustrations and fully worked-out examples further enhance the value of this exemplary introduction to the field. (kn)

J. Bochnak, M. Coste and M.-F. Roy, *Real Algebraic Geometry*, *Series of Modern Surveys in Mathematics 36, Springer, Berlin, 1998, 430 pp., ISBN 3-540-64663-9*
This is a substantially enlarged and updated edition of *Géométrie Algébrique Réelle* by the same authors published in the same publishing house and in the same series as Vol. 12. It is a highly competent monograph written by the leading specialists in the field. Without any doubt this is an indispensable book for mathematicians working in real algebraic geometry, but it is so well written that it can be used as a textbook for postgraduate students. Of course, a preliminary knowledge of complex algebraic geometry is very helpful for understanding the differences between 'a little classical' complex algebraic geometry and real algebraic geometry. But the development of mathematics is very quick, and I can well imagine students who start to study algebraic geometry via the real algebraic geometry. On the other hand, mathematicians who are at least a little familiar with the complex algebraic geometry will appreciate the new real ideas and methods. Some chapters of the book, like the *Nash Functions*, will be interesting for mathematicians working in analysis, other parts like *Topology of real algebraic varieties, Algebraic vector bundles, Polynomial or regular mappings with values in spheres* will be interesting for topologists, the chapter *Algebraic models of C^∞ manifolds* will attract the attention of differential geometers, while algebraists will find here a plenty of interesting material.

The prerequisities for this book are quite modest. Moreover, the authors have included a chapter on ordered fields and real closed fields, where a lot of preparatory material is gathered. (We remark that the book contains much material that is more general than the title of the book suggests; in particular, we find here algebraic geometry over an arbitrary real closed field.) It is not surprising that the authors were not able to cover the whole area of real algebraic geometry. Nevertheless they cover a lot both from 'classical' and 'modern' algebraic geometry.

Where they have not enough space, they sometimes omit proofs, but they always properly explain all notions and assertions and give references where the corresponding proofs can be found. Moreover, at the end of each chapter there are bibliographical notes where we find hints for further reading. The bibliography is large and includes 350 items. (jiva)

B. Bollobás, *Linear Analysis: An Introductory Course*, *Cambridge Mathematical Textbooks, Cambridge University Press, Cambridge, 1999, 240 pp., £16.95, ISBN 0-521-65577-3*
This is a well-written concise introduction to functional analysis, intended for advanced undergraduate students. The contents include a nice exposition of standard material (normed spaces and bounded linear operators, Hahn-Banach, Banach-Steinhaus, closed-graph theorem, Stone-Weierstrass, contraction-mapping theorem, Hilbert spaces, orthonormal systems, adjoint operators, compact operators, compact normal operators, weak topologies and duality), as well as unusual topics like invariant subspaces, fixed-point theorems (Brouwer, Schauder), the Bishop-Phelps theorem and geometry of finite dimensional spaces. This text, although concentrating on abstract spaces, shows the relevance of functional analysis to other areas of mathematics. A nice feature of the book is a large collection of exercises and notes following each chapter where the most important references are provided and historical comments presented. The book will surely be appreciated by students as well as teachers of mathematical analysis. (in)

J. Borwein, P. Borwein, L. Jörgenson and R. Corless, eds., *Organic Mathematics*, *CMS Conference Proceedings 20, American Mathematical Society, Providence, 1997, 412 pp., ISBN 0-8218-0668-8*
This book is the hardcopy version of the electronic 'Proceedings of the Organic Mathematics Workshop' held at Simon Fraser University. The least common denominator of the conference was the mutual affects of mathematics and modern technology. We are seeing a steady growth in the use of new technology, not only in computation but also in research, teaching and communication (including publication). Last but not least, a large portion of the current mathematical knowledge is encoded in computer algebra systems and packages for scientific computation. The organisers of the conference were interested in the benefits of all these facets of this modern development, and 'want the information of the Proceedings to form examples of 'living documents', connected to their references, connected to each other, connected to algorithms for live mathematical work on the part of the reader'. They want them to be 'organic'.

The proceedings contain fifteen invited papers and two associated articles. Many of the underlying papers appeared else-

where, and each paper has been selected by author reputation and with the aim 'to select papers with a good potential for 'activation''. Since not every activity during the conference can be archived in text form, the editors have attempted at least to personalise the Proceedings by adding a short biography of each speaker, with individual pictures. (spor)

J.-P. Bourguignon, P. de Bartolomeis and M. Giaquinta (eds.), ***Geometric Theory of Singular Phenomena in Partial Differential Equations,*** *Instituto Nazionale di Alta Matematica Francesco Severi. Symp.Mathematica vol. XXXVIII, Cambridge University Press, Cambridge, 1998, 182 pp., £40, ISBN 0-521-63246-3*

In May 1995 a workshop on the geometric theory of singular phenomena of PDEs occuring in real and complex differential geometry was held in Cortona. The book containing contributions of participants and related articles is dedicated to Franco Tricerri who was a member of the organising committee of the workshop before his tragic death in a plane crash in China.

The longest contribution (70 pages) is an introduction to twistor techniques by P. de Bartolomeis and A. Nannicini. This paper contains a very nice systematic and detailed description of geometrical properties of twistor spaces for even-dimensional compact connected manifolds with a given conformal structure. The paper ends with a characterisation of manifolds for which the corresponding twistor space is Kählerian. Glueing procedures for constructions of solutions of various geometrical problems (complete immersed minimal surfaces in 3-dimensional Euclidean space, complete embedded surfaces of constant mean curvature and complete conformal metrics of constant positive scalar curvature on subsets of compact Riemannian manifolds) and a discussion of moduli spaces of such solutions are discussed in a paper by R. Mazzeo and D. Pollack.

The conribution by L. Habermann and J. Jost contains a discussion of properties of the metric induced on the Teichmüller space of (marked) Riemann surfaces Σ of a given genus by a choice of a Hermitian metric g^{Σ} on Σ. The paper by M. Giaquinta, G. Modica and J. Souèek describes weak solutions of the variational problem for the Dirichlet integral on the space of maps from a bounded domain in $\mathbf{R}^3$ into the sphere S^2 with prescribed boundary values. Two different approaches are discussed, one in the setting of Sobolev maps and the other in the setting of Cartesian currents. The orbifold fundamental group of the Persson-Noether-Horikawa surfaces is computed in the contirbution by F. Catanese and S. Manfredini.

The book also contains two short papers by F. Labourie (on solutions of the Monge-Ampère equation and its relations to pseudo-holomorphic curves) and by A. M. Nadel (existence problem for Kähler-Einstein metrics on a given Fano manifold). (vs)

G. Buttazzo, M. Giaquinta and S. Hildebrandt, ***One-dimensional Variational Problems,*** *Oxford Lecture Series in Mathematics and its Applications 15, Clarendon Press, Oxford, 1998, 262 pp., £35, ISBN 0-19-850465-9*

The authors, all of them well-known specialists in the field, demonstrate the ideas of modern variational calculus in the one-dimensional case. It enables them to avoid the difficulties connected with multiple variational integrals and to explain main ideas of the calculus of variations (emphasising direct methods) in extremely clear manner. This project has been realised very successfully. The book represents an excellent tool for those who wish to specialise in the calculus of variations and to go on to study more complicated theories of variational problems for multiple integrals. At the same time, it is an interesting textbook for analysts working in different branches who wish to complete their education. The text can be inspiring for graduate students beginning their scientific activities. I much enjoyed the historical notes and the vivid style of exposition.

In Chapter 1, the classical 'indirect methods' based on necessary and sufficient conditions for optimality are treated. Chapter 2 gives a framework of function spaces indispensable for applying the direct methods (absolutely continuous functions, BV-functions and Sobolev spaces). Lower semicontinuity methods are discussed in Chapter 3. In Chapter 4, regularity of minimizers is treated; here also the Lavrentiev phenomenon is studied in detail. Chapter 5 is dedicated to applications, such as the Sturm-Liouville eigenvalue problem, the vibrating string, variational problems with obstacles, periodic solutions of variational problems, periodic soloutions of Hamiltonian systems, noncoercive variational problems, an existence problem in optimal-control theory and parametric variational problems. In Chapter 6 (Scholia) some ramifications of calculus of variation and various connections to pertinent problems for multiple variational integrals are pointed out. (oj)

P. J. Cameron, ***Permutation Groups,*** *London Mathematical Society Student Texts 45, Cambridge University Press, Cambridge, 1999, 220 pp., £15.95, ISBN 0-521-65302-9, ISBN 0-521-65378-9*

This book is intended as a course that requires only rudimentary knowledge of group theory. It has seven chapters, the last comprising tables of simple groups, affine 2-transitive groups and almost simple 2-transitive groups. The sixth chapter addresses several stand-alone topics (such as Blichtfeld's or Jordan's theorem) and so the bulk of the content rests with the first five chapters. The first two are standard (regular primitive and multiply transitive groups, wreath products, orbitals, centraliser algebra, and characters) and the fourth is dedicated to the O'Nan-Scott Theorem, with a short sketch of the proof and with applications (orders and degrees of primitive groups, distance-transitive graphs and some others).

The third chapter connects permutation groups to combinatorial regular structures (such as association schemes, coherent configurations, strongly regular and distance-transitive graphs).

The fifth chapter is somewhat different from the first four, since it concerns infinite permutation groups, and in particular the so-called oligomorphic groups, i.e., such permutation groups on an infinite set Ω for which the number $f_n(G)$ of orbits arising from G when it acts on n-element subsets of Ω is finite for all n. Connections with random infinite graphs, with the theory of models (automorphism groups of countably categorical structures) and with graded algebras are presented with varying level of detail. Attention is also paid to the growth rate of $f_n(G)$ and to preservations of linear and circular orders.

Students should find this book very stimulating because of the many different connections it mentions, and this is particularly true about the fifth chapter. The combinatorial interests of the author obviously influenced the choice of topics and one should not expect an introduction to all aspects of permutation groups.

Another feature of the book is its inclusion of computational group theory. The Schreier-Sims algorithm and Jerrum's filter are included in the first chapter and there is even a short introduction to GAP. The book contains information about resources available on the World Wide Web. (ad)

C. M. Campbell, E. F. Robertson, N. Ruskuc and G. C. Smith, eds., ***Groups St Andrews 1997 in Bath, I, II,*** *London Mathematical Society, Lecture Note Series 260/261, Cambridge University Press, Cambridge, 1999, 737 pp., £29.95/£29.95, ISBN 0-521-65588-9/0-521-65576-5*

Two volumes of conference proceedings contain 64 papers that cover many aspects of group theory. The main lectures are reflected in the proceedings by five survey papers, each 20-50 pages long, concentrating on probabilistic algorithms and geometric group theory. Similar topics appear also in many of other longer papers (those with around 20 pages).

The common theme of the probabilistic papers is the exploitation of Aschbacher's classification of maximal subgroups of the finite classical groups for the purposes of probabilistic recognition in these groups.

Babai and Beals present the black-box group concept and give a number of theorems concerning constructions, recognition and description in Monte-Carlo polynomial time. The paper by Shalev starts by citing some classical probabilistic results on symmetric groups and the author comments on the proof of Dixon's conjecture for simple finite groups. He also presents some applications to free groups and the modular group, and points out connections with profinite groups and Kac-Moody algebras, finishing with a sketch of proof of Cameron's conjecture on the base size of almost simple primitive permutation groups. The essay of Praeger is about primitive prime divisor elements that play

an essential role for recognising algorithms in *GL(d, q)*.

The longest article is an introductory survey on non-positive curvature in group theory by Bridson. He carefully explains the notion of the non-positive curvature and its connection to hyperbolicity, and develops then the theory of *CAT*(0) spaces. First he describes properties of groups that act properly and cocompactly by isometries on *CAT*(0) spaces, and then gives various examples of an interaction between interesting groups and these spaces.

The lecture of Brookes blends filtrations of group rings with non-commutative toric geometry. The developed techniques aim at groups with no non-Abelian free subgroups. Nilpotent groups receive special attention.

Among other papers let us mention the following three: Bogomolov and Katzarkov present a base change construction which allows to prove that fundamental groups of projective surfaces are rather densely distributed among all finitely presented groups. Ol'shanskii shows that under rather weak assumptions, one can find 2-generated 2-groups (p-groups in some cases) with a prescribed growth function. McCammond introduces a generalisation of small cancellation theory which he has applied to the word problem of free Burnside groups. (ad)

M. Capiński and E. Kopp, *Measure, Integral and Probability,* *Springer Undergraduate Mathematics Series, Springer, London, 1999, 227 pp., DM59, ISBN 3-540-76260-4*

This book aims to present Lebesgue integral in a way accessible to undergraduate students as a background to probability theory. This is considered as the main area of application for the theory and the choice of material for the book is influenced by this aim.

A probabilistic interpretation of discussed notions is introduced at the beginning, and leads naturally to the choice of a measure-theoretical approach to the Lebesgue integral. Among the topics covered, we mention the law of the large numbers and the central limit theorem. The course is kept at a level accessible to American students at the third year of their studies. Certain notions from functional analysis are also included. The book contains exercises with solutions. The final Chapter explains the axiom of choice as a tool used to prove the existence of non-measurable sets.

Readers of the book, especially beginners, will appreciate another strategy of the authors: instead of the most elegant or the shortest approach, they prefer what they consider to be more direct or natural. Some assertions are first formulated and left to be proved by readers using the hints provided; their proofs are presented later on. (jiva)

R. W. Carter and M. Geck (eds.), *Representations of Reductive Groups,* *Publications of the Newton Institute, Cambridge University Press, Cambridge, 1998, 191 pp., £35, ISBN 0-521-64325-2*

This book serves as an introduction to a systematic study of the topic and consists of nine articles by different authors. The best description of the content of the book is given by listing the articles and their authors: *Introduction to algebraic groups and Lie algebras* (R. W. Carter), *Weyl groups, affine Weyl groups and reflection groups* (R. Rouquier), *Introduction to abelian and derived categories* (B. Keller), *Finite groups of Lie type* (M. Geck), *Generalized Harish-Chandra theory* (M. Broué and G. Malle), *Introduction to quantum groups* (J. C. Jantzen), *Introduction to the subgroup structure of algebraic groups* (M. W. Liebeck), *Introduction to intersection cohomology* (J. Rickard), *An introduction to the Lusztig Conjecture* (S. Donkin). (lbi)

C. Constatinescu, W. Filter and K. Weber, *Advanced Integration Theory,* *Mathematics and its Applications 454, Kluwer Academic Publishers, Dordrecht, 1998, 861 pp., £237, ISBN 0-7923-5234-3*

This volume is devoted to a detailed and systematic development of the abstract theory of integration. The aim is to build a logically consistent and advantageous construction, suitable for integration in general topological spaces (without local compactness or countability assumptions). The cost is that the terminology in the book differs from the most widely accepted one. Among the major features of the authors' approach, let us mention the following: the integral is defined via the Daniell construction as a functional on a Riesz lattice; the class of integrable functions is wide due to a wide family of negligible sets: null sets for integration are those which are 'locally insignificant'; measures are finite-valued and defined on δ-rings rather than on σ-rings.

The volume is divided into chapters on the following topics: vector lattices, definition of the integral, L^p-spaces, real measures, the Radon-Nikodym theorem and duality, integration of real functions. The n-dimensional integration is not considered separately (of course, it falls within the general theory).

The text is organised in a definition-theorem-proof format and each chapter is endowed with exercises, some of them being important theoretical excursions. To end with, a brief historical chapter is included.

There is another book that uses this approach to integration theory: *Integration Theory: Measure and Integral*, by C. Constantinescu and K. Weber (in collaboration with A. Sontag), John Wiley & Sons, 1985, where the old and new definitions are compared and the advantage of the new approach is explained. The present book contains more material, but for motivation and intuitive remarks the reader is referred to the older book.

The book presents a possibility how to teach measure and integration theory for students whose interest consists in abstract mathematics. It also provides also a theoretical background for various directions in abstract analysis. It is an important document on this way of developing integration theory. (jama)

D. Cox, J. Little and D. O'Shea, *Using Algebraic Geometry,* *Graduate Texts in Mathematics 185, Springer, New York, 1998, 499 pp., DM78, ISBN 0-387-98487-9 and 0-387-98492-5*

Many applications of algebraic geometry methods are demonstrated in this book, which covers a variety of topics related to the algorithmic theory of polynomials. In the first chapter basic results and notions about basic algebraic structures, polynomials, Gröbner basis algorithms and affine varieties can be found. The second and third chapters discuss several approaches to solving polynomial equations, such as elimination theory or resultants. Chapters 4, 5 and 6 are devoted to topics of classical commutative algebra; the reader can find here basic facts about local rings, Milnor numbers, syzygies, Hilbert functions, etc. Chapter 7 deals with geometry polytopes, toric varieties, Minkowski sums and Bernstein's theorem, thereby covering some connections between polynomials and convex polytopes. Chapter 8 illustrates some applications of Gröbner bases to problems in integer programming, combinatorial enumeration problems, spline functions. The last chapter discusses applications from computational algebra and algebraic geometry to problems from coding theory.

Reading the book does not require more than standard undergraduate knowledge. The book can be used in a variety of courses involving solving equations, commutative algebra, and their various applications. It contains a lot of exercises with indications for further development, and includes pointers to the abilities of various computer algebra packages. It would be useful (but not necessary) to read this book in conjunction with *Ideals, Varieties and Algorithms* by the same authors. (spr)

L. Debnath, *Nonlinear Partial Differential Equations for Scientists and Engineers,* *Birkhäuser, Boston, 1998, 593 pp., DM138, ISBN 0-8176-3902-0 and 3-7643-3902-0*

One of the major goals of the book is to provide an accessible working knowledge of some of the current analytical methods required in modern mathematics, physics and engineering. From the immense wealth of the world of non-linear PDEs, the volume emphasises the part dedicated to non-linear wave propagation problems. It contains many new examples of applications in fluid dynamics, plasma physics, non-linear optics, gas dynamics, analytical dynamics and acoustics. With twenty-one pages of bibliography, the work can also serve as a reference book for those with a more detailed interest in some of the considered subjects.

Chapter 1 is an introduction to linear PDEs (method of characteristics, Fourier method, the use of integral transforms and the method of Green's functions). Chapter 2 is dedicated (among other things) to variational principles and the Euler-Lagrange equations. Chapters 3-6 are devoted to

non-linear first-order PDEs. Several sections of Chapter 6 discuss properties of solutions of real-world non-linear models, including traffic flow, flood waves, chromatographic models, etc.

In Chapter 7, various aspects of Whitham's equation (non-linear dispersive waves) are studied. Non-linear diffusion-reaction phenomena are considered in Chapter 8. Chapter 9 develops the theory of solitons and the inverse scattering transform; many recent results on the basic properties of the KdV and Boussinesq equations are discussed. The non-linear Schrödinger equation and solitary waves are the main focus of Chapter 10. Chapter 11 is concerned with the theory of non-linear Klein-Gordon and sine-Gordon equations with applications. Non-linear evolution equations and asymptotic methods are treated in the last chapter.

In a way, the author's style of exposition follows the idea of R. P. Feynman, quoted in the preface: 'However, the emphasis should be somewhat more on how to do the mathematics quickly and easily, and what formulas are true, rather than the mathematicians' interest in methods of rigorous proof.' A great advantage of this book lies in the striking balance maintained between the mathematical and physical aspects of the subject. (oj)

R. W. Easton, ***Geometric Methods for Discrete Dynamical Systems,*** *Oxford Engineering Science Series 50, Oxford University Press, New York, 1998, 157 pp., £50, ISBN 0-195-08545-0*

This small book is an essay on discrete dynamical systems and it is very pleasant to read it. There are no long computations or technically difficult considerations, and the sampling ideas clearly demonstrate the view of topological dynamics which was close to C. Conley. Several open problems are also formulated. The main subject of the book is the long-time behaviour of orbits.

After illustrative examples and basic definitions, chain-recurrent sets and the Conley decomposition theorem are presented in Chapter 2. Chapter 3 is devoted to local analysis near hyperbolic invariant sets (stable manifolds, Hartman-Grobman theorem, Smale's horseshoe and the recent notion of resonance zone). The heart of the book is in Chapters 4 and 5, where isolated invariant sets and the Conley index of an isolated block are explained. A discrete analogue of Hamiltonian systems, symplectic maps, is studied in Chapter 6 and the existence of the Birkhoff normal form is proved. The book ends with the notion of an invariant measure and the Poincaré recurrence theorem. (jmil)

J. Elias, J. M. Giral, R. M. Miró-Roig and S. Zarzuela, eds., ***Six Lectures on Commutative Algebra,*** *Progress in Mathematics 166, Birkhäuser, Basel, 1998, 398 pp., DM128, ISBN 3-7643-5951-X and 0-8176-5951-X*

This volume arises from the following series of lectures given at the Barcelona Summer School on Commutative Algebra in July 1996: *Infinite free resolutions* (L. L. Avramov), *Generic initial ideals* (M. L. Green), *Tight closure, parameter ideals, dual geometry* (C. Huneke), *On the use of local cohomology in algebra and geometry* (P. Schenzel), *Problems and results on Hilbert functions on graded algebra* (W. V. Vasconcelos), *Cohomological degree of graded modules* (W. V.Vasconcelos). Each series is close to a monograph and is a good introduction to its subject. (tk)

G. Friedlander and M. Joshi, ***Introduction to the Theory of Distributions****, 2nd edition, Cambridge University Press, Cambridge, 1998, 175 pp., £42.50, ISBN 0-521-64015-6 and 0-521-64971-4*

In this book the basic notions of the theory of Schwartz distributions are explained. It is especially convenient for those readers who wish to learn the theory of distributions without a knowledge of functional analysis, namely of the theory of topological (locally convex) linear spaces, which is included as an appendix. The book does not even require a knowledge of the theory of the Lebesgue integral. This approach shows that some very deep theorems can be proved in an elementary way; for example, the Schwartz kernel theorem is proved without using the theory of nuclear spaces, referring to the theory of Fréchet spaces only. There are a lot of exercises supplementing the theory. They contain applications mostly to those ordinary or partial differential equations to which this theory is applicable, linear differential equations with $\mathbf{C}^\infty$ coefficients. The basic notions of the theory of distributions are not generalised except for a few pages devoted to Sobolev spaces. No more general multiplication is introduced than that of a distribution with a $\mathbf{C}^\infty$ function; for example, the multiplication of a distribution of order n with a $\mathbf{C}^n$ function is not introduced. Only the last chapter of the book is an exception: it contains harder notions that cannot be found in other textbooks on distributions. In this chapter, multiplication of distributions is generalised using the wavefront sets defined by the growth of their Fourier transforms in a given direction. Roughly speaking, the product of two distributions is defined if, in each direction, one distribution is $\mathbf{C}^\infty$. (jjel)

W. Fulton, ***Intersection Theory****, 2nd Edition, Ergebnisse der Mathematik und ihrer Grenzgebiete, Modern Surveys in Mathematics, Springer-Verlag, Berlin, 1998, 470 pp., DM178, ISBN 3-540-62046-X*

This is the second and unchanged edition of a famous and fundamental monograph, the first edition of which appeared in 1984. The author has added some references that appeared shortly after the first edition, and refers the reader to the second edition of his book *Intersection Theory in Algebraic Geometry*, CBMS 57, Amer. Math. Soc., 1996, for the more recent literature.

For young mathematicians interested in algebraic geometry this book is quite indispensable. It is also of interest to algebraists, topologists, specialists in several complex variables, and for mathematicians who want to familiarise themselves with the profound ideas of intersection theory. It is a modern treatise that includes many new results, as well as simpler proofs of some older results, and also takes into account the historical development of the subject. The text is designed so as to be accessible to anybody equipped with a first course of algebraic geometry, assuming that he/she consults the appendices at the end of the book. Moreover, the organisation of the book enables one, after the first six chapters, to read the other chapters separately. An important role is played by the Examples, which appear in large quantities at the end of each section. These illustrate the general theorems and build bridges between classical and modern approaches, present generalisations and counter-examples, and serve to motivate later results. At the end of each chapter, the Notes and References contain historical remarks and put the material of the chapter into a more general framework. Simply, it is a very good book. (jiva)

L. Gårding, ***Mathematics and Mathematicians. Mathematics in Sweden before 1950****, History of Mathematics 13, American Mathematical Society, Providence, 1998, 288 pp., ISBN 0-8218-0612-2*

This book is an extremely readable history of mathematics in Sweden up to 1950, written by a leading personality from Swedish mathematics. This makes the book different from usual books on the history of mathematics: the text brings an expert overview of the development of mathematics, presented in a master style that reflects a deep insight into the subject. Thus the readers learn important facts from the history of mathematics and extend their previous knowledge in fields that do not exactly overlap their own specialities.

It is natural that the history of mathematics in Sweden is more-or-less a story of university towns and their mathematicians. Thus the main body of the book includes a detailed description of mathematics as well as university life in Uppsala, Lund and Stockholm. The 18th century and up to 1850 are briefly presented, and the time in Uppsala and Lund from 1860 to 1880 is described. There is a chapter devoted to algebraic geometry in Lund before 1900, another chapter deals with the situation in Uppsala during the period 1860 to 1900 and whole chapters are devoted to Bäcklund, Mittag-Leffler, and Mittag-Leffler's and Sonya Kovalevski's mathematical works. A further chapter describes the development of astronomy and optics in the 19th century. More than a half of the book deals with the mathematics developed in Stockholm (1880-1920 and 1925-50), Uppsala (1900-25 and 1930-50) and Lund (1900-50). Here the important contributions of famous Swedish mathematicians are explained, in particular those of Bendixon, Phragmén, von Koch, Holmgren, Nörlund, Carleman, Pleijel, Carlson, M. Riesz, Frostman, Nagell, Beurling and Carleson. This book on mathematics and mathematicians is

strongly recommended to anybody who likes mathematics and its history. (in)

A. J. Hahn, *Basic Calculus. From Archimedes to Newton to its Role in Science*, Springer, New York, 1998, 545 pp., DM98, ISBN 0-387-94606-3

This book is based on calculus courses delivered at the University of Notre Dame. As the author remarks, the title of the book could be *The story of the calculus*. He gives five examples of different first-year courses that could be based on the book. Other examples are available on the web site http://www.nd.edu:80/~hahn/ (the preface contains an obvious URL misprint: a hyphen instead of a tilde). This diversity is partly due to the fact that a large portion of college mathematics is also included.

The first two chapters are devoted mainly to connections between trigonometry and astronomy. The third chapter describes Archimedes' area research and includes the quadrature of the parabola, while the main subject of the fourth chapter is analytic geometry; this comprises about one fifth of the book. The next four chapters deal with the mathematics of Leibniz and Newton. The relation of the rest of material to the history of mathematics is more complicated, but the mathematics included is easier to describe: it concerns properties of elementary functions and their use in simple problems involving differentiation and integration.

The book contains a lot of material that can be used to relate mathematics to the evolution of human knowledge. It gives various ways, both for students and instructors, for coping with the elements of calculus. On the other hand, it is written for non-specialists, such as for students of informatics, biology, economics, or the humanities. A descriptive style of presentation without formal proofs helps to illustrate what is going on, but the approach eliminates a deeper understanding of the nature of mathematics. This is a strong feature of the book as well as its major weakness. The book is more useful for teaching the history of calculus than for teaching the basics of mathematics. Details of the book's contents can be found on the above URL. (jiva)

S. Hassani, *Mathematical Physics. A Modern Introduction to its Foundations*, Springer, New York, 1999, 1025 pp., DM179, ISBN 0-387-98579-4

This book is a condensed exposition of the mathematics that is met in most parts of physics. The presentation attains a very good balance between the formal introduction of concepts, theorems and proofs on one hand, and the applied approach on the other, with many examples, fully or partially solved problems, and historical remarks.

An impressive amount of mathematics is covered. Starting from a set-theoretical introduction and linear algebra, through functional analysis, complex analysis, and a lot of differential equations (both ODEs and PDEs, exact and numerical solutions), up to differential geometry and Lie theory. All of this offers a chance to enjoy mathematics as a source of applicable tools that are all related one to the other and which create the beautiful abstract world of ideas, definitions and theorems. The author has written the book both for physics students, to show them the mathematics they use, and for mathematics students, in order to offer a glimpse of many applications of the abstract ideas they know. The prerequisites comprise just a basic calculus course and all advanced undergraduates should be able to follow the exposition.

The headings of the eight parts of the book are: finite-dimensional vector spaces (covering standard linear algebra), infinite-dimensional vector spaces (including the theory of orthogonal polynomials, Fourier series and Fourier transforms), complex analysis (complex series, calculus of residues, multivalued functions, and analytic continuation), differential equations (mainly second-order equations, including analytical and numerical methods), operators on Hilbert spaces (spectral theory, integral equations and Sturm-Liouville systems), Green's functions (for ODEs and PDEs), groups and manifolds (representation theory and tensor analysis), Lie groups and their applications (differential geometry, symmetries of ODEs and PDEs, variational calculus and Lie theory).

This book can be warmly recommended as a basic source for the study of mathematics for advanced undergraduates or beginning graduate students in physics and applied mathematics, and also as a reference book for all working mathematicians and physicists. (jsl)

J. Hofbauer and K. Sigmund, *Evolutionary Games and Population Dynamics*, Cambridge University Press, Cambridge, 1998, 323 pp., £16.95, ISBN 0-521-62570-X and 0-521-62365-0

The same authors' previous book The *Theory of Evolution and Dynamical Systems* (Cambridge, 1988) has been used both as a reference book and as a textbook. The authors have now restructured it and added a lot of new material to make it closer to evolutionary game theory. This goal has forced them to reduce the biological motivation and ideas. The result is a mathematical text that divides into four parts.

The first part, Dynamical systems and Lotka-Volterra equations, can be understood either as an introduction to population dynamics and the basic ideas of V. Volterra or as an introduction to the asymptotic behaviour of low-dimensional smooth dynamical systems (mainly of dimension 2 for the continuous case). The second part is a concise course in the dynamics of non-cooperative games; the properties of replicator equations are used as a main tool. In fact, these equations are equivalent to Volterra-Lotka systems (Section 7.5). Global properties of replicator equations, mainly permanence and persistence, and algebraic properties of interaction matrices (M,B,P-matrices) are investigated in the third part and are applied to n-species communities. The last part is devoted to connections between the selection, mutation and recombination of genetic information and evolutionary game theory. Special gradients (with respect to a metric on a simplex), so-called Shahshahani gradients, and corresponding gradient systems are continually used here.

A basic knowledge of ordinary differential equations and linear algebra is sufficient for reading this book. There are many exercises of very different types, some providing significant extensions of the material. The systematic explanation, exercises and extensive bibliography can stimulate new research. (jmil)

B. B. Hubbard, *The World According to Wavelets*, A. K. Peters, Natick, 1998, 330 pp., £28, ISBN 1-56881-072-5

This is one of the best books in the popular mathematical literature, remarkable for its fresh style that makes wavelet history, applications and technical advances interesting for non-mathematicians of any age. The author begins her examination of wavelets with the story of the development of Fourier analysis, the essential underpinning for telephones, X-ray machines, and computers. Without any dizzying technical or mathematical details, she describes the more recent meteoric rise of wavelet analysis and its many practical applications. Part II lucidly presents the mathematical formulas and details of wavelet analysis for those seeking a deeper understanding.

In this second edition she includes a discussion of new medical and genetic applications, such as mammography, heart disease and fingerprints. The Part III Appendices contain proofs of the Heisenberg uncertainty principle and the sampling theorem. Readers who are less sophisticated mathematically will also find a brief review of trigonometry, a list of mathematical symbols, and a discussion of integrals and the Fourier transform of a periodic function. The bibliography includes technical books and articles. The author has also included a list of wavelet software and electronic recources.

This excellent book is a wonderful introduction to the world of wavelets. It can be strongly recommended to anybody interesting in using wavelets. (kn)

O. A. Ivanov, *Easy as π?*, Springer, New York, 1999, 187 pp., DM59, ISBN 0-387-98521-2

When lecturing to future teachers of mathematics, possible connections with secondary school mathematics should be emphasised. Many times the chance is lost, because of the lack of good reference book where such things are treated in an accessible way.

This book is aimed at filling the gap. It offers numerous elementary facts, forming a basis for further development of related mathematics going far beyond the scope of the book. In ten chapters the author deals with a range of topics, including induction and Peano axiomatics, combinatorics and generating functions, ornaments and geometrical transforms, quaternions, and

functional equations. Each chapter contains (mostly solved) problems and related theorems that extend the reader's knowledge. Exercises help to test the level of understanding. The book is based on a course taught for several years at St Petersburg University, and will be of interest not only for people oriented towards education but as pleasant and interesting reading for professional mathematicians. It can be highly recommended for the mathematical library of any university. (jiva)

J. Kollár and S. Mori, *Birational Geometry of Algebraic Varieties*, *Cambridge Tracts in Mathematics 134, Cambridge University Press, Cambridge, 1998, 254 pp., £30, ISBN 0-521-63277-3*

This is a very good introduction to the contemporary research on algebraic geometry called 'minimal model programme' or 'Mori's programme'. The general idea is to find in each birational equivalence class of algebraic varieties a variety that can be considered as the simplest one. For example, each irreducible curve is birationally equivalent to a unique smooth curve. A similar investigation of surfaces was started at the beginning of this century and resulted in finding (with few exceptions) the simplest smooth surfaces in each class, called 'minimal models'. It is only in the last two decades that efforts have been made to extend this programme to higher dimensions. There one meets many complications; for example, as minimal models one must allow not only smooth varieties but also varieties with certain reasonable singularities. Next, already in dimension 3, there have appeared quite new birational transformations called 'flips' and 'flops'. So far, many results have been obtained that are valid in arbitrary dimensions, but the minimal model programme has been completed only in dimension 3, by Mori in 1988.

This book gives a very good survey of present research, including possible extensions of the minimal model programme. We mention that this programme has also found interesting applications in other parts of algebraic geometry. The reader is assumed to be familiar with algebraic geometry at the level of R. Hartshorne's *Algebraic Geometry*. The authors have succeeded in giving a very clear presentation of the subject. The bibliography has 154 items and goes up to 1988. (jiva)

P. Koosis, *The Logarithmic Integral I*, *Cambridge Studies in Advanced Mathematics 12, Cambridge University Press, Cambridge, 1998, 606 pp., £29.95, ISBN 0-521-30906-9 and 0-521-59672-6*

The theme of this book is the logarithmic integral. The author shows how one can build up an investigation that explains and clarifies many different, seemingly unrelated problems, from a few simple ideas. With this book one can begin a serious study of real and complex analysis. It can be read as a whole, and presents many results, some unpublished, some new, and some available only in inaccessible journals.

This first of two volumes is self-contained, but assumes graduate real and complex variable theory with a bit of functional analysis (as contained in Rudin's well-known text). In this paperback edition, a number of small errors and some mathematical mistakes in the original hard-cover version have been corrected. The material is presented with useful pictures to help the reader understand the subject.

Chapter I starts with the Jensen's formula. Szegõ's theorem is studied in Chapter II with the pointwise approximate identity property of the Poisson kernel. Chapter III deals with the entire functions of exponential type (Hadamard factorisation, Lindelöf's theorem, Phragmén-Lindelöf theorems, the Paley-Wiener theorem, representation of positive harmonic functions as Poisson integrals, Blaschke products, Levinson's theorem on the density of zeros). Quasi-analyticity is studied in Chapter IV, using Carleman's criterion (including the theorem of Cartan and Corny). Chapter V contains a discussion of the moment problem on the real line (method based on moment sequences, Carleman's sufficient condition, a necessary condition, M. Riesz's general criterion for indeterminacy). Weighted approximation on the real line is the topic of Chapter VI (Mergelian's treatment of weighted polynomial approximation, Akhiezer's method, Mergelian's criterion, Pólya's maximum density, the analogue of Pollard's theorem, de Branges's description of external unit measures, Krein's functions). A question *'How small can the Fourier transform of a rapidly decreasing non-zero function be?'* is the title of Chapter VII (Levinson's result, Beurling's theorems, Kargaev's example, Volberg's work). The final chapter presents the persistence of the form $dx/(1+x^2)$ with special cases (the set of positive lower uniform density, the set of integers, harmonic estimation in slit regions). Some discussion of special topics appears in an Addendum.

The book is well written and can be recommended to anyone interested in real and complex analysis. (pp)

O. H. Kropholler, G. A. Niblo and R. Stöhr (eds.), *Geometry and Cohomology in Group Theory*, *London Mathematical Society Lecture Note Series 252, Cambridge University Press, Cambridge, 1998, 316 pp., £24.95, ISBN 0-521-63556-X*

This volume is the proceedings of the Durham Symposium on Geometry and Cohomology in Group Theory, held in July 1994, and contains 18 articles that provide a mixture of new results and surveys suggesting a framework for future research. The longest survey is by Linnell who studies an analytical version of the zero divisor conjecture over $\mathbf{C}$ when $\alpha\ (\neq 0)$ is in $\mathbf{C}G$ and $\beta\ (\neq 0)$ is in $L^p(G)$. He shows that for $p > 2$ one can construct many elements α in $\mathbf{C}G$ for which there are zero divisors β in $L^p(G)$. However, he conjectures that no such α and β exist when $p = 2$. Much of the discussion of this case is concerned with the classical right quotient ring $U(G)$ of the von Neumann algebra $W(G)$, as the above conjecture is proved to be true in the case when there exists a division ring D between $\mathbf{C}G$ and $U(G)$.

In one of the longer papers Mikhajlovskii and Ol'shanskii first give sufficient and necessary conditions for an HNN-extension of a hyperbolic group G to be hyperbolic, when A and B are isomorphic infinite elementary subgroups of G (here, 'elementary' means cyclic-by-finite). Using this theorem they show that every non-elementary hyperbolic group has a non-trivial verbally complete quotient that is a torsion group, and give a similar result with respect to torsion-free hyperbolic groups.

Further papers include a report by Carlson on some recent developments in the area of quotient categories of modules filtered by complexity, a survey paper by Cornick on homological techniques for strongly graded rings, a paper by F. Jonson on polysurface groups, a survey by J. S. Wilson on finitely presented soluble groups, and a paper by R. I. Grigorchuck which starts a systematic investigation of abstract Tychonoff groups. (ad)

V. S. Kulikov, *Mixed Hodge Structures and Singularities*, *Cambridge Tracts in Mathematics 132, Cambridge University Press, Cambridge, 1998, 186 pp., £30, ISBN 0-521-62060-0*

Let $f : (\mathbf{C}^{n+1}, 0) \to (\mathbf{C}, 0)$ be a germ of holomorphic function with 0 as an isolated singularity. The main aim of the book is to study this singularity by means of 'global' methods of algebraic geometry or the theory of analytic spaces. We mention that the 'global' appears in this 'local' situation roughly as follows. Let B be an open ball in $\mathbf{C}^{n+1}$ of radius ε, S be an open disc in $\mathbf{C}$ of radius δ, and $S' = S - \{0\}$. We let $X = B \cap f^{-1}(S)$ and obtain a map $f : X \to S$. Finally, setting $X' = X - f^{-1}(0)$ and restricting f, we obtain a mapping $f' : X' \to S'$. If ε and $\delta << \varepsilon$ are sufficiently small, then f' is a smooth locally trivial fibration, called a Milnor fibration. This is already a very important 'global' object which represents the starting point for the investigation of the singularity; the Gauss-Manin connection, mixed Hodge structures, and the theory of period maps play an important role here. The book is on the contemporary research level and will be interesting for specialists in singularity theory, algebraic and differential geometry. The author assumes the knowledge and training usual in algebraic and analytic geometry; this includes knowledge of sheaf theory and the technique of spectral sequences. The book is nicely written, and with the above prerequisites makes this interesting topic accessible for postgraduate students. The bibliography has 78 items. (jiva)

T. Y. Lam, *Lectures on Modules and Rings*, *Graduate Texts in Mathematics 189, Springer, New York, 1999, 557 pp., DM119, ISBN 0-387-98428-3*

This textbook is devoted to the basic parts of the modern structural theory of rings

and modules. The first chapter deals with free, projective and injective modules and the second is devoted to flat modules and homological dimensions. Chapter 3 treats some special questions, such as uniform dimensions, singular submodules and non-singular rings, as well as the dense submodules and rational hulls. This is followed by two chapters on various types of rings of quotients. In Chapter 6, Frobenius and quasi-Frobenius rings are investigated, and the last chapter deals with matrix rings, categories of modules and Morita theory, including equivalences and dualities. (lbi)

E. M. Landis, *Second Order Equations of Elliptic and Parabolic Type*, *Translations of Mathematical Monographs 171, American Mathematical Society, Providence, 1998, 203 pp., ISBN 0-8218-0857-5*
This book is based on the author's lectures at Moscow State University.

The main tool in Chapter 1 (non-self-adjoint elliptic equations) and in Chapter 3 (parabolic equations) is the use of sub- and super-fundamental solutions, constructed with the help of Riesz potentials. This approach is used for qualitative studies of the behaviour of solutions near boundary points (Wiener-type theorems) as well as at infinity (Phragmén-Lindelöf and Liouville theorems). Adding the assumptions of Cordes type on the spreading of the eigenvalues of the coefficient matrix, the author uses the same method to obtain a *priori* estimates for the Hölder norms of solutions. It implies the existence of solutions to boundary value problems for quasi-linear equations. In Chapter 2 (self-adjoint elliptic operators), the estimates for the Hölder norms of solutions are derived with help of technical tools different from those used by E. De Giorgi and J. Moser.

The Russian edition of the book appeared 26 years ago. Since then, profound new results have been obtained, such as the well-known results of Krylov and Safonov on the estimate of Hölder norms of the solutions without the assumptions of Cordes type. However, a significant part of the book presents a non-traditional approach which is currently of interest to specialists and cannot be found in other monographs and textbooks.

There are probably few mathematical texts that present these deep results in such a vivid and readable manner. Most sections include bibliographic remarks and comments, some of which were added by the author to the 1997 English edition. I enjoyed reading them - they reflect briefly the exciting way in which the subject has been developed.

The book can be highly recommended to all mathematicians working in the theory of PDEs of elliptic and parabolic types. The precise and clear exposition also makes it attractive for graduate students. (oj)

R. Laubenbacher and D. Pengelley, *Mathematical Expeditions. Chronicles by the Explorers*, *Undergraduate Texts in Mathematics. Readings in Mathematics, Springer, New York, 1998, 275 pp., DM69, ISBN 0-387-98433-8 and 0-387-98433-X*
The book is designed for those who prefer to 'go back to the masters'. The organisation of the book is clear from the titles of its chapters: Geometry: the parallel postulate; Set theory: taming the infinite; Analysis: calculating areas and volumes; Number theory: Fermat's last theorem; Algebra: the search for an elusive formula. Besides the historical development of these themes, the reader will find the relevant parts (in English translation) of the works of the most important contributors to the subject.

The book provides exciting reading for those who wish to see how the subjects evolved in time, what notation or language was used, and how the various ideas unfolded. The book can be recommended for anybody interested in the history of the above branches of mathematics. (spor)

J. Lefort, *La saga des calendriers ou le frisson millénariste*, *Pour la Science, Paris, 1998, 191 pp., ISBN 2-9029-003-5*
The book deals with the origin and development of different lunar and solar calendars (Gregorian, Jewish, Chinese, etc.), compares them, and presents algorithms for passing from a date in one calendar to a date in another, and algorithms for calculating the date of Easter. The reader will find interesting information and get an astronomical explanation for why it was difficult for our ancestors to measure time. The book contains pictures (photographs and reproductions), well-arranged tables and mathematical formulas. It is nicely designed and will provide interesting reading for a wide public. (efas)

I. G. MacDonald, *Symmetric Functions and Hall Polynomials*, *2nd Edition, Oxford Mathematical Monographs, Clarendon Press, Oxford, 1998, 475 pp., £35, ISBN 0-198-50450-0 and 0-198-53489-2*
The first edition of this fundamental monograph on symmetric functions and Hall polynomials appeared in 1979. A Russian translation was published in 1985. This translation was substantially extended, partially in cooperation with the translator A. Zelevinsky. The second edition appeared in 1995 as a hardback, and represents a further large extension. (The Russian translation has 222 pages!) The book under review, published in 1998, is an unchanged version of the second edition, appearing this time as a paperback.

The main aim of the book is to present the theory of Hall polynomials and their applications. The Hall polynomials are closely connected with symmetric functions, and thus the author starts with a rather long chapter (178 pp.) on symmetric functions. Indeed, this first chapter makes the book a standard reference on symmetric functions. The Hall polynomials were discovered only in the 1950s, but have turned out to play an important role in many areas of mathematics. For this reason, MacDonald's book is interesting for mathematicians working in various directions. The prerequisities for the reading are very modest, and the book may therefore be accessible even to undergraduate students. A large part of the book is devoted to Examples; these substantially extend the theory contained in the basic text, and serve also as exercises and problems. Because the book naturally deals with many formulas, we find at the end a helpful index of notations (for each chapter separately). This book should be available in every library. (jiva)

G. Micula and S. Micula, *Handbook of Splines*, *Mathematics and Its Applications 462, Kluwer Academic Publishers, Dordrecht, 1999, 604 pp., £174, ISBN 0-7923-5503-2*
This excellent book covers the global theory of spline functions and their applications to various fields, from the introduction of the word 'spline' by I. J. Schoenberg in 1946 to the newest theories of spline-wavelets and spline-fractals.

The book is divided into eleven chapters. Chapter 1 introduces the polynomial spline functions and their fundamental properties. Chapters 2 and 3 are devoted to multivariate and non-linear sets of spline functions. The most important methods for the numerical solution of integral equations and ordinary differential equations are treated in Chapters 4 and 5. Chapter 6 shows that the most natural framework for using spline functions is that of finite element methods. Chapter 7 is a thorough presentation of the finite element method for the solution of boundary value problems for partial differential equations. Using suitable spaces of spline functions, finite element methods for elliptic Dirichlet and Neumann problems and some non-linear partial differential equations are developed. The spline collocation methods for parabolic and hyperbolic problems in two space variables are discussed. Chapter 8 is devoted to spline curves, spline surfaces and their *B*-spline representation for computer-aided geometric design; the rational point of view is also studied. Chapter 9 briefly describes a model of shape that combines deterministic splines and stochastic fractals, inheriting their complementary features. The notions of box splines and multivariate truncated powers are introduced in Chapter 10. Chapter 11 is a brief introduction to wavelet analysis, and some new aspects of the numerical methods using spline wavelets for the solution of evolution partial differential equations are discussed. The references section at the end of this book aims to be the most exhaustive possible (218 pages). All publications known to the authors up to August 1998 are listed, and subdivided into three sections: books, monographs and conference reports; original papers; and dissertations for a doctoral degree or habilitation.

This book can be strongly recommended to researchers and graduate students involved in numerical methods and computation, approximations, differential equations, and integral equations. (kn)

J. C. Migliore, *Introduction to Liaison Theory and Deficiency Modulus*, *Progress in*

Mathematics 165, Birkhäuser, Boston, 1998, 215 pp., DM98, ISBN 0-8176-4027-4, ISBN 3-7643-4027-4
This is a highly specialised monograph that provides a very good introduction to contemporary research in the fields of liaison theory and deficiency modules. It will be of interest first to algebraic geometers and algebraists.

Liaison (or linkage) is an equivalence relation among subschemes of given dimension in a projective space $\mathbf{P}^n$ over an algebraically closed field. Two subschemes are directly CI-linked if their union is a complete intersection, and directly G-linked if their union is arithmetically Gorenstein. While the first notion is relatively classical, the second is rather new and represents an area of current research. The deficiency modules are defined for a closed subscheme V of Pn of dimension r as cohomology modules $H_*^i(I_V)$, $1 \le i \le r$, of the ideal sheaf of V, and measure the failure of V to be arithmetically Cohen-Macaulay. They appear as an important tool for the study of the liaison. To read this book the reader needs an introductory knowledge of algebraic geometry and commutative algebra, but the author tries to help as much as possible. The first chapter 'Background' presents some less standard notions and results needed in the book.

The author pays great attention to motivation and the geometric aspects of the theory. There are many examples through which the reader is introduced into the theory, thereby stimulating research interest in this field; some of these are computed using the program 'Macaulay'. The book will be useful both for specialists and for postgraduate students in these areas. The bibliography includes 203 items and goes up to 1997. (jiva)

A. D. Osborne, *Complex Variables and their Applications*, *International Mathematics Series, Addison Wesley Longman, Harlow, 1998, 454 pp., £19.95, ISBN 0-201-34290-1*
The author's intention was to write a versatile book suitable for both first and second courses in complex analysis both for mathematicians and for those interested in applications. The only assumed knowledge is calculus and basic real analysis. All important techniques and applications are covered. The book contains a range of exercises from standard to challenging questions; there is a manual providing full solutions to all questions, available to lecturers from the publishers. In addition to classical material, the book includes asymptotic series and elliptic functions as well as applications to ODEs and integral transforms. Everything is carefully explained with a great sense for clear and straightforward approach, accompanied by numerous short historical remarks. Many pictures and very good typographical presentation make reading pleasant end enjoyable. (jiva)

K. H. Parshall, *James Joseph Sylvester: Life and Work in Letters*, *Clarendon Press, Oxford, 1998, 321 pp., £55, ISBN 0-19-850391-1*
This volume presents for the first time 140 letters from Sylvester's correspondence, selected from some 1200 letters from many archives, libraries and private collections in the USA, Great Britain, Germany and France. These letters cover Sylvester's life and work and provide a detailed look at his thoughts and thought processes. They show him in both personal and professional spheres during his 82 years. The letters reflect his research activities, the range of his correspondents, and his interests.

The letters are divided into six chapters. Each chapter opens with a short prelude that gives a thematic overview of its subject. An extensive historical and mathematical commentary accompanies the letters, and references to pertinent secondary literature (mathematical and historical) and bibliography are included. Chapter 1 contains letters from 1834 to 1849, Chapter 2 spans the years 1850 to 1854 when Sylvester formulated his theory of invariants, the 22 years from 1855 to 1876 are covered by Chapters 3 and 4, Chapter 5 is on Sylvester at Johns Hopkins University (1876 to 1883) and the final chapter is devoted to the years 1884 to 1897. (mnem)

A. Pasini, *Elementi di Algebra e Geometria. I. Naziono di base, II. Elementi di Algebra, III. Algebra lineare e Geometria*, *Liguori Editore s.r.l., Napoli, 1998, 179/183/524 pp., 22000L/22000L/ 49000L, ISBN 88-207-2739-0, 88-207-2740-4 and 88-207-2741-2*
This book is designed for students who have begun to study university mathematics; it is divided into three volumes.

The first volume contains basic notions of mathematics (sets, maps, relations, logic, finite sets, binomial coefficients, mathematical induction, infinite sets, countable sets, axiom of choice, cardinal numbers). The second volume covers the necessary algebraic background (fields, rings, groups, semigroups); substantial parts of this volume are devoted to the real and complex fields, and to polynomials in one and several variables.

The third volume is devoted to linear algebra and geometry. It begins with classical material on vector spaces and linear maps (subspaces, linear independence, bases, dimension, direct sums, etc.) and on basic applications, such as systems of linear equations. Also included are inner product vector spaces (orthogonal bases, orthogonalisation, etc.). The next three chapters present standard material on affine and Euclidean geometry. In the final chapters, linear algebra and geometry are presented as closely linked subjects; a central idea is the matrix representation of linear maps (algebra of linear maps, algebra of matrices, eigenvalues and eigenvectors, orthogonal and unitary transformations and matrices, affine transformations, transposed and conjugate complex matrices, bilinear and quadratic forms, conic sections and quadrics).

Each volume includes exercises and an index. They are well written and can be recommended for basic study. (jbe)

J. J. Risler (directeur de la publication), *Matériaux pour l'histoire des mathématiques au XXe siècle*, *Séminaires & Congrès 3, Société Mathématique de France, Paris, 1998, 282 pp., ISBN 2-85629-065-5*
This book is the third volume of materials for the history of mathematics in the XXth century, dedicated to the memory of Jean Dieudonné (1906-92). The volume contains a short introduction that describes the 'history' of the book. In January 1996, on the occasion of the inauguration of the new pavilion of Laboratoire J. A. Dieudonné at the Université de Nice - Sophia Antipolis, there was a conference organised by the University, l'Académie de Sciences, d'Institut des Hautes Études Scientifiques et du Centre National de la Recherche Scientifique. The book contains the conference programme, with eleven contributions in French and English delivered at the conference. They are devoted to fundamental ideas of 20th-century mathematics, such as hyperbolic equations, functional analysis, homotopy theory of fibre spaces, group representations, sheaf theory, the mathematical theory of Brownian motion, and Hilbert's twelfth problem. At the end, an alphabetical index is included.

This book can be recommended to all mathematicians interested in the history of modern mathematics. (mnem)

P. C. Roberts, *Multiplicities and Chern Classes in Local Algebra*, *Cambridge Tracts in Mathematics 133, Cambridge University Press, Cambridge, 1998, 303 pp., £37.50, ISBN 0-521-47316-0*
It is well known that the development of algebraic geometry greatly influenced progress in algebra. In recent decades, the reverse trend appeared and proved to be very fruitful; namely, methods of algebraic geometry started to be applied within the framework of pure algebra. The main idea consists in substituting objects of algebraic geometry by more general objects in pure algebra. This book represents an exposition of some parts of this modern and rapidly developing branch of algebra.

An important notion in algebraic geometry is that of multiplicity of intersection. The author uses two notions of multiplicity. The first generalises the multiplicity of intersection of a plane curve with itself and is called 'Samuel multiplicity'. The second generalises the multiplicity of intersection of two subvarieties of a variety, and its requires the use of homological algebra; it is called 'Serre multiplicity'. Most of this book is devoted to the introduction and investigation of these (and other) multiplicities. For these purposes a lot of techniques are developed. We mention in particular the Chern classes of locally free sheaves, Chern character, and local Chern characters. All these notions were inspired by the corresponding notions of algebraic topology, but they are defined in purely algebraic terms.

The book is nicely written, and serves well as an introduction to this interesting branch of algebra, as well as containing

very recent results. The necessary prerequisities from algebra and algebraic geometry are rather modest, but a good background in algebraic geometry gives the reader better motivation. There are many examples to make the exposition more attractive, and there are exercises at the end of each chapter. The theory presented here is a beautiful interplay of several branches of mathematics and provides good reading for algebraists, geometers, and topologists. (jiva)

K. A. Ross, J. M. Anderson, G. L. Litvinov, A. I. Singh, V. S. Sunder and N. J. Wildberger (eds.), ***Harmonic Analysis and Hypergroups,*** *Trends in Mathematics, Birkhäuser, Boston, 1998, 249 pp., DM208, ISBN 3-764-33943-8, ISBN 0-817-63943-8*
This book contains the proceedings of a conference on harmonic analysis on hypergroups held in December 1995 in Delhi.

Much of this book is concerned with the notion of hypergroups. Let $M(H)$ be the space of all bounded Borel measures on a locally compact topological space H. If H is a group, then there is a canonical product * defined on $M(H)$ by $\delta_x * \delta_y = \delta_{xy}$. For a general H, if * is a product on $M(H)$ satisfying a certain set of axioms (generalising properties of $M(H)$ from the group case), the couple $(H,*)$ is called a hypergroup. Many results in classical harmonic analysis (the Fourier transform, the Plancherel and inversion formulas, the Plancherel theorem) can be extended to hypergroups.

Signed hypergroups and relations to Markov chains are discussed in the contribution by K. A. Ross. Connections among characters of hypergroups, families of orthogonal polynomials (such as Legendre polynomials) and the Sturm-Liouville problem appear in the three lectures by A. L. Schwartz. An extension of the wavelet transform to hypergroups is discussed in the paper by K. Trimeche. An approach to non-commutative harmonic analysis on a Lie group, based on an old idea of Frobenius, and its relation to hypergroups is described in the contribution of N. J. Wildberger.

Other topics include De Branges modules (S. Agrawal and D. Singh), moment functions on hypergroups (L. Gallardo), behaviour of the Plancherel measure and multiplier theorems (M.-O. Gebuhrer), disintegration of measures (H. Helson), multipliers of de Branges-Rovnyak spaces (B. A. Lotto and D. Sarason), applications to measures on compact spaces (R. Nair), applications to functional equations (H. Stetkaer), actions of finite hypergroups on finite sets (V. S. Sunder and N. J. Wildberger), positivity of Turán determinants (R. Szwarc), relations to semigroups of positive definite functions (M. E. Walter) and limit theorems for random walks (H. Zeuner).

The book contains nice survey papers on properties of hypergroups, as well as papers presenting applications and relationships with many different parts of mathematics. (vs)

R. P. Stanley, ***Enumerative Combinatorics,*** *Vol. 2, Cambridge Studies in Advanced Mathematics 62, Cambridge University Press, Cambridge, 1999, 581 pp., £45, ISBN 0-521-56069-1*
The book is a continuation of Volume 1 (1986), starting with Chapter 5, *Trees and the composition of generating functions*, and continuing with Chapter 6, *Algebraic, D-finite, and noncommutative generating functions*, and Chapter 7, *Symetric functions*. The last chapter has two appendices: 'Knuth Equivalence, Jeu de taquin, and the Littlewood-Richardson rule' (by S. Fomin) and 'The characters of GL(n, C)'. Each chapter has its own set of exercises with solutions, 261 in all but many more when sub-exercises are counted. The references to them and the bibliographies to the chapters constitute a giant survey of literature on enumerative combinatorics.

What else is to be added to our comments on this excellent book? Perhaps a quotation from G.-C. Rota's foreword: 'Every once in a long while, a textbook worthy of the name comes along; ... Weber, Bertini, van der Waerden, Feller, Dunford and Schwartz, Ahlfors, Stanley.' (mkl)

T.-T. Tay, I. Mareels and J. B. Moore, ***High Performance Control, Systems & Control: Foundations & Applications,*** *Birkhäuser, Basel, 1998, 344 pp., sFr148, ISBN 3-764-34004-5 and 0-817-64004-5*
The main theme of this book is to determine whether high performance can be achieved in the face of uncertainity. The first three chapters are introductory, with attention paid to the description of all stabilising controllers for which the factorisation approach is developed; various norms are used as performance measures. Chapters 4 and 5 are devoted to an optimal design for tracking some signals or rejecting disturbances. It is supposed that the nominal plant G and the nominal controller K are augmented by a plant G and a controller Q. Optimisation techniques are developed for both types of designs: off-line and iterated or recursive (Q, S)-designs (for S-parametrisation). The next two chapters describe direct and indirect adaptive-Q controls; in the latter, controller designs are based on on-line identified models. As the adaptation proceeds slowly compared to the plant dynamics, averaging techniques are used. In Chapter 8 it is shown how to apply the direct adaptive-Q algorithm to non-linear systems by means of linearisation. The concluding two chapters are closer to real applications: the real-time implementation is discussed and three examples (a disc driver control system, control of a heat exchanger and a flight control system) are studied in detail.

The book is directed to graduate students in system theory; beginners are first recommended to read the book 'Feedback Control Theory' by J. Doyle, B. Francis and A. Tannenbaum (Macmillan, New York, 1992). The proofs are sometimes sketchy and more attention is paid to motivation and to system philosophy. The extensive bibliography with comments on the references is also very useful. This book, together with (e.g.) I. Meerels and J. Polderman's 'Adaptive Control Systems' (Birkhäuser, Basel, 1996), provides a good account of the research that has been done during the last decade. (jmil)

Centre de Recerca Matematica (Barcelona)

List of visitors, September - December 1999

J. L. Balcazar, Barcelona, 5 Sep - 10 Dec 99, Computational theory
K. Baranski, Warszawa, 1 Dec 98 - 31 Oct 99, Analysis
M. Brunella, Dijon, 7 - 30 Nov 99, Geometry
A. Candel, California, 22 Nov - 20 Dec 99, Geometry
W. Chacholski, Connecticut, 1 - 31 Oct 99, Algebraic topology
J. A. Crespo, Barcelona, 1 Sep 99 - 31 Jul 00, Algebraic topology
M. Cruz, Mexico, 10 Nov - 10 Dec 99, Geometry
F. X. Dehon, Paris, 1 Oct 99 - 30 Sep 01, Algebraic topology
S. Dumitrescu, Lyon, 1 - 20 Nov 99, Geometry
K. Faure, Toulouse, 1 Sep 99 - 30 Jun 00, Geometry
J. M. Gambaudo, Dijon, 7 - 20 Nov 99, Geometry
F. Gautero, Valbonne, 14 Sep 98 - 30 Sep 00, Dynamical systems
E. Ghys, Lyon, 1 - 21 Nov 99, Geometry
A. Guillot, Lyon, 1 - 20 Nov 99, Geometry
P. Koskela, Jyvaskyla, 18 Jan - 31 Dec 99, Analysis
M. Lagrange, Dijon, 8 - 20 Nov 99, Geometry
S. Lamy, Prest, 1 Sep 99 - 30 Jun 00, Geometry
J. J. Loeb, Angers, 1 - 15 Nov 99, Geometry
F. Loray, Villeneuve d'Ascq, 24 Oct - 20 Nov 99, Geometry
M. McQuillan, Oxford, 7 Nov - 3 Dec 99, Geometry
M. Mimura, Okayama, 1 Oct - 30 Nov 99, Algebraic topology
I. Morrison, New York, 1 Jan - 31 Dec 99, Applied mathematics
H. R. Morton, Liverpool, 1 - 31 Oct 99, Applied mathematics
F. Sanchez-Bringas, Mexico, 1 - 15 Dec 99, Geometry
J. Seade, Mexico, 30 Nov - 14 Dec 99, Geometry
C. Tarquini, Rennes, 1 Sep 99 - 30 Jun 00, Geometry
A. Verjovsky, Mexico, 10 Nov - 15 Dec 99, Geometry
X. Zhang, Beijing, 1 Mar 99 - 28 Feb 00, Dynamical systems

Journal of the European Mathematical Journal

The first issue of this EMS journal appeared in January 1999. The contents of the first two issues were given in the June Newsletter. Further information can be obtained by e-mail: jems@mis.mpg.de

Volume 1, Number 3

F. Lin and T. Rivière, Complex Ginzburg-Landau equations in high dimensions and codimension two area minimizing currents

J. Kollár, Effective Nullstellensatz for arbitrary ideals

Erratum to M. Burger and N. Monod, Bounded cohomology of lattices in higher rank Lie groups

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