

NEWSLETTER No. 4

1st June 1992

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Typed by Beryl Betts and produced at the Faculty of Mathematical Studies, University of Southampton
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Editors

Ivan Netuka
Mathematical Institute
Charles University
Sokolovská 83
18600 PRAGUE
CZECHOSLOVAKIA

David Singerman
Faculty of Mathematical Studies
The University
Highfield
SOUTHAMPTON SO9 5NH
ENGLAND

* * * * *

**Editorial Team
Southampton:**
D. Singerman
D. R. J. Chillingworth
G. A. Jones
J. A. G. Vickers

**Editorial Team
Prague:**
Ivan Netuka
Jiří Rákosník
Vladimir Souček

Useful Addresses

President Professor F Hirzebruch, Max Planck Institut für Mathematik,
Gottfried Claren Str 26, D-5300 Bonn 3, GERMANY

Secretary Professor C Lance, School of Mathematics,
University of Leeds, Leeds LS2 9JT, ENGLAND

Treasurer Professor A Lahtinen, Department of Mathematics,
University of Helsinki, Hallituskatu 15, SF-00100 Helsinki,
FINLAND

EMS Secretariat Ms T Mäkeläinen, University of Helsinki (address above)
e-mail makelainen@cc.helsinki.fi

Newsletter editors D Singerman, Southampton (address above)
e-mail ds@maths.soton.ac.uk
I Netuka, Prague (address above)
e-mail ummin@csearn.bitnet

**Newsletter
advertising officer** D R J Chillingworth Southampton (address above)
e-mail drjc@math.soton.ac.uk

HUMAN CAPITAL AND MOBILITY PROGRAM OF THE EUROPEAN COMMUNITY - 2

As we have announced in Newsletter 3 the E.C. is launching this new and important program for a total of 480 million Ecus.

We present here a summary of the 4 aspects of this program as far as we know with the name and address of contact people at the E.C., from whom detailed information and application forms can be obtained.

A. Postdoctoral fellowships

This program will provide fellowships for research workers at more or less post-doctoral level to work in a receiving institution for a period of 6 to 24 months. A receiving institution could be a team or an international network. The research workers must be E.C. nationals who apply to work in another E.C. country. Note, however, that the program will be enlarged in January 93 to the countries of the European Free Trade Association.

The procedure is as follows:

First, applications will be expected from receiving institutions, and will be called for twice a year. For the first wave, it is likely that application forms will be available on 1st June, but that the deadline will be 3rd July, which is a very short period.

The list of receiving institutions will then be published, and research workers will be able to apply to them at any time, with 3 selections every year. Also, some institutions would receive a credit to hire research workers directly.

B. Research networks

This is an extension of existing E.C. programs. A network is an association of at least 5 teams in at least 3 E.C. countries, proposing to develop research in a specific direction. The E.C. Funding can cover the cost of cooperation (travel, living expenses) but not the project itself. Applications can be introduced at any time, with 3 waves of decisions each year.

C. Access to large scientific equipment

This covers the use of existing equipment, but not the buying of new ones. Presumably, this program concerns only a minority of mathematicians.

D. Euroconferences

Applications are expected from large scientific organisations, who could set up such high level conferences, and the program will essentially cover the expenses of participants.

The contact address for these four aspects is:

DGXII-H-1 (MO 75), 200 rue de la Loi, 1040 Brussels - BELGIUM

A)	I. Brach	Tel: (32)-2-236 33 03	Fax: (32)-2-236 33 07
B)	M. Soares	Tel: (32)-2-236 21 48	Fax: (32)-2-236 33 07
C)	M. Malacarme	Tel: (32)-2-235 32 77	Fax: (32)-2-235 69 95
D)	J. Shiel	Tel: (32)-2-236 29 84	Fax: (32)-2-236 33 07

For the E.C. Liaison Committee: **Luc Lemaire** Address at end of article

Cooperation program of the European Community with Central and East European Countries

This new program is now announced, with a budget of 55 million Ecus. It concerns only the following countries:

Albania, Bulgaria, Czechoslovakia, Estonia, Hungary, Latvia, Lithuania, Poland, Romania.

The following aspects concern the mathematicians:

(A) Mobility

This includes "Go West" fellowships for around 3 months, for which applications must nominate a Central or Eastern European scientist and a receiving institution in the West, and "go East" fellowships for confirmed researchers to spend 1 to 3 months in Central or East European countries to participate in research or help to develop new directions.

(B1) Scientific networks

Such a network should involve at least 2 E.C. and 2 "Eastern" teams.

(B2) Participation at conferences

These should help to promote collaboration through Europe.

(C) Joint research projects with industry

Among the accepted themes, information and communication technology is probably the only one connected with mathematics.

(D) Support for participation in E.C. programs.

In particular, this should insure participation of Central and East European scientists in the Human Capital and Mobility program mentioned above.

The deadline for application is August 7, 1992

For all information, one can contact:

E.C. Commission, Scientific Cooperation with Central and Eastern Europe

75 rue Montoyer, 1040 Brussels, BELGIUM Fax: (32)-2-236.33.08

For the E.C. Liaison Committee

Luc Lemaire, C.P. 218, Campus Plaine, Bd du Triomphe, 1050 BRUXELLES

Tel: (32)-2-650 58 37 Fax: (32)-2-650 51 13 e-mail: ulbmath@ulb.ac.be

THE FIRST EUROPEAN CONGRESS OF MATHEMATICS

The first European Congress of Mathematics is sponsored by the European Mathematical Society (EMS) with support from the French Mathematical Society (SMF) and the French Society for Applied and Industrial Mathematics (SMAI).

The congress will be held in Paris, July 6-10, 1992, in the very heart of the Latin Quarter. It will take place at the Sorbonne, the centuries-old birthplace of the University of Paris, and at nearby universities.

Scientific Programme

The programme comprises four parts:

- ◆ ten 50-minute plenary lectures
- ◆ forty 45-minute lectures in parallel sessions
- ◆ sixteen 2-hour round tables in parallel sessions
- ◆ poster sessions

The plenary and parallel lectures are intended for a broad audience of mathematicians, not necessarily confined to the speaker's own specialty. They will present current research themes that have recently undergone important developments. Themes and speakers have been selected by the Scientific Committee.

The main purpose of the round tables is to stimulate a broad discussion of the current and future role of mathematics in society. They are aimed at the European mathematical community, the political authorities, the European institutions, the media and the public. Other topics also include the interaction of mathematics with education, industry and with other sciences.

Poster sessions will give participants the opportunity of presenting their work. These sessions will be organized by topic so as to encourage an exchange of ideas.

Congress proceedings are to be published after the Congress. They will include the plenary and parallel lectures, as well as the final reports from each round table.

More than twenty specialized meetings will take place before and after the Congress.

The official languages of the Congress are English and French.

List of speakers

Plenary lectures

V I Arnold (Moscow)
S Donaldson (Oxford)
W Müller (Berlin)
M Vergne (Paris)

L Babai (Budapest)
B Engquist (Stokholm)
D Mumford (Cambridge USA)

C De Concini (Pisa)
P-L Lions (Paris)
A-S Szitman (Zürich)

Parallel lectures

Z Adamowicz (Warsaw)
R Azencott (Paris)
A Beilinson (Moscow)
M Berry (Bristol)
A Björner (Stockholm)
B Bojanov (Sofia)
J-M Bony (Paris)
R E Borcherds (Cambridge UK)
J Bourgain (Paris)
F Catanese (Pisa)
C Deninger (Münster)
D Duffie (Stanford)
J Fröhlich (Zürich)
D Zagier (Bonn)

J Gärtner (Berlin)
M Giaquinta (Florence)
U Hamenstädt (Bonn)
M Kontsevich (Moscow)
S B Kuksin (Moscow)
M Laczkovich (Budapest)
J-F Le Gall (Paris)
E J N Looijenga (Utrecht)
I Madsen (Aarhus)
A S Merkurjev (St Petersburg)
J M Montesinos (Madrid)
J Nekovar (Prague)
Y Neretin (Moscow)

M Nowak (Oxford)
R Piene (Oslo)
A Quarteroni (Milan)
D Salamon (Warwick)
A Schrijver (Amsterdam)
A Shamir (Rehovot)
B Silverman (Bath)
V Strassen (Constance)
P Tukia (Helsinki)
C Viterbo (Paris)
D Voiculescu (Berkeley)
M Wodzicki (Berkeley)
J-C Yoccoz (Paris)

List of round tables

Theme

Mathematics and the General Public
Women and Mathematics
Role of Mathematics in Education Policies
Let's Cultivate Mathematics
European Mathematics, Myth or Historical Fact?
Philosophy of Mathematics: Why and How?
Mathematics in Social Sciences
Mathematics and Industry
Degrees Harmonization
and Student Exchange Programs
European Science Policy for Mathematics
Collaboration with Developing Countries
Mathematical Libraries in Europe
Mathematics and Economics
Mathematics and Computer Science
Mathematics and Chemistry
Mathematics, Biology and Medicine

Organizer(s)

J-P Kahane
E Bayer
J Camus
Y Chevallard
C Goldstein, J Ritter
H Sinaceur
P-A Chiappori, R Guesnerie
J Hunt, H Neunzert
H. Munkholm, I Netuka, V Souček
D Gabay
P Bérard
P Barrat
B Cornet
P Flajolet
E Soulié
R Hiorns

Registration

The Congress is open to all mathematicians. Accompanying persons are welcome. Registration forms can be obtained at the Secretariat of the Congress. From March 1st on the registration fees are fixed to FF 1200.

As of April 15, more than 950 people were already registered. The largest delegations are from Italy, Germany, Spain, Great Britain, USA, Norway, Poland, and of course, France.

Fellowships

Over 500 people applied for fellowships. More than two hundred fellowships were granted. They have been attributed to Eastern Europe mathematicians who can not be supported by their own institutions. The fellowships consist of three parts: exoneration of the registration fees, lodging in University facilities, and a small amount in cash to cover local expenses.

Travel expenses are not covered by the fellowships. Some of the grantees found original solutions, as for example the Hungarian delegation who are considering renting a bus.

Address of the Secretariat of the Congress

European Congress of Mathematics
Collège de France
3 rue d'Ulm
75005 Paris, France
Fax: (33 1) 44 27 17 10

SURVEY OF EUROPEAN MATHEMATICAL PERIODICALS (1990/93)

Professor B Wegner (TU Berlin) has produced a revised and extended version of the 1988 survey. This document is too long to be reprinted here, but copies have been distributed to all corporate members. Individual members may obtain a personal copy on application to the Helsinki office.

List of original names of member societies

Société Mathématique du Luxembourg
Société Mathématique de Belgique - Belgisch Wiskunding Genootschap
Société Mathématique de France
Cumann Matamaitice na hÉireann
Unione Matematica Italiana
Wiskundig Genootschap
Savez Društava Matematičara, Fizičara I Astronoma Jugoslavije
Eesti Matemaatika Selts
Lietuvos matematikų draugija
Gesellschaft für Angewandte Mathematike und Mechanik
Dansk Matematisk Forening
ΕΛΛΗΝΙΚΗ ΜΑΘΗΜΑΤΙΚΗ ΕΤΑΙΡΕΙΑ
Deutsche Mathematiker-Vereinigung
Edinburgh Mathematical Society
Norsk Matematisk Forening
Съюз на математиците в България
Real Sociedad Matemática Española
Sociedade Portuguesa de Matemática
Österreichische Mathematische Gesellschaft
Svenska Matematikersamfundet
London Mathematical Society
ÍSLENZKA STÆRÐFRÆÐAFÉLAGIÐ
Jednota Slovenských Matematikov a Fyzikov
Institute of Mathematics and Its Applications
Société Mathématique Suisse
Societatea Matematicienilor din România
Jednota českých matematiků a fyziků
Société de Mathématiques Appliquées et Industrielles
Bolyai János Matematikai Társulat
Suomen matemaattinen yhdistys
საქართველოს მათემატიკოსთა კავშირი

EUROPEAN NEWS: Country by Country

BULGARIA **Please note the correct address for**

Union of Bulgarian Mathematicians is

Acad. G.Bonchev Str., Block 8

1113 Sofia

BULGARIA

HUNGARY

Conferences: 16th ALGEBRAIC CONFERENCE

Lattices, Ordered Sets and Universal Algebra

August 23-27, 1993

Location: Szeged

Organizers: Gabor Czedli and Agnes Szendrei

JATE Bolyai Institute

Szeged, Aradi vertanuk tere 1.

H-6720 Hungary

e-mail: h1031cze@ella.hu

h1029sze@ella.hu

The following conferences are organized by the Bolyai Janos Mathematical Society

COLLOQUIUM ON ANALYTICAL NUMBER THEORY

June 21-26, 1993

Location Lillafured

COMBINATORICS COLLOQUIUM

July 18-24, 1993

Location Keszthely

ANALYSIS COLLOQUIUM

August 9-13, 1993

Location Szeged

TOPOLOGY COLLOQUIUM

August 22-27, 1993

Location Lillafured

Contact: The Bolyai Mathematical Society, BUDAPEST

Fo u.68. II. 224. H-1027

Tel: 201-6974, 201-7656, 201-2011

FRANCE

Conference: 4TH INTERNATIONAL SYMPOSIUM on Orthogonal Polynomials and their Applications

October 19-13, 1992 Location: Evian - France
Organizer: Association Française d'Approximation

After the congresses of Bar-Le-Duc (1984), Segovia (1986) and Erice (1990), the 4th International Symposium on *Orthogonal Polynomials and their Applications* will be held in Evian (France) from October 19 to 23, 1992.

Accommodation and conferences will take place at the Village-Vacances-Familles (VVF) of Evian, beautifully located on the bank of the Lake Lemman in the French Alps. Evian can be reached by train or by plane (international airport of Geneva in Switzerland and then train to Evian. A Swiss visa will be needed for some foreigners).

The aim of this congress is to gather mathematicians, scientists and engineers working on or using orthogonal polynomials. All the aspects of the subject are intended to be covered. The proceedings will be published.

Participants are invited to arrive on Sunday 18 October and to leave on Saturday 24 October. Accommodation is only by apartments with two bedrooms (each with a bathroom) and a common living room. The price for full board is 305 FF per day and per person. The registration fees (including the social events and a copy of the proceedings) are 1100 FF (500 FF for accompanying persons) and they must be sent (in French Francs and free of charge for us) together with an advance of 900 FF for accommodation to

Account # 13606 / 00071 / 30708125000 / 41
beneficiary: Assoc. d'Approx. - Mr Le Méhauté
bank: Crédit Agricole, 61 rue Nationale, 35135 - Chantepie, FRANCE

Deadline for registration, sending the abstract (1 page) and a proof of payment is **May 3, 1992.**

An additional fee of 100 FF will be charged for late registration.

The complete papers should be brought at the congress.

If you intend to participate and give a talk, please write as soon as possible to

Claude Brezinski, ISOPA4
Laboratoire d'Analyse Numérique et d'Optimisation
UFR IEEA - M3
Université des Sciences et Technologies de Lille
59655-Villeneuve d'Ascq Cedex, FRANCE
e-mail LABANO@FRCITL81.BITNET

A second announcement, with details about the proceedings, will be sent in June.

The Organizing Committee

S Belmehdi, C Brezinski, M Prévost, H Sadok, J van Iseghem (Lille), A P Magnus (Louvain-La-Neuve), P Maroni (Paris VI), M Redivo Zaglia (Padova), A Ronveaux (Namur)

GERMANY

Announcement

At the Third European Conference of the European Council for High Ability (ECHA) on "Competence and Responsibility" (University of Munich, October 11-14, 1992) amongst many others a Workshop on the topic "High Ability in Mathematics, Natural Sciences, and Technology" will be organised. For the conference write to

Conference Secretariat
Institute of Educational Psychology
University of Munich, Leopoldstraße 13
W - 8000 Munich 40, GERMANY

Tel: +49 89 - 2180/5149 Fax: +49 89 - 2180/5250

For the workshop you can write to Professor Schweiger who is one of the organisers:

Professor Dr. Fritz Schweiger
Universität Salzburg
Hellbrunnerstraße 34
A - 5020 Salzburg, AUSTRIA

For reasons of space the following meeting was omitted from the list of DMV Seminars in Newsletter 2, to which the reader is referred to for further details.

Conference: MULTIVARIATE STATISTICAL ANALYSIS

November 22 - 29, 1992

Location: Schloß Reisenburg, 8870 Günzburg

Subjects: The structure and analysis of multivariate normal models defined by algebraic conditions on the mean and/or covariance, including group symmetry covariance models, lattice-ordered conditional independence models, and totally ordered linear models. Applications to monotone and non-monotone missing data patterns, GMANOVA and its extensions, patterned covariance matrices. The algebraic definitions of such models lead to unified and explicit likelihood analyses and to structure and characterization theorems for the models themselves, as well as for the problem of testing between two models in the same class.

Prerequisites: Familiarity with statistical inference for the multivariate normal distribution at the level of T.W. Anderson's book "An Introduction to Multivariate Statistical Analysis" (Wiley, 1984, 2nd edition), or M.L. Eaton's book "Multivariate Statistics: A Vector Space Approach" (Wiley, 1983)

ROMANIA

Conferences: **FIRST FRANCO-ROMANIAN CONFERENCE** on Optimization, Optimal Control, Partial Differential Equations.

September 7-11, 1992

Location: Iași

Organizers: INRIA (France) and Institute of Mathematics of the Romanian Academy.

Contact: V Barbu, University of Iași
str.23 August 20 (Copou), Iași, 6600 - ROMANIA

INTERNATIONAL CONFERENCE on Differential Geometry and its applications, on the occasion of the 90th anniversary of Akitsugu Kawaguchi's birth.

August 24-29, 1992

Location: Bucharest.

Organizers: Tensor Society-Romanian Academy

Contact: R Iordănescu
Institute of Mathematics of the Romanian Academy
P.O. Box 1-764, RO-70700, Bucharest, ROMANIA

SCOTLAND

Conferences: **BRITISH APPLIED MATHEMATICS COLLOQUIUM**

35th British Theoretical Mechanics Colloquium

April 5 - 8, 1993

Location: University of Strathclyde in Glasgow

Invited Speakers

Computational Mathematics	Professor Bengt Fornberg (<i>Exxon Corporate Research, USA</i>)
Mathematical Biology	Professor Bob May, FRS (<i>University of Oxford</i>)
Solid Mechanics	Professor Ingo Müller (<i>Technische Universität Berlin</i>)
Differential Equations	Professor Larry Payne (<i>Cornell University, USA</i>)
Rheology	Professor Ken Walters, FRS (<i>University College of Wales, Aberystwyth</i>)
Stewartson Memorial Lecture	Professor Alex Craik (<i>University of St Andrews</i>)

continued.....

SCOTLAND continued.....

MINI-SYMPOSIA

Liquid Crystals
Inverse Problems

Industrial Mathematics
Nonlinear Dynamical Systems

Contact: Dr Ian Murdoch, Colloquium Secretary
British Applied Mathematics Colloquium
Department of Mathematics
University of Strathclyde
Glasgow G1 1XH, UK
Email bame93@uk.ac.strath
Tel: 041 552-4400 ext 3657

OTHER CONFERENCES

INDIA

Conference: **WORLD ORGANISATION OF SYSTEMS AND CYBERNETICS**

Ninth International Congress of Cybernetics and Systems

18 - 23 January 1993

Location: New Delhi, India

To be jointly held by

The Society for Management Science and Applied Cybernetics, New Delhi, India.

Systems Engineering and Cybernetics Centre, Tata Consultancy Services, Hyderabad, India.

Contact:

A Ghosal, Secretary
Society of Management Science
and Applied Cybernetics
C/- CSIR Complex, Pusa
NEW DELHI - 110 012, INDIA

P N Murthy,
Tata Consultancy Services
3rd Floor, Shakar Bhavan
Fateh Maidan Road
HYDERABAD - 500 004, INDIA

Tel: 91-(11)-573-2193
Telex: 31 61 635 TBG IN

Tel: 91-(842)-231246/231247
Telex: 0425 - 6645 TCSH IN

A Perspective for the Work of the Committee for Mathematics Education

Willi Dörfler, Chairman

At the meeting of the Executive Committee of EMS in Prague (March 28-29) the Committee for Mathematics Education (CME) of the EMS was re-established. This had become necessary after Dr. Tibor Nemetz had to resign as chairman due to his health condition. My first action to be taken as the newly appointed chairman of CME is to thank Tibor for his commitment. There cannot really be a replacement for him and we all wish that he recover soon. He has laid good foundations for a CME and it is relatively easy for me to start from that.

I accepted the appointment as chairman of CME under the premises that this is a committee within the society dedicated in principle to all aspects, questions and developments of mathematics education as a research field and as a practice field in schools and at universities. That is a tremendously complex and widespread area of activities carried out by researchers and teachers at many different levels. Therefore it appears to be wise to choose some focus of interest and emphasis at least for the start of the committee. By that we do not want to exclude any other topic or section of mathematics education and the following list of points of interest is open to discussion in any case:

- ◆ **Undergraduate mathematics education** currently shows a bunch of problems and phenomena which are worth to be investigated: resequencing of contents (e.g. calculus vs. discrete maths), role and usage of computers, relation to computer science education, high drop-out rates, student learning and understanding, advanced mathematical thinking, proportion of independent student work vs. lectures, content and form of exams (e.g. when using the computer)
- ◆ A longstanding and as yet unsolved problem is **mathematics as a service subject** in other studies. There too, the computer (e.g. via Mathematica or Maple) will give rise to changes in content and method (e.g. what about project studies and more integration with the main subject)
- ◆ In various places special types of **curricula for mathematics studies** are developed and implemented (like Industrial Mathematics, Computer Science Mathematics). Their rationales and goals are of much interest and the programs should be evaluated adequately. Further, what is the relation to the more traditional studies? What about a modular structure of mathematics curricula which gives students more flexibility and choice? More generally this addresses the question of applications within the mathematics studies.
- ◆ The **recruitment of students** for mathematics studies is far from being satisfactory in many places. One should investigate in more detail the (complex) reasons and possible remedies.
- ◆ This leads to another proposed focus of work for CME: **mathematics education at the (upper) secondary level**. Here again a restriction will be wise, for instance to questions like the following ones:

- ◆ differentiated curricula versus universal ones, how to differentiate, role and influence of computers and mathematical software, changes in the curriculum (e.g. discrete mathematics, dynamic systems), role of applications, affective aspects of mathematics education in school (how to create enthusiasm instead of disdain?).
- ◆ Many grave and serious problems are related to the transition from school to university. New ideas for smoothing this sharp gap are needed.
- ◆ Teacher education might be the key to solve at least partly some of the problems mentioned above. Getting more information about successful models or projects would be very valuable here: Amount and content of mathematics education in teacher education, school practice, student teaching, scope of maths as part of the teacher education, etc..

Well, that is already a long and demanding list. How can and will CME support activities on these topics and problem fields? In general, the committee is very much dependent on what the colleagues concerned with educating students in school and at universities and maths education researchers are proposed to contribute. CME will offer:

- ◆ to communicate pertinent information on all related activities in the form of a supplement to the EMS newsletter. This supplement will also be distributed outside of EMS (like to Maths Education Societies, Teacher Organizations, etc.) Welcome are among others: (short) reports, announcements, hints to publications and the like.
- ◆ to function as a general clearing house and point of liaison for contacts between EMS and all bodies professionally concerned with mathematics education.
- ◆ to initiate and enhance the organization of seminars on selected topics, e.g. from among the above list.
- ◆ to establish or to support establishment of study groups or special interest groups on specific topics.
- ◆ to support plans and projects for specific publications on maths education.

Taking into account the limited resources - human and financial as well - CME views itself rather acting as a catalyst for all these endeavours and as a forum for exchange of ideas, experiences and research outcomes. All those concerned with educational questions and problems are warmly invited to make use of CME and to contribute to our work. Please send all correspondence to the following address:

Prof. Dr. W. Dörfler
 Universität Klagenfurt
 Institut für Mathematik
 Universitätsstraße 65
 A - 9020 Klagenfurt, AUSTRIA

TEL: (0463) 2700/426 FAX: (0463) 2700/427
 EMail(EARN/BITNET): doerfler@edvz.uni-klagenfurt.ada.at

On the history of non-Euclidean geometry - 2 *

by Jeremy Gray

Faculty of Mathematics, The Open University, Milton Keynes MK7 6AA.

Gauss's long self-imposed isolation from other mathematicians ended in the 1850s when Dedekind and Riemann amongst others came to Göttingen. In Riemann's *Habilitationsvortrag* of 1854 Gauss heard the key idea that he had perhaps missed in his own study of non-Euclidean geometry and which provided the most fruitful focus for organising new ideas. Riemann broke entirely with the programme of basing geometry on a set of postulates or axioms. Instead, he took the view that all geometry was essentially intrinsic differential geometry. To do geometry one required only a space of points and a notion of the distance between them. On that basis one could define geodesics, Gaussian curvature, and so forth in an intrinsic way, leaving aside the interesting but no longer basic question of whether the given space was a subset of Euclidean space. Geometry need no longer be confined to Euclidean space of two or three dimensions, and conversely geometrical spaces of two or three dimensions need not be Euclidean.

Non-Euclidean geometry is not mentioned by name in Riemann's lecture, although it may be hinted at in the opening reference to Legendre. But Riemann does describe the three possible surfaces of constant curvature, and indicate their connection to the angle sums of triangles. The space of constant negative curvature, in which such angle sums are always less than π , is therefore tacitly established as non-Euclidean two-dimensional space.

For some reason, Riemann did not seek to publish his profound lecture. Independently, the Italian mathematician Eugenio Beltrami came to much the same ideas but precisely in the limited context of seeking to understand non-Euclidean geometry. Cremona, the leader of the Italian geometers, was not convinced, however, and so Beltrami delayed publishing until rumours of Riemann's work reached him when, thus emboldened, he gave his description of non-Euclidean space in his paper of 1868. The space is described via its image on a disc carrying a novel metric; non-Euclidean geodesics appear as straight lines. This description is the first rigorous account of its subject. Problems with the pseudosphere (a surface of rotation having constant negative curvature but a rim of singular points) were avoided - they relate to the non-existence of a smooth isometric embedding of non-Euclidean space in Euclidean three-dimensional space, only later established by Hilbert.

Even now the mathematical community hesitated to accept the new geometry, such was the magnitude of the change involved. It met with the enthusiastic support of Helmholtz, although he imposed on Riemann's ideas the restrictive idea of rigid body motion as the source of the metric. The British fought a rearguard action

* This is the second of a series of four articles on the history of non-Euclidean geometry by Jeremy Gray

against it as Joan Richards described in her book *Mathematical visions*. Cayley never fundamentally accepted it. Even when Klein realised that Beltrami's description was easy to incorporate into projective geometry (precisely because geodesics straight lines inside a conic) he still spoke of the 'so-called non-Euclidean geometry'

Reasons for this cautious response are speculative, but several seem plausible. Geometrical thought seems inborn to us, and from there it is but a short step to a Kantian position whereby our minds are pre-set to Euclidean geometry. It was this step, but not its starting point, that Helmholtz sought to persuade his readers was not necessary. Cayley's position, in modern terms, came close to asserting that the geometry of the tangent space (infinitesimal geometry) was necessarily Euclidean. Moreover, according to Riemann one must put away childish things: it is not youthful intuition that mathematics formalises but rather mature mathematics that proposes infinitely many mathematical descriptions of the world for us to adopt.

Still, in the 1860s things began to change. Gauss's *Nachlass* began to reveal the extent of his serious interest in non-Euclidean geometry, and the degree to which the Prince of mathematicians had departed from Kantianism. The French mathematician Hoüel, who had good contacts with the Italians, published a translation of Beltrami's paper, and somehow it came to the attention of Poincaré, who was only patchily aware of contemporary mathematics. It lay fallow in his mind until the famous change of buses at Coutances in Normandy one day in 1880. He had been working on the theory of Fuchsian differential equations for a Paris Academy prize, and had in mind a case where analytic continuation of the solutions maps the upper and lower half planes onto a succession of circular-arc triangles lying inside a disc. His question was: do they fit together nicely at the vertices, or overlap? To prove that the angles, of the form π/k , fit nicely together he transformed the figure so that the sides were all straight. "On boarding the bus", he wrote much later, "the idea came to me that the transformations I was using were those of non-Euclidean geometry". Recently discovered and still unpublished essays written by him not long afterwards document the extent to which the realisation that analytic continuation had here a geometric interpretation helped him to discover and develop the theory of Fuchsian functions. His published papers on the subject undoubtedly helped to establish the importance of non-Euclidean geometry.

If non-Euclidean geometry is not to be represented isometrically on a surface in Euclidean three-space, what can be done? One answer, known to Weierstrass and later to Poincaré, is to represent it on one sheet of a two-sheeted hyperboloid. With respect to the Einsteinian metric $(+, +, -)$ and the group $SO(2,1)$ that preserves the hyperboloid, the induced metric on the hyperboloid imposes non-Euclidean geometry upon it. Another answer, first given by Brill in 1885, is to write down an isometric embedding of the non-Euclidean plane in \mathbb{R}^5 . The non-Euclidean's task is a little easier, for they have merely to discover an isometric embedding of the Euclidean plane into their three-dimension space. Readers might like to investigate what it looks like as a surface inside the three-ball with the usual Poincaré metric, or (even more suggestively) as a surface in upper half-space $\{(x,y,z) ; z > 0\}$.

BRIEF REVIEWS

Edited by Ivan Netuka and Vladimír Souček. Books submitted for review should be sent to the following address:

Ivan Netuka, MÚUK, Sokolovská 83, 18600 Praha 8, Czechoslovakia.

A. Weil: The apprenticeship of a Mathematician, Birkhäuser, Basel, 1992; translated from French by J. Gage; 197 pp., SFr 58.

Extremely readable recollections of the author: his childhood, the years at Ecole Normale, stays in Italy, Germany, Russia, Finland, France, England, U.S.A., Brazil; stays not only full of mathematics but often marked by unusual and sometimes even dramatic episodes. A rare testimony of a period of the history of 20th century mathematics. Includes very interesting recollections on the author's participation in the formation of the Bourbaki Group, tells on his meetings and conversations with leading mathematicians, reflects his views on mathematics. The book describes an extraordinary career of an exceptional man and mathematician. Strongly recommended to specialists as well as to the general public. (in)

Z. Magyar: Continuous Linear Representations, North Holland, Amsterdam, 1992; North-Holland Mathematics Studies, vol.168; viii + 302 pp., \$92.50.

Well written and carefully organized explanation of the theory of continuous linear representations of the general Lie groups (and semigroups) on locally convex spaces. The main theme of the book is a description of the methods and facts known for such representations for Lie groups having no special structure. The discussion in the first half of the book is centered around the problem whether an infinite dimensional representation of a Lie algebra can be integrated to a representation of the corresponding simply connected Lie group, the main method used is regularization. The topics discussed in the second half of the book are representations of compact and commutative groups, induced and projective representations. In the last chapter projective representations of the Galilean and Poincaré groups are investigated in detail. To make the book self-contained, the author collected and described in 6 appendices all necessary facts needed in the main part (without proofs). Each chapter includes exercises. Valuable both for mathematicians and physicists with interests in the field. (vs)

Bert Øksendal: Stochastic differential equations. An introduction with applications, 3rd ed., Springer, Berlin, 1992, pp. xiii+222 pp., DM 48.

The fact that the third edition of Øksendal's book has appeared so quickly (the first edition was published in 1986) testifies to a lasting need for such a type of textbook: directed at a non-specialist, with an emphasis on both motivation and application (filtering, optimal stopping, stochastic control, a probabilistic approach to boundary value problems). The exposition is not detailed or comprehensive, but quite lucid and vivid, with a successfully chosen balance between results explained in some complexity and those merely sketched. It may be surprising how large amount of material is at least mentioned in the part of the book devoted to stochastic analysis itself (stochastic integration, stochastic differential equations driven by a Brownian motion, solutions as Markov processes, their generators and characteristic operators, the Girsanov formula...). The third edition was enhanced compared to the previous one by including exercises into almost all chapters. (jis)

A.I.Janis, J.R. Porter (Eds.): Recent Advances in General Relativity (Essays in Honor of Ted Newman); Series Einstein Studies, vol.3; Birkhäuser, Basel, 1992; xi+266 pp., DM 188.

Contains contributions presented in the Conference held in Pittsburg, May 1990. Topics of invited talks come from a broad area in general relativity and astrophysics using a mathematical viewpoint as well as a viewpoint of theoretical and experimental physics. Survey papers cover the connection of Newman's heaven spaces with twistor theory and integrable systems, the conformally invariant operator on the Riemann sphere (the edth operator), integrable systems obtained by dimensional reduction, Ashtekar and holonomy variables in general relativity, topics from black hole physics, relativistic astrophysics and asymptotic structure of spacetimes. Also included are different viewpoints on the problem of the correct cross section for a bar detector of gravitational waves and reports on three workshops held during the Conference (classical relativity, quantum gravity and computational relativity). An overview valuable for physicists as well as for mathematicians with interest in physics, especially for those working in general relativity and astrophysics. (vs)

Manfredo P. do Carmo: Riemannian Geometry; Series Mathematics: Theory and Applications; Birkhäuser, Basel, 1991; translated from Portuguese by F. Flaherty; 300 pages, 51 figures, DM 89.

The book has its origin in a course given in Berkeley in 1968 and the English edition is the 3rd one in succession. This is a very nice introduction to global Riemannian geometry, which leads the reader quickly to the heart of the topic. Nevertheless, classical results are also discussed on many occasions, and almost

60 pages are devoted to exercises. Contents: (0) Differentiable manifolds, (1) Riemannian metrics, (2) Affine connections, Riemannian connections, (3) Geodesics, convex neighborhoods, (4) Curvature, (5) Jacobi fields, (6) Isometric imersions, (7) Complete manifolds, Hopf-Rinow and Hadamard theorem, (8) Spaces of constant curvature, (9) Variations of energy, (10) The Rauch Comparison theorem, (11) The Morse Index theorem, (12) The fundamental group of manifolds of negative curvature, (13) The sphere theorem. (ok)

J. Eells, D. Toleso (Eds.): Hassler Whitney - Collected papers I,II: Series Contemporary Mathematicians; Birkhäuser, Basel, 1992, 592 pp, 600 pp; DM 208,-,DM108.

The collection of the published papers by H. Whitney, including the introduction to the book "Geometric Integration Theory" and an unpublished manuscript on the four-colour problem. Papers are grouped by topics covering a vast field in discrete mathematics, topology and analysis: graphs, combinatorics, algebraic topology, bundles and characteristic classes, differentiable functions and their singularities, analytic spaces and geometric integration theory. The paper "Moscow 1935: Topology moving towards America", written for the Centennial of the AMS, serves as a charming introduction evoking the taste of a heroic period of topology and illuminating Whitney's own research in the background of the general development of the field. Useful for the general public, especially for mathematicians working in the field. (vs)

B. Anger, C. Portenier: Radon integrals, An abstract approach to integration and Riesz representation through function cones; Series Progress in mathematics, vol.103; Birkhäuser, Boston, 1992; 332 pp, DM 98.

This monograph presents a unified approach to the functional analytic and set-theoretical measure theory. The method used enables one to construct a Radon type measure theory on an arbitrary Hausdorff space. Radon integrals are defined as regular linear functionals on an arbitrary function cone S ; regularity is expressed in terms of an approximation property by integrals of minorants from $(-S)$. The corresponding integration is a kind of abstract Riemann integration theory. The approach chosen gives also a possibility to develop a large number of representation theorems in various contexts. The theory includes previous ones, like Radon measures in the sense of Choquet, contents on lattices of sets, Daniell and Bourbaki integration theories as well as Loomis' abstract Riemann integration. The presentation is clear and several results included in the book are published for the first time. Specialists and graduate students, in particular those oriented to analysis and probability, will find this book useful. (in)

(Editorial note - The following is an edited and slightly condensed version of an article by Professor Simis which has reached us through Professor Pierre Bérard.)

A UNIVERSAL AXIOM

A Simis

IMPA and Universidade de Bahia, former President, Sociedade Brasileira de Matemática

Scientific activities in Brazil have lately suffered serious deterioration, with grave consequences for the country as a whole. In particular, the hope that Brazil will become a member of the developed world, a favourite theme of the present government, is rapidly receding.

The situation is now so bad that government agencies responsible for financial support of basic science and high technology scarcely function.

No one can recall a time when the foundation on which science in Brazil is built has been so close to destruction.

The early development of science in Brazil was achieved by the efforts of isolated individuals, followed by the creation of Research Institutes and laboratories in the most highly developed parts of the country. A bold step forward was taken with the founding of the Conselho Nacional de Pesquisas (CNPq), a government based agency, with some resemblance to the US National Science Foundation (NSF) in its general scope and objectives.

The inception of CNPq coincided roughly with the consolidation of the Federal (State) Universities throughout the country. Brazil then developed rapidly in the various fields of science, and talented young people were encouraged to acquire specialised training abroad. Simultaneously, the Brazilian universities began to develop graduate schools of their own.

A little later the Financiadora de Estudos e Projetos (FINEP) was founded to complement the work of CNPq in the more applied areas of science.

The FINEP grew rapidly in importance for the scientific community, soon becoming a stronghold of pure science as well as applied, overlapping increasingly CNPq's support areas, with very healthy consequences for the development of Brazilian Science as a whole.

In retrospect, this was a golden period for science in this country, lasting about 15 years, but coming to an abrupt halt after 1990. The reasons for this are too complex to be analysed here, but the effects are clear.

The effective dismantling of both CNPq and FINEP is a nearly suicidal act that has already brought dramatic consequences to the various levels of research in this country, gravely affecting scientific output for decades to come.

For example part of the salary cost of an entire Center of Science and Technology was supported by FINEP money directly. This Center - located in the Pontifícia Universidade Católica (PUC, Rio de Janeiro) - is now deteriorating rapidly, many of its scientists leaving for other institutions inside or outside Brazil.

Another illuminating example is CNPq's Instituto de Matemática Pura e Aplicada - better known as IMPA - where salaries have sunk to the point where some are lower than many of the lowest wages in non-qualified public service. Other Institutes of CNPq are suffering likewise.

Our concern, however, is not with salary levels as such, but with the devastating effects of removing even minimal support for research. There is a self-contradictory government policy of giving wide publicity in support of high-tech imports while stopping the release of funds for importing research equipment.

Yet another instance has to do with CNPq grants, recently tailored to suit best researchers needs, very near to NSF grants format.

Although the approved grants have been announced since July 1991, to this moment not a single penny has yet been transferred to any grantee throughout the country!

To understand how grave the consequences are, it's enough to say that included in these grants is provision for bringing visiting scientists from abroad, in a period where scientific collaboration is increasingly essential.

Research in Brazil may be coming close to total collapse. We are speedily approaching level zero. Whether a true *coup de grace* can be avoided is something that may depend on an organized orchestration of our national scientific societies as well as scientific organizations and institutions abroad.

Brazil is not exceptional in that governmental failure to respond to the needs of basic science is a worldwide phenomenon. It is also clear that such incomprehension is more widespread in underdeveloped than in developing countries.

Our present administration is neither better nor worse than its predecessors. None has been or will ever be truly concerned with the delicate structure of stable research conditions.

It is, consequently, up to the scientific community itself to fight strongly against irresponsible and blind government policy.

All this undoubtedly sounds like an obvious proposition. However, it deserves repetition as if it were a new corollary. New generations of researchers discover it over and over again. The time has come to declare it a universal axiom.

COUNCIL DELEGATES

As reported in Newsletter 3, 12 nominations were received for the 12 positions of Council delegate representing individual members. We print here the names of these delegates, with a brief indication of their professional position and interests, and an 'election manifesto' in (almost) each case. Biographical details have been omitted for space reasons.

Thierry Aubin: Professor, Université de Pierre et Marie Curie (Paris VI).
Interests: Differential geometry, analysis on manifolds, differential equations.

Statement: The aim of the European Mathematical Society should be to develop and extend the fields of mathematical knowledge. At the present time, when a field of Mathematics is scarcely represented or does not exist at all in a country, it is only by individual initiatives that foreign mathematicians are encouraged to visit these countries to teach and promote research in the field. The E.M.S. should also organize meetings between mathematicians of various fields; each of these would give basic lectures of initiation into their fields and would talk about the best new results.

Pierre Bérard: Professor, Université de Grenoble (Institut Fourier). Interests:
The interplay between analysis and geometry.

Statement: I intend to work towards two goals:

1. promote doctoral studies at the European level (through "summer schools" or workshops); intertwining laboratories and exchange of students and post-doc);
2. promote collaboration with developing countries.

Bodil Branner: Professor, Technical University of Denmark. Interests:
Dynamical systems, in particular holomorphic dynamics.

Statement: Since 1986 I have been involved in forming a network for European Women in Mathematics. This has changed my perspective on the international mathematical community a bit. The dominating experience — going from one mathematical department to another — still the amazing homogeneity. But looking particularly at the number of women mathematicians it is amazing how much that differs throughout Europe. We don't know too much about why it is so. But I think we can learn a lot from each other by gaining an understanding of the influence of the different cultures, traditions and the different systems of education. An understanding which could benefit the entire mathematical community.

Jean-Marc Deshouillers: Professor, Université de Bordeaux 2. Interests: Analytic number theory (additive number theory, applications of modular forms), stochastic mathematics.

Statement: Chèr(e)s Collègues, I happened to be one of those who strongly advocated the creation of a European — the broadest geographical acceptance — mathematical body built with the aim of developing a community of European mathematicians. The role of individual members who are not compelled to represent national interests is thus crucial. I feel specially concerned by the east-west brain drain within the world and within Europe, the training of postgraduate students, and the link between those two points. I wish to contribute to the actions the EMS has already started in those directions.

Vive la Société Mathématique Européenne!

N. Desolneux-Moulis: Professor, Lyon. Interests: Hilbert and Banach manifolds, dynamical systems, principally Hamiltonian systems.

Statement: To contribute, as representative of individual members to the dynamism of the EMS. To act so that fruitful relationships be established with the former Eastern European countries by the development of a fellowship system, of congresses and Summer-Schools, these activities being not only for the profit of the well-known and prestigious centers. Support the initiatives of the "Women and Mathematics" Committee.

Sean Dineen: Professor, University College, Dublin. Interests: Infinite-dimensional complex analysis.

Roger Fenn: Senior Lecturer, University of Sussex. Interests: Low-dimensional topology.

Statement: With the opening up of the Eastern European Countries and the closer cooperation of the Western European Countries I believe that a great opportunity has been presented to the peoples of Europe to enrich their lives, in particular their intellectual and cultural lives. Therefore I am very enthusiastic about greater mathematical cooperation and the foundation of the European Mathematical Society.

The topic of language is a vexed one and its discussion has often generated more heat than light. It is, however, a fact of life that English is now the common language of all mathematicians rather as Latin was in the middle ages. I believe, however, that the publications of the European Mathematical Society should include articles in any of the major European languages, and that short

articles in a minority language, accompanied by an English translation, could be considered in appropriate cases. If elected as a delegate to the council I will do my best to promote mathematical cooperation for the whole of the European Community.

John Howie: Professor, University of St. Andrews. Interests: Algebraic theory of semigroups.

Statement: I believe that I can make a useful contribution to the work of the European Mathematical Society. My experience with the London Mathematical Society (a total of 9 years on the Council) has made me aware of the problems and challenges facing major mathematical societies. Also, my involvement with the Edinburgh Mathematical Society makes me familiar with the different problems for a small society. I represented the Edinburgh society at meetings of the European Mathematical Council in Warsaw, in Prague and in Oberwolfach, and so am aware of the discussions that led to the setting up of the EMS. My languages are English and French.

Max Karoubi: Professor, Université Paris VII. Interests: K-theory.

Statement: My suggestions for the future activities of the EMS:

- ◆ Establish a European diploma for the first years at the University. This diploma will enable students to study and travel freely from one country to another.
- ◆ Thanks to the newsletter, Society Members should be informed of all existing scientific programs of cooperation in Europe.
- ◆ Promote summer (and winter) schools in order to attract young European students to Mathematics and their applications.
- ◆ Promote the 1996 ECM. The first ECM, which I initiated, is just the starting point for a reflection on the role of Mathematics within our European culture.

Paul Malliavin: Professor, Université de Paris. Interests: Analysis.

Statement: The different cultural background of the European Nations is a magnificent treasure which has to be fully preserved, enforced, and developed by appropriate National Institutions.

- ◆ The European Mathematical Society has an opposite vocation: merge all european mathematicians without any other consideration than personal talent towards a united community working for scientific progress.
- ◆ Specific scientific activities of the Society have to be organized as soon as possible in sectors which are not presently properly covered by existing National Activities. One possibility is the organization of three weeks Summer Institutes on a specific branch of mathematics changing each year.
- ◆ A monthly information journal sent to all the members giving the full programme of meetings and visitors is urgently needed.

Henrik Martens: Professor, NAVF (Research professorship funded by the Norwegian Research Foundation). Interests: Closed Riemann surfaces.

Statement: Professor Martens has in addition to his profound contributions to the theory of Riemann surfaces, been an active spokesman for the importance, both for mathematics and industry, of the application of mathematics to industrial and technological problems. He was the key initiator of the successful program for Industrial Mathematics at the Norwegian Institute of Technology, Trondheim. Furthermore, he was one of the co-founders of ECMI, the European Consortium for Mathematics in Industry.

Mireille Martin-Deschamps: Professor, ENS, Paris. Interests: Algebraic geometry.

Statement: Les 4 ans passés au bureau de la SMF m'ont convaincue de la nécessité pour les mathématiciens d'agir ensemble au niveau national pour défendre et promouvoir leur discipline. Avec le développement de l'Europe, la disparition des barrières nationales et l'arrivée des pays de l'Europe de l'Est sur la scène européenne, il faut prolonger cette action au niveau européen, et la naissance de la SME ca dans ce sens. Responsable des relations internationales de mon département (ENS, Paris), je suis particulièrement concernée par ces problèmes.

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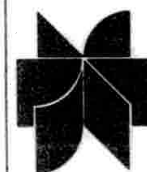
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