European Mathematical Society

NEWSLETTER No. 5

1st September 1992

CONTENTS

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Executive Committee and Council

The Council met over the weekend of 4-5th July and the Executive Committee on 7th July, in Paris. Among decisions taken at the former are those to admit the Israel Mathematical Union and the Societat Catalana de Mathemàtiques to corporate membership, and to hold the next European Mathematical Congress at Budapest in 1996.

Summaries of the main business transacted at both meetings will be printed in Newsletter 6, which will also contain an account of the Executive committee meeting planned to take place on 24-25th October, 1992 in Helsinki.

The need to devise more effective procedures for communication with Council delegates and with the membership at large will be high on that agenda.

Acting Secretary September 1992 - September 1993

The Executive Committee has confirmed the decision of Council to appoint D.A.R. Wallace (address etc. on page 2) as Acting Secretary of the Society for the above period, as temporary replacement for E.C. Lance, who is taking sabbatical leave.

HUMAN CAPITAL AND MOBILITY PROGRAM OF THE EUROPEAN COMMUNITY - 3

Euroconferences - Call for proposals

The E.M.S. is hoping to make maximal use of the possibility of financing large European conferences in the framework of the E.C. program "Human Capital and Mobility".

These could be either advanced meetings or Summer Schools intended to promote the development of young research workers. They should be large meetings and help promote contacts between mathematicians throughout Europe.

Therefore, the E.M.S. calls for proposals by groups of mathematicians interested in organising such meetings. These proposals should give a general idea of the subject, organisation, logistics and budget of the planned meeting.

Because the financial possibilities of the E.C. are bounded, the E.M.S. will ask a scientific committee to choose each year a limited number amongst those proposals, which will then be endorsed by the E.M.S.

This should greatly help the chance of the financial application produced to the E.C.

Proposals should be sent to: Professor F. Hirzebruch, President of the EMS
Max Planck Institut für Mathematik
Gottfried Claren Str 26, D-5300 Bonn 3, GERMANY

For the E.C. Liaison Committee

Luc Lemaire, C.P. 218, Campus Plaine, Universite Libre de Bruxelles,
Bd du Triomphe, 1050 Bruxelles - BELGIUM e-mail: ulbmath@ulb.ac.be

UNIVERSITY OF COPENHAGEN — Professorship in Mathematics

The Institute of the University of copenhagen expects to fill a full professorship in mathematics, with service starting on the 1st September 1993.

The formal employer is the Ministry of Education and its associated institutions.

The position is placed in wage bracket 37 and the salary is DKK 354.902,50 plus DKK 35.043,78 per annum.

The successful candidate will be expected to participate in the research as well as the administration and teaching undertaken by the Institute. This may include the teaching of mathematical economics students at the Business College of Copenhagen.

Please include in your application a description of current and planned research projects.

Also please include copies (3, if possible) of publications that you want to have included in the assessment.

The departmental standing committee on studies must make an assessment of the teaching qualifications of all applicants. Please include documentation to make this possible.

All applications will be assessed by an *ad hoc* committee whose final report will be made available to all applicants.

Additional information about the research activities of the Institute and the conditions of employment may be obtained from the chairman of the Institute, Universitetsparken 5, DK-2100 Copenhagen Ø, Tel: 35320726.

Your application should be submitted before the **16th November 1992,** and addressed to the Queen of Denmark and mailed to: The Faculty of Natural Sciences, Blegdamsvej 3, DK-2200 Copenhagen N.

Please send to the Faculty of Natural Science, Blegdamsvej 3, DK-2200 Copenhagen N.:
Original Application, List of Publications, Curriculum Vitae together with coauthor declaration.

To the Institute of Mathematics, Universitetsparken 5, DK-2200 Copenhagen N. you have to send in 3 copies:
Copy of above paper together with the work you want to have included in the assessment.

The following pages contain a selection of material relating to the ECM at Paris (July 1992) that may be of interest to EMS members. Many important items (for example the President's opening address) have been omitted for reasons of space. These will of course be printed in full in the Proceedings of the Congress.

ECM

MINISTERE
DE LA RECHERCHE
ET DE L'ESPACE

Le Congrés Européen de Mathématiques, un lieu de réflexion sur la place accordée aux Mathématiques

Le premier Congrès Européen de Mathématiques sera un lieu de réflexion privilégié de la Communauté des Mathématiciens sur leur Science, sur ses liens avec les autres Sciences et ses liens avec la société.

C'est pourquoi, à côté d'exposés de type classique, qui devront synthétiser les connaissances dans les principales branches de la discipline, l'effort essentiel a été porté sur seize "Tables Rondes", point d'aboutissement et de départ d'une réflexion en profondeur sur la place des Mathématiques dans notre société

L'ensemble de ces Tables Rondes constitue l'un des **Grands Colloques de Prospective** que le **Ministère de la Recherche et de l'Espace** français tient afin de dégager l'évolution des différents domaines scientifiques et secteurs technologiques, et de prévoir la progression des besoins que ceux-ci doivent satisfaire.

Les Mathématiques occupent dans la Science une place exceptionnelle. En effet, alors qu'elles pourraient apparaître comme une discipline abstraite et détachée du monde réel, il n'est pas de Science, aussi appliquée soit-elle, qui ne les utilise quotidiennement. Et ce phénomène ne saurait que croître à mesure que la Mathématique appréhende des champs de plus en plus complexes et se voit ainsi de plus en plus apte à modéliser des phénomènes sociaux ou biologiques.

Dans ce contexte des Grands Colloques de Prospective, les participants au Congrès Européen sont appelés à s'intéresser aux questions : quels sont les domaines sur lesquels un pari doit être fait aujourd'hui ? comment gérer le lien complexe entre les Mathématiques et les autres Sciences ? à l'heure où l'opposition Mathématiques Pures-Mathématiques Appliquées a laissé la place au renforcement mutuel du Noyau et des Interactions des Mathématiques, quel rôle les Mathématiques jouent-elles dans notre société et notre économie ?

Certaines de ces Tables Rondes ont demandé un travail important de recueil de données, souvent sur toute l'Europe. Elles produiront des rapports, qui seront publiés dans les Actes du Congrès, et parfois des documents beaucoup plus amples, fournissant la substance de livres : toute une série de suggestions, voire de recommandations, portant sur l'orientation de la recherche en Mathématiques ainsi que sur l'enseignement de cette discipline, que ce soit l'enseignement adressé à de futurs mathématiciens, ou celui adressé aux autres scientifiques ou aux ingénieurs.

Les sujets abordés peuvent être - de façon un peu arbitraire - classés en trois thèmes :

• <u>Mathématiques et société</u>.

- **"Mathématiques et grand public"** se propose d'intéresser les mathématiciens aux problèmes posés par les contacts avec le grand public et le public par la problématique de notre discipline, et de se demander, entre autres : "Y-a-t-il une image des mathématiques et des mathématiciens à rectifier ?"

- **"Pays en voie de développement"** cherchera à élaborer des propositions concrètes d'aide après avoir fait un inventaire de ce qui existe et une évaluation des besoins dans les pays du tiers-monde, tant au niveau de la recherche en Mathématiques, que de l'enseignement supérieur, ou des besoins d'équipement (bibliothèques, informatique, ...).

- **"Femmes et Mathématiques"** fera des propositions concrètes relatives à la situation des femmes mathématiciennes.

- **"Réalité historique"** se posera la question : est-il légitime de parler de mathématiques européennes ?

• <u>Mathématiques et Europe</u>.

Ces Tables Rondes se pencheront sur les questions d'organisation de la recherche et de l'enseignement, en particulier vues sous l'angle de l'ouverture européenne :

- **"Politique éducative"** présentera la situation dans les pays européens en matière d'enseignement des Mathématiques, de recrutement, de formation des enseignants, de disciplines de service, de formation des ingénieurs et de recherche sur l'enseignement des Mathématiques.

- **"Harmonisation des diplômes et échanges d'étudiants"** et **"Politique Mathématique européenne"** partiront d'une comparaison des cursus dans les différents pays et d'une description des programmes d'échange existants pour s'interroger sur les voies facilitant la mobilité européenne des étudiants et discuter de l'opportunité de diplômes délivrés au niveau européen.

- **"Cultivons les Mathématiques au Lycée"** s'intéressera aux expériences de renouvellement des modes d'enseignement des mathématiques au lycée et s'interrogera sur la possibilité de réconcilier culture et mathématiques.

- **"Bibliothèques"** traitera de l'outil fondamental du Mathématicien (problèmes liés à l'informatisation, nouvelles techniques de diffusion).

• <u>Mathématiques et autres sciences</u>.

Enfin, plusieurs Tables Rondes examineront les liens complexes entre notre discipline et les sciences voisines (mathématiques de service ou moteur du développement ?, application des Mathématiques ou sources de nouvelles recherches en Mathématiques ?). Pour certaines disciplines, les liens sont faciles à concevoir, mais délicats à préciser : "Mathé- →

Le Congrés Européen de Mathématiques, un lieu de réflexion sur la place accordée aux Mathématiques

continued.....

→ matiques et Industrie", "Mathématiques et informatique", "Mathématiques et économie", "Mathématiques et biologie-médecine", "Mathématiques et chimie". Les retombées pour la production industrielle d'une analyse mathématique sophistiquée sont, par exemple, loin d'être claires aux yeux de la plupart des décideurs, comme le sont les possibilités d'employer avec pertinence une modélisation mathématique fine dans des domaines tels que l'économie, ou les sciences du vivant. Pour d'autres disciplines le lien, encore moins évident, sera cerné dans les Tables Rondes **"Philosophie des Mathématiques", "Mathématisation des Sciences Humaines".**

Il est fondamental qu'une Communauté s'interroge périodiquement sur son rôle. Cette démarche relève de l'interrogation scientifique, mais, dans la mesure où c'est la société qui entretient le Mathématicien et en attend en retour un bénéfice - bénéfice purement cognitif, soutien aux autres sciences, ou bénéfice plus matériel - c'est aussi une interrogation sociale.

La réunion à Paris du Premier Congrès Européen de Mathématiques symbolise une double constatation : les Mathématiques représentent historiquement un point fort de la Science française ; il importe qu'à l'échelle de l'Europe en création les Mathématiques puissent jouer le rôle essentiel qui est le leur.

Happy birthday Monsieur Cartan!

Henri Cartan was born on July 8, 1904. His 88th birthday falls in the middle of the first European Congress of Mathematics. Amazing coincidence for a man who dedicated his life to mathematics, to Europe, and to human rights.

The mathematical influence of Henri Cartan is well known: his participation in Bourbaki, his seminar (le "séminaire Cartan"), his role as a professor at École Normale Supérieure in the fifties and the sixties, where he trained so many mathematicians, and as a member of the French Académie des Sciences.

But Henri Cartan was also a European militant of the first hour. A few aspects of his action are well known: In 1946, he was one of the first to resume mathematical contacts between French and German mathematicians. He became a member of the European Federalist Movement in 1952. In 1962, he participated in the elaboration of the European studies passport.

More recently, he became very involved in the Comité des Mathématiciens, which fought for human rights.

Could there have been another choice for the President of the Haut Comité du Congrés Européen and could there have been a better birthday present than this European Congress of Mathematicians, with a massive participation of our colleagues from Eastern Europe?

(Extract from ECM news July 8th 1992)

The following is the text of a Press Release issued from the office of

Dr. Manfred Vohrer, Member of the European Parliament

First European Congress of Mathematics
Sorbonne, Paris, 06 - 10 July 1992

In September 1989 I was informed by Rudolf Rentschler, a good friend of mine, of the project of the First European congress of Mathematics to be held 1992 at the Sorbonne in Paris. Spontaneously I gave my support to this excellent idea.

In 1990 I supported, as a member of the European Parliament, the efforts of Eva Bayer, Alain Connes, Jacques Dixmier, Rudolf Rentschler and of the founder of the congress, Max Karoubi, to get financial support from the European Commission. There was some success; nevertheless I regret that they got only 15-20% of their needs.

Today I am very happy about the wonderful success of this First European Congress of Mathematics that started on Monday, July 6th, in the Sorbonne with a prestigious opening session and especially with a remarkable speech of the French Minister of Research, Hubert Curien. The presence of more than 1300 mathematicians from France, Germany, Italy, Spain, the United Kingdom but also from the Czech and Slovak Federal Republic, from Hungary, Latvia, Poland, Russia and the Ukraine shows the real European dimension.

The excellent scientific program combined with 15 Round Tables on "Mathematics and Society" and the delivery of 10 prizes by a former French Prime Minister to young women and men who are brilliant researchers in mathematics, and all this in the framework of Europe as a whole, makes this congress an outstanding event, as well on the scientific as on the political level. Mathematicians in Western Europe have a long tradition of close contact with their outstanding Russian colleagues. These relations have been stronger than the Iron Curtain and they have been of an inestimable value.

I see with admiration that mathematicians have been able within a very short time to achieve in their domain the United Europe as a whole. The politicians should now follow rapidly, first in the scientific and cultural sector, and then in a further step on the economic sector.

Therefore I consider that all scientific programs of the EC should be extended to Europe as a whole, especially the program on "Human Capital and Mobility". I am intending to inform the European Parliament of the outstanding event of this First European Congress of Mathematics now being held in Paris, and I shall ask them to give appropriate help for further developments of the Second European Congress of Mathematics to be held in 1996 in Budapest.

We have done everything possible to further this congress on the European level. We hope that the results will bear fruit within the context of European Integration.

July 10, 1992

PRIZES AWARDED BY THE CITY OF PARIS

ON OCCASION OF THE FIRST EUROPEAN CONGRESS OF MATHEMATICS

(The following text was issued to participants at the Congress)

On occasion of the first European Congress of Mathematics, the City of Paris awards ten prizes to young mathematicians in order to recognize their exceptional talents and to encourage them in their research. The number of countries they are coming from, and the various areas of mathematics to which they have devoted themselves, emphasize the great diversity which is the asset and the richness of the new Europe on the eve of the third millenary.

These scientists have been selected by an international Prize Committee chaired by Max Karoubi, Professor at the University of Paris 7.

The City of Paris would like to congratulate again the young prize winners and to extend its best wishes of success to the Congress which appears as the illustration of an examplary European cooperation.

Richard Borcherds (United Kingdom). Richard Borcherds was born in 1959 in South Africa, but moved to England in 1960, and was educated there. He studied at Trinity College Cambridge, and wrote his Ph.D thesis in 1985 under J.H. Conway. In it he classified 25 dimensional unimodular lattices, and proved a conjecture of Conway and Sloane about the automorphism groups of Lorentzian lattices.

His next work was to develop the theory of vertex algebras, which is a mathematical formalization of a part of conformal quantum field theory. That led him to discover a new class of infinite dimensional Lie algebras which have a character theory generalizing that for Kac-Moody algebras. The formula provides a large supply of unexpected algebraic identities, one of which is a remarkable factorization of the classical modular function as an infinite product. From this, he derived a proof of the "moonshine" conjectures of Conway and Norton relating the modular function to the representations of the monster simple group.

Most recently, he has found a new family of identities involving Siegel modular forms.

Jens Franke (Germany). Jens Franke was born in 1964 in Gera, former East Germany. From 1983 to 1985 he studied mathematics at the Friedrich-Schiller-Universität in Jena. He wrote his thesis in analysis under Tribel. Then, he visited Moscow from 1986 to 1988, where he studied number theory and algebraic geometry. From 1988 to 1989, he held a position at the Karl-Weierstraß-Institute in Berlin. Later, he attended Princeton Institute, the MPI in Bonn, the Universities of Bielefeld and Eichstätt. He recently accepted a position as Professor at the University of Bonn.

His mathematical interests cover a wide range of areas : algebraic geometry, number theory, automorphic forms, K-theory and homotopy theory. One of his greatest achievements is the proof of A. Borel's conjecture about the cohomology of arithmetic groups. He combines there deep analytical tools with sophisticated methods from homological algebra.

Alexander Goncharov (Russia). Alexander Goncharov was born in Nocopol, Ukraine. He attended I.M. Gelfand's seminar in Moscow, then Yu I. Manin's seminar. He started his research by introducing the notion of self-dual quaternionic manifold and worked until 1988 on integral geometry.

Since 1988, A. Goncharov has essentially worked on algebraic K-theory, polylogarithms and regulators. With Beilinson, Schechtman and Varchenko, he studied a presentation of algebraic K-theory groups in terms of generators and relations and has done research on a "motivic" cohomology. In 1989, A. Goncharov discovered the functional equation of the trilogarithm, in relation with the configuration of 6 points in the projective plane. This enabled him to compute explicitly A. Borel's regulator and to prove D. Zagier's conjecture on $\zeta(3)$. Later, he discovered motivic versions of Chern's first classes.

Finally, A. Goncharov has also studied the mathematical aspects of tomography and of the electronic microscopy of biomolecules.

Maxim Kontsevich (Russia). Maxim Kontsevich was born in 1964, near Moscow. He studied mathematics at Moscow University from 1980 to 1985 and attended more especially I.M. Gelfand's, Yu I. Manin's and V.I. Arnold's seminars. In 1989, he simultaneously found out a "uniformization" of the moduli of algebraic curves by Virasoro's algebra (question raised by Yu I. Manin), the axioms for a conformal quantum field theory and a way of defining invariants for 3 dimensional manifolds (thanks to rational correlation functions).

M. Kontsevich's most spectacular work was the solution of Witten's conjecture in 1990 : the intersection of divisors on the moduli space of algebraic curves can be computed by means of a solution to a non-linear Korteweg-de-Vries equation. In this method, he uses Feynman's diagrams and matrix integrals that are new in physics.

More recently, M. Kontsevich has discovered unthought-of relations between strings' theory and Chern-Simon's theory thanks to explicit integral representations for invariants of knots recently introduced by V. Vassiliev.

François Labourie (France). François Labourie was born in 1960. He studied at the Ecole Normale Supérieure in Paris and works now at the "Centre National de la Recherche Scientifique" and at the Ecole Polytechnique. F. Labourie has investigated various important fields of geometry (convex hypersurfaces, pseudo-holomorphic curves, Anosov's flows, etc.). Using methods based on differential geometry, he made in-depth contributions about the complex projective structures on surfaces and on their relation with 3 dimensional hyperbolic geometry, a classical field of research dating back to Schwarz, Klein and Poincaré, which has been reactivated by Thurston's work. In a series of papers in collaboration with Y. Benoist and P. Foulon, he solved a famous conjecture on Anosov's flows in compact contact manifolds, proving that the regularity of stable and unstable foliations implies that, after reparametrization, the model is the geodesic flow of a locally symmetric space. His work, influenced at the beginning by M. Gromov's ideas, shows an outstanding association of technical virtuosity and of geometrical ideas.

Tomasz Luczak (Poland). Tomasz Luczak was born in 1963 in Poznan. He studied at Adam Mickiewicz University where he now holds a position as Professor.

In 1991, he obtained the Kuratowski Prize, awarded by the Poland Society of Mathematics.

Most of his research is linked to the theory of random discrete structures. He particularly studied chromatic numbers in random graphs, the phase transformation phenomena of random discrete structures and the 0-1 laws of these structures.

Stefan Müller (Germany). Stefan Müller was born in 1962 in Wuppertal. He obtained his doctorate from Heriot-Watt University, Edinburgh. He currently holds a postdoctoral position at the University of Bonn. He was awarded the prize in recognition of a number of highly original and powerful contributions to applied analysis and solid mechanics. His work in solid mechanics has covered many aspects of the subject, including the existence of solutions in nonlinear elasticity, composite materials, cavitation, and the discovery of striking effects on crystal microstructure induced by the competition between bulk and interfacial energy.

His research in elasticity theory has revealed important properties of the Jacobians of mappings. For example, he proved the very surprising theorem that if $\Omega \subset \mathbf{R}^n$ is open, $y : \Omega \longrightarrow R^n$, $\int_K |Dy|^n \, dx < \infty$, and $\det Dy \geq 0$, then for any compact subset K of Ω, we have $\int_K \det Dy \log(1 + \det Dy) \, dx < \infty$, a result which has led to a number of important advances in partial differential equations and harmonic analysis. He also showed that a natural definition of det Dy as a distribution is equivalent to the usual pointwise definition provided the distribution defines a function in $L^1(\Omega)$.

Vladimir Sverak (Czechoslovakia). Vladimir Sverak was born in 1959. He obtained his first degree and doctorate from Charles University in Prague, where he holds the position of Associate Professor. He is currently a Research Associate Professor at Heriot-Watt University, Edinburgh. He was awarded the prize in recognition of his outstanding work in the calculus of variations, and in particular for his recent discovery of a counterexample to the long-standing open question of whether *rank-one convexity* implies *quasiconvexity*, first posed by C.B. Morrey in 1950. Morrey's quasiconvexity condition on the integrand f of a variational integral

$$I(u) = \int_{\Omega} f(x, u, Du)\, dx \ ,$$

where $u : \Omega \longrightarrow R^n$, and $\Omega \subset R^n$ is bounded and open, plays a central role in the theory of the existence and regularity of minimizers, while rank-one convexity of f is equivalent to the well-known *Legendre-Hadamard* (or *strong ellipticity*) condition. Sverak's counterexample in the case n = 2, m = 3 consists of a subtly chosen quartic polynomial. Sverak is also well known for several other key results illuminating the meaning of quasiconvexity and characterized by penetrating and elegant proofs, as well as for a definitive analysis of invertibility of mappings $u \in W^{1,n}(\Omega; \mathbf{R}^n)$. These results have important applications to elasticity theory and other fields in which systems of nonlinear partial differential equations arise.

Gabor Tardos (Hungary). Gabor Tardos was born in 1964. He studied and obtained his Phd at the Eötvös University. He now holds a position as research scientist at the Mathematical Institute of the Hungarian Academy of Sciences. He held visiting positions in the American Universities, in Chicago and Rutgers. His exceptional talents in mathematics were recognized very early and he won numerous contests in Hungary and abroad, like the Schweizer contest of the Bolyai Society that he won four times, an achievement only equalled by I. Csiszar, L. Lovasz and I.Z. Ruzsa.

Gabor Tardos has a broad scope of mathematical interests. His main research areas are focused on computing, combinatorics and universal algebra. In his papers, he deals with a wide range of problems, from algorithms to universal algebra, from sequences to free groups. He has introduced important new notions and has solved problems under study for a long time.

Claire Voisin (France). Claire Voisin was born in 1962 at Saint Leu la forêt. She studied at the Ecole Normale supérieure in Paris and is now working at the "Centre National de la Recherche Scientifique", in the team of algebraic geometry, at Orsay.

Her thesis, which she defended in 1986, was directed by A. Beauville. She proved Torelli's theorem for cubic hypersurfaces of dimension 4. An important part of her later work was inspired by P. Griffith's ideas on variations of Hodge structures. The leading principle is based on the use of algebraic information contained in the infinitesimal variation like period maps, Abel-Jacobi maps and Hodge's classes. For instance, she has obtained important informations on Picard's group of surfaces in the complex projective space of dimension 3 by giving precise estimates on the codimension of moduli of surfaces that have a non-generic Picard group.

In the same spirit, she brought an independant and considerably simplified proof to H. Clemens' theorem, according to which the group of cycles homologically equivalent to 0, mod. algebraic equivalences, is of infinite rank for quintic hypersurfaces of dimension 3. This method enabled her to extend partly this result to all sufficiently general Calabi-Yau manifolds of dimension 3. For all these problems, she went straight to the point and gave final answers.

The prize Committee wished to pay a particular tribute to ***Andreas Floer****, born in Duisburg in 1956 and who died in 1991 under tragic circumstances. He studied at Bochum University, where he held a position as Professor of analysis and geometry at the moment of his death.*

Andreas Floer was an extremely brilliant mathematician who worked in several areas : dynamical systems, symplectic geometry, Yang-Mills theory, manifolds of low dimension. On the basis of ideas of Conley, Gromov and Witten, he defined a new homological theory, now termed "Floer's homology". It is based on the combinatorial study of solutions of certain partial differential equations in manifolds. The most well-known example is Floer's homology of 3-spheres, which is a refinement of Casson's invariant. The simultaneous use of Floer's homology and of "Ekeland-Hofer's capacity" led to new invariants for symplectic manifolds. Andreas Floer's point of view in the field of variational theory and symplectic geometry will certainly deeply influence further developments in these areas. In his most recent research, he applied himself to defining Yang-Mills invariants of knots and manifolds of dimension 3.

As a conclusion, all these works and methods had a deep impact on the development of mathematics and permitted to solve problems regarded, thus far, as inaccessible.

EUROPEAN NEWS: Country by Country

SWITZERLAND

Preliminary Announcement

The International Congress of Mathematicians 1994

The next International Congress of Mathematicians will be held in Zurich, Switzerland, from August 3 to August 11, 1994, under the auspices of the International Mathematical Union. The lectures will be held at the Kongresshaus of the city of Zurich and in lecture theatres at the Federal Institute of Technology (ETHZ) and at the University of Zurich.

The Swiss Mathematical Society has entrusted a committee with the organization of the congress. The president of this committee is Henri Carnal, and the secretary is Christian Blatter. The administration of the participants (hotel reservations etc.) has been delegated to a professional congress organizer.

The first announcement containing further details and an application form will be distributed in July 1993.

Please write to the following address for further information:

ICM 94, International Congress of Mathematicians
ETH Zentrum, CH-8092 Zurich, SWITZERLAND

LITHUANIA

Conference: **Sixth International Vilnius Conference on Probability Theory and Mathematical Statistics**

June 28 - July 3, 1993

Location: Vilnius

Organizers: Institute of Mathematics and Informatics of the Lithuanian Academy of Sciences
Vilnius University
Lithuanian Mathematical Society
2734 Vilnius, LITHUANIA

GERMANY

Sonstige GAMM-Veranstaltungen

Seminar: **GAMM-Seminar on Multigrid Methods**

September 21 - 25, 1992

Location: Gosen near Berlin

Chair: S. Hengst (Berlin), P. Knabner (Berlin), U. Langer (Chemnitz)

Information: Dr. Sabine Hengst, IAAS, Hausvogteiplatz 5-7,
D-O-1086 Berlin, GERMANY

Tel: + 030 20377 560
Fax: + 030 2004975

Continued.....

Sonstige GAMM-Veranstaltungen

Symposium: **International Symposium on Operator Equations and Numerical Analysis**

September 28 - October 2, 1992
Location: Gosen near Berlin
Co-sponsored: by GAMM
Organizing Committee: S. Prößdorf (Berlin), B. Silbermann (Chemnitz)
Conference Manager: Mrs. M. Teuchert

Topics: Approximation methods for integral and pseudodifferential equations - Numerical analysis for boundary integral equations on non-smooth surfaces - Banach algebra techniques in operator theory. Applications of integral and pseudodifferential equations.

Information:
Professor Dr. S. Prößdorf/Mrs. M. Tuechert,
Institute for Applie l Analysis and Stochastics (IAAS),
Hausvogteiplatz 5-7, d-O-1086 Berlin, GERMANY.
Tel: + 030 20377 555/+ 030 20377 594
Fax: + 030 2004975

Workshop **GAMM/IFIP-Workshop on Stochastic Optimization: Numerical Methods and Technical Applications**

June, 1993
Location: Neubiberg/München, Germany
Program Committee: H.A. Eschenauer (Siegen), P. Kall (Zürich), K. Marti (Neubiberg), F. Pfeiffer (München), G.I. Schuëller (Innsbruck)

Information:
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Universität der Bundeswehr München
Werner-Heisenberg-Weg 39
D-8014 Neubiberg/München, GERMANY
Tel: (089) 6004 2541/2109
Fax: (089) 6004 3560

Symposium: **MTNS 93, International Symposium on the Mathematical Theory of Networks and Systems**

August 2 - 6, 1993
Location: Regensburg, Germany
Co-sponsored: by GAMM
Chair: U. Helmke (Regensburg), R. Mennicken (Regensburg)

Topics: Systems Theory: Modelling, Realization and System Identification; Control of Linear and Nonlinear Systems; Circuit Theory; Mathematics for Control, System and Circuit Theory; Specific Applications.

Information:
Professor R. Mennicken
NWF I - Mathematik
University of Regensburg
Universitätsstr. 31
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Tel: (0941) 943 2992
Fax: (0941) 943 2305
Email: mennicken@vaxl.rz.uni-regensburg.dbp.de

Continued.....

Sonstige GAMM-Veranstaltungen

Conference: **First European Nonlinear Oscillations Conference**

August 16 - 20, 1993

Location: Hamburg, Germany

Auspices: European Mechanics Council

Information:
Professor Dr.-Ing. E. Kreuzer
Arbeitsbereich Meerestechnik II
Technische Universität Hamburg-Harburg
Eißendorfer Str. 42
D-2100 Hamburg 90, GERMANY
Tel: (040) 7718 3120
Fax: (040) 7718 2684

Symposium: **IMACS Symposium on Mathematical Modelling**

February 2 - 4, 1994

Location: Vienna, Austria

Co-sponsored: by GAMM

Information:
Professor Dr. I. Troch
Institut für Analysis
Technische Mathematik und Versichrungsmathematik
TU Wien, Wiedner Hauptstr. 8 - 10
A-1040 Wien, AUSTRIA
Tel: 0222/588 01

GAMM-Jahrestagung 1993 in Dresden

Die wissenschaftlich Jahrestagung 1993 der GAMM findet in der Woche nach Ostern

vom 12. bis 16. April 1993.

an der Technischen Universität Dresden statt.

Anreisetag: **12 April 1993**

Information:
Professor Dr. M. Ludwig
Abteilung Mathematik
Technische Universität Dresden
Mommsenstraße 13, DEUTSHLAND

Die Einladungen werden voraussichtlich Anfang Oktober 1992 versandt.

International Conference co-sponsored by GAMM in CHINA

Conference: **The Second International Conference on Fluid Mechanics (ICFM - II)**

July 7 - 10, 1993

Location: Beijing, China

Topics: Flow Instability and Turbulence, Aerodynamics and Gas Dynamics, Geophysical and Astrophysical Fluid Mechanics, Hydrodynamics, Plasma Dynamics and Magneto-Hydrodynamics, Biofluid Mechanics, Physico-Chemical Fluid Dynamics, Non-Newtonian Fluid and Multiphase Flows, Industrial and Environmental Fluid Mechanics, Others.

Information:
Professor Zhang Zhaoshun
Department of Engineering Mechanics
Tsinghua University
100084, Beijing, CHINA

UNITED KINGDOM

WARWICK SYMPOSIUM 1992-3

The topic is Analytic and Geometric aspects of Hyperbolic Geometry and the organisers are David Epstein and Caroline Series. The main activity will be from April - July 1993 but there will be seminars etc. throughout the year.

Special events

Instructional conference on Teichmüller theory. September 13-19, 1992.

Workshop: April 15 - 22, 1993

Durham conference: July 4 - 10, 1993

Contact: Elaine Shiels, Business Manager
Mathematics Research Centre
Warwick University, Coventry CV4 7AL, UK
Email es@maths.warwick.ac.uk

The Research Centre has a small grant from the London Mathematical Society to assist with expenses for British Mathematicians attending mathematical activities at Warwick.

WORKSHOP ON GEOMETRIC AND CONBINATORIAL METHODS IN GROUP THEORY

Date: March 9 - April 8 1993

Location: **EDINBURGH** (at the ICMS)

Contact: A. Duncan, N.D. Gilbert, J. Howie
Department of Mathematics, Heriot-Watt University
EDINBURGH EH14 4AS, Scotland
Email groups93@cara.ma.hw.ac.uk

THE INSTITUTE OF MATHEMATICS AND ITS APPLICATIONS

Conferences and Symposia to be held in 1992 and 1993

1992 FOURTH IMA CONFERENCE ON STABLY STRATIFIED FLOWS - FLOW AND DISPERSION OVER TOPOGRAPHY
21 - 23 September — University of Surrey

TUTORIAL - EMERGING TECHNIQUES IN SIGNAL PROCESSING
14 December — University of Warwick

THIRD IMA CONFERENCE ON SIGNAL PROCESSING
15 -17 December — University of Warwick

1993 MULTISCALE STOCHASTIC PROCESSES ANALYSED USING MULTIFRACTALS AND WAVELETS
29 - 31 March — Cambridge

MODELLING OF FOOD SAFETY
14 - 16 April — Belfast

CONFERENCES WHICH THE IMA ARE CO-SPONSORING

1992 RADAR 92
12 - 13 October — Brighton Conference Centre

1993 THIRD INTERNATIONAL CONFERENCE ON ARTIFICIAL NEURAL NETWORKS
25 - 27 May — Brighton

Information: Miss Pamela Irving, Institute of Mathematics and its Applications
16 Nelson Street, Southend-on-Sea, Essex SS1 1EF
Tel: 0702 354020 Fax: 0702 35411

Willi Dörfler, Klagenfurt

From the Committee for Mathematics Education:

Complementing the announcement in the preceding issue of this Newsletter I am glad to let our readers know that the colleagues listed below have agreed to join CME and to support its work. Any note, article or information can be sent to all committee members. There will be still another member from France who has not yet been determined and will be announced in the next issue.

Claudi Alsina
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Tel: 34-4-4016367
FAX: 34-3-3343783
e-mail: ealsina@ebrupc51

Werner Blum
Gesamthochschule Kassel
Fb 17 - Mathematik
Heinrich-Plett-Straße 40
D - 3500 Kassel
Tel: 0561-804/4623
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Lucia Grugnetti
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Tibor Nemetz
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Some editorial remarks! In this issue you find reports on ongoing teaching projects for students in their first year of mathematics where the computer is extensively used as a tool and a medium for learning. I should like to encourage colleagues carrying out similar projects and with related experiences to communicate them here in the Newsletter. The changes to mathematics (and maths education) already brought about and those still to come by the use of computers surely deserve the interest not only of the research mathematician but equally of the university or college professor. Our goal should be co collect more systematic and soundly based experience and empirical data about the influences of computer use on the learning of mathematics at the university level. I look forward to your contribution!

Computers: Change in the Teaching and Learning of Calculus

Edith Schneider

During recent years computers have more and more become part of the teaching equipment of universities and have opened up numerous varieties of utilization. Related to this new equipment the problem of adequate and effective application of computers in the classroom arises. For an adequate and effective application of computers in the field of calculus it is not sufficient to regard computers merely as mathematical instruments or tools, but it is necessary to regard them in a didactical sense, as an additional teaching and learning medium. Both the teaching and learning of calculus can be significantly changed through the utilization of computers. This was the topic of a research project at the Department of Mathematics, University of Klagenfurt.

Since the beginning of the academic year 1990/91 computers have been used intensively at our department in undergraduate courses. The application of computers in the calculus classroom focuses on questions relating to the organization of courses and exams, the use of computers as "teaching assistants", and above all on questions concerning the influence of computer utilization In the development of mathematical concepts, the changes in the students' traditional approaches to fundamental mathematical concepts and the extent to which certain aspects of mathematical concepts will be intensified and others weakened.

The problem of the development in the student's mathematical concepts has been the concern of an analysis of topics and of software which has resulted in an annotated collection of exercises. These exercises have been tested in undergraduate courses throughout the academic year and the experiences made in these tests formed a basis for a further development of the exercises. It is important that the central point of interest in these exercises was not the operational procedure involved but rather the mathematical concept in itself. The students were introduced to a number of different approaches to fundamental mathematical concepts in order to get support in their attempt of developing an adequate understanding of these concepts. One of the most important factors in this experiment was the role of visualization. An exercise from the field of analysis could, for example, focus on the problem of interaction between term and graph of a function. The main attention in this problem is the direct interrelation between these two forms of representation. In other words, the students should become aware of the strong interaction between the shape of the graph and the structure of the term, so that starting from the term, they could be able to make a sketch of the graph or respectively transfer changes of parameters to the shape of the graph. Empirical experiments about the previous mathematical knowledge students of mathematics and informatics have shown that this aspect of the concept of functions either poses difficult problems to the students or does not enter their awareness at all. Computers can take on a decisive role in the realization of such conceptual aspects. An illustration of the interrelations between term and graph can directly be observed on the screen, and due to the computer's ability of quickly constructing new graphs the experiment can be carried out without major effort and much time. Thus, the students have the opportunity to gain knowledge of this matter through autonomous and independent explorative work, and they can easily expose and correct former misconceptions.

The research method employed for the evaluation of the construction process of mathematical concepts is empirical in that it is based on data of clinical interviews and questionnaires. The project has now run for 2 years (September 1990 - July 1992) and its results will be presented in a comprehensive report. Despite some obstacles and problems one can say that the response to the changed learning context was very positive and successful on part of the students. For more information please write to:

Institut für Mathematik, Universität Klagenfurt, Universitätsstraße 65, A-9020 Klagenfurt.
Tel: 0463 2700-425 Fax: 0463 2700 427

Experiences with a computer-assisted graduate course on Optimization for students of chemistry

Dietmar Dorninger
TU Wien, Institut für Algebra und Diskrete, Mathematik, Wiedner Hauptstraße 8-10, 1040 WIEN

The course was scheduled for one semester with two hours for lectures and one hour for exercises per week. The course was attended by about 20 students of chemistry who had already completed a two semester undergraduate course on mathematics and had some knowledge in BASIC. The lectures took place in a lecture room which was equipped with a PC and a data projector to show the contents of the monitor on a big screen. For the exercises every student could use a computer of his own (which was linked to a server). Program-packages for linear and non-linear optimization (one- and multidimensional, restricted and non-restricted) as well as for dynamic programming were available; the source code of all programs was in BASIC.

The course started with a survey on the most important optimization techniques in chemistry. With this survey the following pattern was used : First, a concrete problem of chemistry was formulated, then the mathematical model was established; next the class of problems to which the problem under consideration belonged was given attention and finally the concrete problem formulated at the beginning was solved by means of a computer program. At this stage the computer-program was treated as a "black box". In the course of the following chapter, which was devoted to linear programming, parts of the "black box" were turned into a "white box": the SIMPLEX-algorithm was discussed in detail from the mathematical foundations up to the BASIC source-code. - A similar procedure was chosen for the last but one and last chapter dealing with dynamic programming and optimization problems arising with simulating chemical plants, respectively.

With non-linear optimization, the chapter following the one about linear optimization, it was different: Here the emphasis was on the various mathematical techniques and on explanations how and in which parts of the computer-programs the discussed techniques were used. E.g., it was made clear, what a Fibonacci-search meant and how gradient-methods worked; but the source-code wasn't looked upon.

In class, about 50% of the whole time was devoted to the use,

contents and application of computer programs in connection with the concrete problems, mathematical methods and algorithms that were discussed. Written notes were distributed, so that the students could concentrate on what they were shown on the screen. During the exercise course the students had to work out problems similar to the ones they were taught in the lectures. Of course, there were tutors around to help them. Besides the exercises, the students were offered supplementary time in the computer-room for practicing by themselves. This facility was used extensively by some students, who were very familiar with the use of computers. On the other hand, there were students who badly needed help even with the handling of a computer, an inconsistency, which turned out to be the greatest problem of the course. No problem meant that the students had to watch a screen during the lectures in the class room and didn't have computers of their own.

Another difficulty arose with the task of modelling a chemical problem in such a way that it can be treated by means of the very computer-programs that are available. However, no effort was made in teaching to write routines to modify or link the programs used in the course or to write a completly new program (though some students would have been interested).

A well known argument against the use of computers in mathematic-lectures is that in devoting so much time to the computer there is little time left over for doing mathematics properly. No such problem arose, because, apart from the SIMPLEX-algorithm, there were not presented any proofs, so that there was enough time for precisely formulating and classifying mathematical problems and studying methods and algorithms. It turned out that the students had to be even more careful with the mathematics when they implemented a problem on the computer, and there were also new interesting mathematical questions that came up with the implementation. That some of the questions could be answered immediately by trial and error was one of the advantages of using a computer.

Taking it all around the computer-assisted course was well accepted and showed some interesting new aspects of teaching mathematics. Though it needs a lot of time for the instructor to prepare such a course, it is surely worth while to take the time.

MATHEMATICS FOR BUSINESS ADMINISTRATION STUDENTS

A Business and Computer Oriented Approach

G. Ossimitz, Universität Klagenfurt, Austria

I. What kind of mathematics do business students need?

Mathematics courses for business administration students are usually a mixture of elements from calculus and linear algebra, using almost the language and notation of sets and the same deductive style of reasoning as courses for mathematics students. This is comfortable for a mathematically trained teacher, but does it also meet the needs of business administration students?

At the Universität Klagenfurt some empirical research about the mathematical requirements of business students was undertaken, especially an in-depth analysis of the mathematical contents of a number of major german business administration textbooks. The main results of this investigation are:

- Mathematics in business textbooks is mostly elementary arithmetic or descriptive mathematics. Both in theoratical and practical business administration texts argumentations using function graphs are crucial for understanding the text.
- Concepts of calculus (functions, derivatives) are much more frequently used in business textbooks than concepts of linear algebra (linear equations, matrices etc.).
- mathematical concepts appear in a special business meaning and terminology. For example: In a business context the notion of a function implies some independent and dependent variables; not the idea of a special subset of the product of two sets.
- The level of consciousness about mathematical modelling (modelling assumptions, limits of models) is in the investigated business textbooks very low.

II. Mathematics courses for business students

The curriculum of applied business administration at the Universität Klagenfurt is very broad. For mathematics (without statistics) only a single one-semester-course (with 2 hours per week lecture and 1 hour per week practical exercise) is devoted. Both the very strict time limitations and the empirical research motivated a completely new concept of teaching mathematics to business students. Its most important ideas are:

1) Service-orientation: Mathematics for business students is regarded as a service subject, which should be devoted more to the needs of the business students than to mathematical ideas and principles of teaching mathematics. Especially the deductive style of mathematical teaching is given up in favour of a more business oriented view of mathematics.

2) Business orientation: Both the choice of topics and the presentation of the subject should fit as much as possible the needs and knowledge background of business students. For example: The concept of derivatives is being presented in the business context and terminology (using terms like "marginal costs" etc.) Terms and concepts without practical use for business students (like convergence criteria of series and functions etc.) are skipped in favour of more business oriented questions like the difference between marginal and average costs.

3) Descriptive mathematics: In a business context mathematical tools (beyond elementary arithmetics) are mostly used for descriptive reasons. Therefore business students should be trained to use different mathematical descriptions. In the application context it makes a big difference whether a function is denoted as a term, as a graph or as a table, since each description allows different operations and insights.

4) Reflection of mathematical tools and models: Modelling assumptions and the limits of mathematical models are an integrated part of the course.

III. Computer-oriented mathematics for business students

Since 1989 students do a part of their practical exercises with the aid of a spreadsheet program (with graphic capabilities). Despite of the strict time-limitations the introduction of a spreadsheet program proved to be a very effective innovation in practical mathematics teaching for business students. Although 2/3 of our students had no prior computer experience and there was some fear about the new tool in the beginning, at the end of the course almost all regarded a computer-supported mathematics course for business students much better than a conventional course using just a pocket calculator. In the computer-oriented courses also significantly fewer students dropped out.

At the beginning of the course students learn within a few weeks the basic principles of working with a spreadsheet program. Further spreadsheet knowledge (special functions, etc.) is being introduced just when it is needed. Most spreadsheet models are created by the students themself; some more complicated sheets (e.g. about linear equations or linear programming) or models which contain more empirical data are handed out to students at the beginning of the course.

For further information please contact:

Mag. Dr. Günther Ossimitz, Institut für Mathematik, Universität Klagenfurt. A-9020 Klagenfurt, Austria. ☎ (463) 2700-437; Fax (463) 2700-427. (Teaching material for lectures is available in German; spreadsheet models in a LOTUS-compatible data format.)

TIMSS

The Third International Mathematics and Science Study

The Third International Mathematics and Science Study (TIMSS) is a ten-year research project conducted under the auspices of the International Association for the Evaluation of Educational Achievement (IEA). More than fifty nations, from all regions of the world, and at all stages of economic development are participating. Cross-national studies have a long history, and the research foci of the current study result from reflection of past studies. The emphasis on the nature of assessment, and the importance of understanding the educational context as well as achievement measures guide the activities of TIMSS. The current climate of competitiveness is an economic reality and the effectiveness of the education system provides further impetus for this large study.

The International Coordinating Centre for TIMSS is housed at the University of British Columbia (UBC), Vancouver, Canada. Dr. David Robitaille, Head of the Department of Mathematics and Science Education in the Faculty of Education,is international coordinator for the project. Coordination of the activities takes place at UBC, but the development of background instruments and achievement surveys is distributed worldwide through the international composition of task forces and review committees, as well as through cooperative development ventures between institutions.

The curriculum analysis preparatory work has already begun, with the structuring of comprehensive analyses of texts and curriculum guides. An intensive survey of the time of introduction of topics and the age of concentration on those topics forms the basis for the achievement test development. Piloting of background questionnaires and achievement items is now being completed in several countries. These are the first three piloting phases. When piloting is competed, all items will have received international review, and item statistics will permit selection of the most appropriate questions.

There are regular newsletter publications that describe the status of TIMSS, discuss issues, and present information about both administrative and research aspects of the study. Interested readers will be added to the distribution list if they send their address to:

International Coordinating Centre, Third International Mathematics and Science Study
Faculty of Education, University of British Columbia, 2125 Main Mall, Vancouver V6T 1Z4, CANADA

fax: +1 604 822 8571 e-mail: (bitnet): timss_icc@ubcmtsg.bitnet or (internet):_icc@mtsg.ubc.ca

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Articles for future publication

Articles on **Mathematical Education** should be submitted to Professor W Dörfler, Institut für Mathematik, Universität Klagenfurt, Universitätsstraße 65-57, A-9022 Klagenfurt, Austria
or to one of the members of CME listed on page 14.

All other articles should be submitted to one of the newsletter editors listed on page 2.

If possible, articles should be submitted in A4 size, preferably 1" margins in single space, 11 point, headings bold 17 point.

Files on IBM compatible discs in Wordperfect 5.1 or as an ASCII file would be helpful.

The Newsletter is published four times a year on the first days of March, June, September and December.

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.

M. H. Fenrick: Introduction to the Galois Correspondence, Birkhäuser, Basel, 1992; x+195 pp., DM 88 , ISBN 3-7643-3522-X—

This nice book grew out of lectures given by the author at Mankato State University (USA). It is an excellent and inspiring text with many good examples and more than 250 exercises; many of them include hints. It contains 4 chapters: I. Preliminaries – Groups and Rings (60 pp.), II. Field Extensions (25 pp.), III. The Galois Correspondence (40 pp.), IV. Applications (21 pp.: Constructibility, Roots of Unity, Wedderburn's Theorem, Dirichlet's Theorem and Finite Abelian Groups), a short bibliography and index. (bn)

R.R.Akhmerov, M.I.Kamenskiĭ, A.S.Potapov, A.E.Rodkina, B.N.Sadovskiĭ: Measures of Noncompactness and Condensing Operators; Series Operator Theory: Advances and Applications, vol. 55; Birkhäuser, Basel, 1992; translated from Russian by A.Iacob; viii+249 pp., DM 148 , ISBN 3-7643-2716-2—

This monograph gives a clear presentation of the theory of measures of noncompactness and condensing operators. A boom of research in this area began in the second half of the sixties and lasted for almost ten years. The contents of the book may be described by the titles of chapters: Measures of noncompactness, The linear theory, The fixed-point index of condensing operators, Applications. The fixed-point index relies on the notion of a fundamental set introduced by M.A. Krasnosel'skiĭ, P.P. Zabreĭko and V.V. Strygin in 1972. Applications concern especially the Cauchy problem for differential equations in a Banach space and functional-differential equations of neutral type. The book mainly reflects results achieved in the former Soviet Union. Nevertheless, it may be recommended both to the novice and the expert in functional analysis and its applications. (joda)

A.N.Kolmogorov, A.P.Yushkevich (Eds.): Mathematics of the 19th Century (Mathematical Logic, Algebra, Number Theory, Probability Theory), Birkhäuser, Basel, 1992; translated from Russian; xiv+308 pp.,DM 228 , ISBN 3-7643-2552-6—

The book is the first volume of a series, it contains essays (written by different authors) devoted to the evolution of mathematics from the early nineteenth century till the begining of the second world war (the other two volumes were already published and the fourth and the fifth volume are essentially ready). The original Russian edition of the book was published in 1978. The topics of the four chapters of the book are indicated in the title. The main objective is to study forces behind the evolution of mathematical ideas, including those coming from technology, natural sciences, philosophy and from interrelations among various mathematical disciplines. The knowledge of the roots of modern concepts and of the evolution of basic streams in mathematics of the last century and their interrelations is certainly important for a good orientation in helping understand modern mathematics. The book, indispensable for historians of mathematics, can be warmly recommended to every working mathematician.

H.-D.Ebbinghaus et al.: Numbers, Edited by J.H.Ewing, Springer-Verlag, Heidelberg, 1991; Graduate Texts in Mathematics 123; translated from the German by K.Lamotke; 395 pp., 24 figs., DM 78 , ISBN 3-540-97497-0—

The book is a translation of the second edition of the quite successfull German publication "Zahlen" (Grundwissen Math. 1, Springer-Verlag, 1988; 1st ed. 1983). The first part "From the Natural Numbers, to the Complex Numbers, to the p-adics" describes the structure of the fundamental number-systems, the second part "Real Division Algebras" is devoted to the systems of hypercomplex numbers (quaternions, octonions, theorems of Frobenius, Hopf, Gel'fand-Mazur, composition algebras etc.), the third part "Infinitesimals, Games and Sets" deals with two relatively new extensions of the real number system (nonstandard analysis, number and games etc.). One of the principal aims of the book is to make the reader aware that mathematics does not consist of isolated disciplines. Relationships among the different theories are emphasized and presented in the historical perspective (from ancient Egypt to the late twentieth century). A well written and carefully organized exposition that can be read on several levels. Strongly recommended to specialists as well as to amateurs. (jbe)

H.Andréka, J.D.Monk, I.Németi (Eds.): Algebraic Logic, North-Holland, Amsterdam, 1991; Colloquia Mathematica Societatis János Bolyai, vol. 54; vi+746 pp., US $ 218 , ISBN 0-444-88543-9—

The collection is not restricted to papers presented at the Colloquium (Budapest, August 8 – 14, 1988). Its aim is to provide the reader with a consistent approach to algebraic logic, the current research being emphasized, so that, introductions to cylindric algebras, relation algebras and Boolean algebras with operators are included. The following topics are also covered: polyadic algebras, universal algebraic logic, applications in computer science and logic, historical aspects and connections with categorical logic. The volume ends with a list of open problems. (tk)

L.Salem, F.Testard, C.Salem: The most beautiful mathematical formulas, J.Wiley & Sons, Inc., New York, 1992; translated from French by J.D.Wuest, xiii+142 pp., US $ 21.95 ISBN 0-471-55276-3—

"The goal of this book is to reveal the beauty of mathematical formulas. This beauty springs from the plasticity of mathematical symbols, the simplicity of mathematical statements and the esthetic appeal of their implications. Like all sciences, mathematics has its own harmony. Our goal is to explore this harmony." (*From the introduction.*) Almost 50 short amusing stories (and more than 70 cartoons) guide the reader through a nice part of the world of mathematical notions and formulas: numbers, series of numbers, equations logarithms, exponentials, triangles, rectangles, squares, circles, angles, objects in space, chance ... . This charming book is accesible to everybody with a basic knowledge of high school level algebra and geometry. (in)

R.A.Piccinini: Lectures on Homotopy Theory, North-Holland, 1992; North-Holland Mathematics Studies 171; xii+292 pp., US $ 92.50 ISBN 0-444-89238-9—

The book is a good introduction to the homotopy theory of topological spaces suitable for beginning graduate students familiar with basic facts of point-set topology. It grew out of lectures on homotopy theory given at the Scuola Matematica Interuniversitaria in Perugia, 1989. As well as reviewing the necessary basic notions, the main topics discussed in the book are fibrations, cofibration and homotopy theory of CW-complexes and simplicial complexes. Moreover, two appendices on colimits and compactly generated spaces are included and approximately 30 pages are left to exercises. The book can be recommended to readers willing to learn the above mentioned topics quickly. (jbu)

Stefan Banach (1892 - 1945)

Professor Wieslaw Zelazko

Stefan Banach was born in Cracow on 30 March 1992. Not much is known about his family background and his childhood. According to Steinhaus [3] the name of his father is Greczek and the name of his mother is unknown. Immediately after the birth the baby was taken under the care of a Cracow laundress named Banach. Another source says that Banach was named after his mother's servant who put him under the care of a Cracow laundress. Quite early on Banach had to take care of himself getting a small income tutoring other schoolboys in mathematics. Nevertheless in 1919 he finished his secondary education and entered Lvov Polytechnic University. At the outbreak of the first world war in 1914 his formal education was interrupted and Banach never completed his University education. Banach spent the war in Cracow studying mathematics by himself and in discussions with friends. One such discussion, between Banach and Otto Nikodym, was overheard by Hugo Steinhaus, who was then already a doctor of Mathematics. He approached them and explained a problem concerning trigonometric series he was working on. To his astonishment Banach produced a solution a few days later. In this way the first paper of Banach written jointly with Steinhaus was written, (due to the war conditions it did not appear until 1919). It was Banach's dream to obtain a position of teaching assistant at the Lvov Technical University. The dream was realized in 1920. The same year he obtained his Ph.D. in the Jan Kazimierz University in Lvov. His thesis contained an outline of theory of certain abstract spaces now called Banach spaces (the name was proposed by Frechet). Two years later Banach habilitated and obtained the position of an extraordinary professor at the Jan Kazimierz University. The habilitation thesis concerned the theory of measure. His career proceeded very quickly. In 1927 he became an ordinary professor; in 1929 he founded together with Steinhaus the journal Studia Mathematica and in 1932 he published his famous Théorie des Opérationes Linéaires as the first volume of the series Monografie Matematyczne of which he was one of the cofounders. The Polish version of the book was published one year earlier. In these times Lvov become a famous centre of functional analysis. Banach, his friends, and very often guests from abroad used to meet in Kawiarnia Szkocka (the Scottish Cafeteria) and discuss mathematics.

The famous Scottish Book (a list of unsolved problems) was also a result of these sessions. Let us mention several names connected with the Lvov School of Mathematics: besides Banach and Steinhaus there were Herman Auerbach, Max Eidelheit, Marek Kac, Stefan Kaczmarz, Stanislaw Mazur, Wladyslaw Orlicz, Juliusz Schauder and Stanislaw Ulam. They worked not only in functional analysis. In fact most of Banach's works concern themselves with real functions and measure theory. In 1936 in his plenary address at the International Congress of Mathematicians in Oslo, Banach described the work of the Lvov School and their further plans. Unfortunately the war was going to come soon. Just before the war in 1939 Banach was elected President of the Polish Mathematical Society. After the outbreak of war, Lvov fell under Soviet occupation and was incorporated into the Soviet Union. Nevertheless the University still worked (renamed Ivan Franko University - after the name of a Ukrainian poet) and Banach even become the dean of the Faculty of Sciences. In 1941 the German occupation started in Lvov. During this time Banach was employed in a bacteriological institute as a lice feeder. This position gave him a lot of time to think about mathematics in relative safety (many of his fellow mathematicians were killed during the Nazi occupation). After the war Banach accepted a chair of mathematics in Jagielonian University in Cracow. He never arrived there; Banach died of lung cancer on 31 August 1945 and is buried in Lvov in the Lyczakow Cemetery.

References

[1] S. Banach, Oeuvres, vol 1, Warszawa 1967
[2] S. Banach, Oeuvres, vol 2, Warszawa 1979
[3] H. Steinhaus, Stefan Banach, Studia Math.Ser.Spec.Z.1(1963), 7-15 (see also pp. 13-22 in [1]).

The Stefan Banach

International Mathematical Centre in Warsaw

Czeslaw Olech

On January 13 1972 an agreement was signed in Warsaw between the Academies of Bulgaria, Czechoslovakia, Hungary, Poland, Romania, USSR, and in Berlin giving birth to the Banach Centre.

Its aim has been, as with most such organizations, to promote and to stimulate international cooperation and cooperative research in mathematics, to give beginners an opportunity to learn from the very source, to improve their research ability, and to present to experts their first results. At the time we were proposing the creation of the Banach Centre an important argument was the need felt by many of intensifying the contacts in mathematics between the East and the West. We believed that the tradition and strength of mathematics in Poland, and the geographic location of Warsaw, would provide a solid foundation for successfully building such a centre.

We are fulfilling those aims by organizing "semesters", two each year, one in the spring and one in the fall. These are conferences running for two-three months with changing sets of participants but concentrated on a specific field of mathematics. The main difference from other research conferences is that the program is not overloaded and gives the participants an opportunity to present their results in a more detailed form and time to enjoy the other talks. It also leaves some free time for interaction between the speakers.

Though the Centre was founded in 1972 the activity started in the spring of 1973. Thus this year is the twentieth year of the activity at the Banach Centre. Thirty nine semesters have been held up to now and the fortieth on complex analysis is planned for this fall. Practically all areas of mathematics were covered.

The XXXIX Semester of the present year 1992 was devoted to the 100-th anniversary of Banach's birthday and it started with some lectures on the history of functional analysis and in particular on the Lvov school of Banach and Steinhaus. Then a two weeks workshop on approximation theory followed, organized by Z. Ciesielski. During the remaining two months of April and May the discussion was concentrated around operator theory and Banach algebras under the leadership of W. Zelazko. The Semester was well attended. A contract with UNESCO concerning the workshop on operator theory provided some extra opportunity to facilitate and increase the participation from abroad.

The twentieth year of the activity of the Banach Centre will be completed this fall with the XL Semester on Complex Analysis. The organizer is W. Pleśniak from Kraków. The Semester will run from the middle of September until the middle of December and will consist of six workshops, each for about a two week period: Invariant pseudodistances in complex analysis; Boundary properties of holomorphic functions and mappings; Integral representation and residue; Approximation theory in several complex variables; Extremal problems of the theory of functions of one complex variable. An important novelty to be noticed in connection with this is the recent agreement of cooperation between the Max-Planck-Institute für Mathematik in Bonn and the Banach Centre through which this Semester will be partially supported.

Most of the visitors are invited speakers. The support the Centre offers them helps only with local expenses and is quite modest but comparable to a professor's income in Poland. The number of participants in a semester varies from between one and two hundred, more than two thirds from abroad. There are a few cases when it exceeded two hundred. The "record" belongs so far to the XXXIst semester on algebra in the spring of 1988 with a total number of 243 participants (198 foreigners among them). The minimum occurred during martial law in Poland in 1982 when, in the spring semester, we had only 26 visitors from abroad.

The results and effects of the activity of the Banach Centre are difficult to measure. However the author is convinced that the Banach Centre has served mathematics well both globally and locally. There is no question that Poles have profited more than others but the Banach Centre was also important for neighbouring countries as a place for scientific contacts and a source of mathematical

information that has contributed to the development of mathematical research. The series of books entitled the Banach Centre Publications, which contain the research papers and survey lectures delivered at the Banach Centre, form a lasting trace of this activity. Twenty six of them have appeared and a few more are in preparation.

The Centre is a part of the Institute of Mathematics of the Polish Academy of Sciences and in legal matters is represented by the Institute. It has been financed only by Polish sources. The sponsoring Academies helped by supporting student participants and facilitating the visits to the Centre of invited speakers from their countries. Their essential contribution to the prestige of the institute was very important to us. The international character of the Centre was manifest through the Scientific Council responsible for the scientific program. It is composed of two representatives of each party of the agreement and of the Director of the Centre. The author served in the latter post for all these twenty years and decided to step down this summer.

The statures of the Centre will undergo some changes but it will remain a statutory part of the Institute. Also it is essential to continue to have an international advisory body related to the Centre replacing the present Scientific Council. We would like to have an *a priori* upper bound for the number of members in this committee and the question of how it should be completed remains to be solved. The division of Europe into East and West is not so sharp any more. Thus we hope that our Centre will become more European.

On the history of non-Euclidean geometry -3 *

Jeremy Gray

Faculty of Mathematics, The Open University, Milton Keynes, UK.

At the end of the 19th Century non-Euclidean geometry was for a while publicly contentious. Dostoevsky made Alyosha in the *Brothers Karamazov* [1880] say: "If God really exists and he really has created the world, then, as we all know he created it in accordance with the Euclidean geometry.... And yet there have been and there still are mathematicians and philosophers, some of them indeed men of extraordinary genius, who doubt whether ... all existence was created only according to Euclidean geometry and they even dare to dream that that two parallel lines ... may meet somewhere in infinity." This Alyosha at least refused to accept. With less excuse he was joined by Frege, who illustrated several points in his *Foundations of Arithmetic* [1884] with geometrical examples that non-Euclidean geometry refutes. To take just one, the concept of identity was illustrated with the claim that the concept of parallelism implies that of direction. This in one of the first works to endorse Cantor's theory of transfinite numbers!

Frege was led astray by his rooted opposition to an axiomatic approach to mathematics. "Surely," he wrote "everything geometrical must be given originally in intuition." And elsewhere: "One cannot serve truth and untruth. If Euclidean geometry is true, non-Euclidean geometry is false, and if non-Euclidean geometry is true, Euclidean geometry is false." He wrote to Hilbert: "I give the name of axioms to propositions which are true but which are not demonstrated, because their knowledge proceeds from a source which is not logical." Hilbert replied to the contrary: "If the arbitrary posited axioms do not contradict one another or any of their consequences, they are true and the things defined by them exist." In this spirit he presented his famous *Grundlagen der Geometrie* [1899]. Hilbert's creation of abstract axiomatics not only shifted the debate about the foundations of geometry away from discussion about the objects of geometry to its rules of inference, it was soon seen to have much wider implications. As Hurwitz wrote to him to say: "You have opened up an immeasurable field of mathematical investigation which can be called the mathematics of axioms."

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* Parts 1 and 2 appeared in the previous two editions of the Newsletter.

Constructivism aside, intuition as *a*, even *the*, foundation of mathematical knowledge fell into disrepute. One reason was the remarkable disparity between what intuition taught thinkers normally as acute as Kant and Frege and what generations of mathematicians were able to establish. A more sophisticated defence of intuition was clearly necessary. So, to quote Poincaré: "What then are we to think of the question: Is non-Euclidean geometry true?" He answered: "It has no meaning.... One geometry cannot be more true than another; it can only be more convenient. Now, non-Euclidean geometry is and will remain the most convenient: 1st, because it is the simplest....just as a polynomial of the first degree is simpler than a polynomial of the second degree; 2nd, because it sufficiently agrees with the properties of natural solids, those bodies which we can compare and measure by means of our senses."

This seemingly plausible view begs many questions. What statements about the world can, on this view, be true? May we believe that Aristotelian dynamics is true - if a little inconvenient and in need of some *ad hoc* repairs? The simplicity and plausibility may also be contested. Poincaré himself had offered an interpretation of non-Euclidean geometry as the geometry on one sheet of a two-sheeted hyperboloid $(x^2+y^2-z^2 = -1)$ where non-Euclidean straight lines are the curves cut out by planes through the origin and the group of motions is the linear maps sending the sheet to itself. But if we suppose that the simplest physically plausible geometry is that of special relativity, where the group preserves the relativistic metric $(+,+,-)$, then another possibility open up, for the geometry of special relativity applied to space induces non-Euclidean geometry on the hyperboloidal sheet.

To see this, let the coordinates on the sheet be u and v, where

$$x = shu, \quad y = chushv, \quad \text{and} \quad z = chuchv.$$

Then the spatial metric $ds^2 = dx^2 + dy^2 - dz^2$ induces the metric:

$$ds^2 = du^2 + ch^2udv^2$$

on the sheet implies that the intrinsic geometry has constant curvature -1.

As is well-known, special relativity proved congenial to mathematicians only after Minkowski had described it in coordinate terms in his paper of 1910. Then in the *Jahresbericht der DMV* for 1912 the Yugoslav mathematician Vladimir Varicak showed how non-Euclidean geometry was a natural geometry for the study of relativity. His imagination had been caught by the fact that Euclidean geometry appears as a limiting case of non-Euclidean geometry, just as classical mechanics appears as a limiting case of relativistic. Then he came across Sommerfeld's paper of 1910 in which the composition of velocities in special relativity was treated using spherical trigonometry with imaginary sides. It being only a small step from geometry on an imaginary sphere to non-Euclidean geometry, Varicak proceeded to establish that "Not only are the formulae of relativity theory essentially simpler when expressed in the terminology of non-Euclidean geometry, but they are given a geometrical interpretation quite analogous to the interpretation of the classical theory in Euclidean geometry." The central point was that the addition law for rapidities (the quantity w related to the velocity v by the formula $v = tanhw$) is the same as the addition law for non-Euclidean lengths r(related to Euclidean lengths s in the disc model by the formula $s = \tanh(r/2)$).

Several others took up this story, notably Max Born among the physicists and AA Robb among the mathematicians, who gave a Hilbertian axiomatic style account of special relativity. But a modern reader attuned to general relativity and gravitation might not dally with constant curvature. However, there are models, such as Flamm's paraboloid, which represent gravity in plausible, if naive, ways and where space carries a metric of negative curvature that approaches zero as one moves away from the vertex of the paraboloid. These models also suggest that space may more naturally be thought of as locally non-Euclidean than as Euclidean.

The Sofya Kovalevskaya Museum

Valentina Rumyantseva

A memorial museum for Sofya Kovalevskaya is being created at the Polibino settlement, near the town of Velikiye Luki, in the Pskov region of northwestern Russia. It was here that Kovalevskaya spent her years as a child, described later in her famous 'Childhood Memories', first published in Sweden in 1889 as 'The Raevsky Sisters'.

The main house and wing of the Korvin-Krukovsky country estate are still standing, surrounded by the park, with trees up to two hundred years old. The estate also includes a beautiful lake.

A decision to restore the Polibino estate and to set up a memorial museum here for S. Kovalevskaya was taken in 1983 by the Russian Ministry of Culture.

Museum officials began their research in the archives at Moscow, Leningrad, Minsk and Velikiye Luki. Their main task was to find the original plans of the estate, and to recreate the history of that country house, while assembling documentary and other items that might be used as museum exhibits. A number of important papers and personal possessions belonging to Kovalevskaya and her closest relatives and friends were acquired. The scientific content of the museum will be based on archival material and on Kovalevskaya's private papers.

The memorial complex in Polibino will consist of a two-storey house with a three-storey tower, a large wing, a park (where Kovalevskaya's parents were buried), and the lake, covering an area of thirty six hectares in all.

The house and wing need considerable renovation. During the period of postwar reconstruction, the internal structure of the house was altered, leaving the museum staff to solve the difficult but very interesting problem of restoring the house to its condition in the decade 1850-60. By 1987, a reconstruction programme was formulated, involving the restoration of a marble staircase, a wooden spiral staircase, balconies and terraces, all of which had been either lost or destroyed.

There is a great deal of work to be done in the park. Many alleys and paths are being restored. Extensive planting (over a thousand trees and ten thousand shrubs) is envisaged. In addition to work on the house and wing, it is intended to rebuild certain other structures that have been lost: the chapel where Kovalevskaya's parents were buried, pavilions, bathing huts, green houses and a distillery.

The restoration is planned to take place in two stages, and it is hoped to complete the museum complex by the year 2000, when we celebrate the 150th anniversary of Kovalevskaya's birth.

The museum will be the only one in Russia, and probably in the world, dedicated to Kovalevskaya. It is intended to be a storehouse of memorial relics and to serve also as a centre for the promotion of women's rights in science and in life generally. The museum aims to provide a picture of Kovalevskaya's life and to explain the significance of her scientific and public work. While much of the material on display will be devoted to the Polibino period of Kovalevskaya's life, there will be an extensive exhibition covering her life in Germany and Sweden where her scientific career began. An important subsidiary aim of the museum is to recreate the way of life of a provincial Russian estate of the mid-nineteenth century.

We want to spread information about Kovalevskaya's life and work throughout the world. We are in touch with the Kovalevskaya foundation in the USA, which is headed by Mrs Koblitz, and hope to learn more of its activity. We are also in touch with Kaiserslautern University, which has established an exchange-professor scheme in Kovalevskaya's name, beginning this year. The exhibition will include an account of this scheme's operation.

We are grateful to the Swedish Mittag-Leffler Mathematics Institute for allowing us to study the Kovalevskaya archive and to copy material for our museum. We continue to collect memorial relics and documents relating to Kovalevskaya, and seek knowledge of Kovalevskaya's relatives, wherever they may be. If you have any information about Kovalevskaya, her life or her work, please write to:

Director Valentina Rumyantseva, Polibino, Velikiye Luki District, Pskov Region 182157, RUSSIA.

UNION OF BULGARIAN MATHEMATICIANS

Sava Grozdev, Secretary of the UBM
P.O. Box 155, Acad. G. Bonchev Str., Block 8, 1113 Sofia, BULGARIA

February 14, 1898 was the birthday of the Union of Bulgarian Mathematicians (UBM), when the Sofia Physico-Mathematical Society was formed. This happened several months after the appearance of the International Mathematical Union (IMU) in Zurich, in August, 1897. In 1960 the Bulgarian Physico-Mathematical Society was set up. Later, on October 17, 1971 a Society of Bulgarian Mathematicians with its first President A. Mateev (1914-1979) was formed from it. In 1975 Academician L. Iliev became President. Since April 1977 when the regular annual meeting was developed into the Constituent Congress, this society is called the Union of Bulgarian Mathematicians. Since then, the UBM conducts regular congresses every five years. The last one, i.e. the Fourth Congress (April 2-3, 1992) elected Acad. L. Iliev, President for the last 17 years, as Honorary President of the Union. The Governing Council was elected too, consisting of 29 persons. It assembles 3-4 times a year and governs the Union between congresses. It elected Prof. L. Davidov as President of the UBM, and also the Executive Committee consisting of 9 persons. The Executive Committee carries out the operative management between two consecutive meetings of the Governing Council. It elected Prof. P. Azalov and H. Lessov as Vice-Presidents and Prof. S. Grozdev as Secretary of the UBM.

At present the UBM consists of about 5000 members, distributed in 71 Sections all over the country. These are teachers in Mathematics and Informatics, scientists, specialists and university professors. Annually, since 1972, the UBM conducts Spring Conferences with scientific programs that cover Mathematical topics, Informatics, Mathematical Modelling, Mechanics and Mathematical Education. Generally, discussions have been included in the Spring Conferences on educational problems, secondary school books, professional training, etc. Thus, the Spring Conferences realize useful contacts between secondary school teachers and university professors and specialists. Also, Proceedings of the Spring Conferences are edited in the series "Mathematics and Mathematical Education", reviewed by MR, Zbl.Math. and RJ.

The UBM is co-organizer of scientific events covering various directions in Mathematics and Informatics. In the period 1970-1991 about 150 international conferences, summer schools, symposia, seminars, etc. took place in this country with the participation of more than 10,000 participants from about 40 countries. To develop this activity successfully in future, the UBM is in the process of constructing an International Scientific Centre like the one in Oberwolfach, Germany. The Base of this Centre is the historical settlement of Arbanassy, near the old Bulgarian Capital Veliko Tirnovo.

At all times, different national seminars act under the name of the UBM. The National Colloquium on Mathematics, the Scientific Seminar on Informatics and others are among them. The work of the UBM, concerning talented students and teachers, is of great importance. By its Team for Extracurricular Activities in Mathematics and Informatics, consisting of scientists and university professors, the UBM provides for scientific guarantee of all national olympiads and competitions, as well as preparing the Bulgarian representatives in the International Olympiads and Balkaniads.

In one of its departments the UBM carries out some engineering and business activities. Several projects, with foreign cooperation, are in motion and they concern realization of software products preparation of specialists, etc.

In the international domain the UBM collaborates with corresponding institutions in Greece, Poland, Czech-Slovakia, Hungary, Luxemburg and others. The relations with them are based on direct contracts for the exchange of specialists. Joint scientific events are held like the two Bulgarian-Greek Seminars on Mathematical Education in 1990 and 1991, in Sofia and Thessaloniki, respectively. The governing Council of the UBM cares for the development of these contacts and strongly wishes to activate the presence of the UBM in the European Mathematical Society.

SMAI, Société de Mathématiques Appliquées et Industrielles (*)

Status report - 1992

A little history

SMAI is an association chartered under the French law of 1901 and was created in 1983 by applied mathematicians in France. In 1986, SMAI had about 700 members; today there are over 1,500 members. The membership is made up of teachers and researchers, from both the university and industry, and represents a very broad range of specialties within applied mathematics.

Purpose of SMAI

The principal objective of SMAI is to promote the recognition and development of applied mathematics in the university as well as in industry.

Activities of SMAI

SMAI organizes and helps organize various meetings, lectures, and special day-long study sessions with a particular emphasis on encouraging interaction between industry and academia. In addition, SMAI has two regular publications:
- its bulletin, called MATAPLI. It is sent to all members of SMAI and is the main organ of communication of the society. MATAPLI is published quarterly.
- a series of lecture notes, called Mathématiques et Applications, based on research level university courses ("3rd-cycle" courses) in applied mathematics.

Since its annual meeting in 1991, SMAI has included three permanent subgroups of the society, representing various aspects of applied mathematics, such as scientific computing, mathematics of finance, statistics, numerical analysis, discrete mathematics, automata theory, probability, control theory, optimization, etc. The three subgroups are

- GAMNI, Groupe pour l'Avancement des Méthodes Numériques de l'Ingénieur (Group for the advancement of numerical methods in engineering);
- GMAS, Groupe de Modélisation Aléatoire et Statistique (Group for stochastic and statistical modelling);
- GMODE, Groupe de Mathématiques de l'Optimisation et la Décision (Group for optimization and decision theory).

Each of these groups organizes international meetings in its particular areas of interest.

In order to encourage scientific meetings, as well as reflection on scientific matters, SMAI develops and maintains relationships with:
- other French professional societies having interests related to those of SMAI, especially the SMF, i.e. the Société de Mathématique de France (the French Mathematical Society),
- foreign professional societies of a similar nature, such as AMS, SIAM, IMA, GAMM, etc. Also, SMAI is an institutional member of the newly created European Mathematical Society (EMS).

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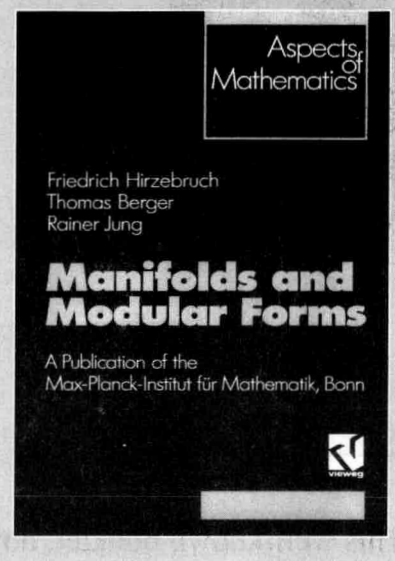
A Publication of the Max-Planck-Institut für Mathematik, Bonn.
Translated by Peter Landweber.
1992. xii, 211 pp.
(Aspects of Mathematics, Vol. E 20; ed. by Diederich, K.)
Hardcover DM 68,– / £ 26.00
ISBN 3-528-06414-5

This book provides an introduction to the theory of elliptic genera due to Ochanine, Landweber and others. The theory displays a rich interplay between manifolds and modular forms. The genera are constructed using cobordism theory and the classical theory of elliptic functions. The construction shows that they all come from a universal elliptic genus. This associates to every oriented manifold a modular form which is an ivariant of the corbordism class of the manifold. Most results are generalized to elliptic genera of higher level. They are invariants of stably almost complex manifolds, again given by modular forms. The text is in most parts selfcontained. Many explicit examples are given and most of the results are illuminated by comparison with classical theorems.



Racke, Reinhard

Lectures on Nonlinear Evolution Equations

Initial Value Problems
1992. viii, 259 pp. (Aspects of Mathematics, Vol. E 19; ed by Diederich, K.)
Hardcover DM 68,– / £ 26.00
ISBN 3-528-06421-8

This book serves as an elementary, self contained introduction into some important aspects of the theory of global solutions to initial value problems for nonlinear evolution equations. The presentation is made using the classical method of continuation of local solutions with the help of a priori estimates obtained for small data.

Hulsbergen, Wilfried, W. J.

Conjectures in Arithmetic Algebraic Geometry

1992, viii, 236 pp. (Aspects of Mathematics, Vol . E 18; ed. by Diederich, K.)
Hardcover DM 64,– / £ 25.00
ISBN 3-528-06433-5

The main purpose of this book is to give an introduction to Beilinson's Conjectures. In two motivational chapters on classical number theory and elliptic curves, L-functions and regulators are introduced. Topics discussed are Fermat's Conjecture, Dirichlet and Artin L-functions, L-function of elliptic curves, the conjectures of Shimura-Taniyama-Weil and of Beilinson's Conjectures and those of Hodge and Tate in Jannsen's approach. Also, the necessary tools such as higher algebraic K-theory, Poincaré duality theories, Chern characters and motives, are treated in some detail. In the final chapter a few examples are discussed of cases where some of the conjectures are verified.

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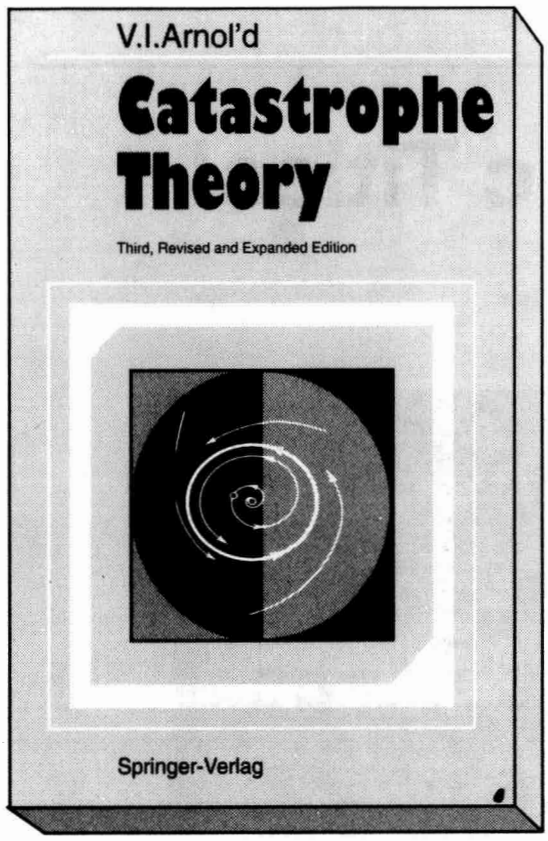


V.I. Arnol'd, Steklov Mathematical Institute, Moscow, Russia

Catastrophe Theory

To the Memory of M.A. Leontovich
Translated from the Russian by G.S. Wassermann based on a translation by R.K. Thomas

3rd rev. and exp. ed. 1992. XIII, 150 pp. 87 figs. Softcover £ 13.50
ISBN 3-540-54811-4

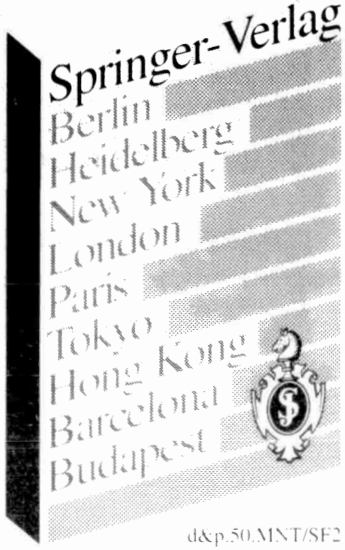
This well-known booklet, now in its third, expanded edition, provides an informal survey of applications of singularity theory. Readers familiar with the previous editions will find much that is new, e.g. topics like shock waves, implicit differential equations and folded singularities, and interior scattering. Three new sections give an overview of the history of singularity theory from Leonardo da Vinci to modern times, a discussion of perestroika in terms of the theory of metamorphoses, and a list of 93 problems.
Arnol'd's goal with this edition remains the same: to explain the essence of the results and applications to readers having a minimal mathematical background. All that he asks, is that the reader have an inquiring mind.

V.I. Arnol'd, Steklov Mathematical Institute, Moscow, Russia, CIS

Ordinary Differential Equations

Translated from the Russian by R. Cooke

1992. IV, 334 pp. 272 figs. (Springer-Textbook)
Softcover £ 28.00 ISBN 3-540-54813-0
(Translated from the 3rd original Russian edition published by Publisher Nauka, Moscow, 1984)



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