European Mathematical Society

NEWSLETTER No. 24

June 1997

Produced at the Department of Mathematics, Glasgow Caledonian University

Printed by Armstrong Press, Southampton, UK

ISSN 1027 - 488X

NOTICE FOR MATHEMATICAL SOCIETIES

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

Many thanks.

Ms T Mäkelainen

EMS AGENDA

1997

May 27- June 2

Second EMS Lectures Helsinki (Finland)
"Loeb measures in Practice : Recent Advances" by Professor Nigel Cutland from University of Hull (UK)

June, 16th

Deadline for receipt of proposals to the **TMR Programme** "Access to large facilities".

August, 15th

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

October, 11-12th

Executive Committee Meeting in Capri (Italy)

Autumn

Second **Diderot Mathematical Forum** on Mathematics and Environment (Amsterdam, Madrid and Venice)

November

The number of individual members of EMS is fixed.

November, 15th

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

December

All the information about Council Meeting and voting slip for the delegates of the individual members are in the December Issue of the Newsletter.

1998

February

Nominations for delegates for individual members received by the secretariat and ballots sent to individual members.

March 31st

Ballots back to the secretariat.

August

Council of the EMS in Berlin

2000

July 10-14

ECM3 in Barcelona (Spain)

EUROPEAN MATHEMATICAL SOCIETY

Meeting of the Executive Committee
Vienna (Austria) April 5-6, 1997

Main topics of the agenda and decisions

A detailed report will appear in the September Issue of the Newsletter.

Fifth Framework Programme

The EMS document should be sent to the member societies for action. The attempts to get Zentralblatt für Mathematik accepted as a large facility by the EU continue.

Summer Schools

In 1997 there are two summer schools, one in Portugal and one in France.
The deadline for submission to 1998 proposals is June 15, 1997.

Reference Goals for Mathematical Education

EMS was asked by the Commission to set up reference levels for students in EU countries at three different ages and different levels (age 16 is a priority). The Education Committee agreed to undertake the project.

Mathematical Press Agency

The Mathematical Press Agency, to be called EMPRESSA, is now being formed in Strasbourg, aimed at mathematicians and press.

EMS Lecturer

N. Cutland, the second EMS Lecturer, have given talks at Gothenburg on May 23 and 26, and four lectures in Helsinki on May 27-June 2 entitled "Loeb Measures in Practice: Recent Advances".

3ECM in 2000

The Third European Congress of Mathematics will be held on July 10-July 14, 2000. Its motto is: Shaping the 21st Century.

Diderot Mathematical Forum

The Forum on Mathematics and Environment pays special attention to problems concerning water. It will be held in Autumn 1997 in Amsterdam, Madrid and Venice. An appplication is being submitted to the DGXII. A telecommunications link is now possible.

WMY 2000

Among contributions of EMS in the World Mathematical Year 2000 will be the Alhambra project. The idea of posters in subways of great European towns should be carried on. Stamps with a common symbol could be suggested in various countries.

Mathematics in the Countries of Southern Africa, Realities and Aspirations

Dr. Edward Lungu, University of Botswana
Dr. Precious Sibanda, University of Zimbabwe

Currently there is a dearth of qualified mathematics teachers both at high school and university levels in the entire Southern African region. In a continuing effort to remedy this basic structural problem in our countries, each university in the region aims to train its staff through staff development programmes. These are programmes where the best students are encouraged to go for MSc degrees in the hope that, upon completion, they will join as members of the university staff. Even these programmes are currently hampered by the lack of financial resources. As an example, the University of Zimbabwe used to send its graduates overseas for MSc/PhD studies but cannot afford to do so now because there is no longer any money to fund these students. Locally the facilities for their advanced training are either inadequate or simply non-existent.

Funding for mathematics education and mathematics programmes by the various governments of the region is simply inadequate. Most universities have neither the resources nor the expertise to offer mathematics courses with sufficient specialisation at bachelors degree level or above. For example, in the region, the University of Zimbabwe and the National University of Science and Technology (also in Zimbabwe) are the only two which offer honours degrees in Mathematics. As a result, the use and application of mathematics in modelling industrial, environmental or other real life problems is fairly unknown in this part of the world since there is a dire shortage of qualified personnel.

The governments of our various countries tried hard to train manpower when our economies were "strong". As the economies have declined, less money is being spent on manpower training. For this reason, the universities in the region are pooling their resources by establishing regional programmes. Recently, for example, through partnerships with the University of Oslo and with the Austrian government, small combined regional Masters programmes in Mathematical Modelling and in Graph Theory have been established at the University of Zimbabwe. To widen the pool of graduates entering these local programmes as well as programmes abroad, the region requires a "Pre-MSc" programme through which many people will be raised to the required level.

A 12-month intensive "BSc Honours" programme at the University of Botswana is currently being contemplated to bridge the gap between the university preparation in mathematics available in many surrounding countries and advanced programmes such as those in Zimbabwe. It can be also used as preparation for various staff development fellows from Southern Africa Development Corporation countries. There are also good students who pursue combined majors in mathematics with another science subject. Upon completion of their studies, these students will not have done enough advanced courses in mathematics. The 12-month programme can be used to raise the standard of these students to "pre-MSc" level. This programme at the University of Botswana can and will go a long way towards addressing the problems of advanced undergraduate mathematics education in the region.

With colleagues from Europe who have worked in the region, we are currently attempting to formalise these efforts, incorporate them into a several-year co-operative plan and, with the help of the international mathematical community, find the financial and human resources that will help us to a full and fruitful implementation. We are calling the project MUSA (Mathematics and its Uses in Southern Africa).

The goal of MUSA is to foster dialogue and co-operative activities involving mathematicians and students of mathematics from a geographically connected region of sub-Saharan Africa, hopefully including Botswana, Malawi, Mozambique, Namibia, Zambia, and Zimbabwe, as well as Lesotho and Swaziland. Ties with the South African mathematical community would also be sought. MUSA will focus on regional development of a vigorous community of mathematicians, students of mathematics, and users of mathematics in government and business. MUSA is building upon three components:

1) A 12-month full-time programme called a "BSc with Honours in Mathematics" at the University of Botswana in Gaborone consisting of four year-long courses:

Abstract Algebra/Linear Algebra
Real/Complex Analysis
Topology/Geometry
Functional Analysis/Applied Mathematics

With the help of the international mathematical community, MUSA hopes to generate a scholarship fund to enable qualified students from participating countries to complete this programme.

2) The 18-month MSc in Mathematical Modelling programme at the University of Zimbabwe which has been established in recent years under a co-operative agreement with the Norwegian Universities' Committee for Development, Research and Education (NUFU). Again with the help of the international mathematical community, MUSA hopes to generate a scholarship fund for this programme. The support of countries in the region will also be sought in the form of continuing the salaries of mathematics teachers and others employed as mathematicians during a leave of absence to complete this programme. In addition visiting students from government, industry and other countries would be encouraged.

3) The gradual formation and strengthening of a community of researchers/teachers connected with a small number of mathematical research centres in Europe, the Americas, and Asia. We envisage the establishment of an annual teaching/research meeting in consultation and co-operation with existing activities of the Southern African Mathematical Sciences Association. The site of this meeting would rotate among the countries having students/teachers/researchers participating in the programme at any level. In addition the contents of this meeting would include mini- courses, mini-research projects, and research talks, as well as a pedagogical component. The emphasis of each component would change from year to year depending on the mathematical situation of the country in which it is held.

In addition and again with the help of the international mathematical community, MUSA hopes to establish a series of small pilot programmes:
i) A visiting programme for research mathematicians from established centres outside the region to participating Southern African centres. These visiting mathematicians would teach undergraduate and postgraduate courses and participate in research activities. (Preference would be given to those involved in longer term joint research or learning projects.)
ii) A programme of visits to established centres for the African mathematicians, again with preference for those involved in longer term joint research or learning projects.
iii) A programme of 1-2 year "visiting lectureships" for young mathematicians with degrees from established centres outside the region to work on-site, teaching and collaborating in the above activities. We would design such positions so as to allow the young mathematicians ample time to continue their own research programmes during their lectureships.
iv) A programme of research and teaching visits for mathematicians from one participating South African country to teach advanced undergraduate and postgraduate courses and to do research in other participating countries.

These annual teaching/research meetings and the visiting programmes, although long-term projects, would greatly benefit a lot of young mathematicians in the region who, after their PhD, find themselves overburdened by teaching demands and with no prospects of promotion by authorities requiring "a good research record".

Alone our countries do not yet have the human and financial resources to realise these aspirations for our mathematical community. Indeed a good part of the programme outlined above will require funding from abroad, in the form of either foundation grants or co-operative agreements. In the hope that we can gradually find friends for our efforts and other countries, we wish to draw the attention of the wider mathematical community to our current work and future aspirations here in Southern Africa.

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The Nativity of Euroscience
Aatos Lahtinen

Concordia res parvae crescunt, discordia maximae dilabuntur. (Sallustius, 86-35 B.C.)

The mythical history of Europe starts with the abduction of the Phoenician princess Europa to Crete. From this discordant beginning our continent has been constantly split into several, often hostile parts, separated by religion, nationality or culture. Now, for the first time since the Roman Empire, Europe is succesfully striving for unification following the wise maxim of Sallustius on the power of concord.

This progress is taking place on many levels. The European Union has grown steadily. It last accepted new members in 1995 and is already planning the next enlargement. At the same time the prospective members are altering their legal and economical structures to meet the demands of EU and to attain the same standard of living that already prevails inside EU. In the same way, the attitude towards science and research is growing throughout Europe. Under economic pressure this too often means a more shortsighted policy and increased cutting of the resources for research.

Seeing the dangers of this development to the whole of Europe, a group of scientists published a call to European scientists on April 22, 1996 for the creation of a large, multidisclipinary movement for the promotion of science and technology in Europe. By choosing the number of signatories to be thirteen, a number avoided by the superstitious, they aptly manifested that the movement is not based on emotion but on a rational evaluation of the situation. Mathematics was represented in The Thirteen by Jean-Pierre Bourguignon, the president of EMS. This movement was proposed to take the form of an open association called Euroscience.

There are already several organisations defending science. The aim of Euroscience with respect to already existing bodies such as universities, research institutes, government agencies and learned societies would be to form an association of scientists actively involved in research and education representing all areas of science and engineering, including social sciences and humanities. In addition it is intended that a significant number of people whose interests or activities are associated with science would join Euroscience. Thus it could have the same sort of influence as the American Association for the Advancement of Science on the other side of the Atlantic Ocean.

In a short period of time, over one hundred people gave their support to the movement by expressing their will to be among the founding members of the society. With this encouragement the initiative was presented in Nature in November 14, 1996 by the following introduction: "This association for science and society in Europe deserves antenatal support." An article of Francoise Praderie gave a clear synopsis of the aims and means of Euroscience.

In the wake of this article, the initiative received a significant amount of support. Encouraged by this, the group of initiators called the foundation meeting of Euroscience. The meeting took place in Strasbourg on March 15-16, 1997. The European Mathematical Society was well represented: Jean-Pierre Bourguignon, Andrzej Pelczar, Mireille Chaleyat-Maurel and myself were all present. Of the 192 founding members, over a hundred participated.

The meeting was very lively with much positive debate on the aims and means of Euroscience. Three main items were identified for attention, namely
* the future for young scientists,
* ways and means to strengthen scientific collaboration with Eastern European countries,
* accountability of scientists to European society; industry and other social demands.

In addition several other themes were presented for the initiative of Euroscience. Among them were the wish to influence science policy and to increase public awareness of science, to foster interdisclipinary research, to create science policy databases, to create a new scientific media, and to increase scientific literacy. The problems faced by women in science were also mentioned.

Based on this multitude of ideas, a practical programme for the work of the society was presented by Jean-Pierre Bourguignon. The well-thought entirety included, amongst other things, establishing working groups for the key points, good contacts with other bodies with similar aims (like EMS, I suppose), good record keeping, data collecting and a publication of a bulletin. As an ambitious aim for Euroscience, Bourguignon set a target of 1000 members within a year, increasing to 5000 after two years.

The weekend meeting turned out to be too short for completing all the intended tasks. For instance, the statutes were accepted only in principle. Their final form will be prepared incorporating the comments made at the foundation meeting and will be presented for acceptance later on. Despite some protests, the election of the first governing board was also decided to be staged at a future date in two parts: firstly 17 members will be elected by postal vote; secondly, the elected board will invite eight more members onto the board. However, the most important decision was taken: the meeting decided unanimously to found Euroscience for the benefit of Europe and science.

Strasbourg is an appropriate site for the foundation of an association with Pan-European aims. Its history is a constant reminder of the hazards of dividing Europe and its presence is a testament for the work for the whole of Europe. Strasbourg also offered a reminder of the turbulent past and of an alternative future of Europe. A week later the city was a scene of a party meeting of the National Front. Jean-Marie Le Pen was preaching isolation and separation; violent demonstrations erupted. There is still a lot to do for the real unification of Europe.

The election of the first governing board was completed in the first half of April. In the ballot of April 17 it was seen that the will of electors produced a board fairly balanced in age, gender and occupation. The board has already started the organisation of Euroscience and the work to achieve its aims. In this task it needs the support of all people interested in the well-being of science and the evolution of Europe. The board invites all such persons to join Euroscience and to take part to the success of this enterprise.

Euroscience
Provisional address:
Dr. Francoise Praderie
Observatoire de Paris
61, Avenue de l'Observatoire
F-75014 PARIS

http://www.iway.fr/sc/tribune/eurosc.htm

Diderot Mathematical Forums

During the last Executive Committee meeting in Vienna, it was decided to establish lists of experts who would be able to assist in the development of the Diderot Mathematical Forums (DMFs). It became apparent during the preparation for the second DMF that such lists of experts would be very helpful to the organisers in their tasks of finding speakers, determining sites and developing topics and themes.

As a start, it would be helpful if members of the EMS were to suggest names of people who would be suitable for inclusion in these lists and also to send ideas and comments about the development of the DMF - topics, locations, resources required - to Professor Mireille Chaleyat-Maurel (mcm@ccr.jussieu.fr). The following themes have been suggested for forthcoming DMFs:

Mathematics as a force of cultural evolution
Mathematics and Music
Mathematics and Medicine
Mathematics and Risk
Mathematics and Networks
Mathematics and Forecasting
Mathematics and Art
Mathematics and Space
Mathematics and Climate
Mathematics and Telecommunications
Mathematics and Energy

Your comments, thoughts and ideas on these proposals will also be gratefully received.

A "Mathematics Rally" In Primary School: A Problem-Solving Experience

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François Jaquet - IRDP (Institut Romand de Recherche et de Documentation Pédagogiques) P.B. 54 - CH-2007 Neuchâtel

Summary: a "Mathematics Rally" is a competition based on problem-solving which is an enhancing activity for both pupils and teachers. In this communication, we analyse the educational aims of such an activity, the quality of the terms of the problem, the strategies adopted by the pupils and the evaluation of their work.

INTRODUCTION

Several reasons exist for teaching/learning by solving problems and nowadays there is a large amount of relevant literature.

In this "Mathematics Rally", the idea is that of a class competition: the whole class has to produce a unique solution for each given problem. As there are too many problems for a single pupil, it is necessary for the pupils to work in groups.

In 1992, Math-Ecole (a Swiss French-speaking review for teachers of mathematics) proposed an initial challenge of mathematical problems for 3rd, 4th and 5th grade classes. Interest for this project developed quickly and two years later some Swiss-Italian classes participated too.

SOME EDUCATIONAL AIMS

To solve problems is to do mathematics

Learning mathematics, as we well know, is not merely the mastering of technical calculations or book-learning. Solving problems constitutes the aim and the foundation of learning by experience; it gives a significance to situations that are to be solved using mathematics. The context of the rally is stimulating, the problems proposed are considerable and original, the pupils become involved and learn to be responsible. In fact, the problems proposed are not simply applied exercises from the last chapter that was studied, but original situations to be solved mathematically: pupils have to transfer their personal knowledge to different ambits or create new tools.

Today, the ability of working in a group is essential

In today's society, it is more and more important to work in a group; this means being able to: divide up the work, manage time, suggest ideas, accept other pupils' ideas and cope with various points of view. In this rally, there are too many problems for a single pupil to solve, but the rules of the game assure co-operation and development of interaction among the pupils.

Confrontation is a source of renewal

Pupils, teachers and mathematical activities in the classroom are all stimulated by the external contribution of problems. There are new ideas, new paths to explore, exchanges, comparisons, challenges, group analysis, etc. The rally is not only a competition, it is also the occasion to analyse in detail the results, to give prominence to different procedures, representations and difficulties.

WORKING OUT PROBLEMS

In this kind of rally, the first thing to consider is the selection of problems – which have to satisfy certain criteria of quality.

The language for the terms of the problem must be clear and rigorous in order to avoid misunderstanding arising from local habits; the style must be adapted to the pupils' language but differ from the traditional stereotyped school exercises. From the mathematical point of view, we must be sure of the existence of one or more solutions and that the required knowledge matches the pupils' development. From the didactical point of view, it should be possible for the problems to be done within the school curriculum, using different strategies and representations, with difficulties at different levels (so that everybody can do something). It is important to be able to interpret the pupils' different procedures, especially procedures with typical mistakes that reveal the pupils' conceptions and models. The problems must be completely original.

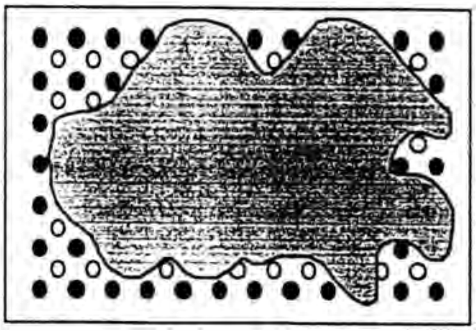
'A PRIORI' AND 'A POSTERIORI' ANALYSIS

An 'a priori' analysis is controlled by the teachers' teams who work out the problems: the choice of the activity within the ambit, the description of the task and expected strategies, the definition of the assessing criteria. The comparison between the 'a priori' analysis and the 'a posteriori' one is fundamental: i.e. the interpretation of unexpected strategies, the analysis of all the strategies and arguments of the pupils, the statistical comparison, etc. This activity also helps to spotlight the pupils' difficulties and misconceptions.

The teacher knows where he/she stands concerning the development of classroom mathematics.

AN EXAMPLE : THE STAIN

Toto spilt the pot of jam onto the beautiful spotted tablecloth.
How many spots are completely covered by the jam?
Show how you found your solution.



Classes involved

This problem has been proposed to 84 classes (71 in French speaking Switzerland and 13 in Parma- Italy) of primary school: 17 third grades (8-year-old pupils), 19 fourth grades (9 year old pupils) and 48 fifth grades (10-year-old pupils).

Terms of the problem

Before arriving at the actual terms of the problem, we had to modify the first proposition based on a previous model, because that previous model had already been used in last year's rally (in French-speaking Switzerland). In order to get an original and more complex problem, we figured out two types of "spots" that compelled the pupils to do two different operations. The two colours, on the other hand, helped with their separation.
The stain had to be big enough for the strategy of successive multiplications, additions, then the substraction of the remaining spots, to be clearly more profitable than drawing and counting the hidden spots. But it was difficult to find the right shape and size of the stain, as we needed an almost complete line and column of spots.

Expected answers and marks accorded

For that particular problem, the number of marks accorded to the the different types of answers are not exactly the same for the two teams (Swiss/CH and Italian/IT):

- correct answers with explanations, calculating first the total number of spots by multiplying/adding (7x12) + (6x11) = 84 + 66 = 150, then substracting the number of visible spots : 150 - 48 = 102 — 4 points (CH + IT)
- correct explanation but a mistake counting the visible spots (47 or 49) giving the answers 101 or 103 — 3 points (CH), 2 points (IT)
- correct number of invisible spots (102), but without any explanation — 3 points (CH + IT)
- a mistake in counting the visible spots, giving a remaining number of invisible spots of 101 or 103 — 2 points (CH), 1point (IT)
- calculating the total number of spots by multiplying 13 x 23 = 299, then giving the number of invisible spots of 299 - 48 = 251 — 2 points (CH), 1 point (IT)
- any other mistake of calculation or counting, one only — 1 point (CH+IT)
- any other mistake of calculation or counting, more than one — 0 point (CH + IT)

Analysis of the results and evaluation

In the first category of answers (4 points), we find 44% of all the classes: 35% in 3rd, 42% in 4th and 48% in 5th.
The aim was, of course, to observe the progression from an elementary strategy, where the hidden spots were just counted, to a more elaborate one, where the number of hidden spots was calculated by the substraction of the visible spots from the total number of spots. The most effective strategy was the last one. Very few classes counted the 102 hidden spots, this method often led to counting mistakes: we drew the missing spots, covered by the stain, following the order of the ones that are not covered, and we found 101.
Contrary to the problems previously analysed, this one proved to be more difficult as 37% of the classes made more than one mistake, either of counting or of methodology.
Among the bad strategies of calculation of all the spots, the multiplication 13x23 was planned and was used by about ten classes. Nonetheless, the most frequently found mistake, made by 20% of the classes, had not been foreseen in

the 'a priori' analysis: it was the sequence of operations (7x12) - 48 = 36 which didn't take into account the white spots in the multiplication, but only in the substraction.
We see, in that mistake, more than just simple forgetfulness: it seems that we have here a didactical obstacle to overcome, brought about by habit (or the "theorem-in-action") consisting of multiplying the number of objects situated along the length of any rectangle by the number of objects situated along its width. There are 12 spots along the length and 7 along the width (12 x 7 = 84) and 48 spots without jam (84 - 48 = 36), or : the two borders are counted and make 7 x 12 = 84.

Developments and ties with the programme

This activity belongs to the field of problem- solving where addition (substraction) and multiplication are combined. In the Italian programmes we find the aim: "Recognise mathematical situations in day by day experiences and in classroom-experiences while formulating and justifying hypotheses of solutions by using the appropriate mathematical tools, either arithmetical or of another type".

Final comments

In most cases, the teachers who were invited to take part in the rally with their classes expressed at first their fear about working in groups, which so far had not been much explored was problem-solving. The skills that pupils can develop when working in groups are generally understated, the biggest fear was that conflict or episodes of over-confidence could take place. Indeed, during the first "training tests", the discussion, which was quite lively within each group, sometimes caused conflicts among the pupils and tested the authority of the leaders. On the other hand, as the teachers unanimously stated, the rules of the discussion gradually became clearer and the organisation of the groups improved during the various rounds of the rally. Eventually the teachers' fears turned into enthusiasm and a wish to continue. An important aspect of the rally is also linked to the oppotunity of continuing without the teacher's help: one must make decisions on the answers to be given, which implies the pupils' resort to substantive argument in order to support their statements and then leads to the validation of the mathematical activity. These are didactical aspects that concern all levels of schooling. Therefore this year (1997) the rally has been extended to middle school. Their resulting experience will certainly offer guidance on the possible extension to upper secondary school.

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The Ferran Sunyer i Balaguer Prize

Ferran Sunyer i Balaguer (1912 – 1967) was a self-taught Catalan mathematician who, in spite of a serious physical disability, was very active in research in classica Mathematical Analysis, an area in which he acquired international recognition.

Each year, in honour of the memory of Ferran Sunyer i Balaguer, the *Institut d'Estudis Catalans* awards an international mathematical research prize bearing his name. This prize was awarded for the first time in April 1993. the competition is open to all mathematicians, subject to the following conditions:

(1) The prize will be awarded for a mathematical monograph of an expository nature presenting the latest developments in an active area of research in Mathematics, in which the applicant has made important contributions.

(2) The monograph must be original, written in English, and of at least 150 pages. In exceptional cases, manuscripts in other languages may be considered.

(3) The prize, amounting to 1,800,000 pta, is provided by the Ferran Sunyer i Balaguer Foundation. The winning monograph will be published in Birkhäuser Verlag's series "Progress in Mathematics", subject to the usual regulations concerning copyright and author's rights.

(4) The winner of the prize will be proposed by a Scientific Committee consisting of:
Prof. Friedrich Hirzebruch (Max-Planck Institut)
Prof. Paul Malliavin (Université de Paris VI)
Prof. Joseph Oesterlé (Université de Paris VI)
Prof. Joan Solà Morales (Universitat Politècnica de Catalunya)
Prof. Alan Weinstein (University of California at Berkeley)

(5) Monographs should be preferably typeset in TeX. Authors should send a hard copy and two disks containing the DVI and PostScript files, together with a letter of submission to the following address before December 5, 1997:
Institut d'Estudis Catalans
Apartat 50
08193 Bellaterra
Spain
Electronic mail: crm@crm.es

(6) The name of the prize-winner will be announced in Barcelona in April 1998.

(7) The submission of a monograph implies the acceptance of all of the above conditions.

(8) For further information on the *Ferran Sunyer i Balaguer* Foundation, see Web: http://crm.es/info/ffsb.htm

The Fifth Ferran Sunyer i Balaguer Prize

The *Institut d'Estudis catalans* awarded the fifth Ferran Sunyer i Balaguer Prize to A. Böttcher and Y.I. Karlovich on April 22 for their monograph entitled **Carleson Curves, Muckenhoupt Weights, and Toeplitz operators.**

The awarded monograph is a self-contained exposition of the spectral theory of Toeplitz operators with piecewise continuous coefficients, to which the authors have significantly contributed. It also covers topics such as Carleson-David curves, Muckenhoupt weights, weighted norm inequalities, Cauchy singular integrals, Wiener-Hopf factorisation and Banach algebras generated by idempotents.

The prize consists of 1,800,000 pta. The monograph will be published in Birkhäuser Verlag's series "Progress in Mathematics".

THIRD EUROPEAN CONGRESS OF MATHEMATICS

Barcelona, July 10 to July 14, 2000

As already announced in previous issues of the Newsletter, the third ECM will be organized in Barcelona by the Catalan Mathematical Society, under the auspices of the European Mathematical Society. The following persons have agreed to preside over committees.

President of the Scientific Committee: Sir Michael Atiyah

President of the Prize Committee: Jacques-Louis Lions

President of the Round Table Committee: Miguel de Guzmán

The Organizing Committee, nominated by the Catalan Mathematical Society, consists of Ll. Alsedà, J. Amorós, C. Broto, J. M. Brunat, M. J. Carro, T. Crespo, J. M. Font, G. Lugosi, J. Moncasi, A. Palanques-Mestre, J. Saludes, O. Serra, F. Utzet, M. València, J. Verdera, and S. Zarzuela. Their tasks are coordinated by an Executive Committee with the following members:

President: Sebastià Xambó (sxd@ma2.upc.es)
Secretary of Organization: Marta Sanz (sanz@cerber.mat.ub.es)
Infrastructure: Ferran Puerta (puerta@ma1.upc.es)
Programming and Activities: Rosa Maria Miró (miro@cerber.mat.ub.es)
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The congress web site contains preliminary information at http://www.iec.es/3ecm/

EUROPEAN NEWS: Country by Country

CZECH REPUBLIC

Sixth International Spring School
Nonlinear Analysis, Function Spaces and Applications
Prague, May 31 – June 6, 1998

The sixth spring school, which continues the series of preceding five schools, organized by the Mathematical Institute in 1978, 1982, 1986, 1990, and 1994, will take place in Prague from Sunday, May 31 (the day of arrival) to Saturday, June 6, 1998.
The school will concentrate on survey lectures on the topics listed in the title. The invited speakers

V.I. Burenkov (Cardiff, UK)
F. Cobos (Madrid, Spain)
V.G. Maz'ya (Linköping, Sweden)
L. Pick (Prague, Czech Republic)
C. Sbordone (Naples, Italy)
H. Triebel (Jena, Germany)
I.E. Verbitsky (Columbia, MO, USA)
W.P. Ziemer (Bloomington, IN, USA)

will deliver a series of four lectures each. In addition to the main lectures there will be a limited possibility of short communications and a poster session.
For registration and for further information please contact A. Kufner (Chairman of the Organizing Committee) or L. Pick (Secretary), Mathematical Institute, Academy of Sciences, Žitná 25, 115 67 Praha 1, Czech Republic; e-mail address: pick@mbox.cesnet.cz

FRANCE

Instructional Conference On Algebraic Independence
Luminy, France, 29 September-3 October 1997

AIM. In the past two years some remarkable progress has been made in transcendental number theory. Barre'-Sirieix, Diaz, Gramain and Philibert proved that the modular function J assumes transcendental values at algebraic points q with $0 < |q| < 1$. Nesterenko extended their method and proved a series of algebraic independence results, for example the algebraic independence of π and e^{π}. Nesterenko's results have been used to derive an algebraic independence result which implies that the infinite sum of the terms 2^{-n^2} $(n = 1, 2, ...)$ is transcendental. The aim of the present instructional conference is to enable primarily graduate students and post-docs to get acquainted with the new methods and results. The lectures will make a full course.

LECTURERS: F.Amoroso (Pisa), M. Laurent (Marseille), Yu.V. Nesterenko (Moskva), P. Philippon (Paris), D. Roy (Ottawa), M. Waldschmidt (Paris).

INFORMATION. R. Tijdeman, Mathematisch Instituut RUL, P.O. Box 9512, 2300 RA Leiden, The Netherlands
e-mail: tijdeman@wi.leidenuniv.nl
WWW: http://www.math.jussieu.fr/ miw

FINLAND
VII JYVASKYLA INTERNATIONAL SUMMERSCHOOL
August 4-22, Jyväskylä, Finland

COURSES ON MODERN DYNAMICAL SYSTEMS

Lectures:
Peter Gacs (Boston) : Reliable cellular automata with selforganisation, Aug.4-8 (10 hours)
Bodil Branner (DTU, Lyngby): Quasiconformal surgery in holomorphic dynamics, Aug. 11-15 (10 hours)
Thierry Gallay (Orsay, Paris): Introduction to extended dynamical systems, Aug. 11-15 (10 hours)

Workshop on modern dynamical systems Aug. 9-10

These courses are EU-funded. The citizens of EU-countries or Norway or Israel can get EU support for the travel and living expenses.
For more information and registration see www-pages at the address
http://www.jyu.fi/summerschool/

GEORGIA
Tbilisi International Centre of Mathematics and Informatics (TICMI)
Advanced Course on Pseudodifferential Operators and Their Applications 1
25 June-5 July 1997, TICMI (Tbilisi)

Roland Duduchava (University of Tbilisi, Georgia)

PSEUDODIFFERENTIAL EQUATIONS ON MANIFOLDS WITH SMOOTH BOUNDARY: SOLVABILITY, ASYMPTOTICS OF SOLUTIONS, APPLICATIONS

Summary:
Pseudodifferential operators (PsDOs) on manifolds (definition, properties). Boundedness of PsDOs in anisotropic Sobolev spaces with weight. Factorisation of matrix elliptic symbols and Fredholm properties of PsDOs. Asymptotics of solutions to elliptic systems of pseudodifferential equations. Application to some problems in elasticity.

B.-Wolfgang Schulze (University of Potsdam, Germany)

THE PSEUDO-DIFFERENTIAL CALCULUS FOR SINGULAR AND DEGENERATE OPERATORS

Summary:
The lectures present the basic methods of PsDOs for solving elliptic and parabolic problems on configurations with singularities (conical, edge, corners, cuspidal etc.). Essential tools are the Mellin transform, meromorphic operator-valued symbols and weighted wedge Sobolev spaces with asymptotics. The calculus is aimed at constructing parametrices or inverses with the calculus and to illustrate the connection to concrete models in applied sciences.
Coordinator: George Jaiani

ADVANCED COURSE ON THEORY OF ELASTICITY 2

Date: 16-25 September 1997
Location: TICMI Tbilisi
Veronique Lods, Gerard Tronel (Universite P. et M.Curie, France)

THREE- AND TWO-DIMENSIONAL ELASTICITY

Summary:
During the past decades, substantial progress has been made in the mathematical analysis of three-dimensional elasticity and in the understanding of the two-dimensional linear and nonlinear theories of plates and shells by means of the technique of asymptotic analysis. The lectures will thoroughly review these recent developments.
Tamas Vashakmadze (University of Tbilisi, Georgia)

ON THE CONSTRUCTION OF A MATHEMATICAL THEORY OF ANISOTROPIC NONHOMOGENEOUS ELASTIC PLATES AND SHELLS

Summary:
Construction of finite models (e.g. such as von Karman, Reissner, Kirchhoff etc) without simplifying hypotheses. Investigation of problems of error estimation, convergence and effective solvability of two-dimensional models corresponding to the reduction methods (e.g. Theories of Vekua, Babushka). Some similar generalisations for piezoelastic and electric elastic plates and shells. New numerical processes for solving of some two-dimensional problems in above sense.
Coordinator: George Jaiani

These courses are suitable for advanced graduate students or recent Ph.Ds. The participants will also have an opportunity to give 20-minute talks on their own work at a mini-symposium which will take place during the Advanced Course. Lectures and abstracts of the talks will be published and distributed among the lecturers and participants after the Advanced Course. The registration fee for participants is 400 USD which includes all local expenses during the Advanced Course. A restricted number of participants will be awarded grants.

Further information:
TICMI,Vekua Institute of Applied Mathematics of Tbilisi State University, University Str. 2, Tbilisi 380043, Georgia
e.mail:jaiani@apmath.acnet.ge or gmu@imath.acnet.ge
Fax:00995 32 304697
Tel.:00995 32 303040

PORTUGAL
1st International Meeting on Geometry and Topology
Braga, (Portugal), September 11-13, 1997

The Conference consists of one hour lectures given by the following invited speakers:

W. Ballmann (Bonn, Germany)
D. Salamon (Warwick, England)
R. Osserman (Berkeley, USA)
A. Verjovsky (Lille, France)

The programme of the Conference will also include sessions for short communications (30 minutes) and posters.

Scientific Committee:
L. A. Cordero (Santiago de Compostela), F. Craveiro de Carvalho (Coimbra), J. Eells (Cambridge), A. Machado (Lisboa), L. Magalhães (Porto), S. A. Robertson (Southampton).

Local organization:
Ana Pereira do Vale
Centro de Matemática da U.M. - Campus de Gualtar 4710 Braga Portugal
e-mail: avale@math.uminho.pt
fax: 351-53-678982

There is also information on the following adress:
http://www.math.uminho.pt/~mat/mgt97/mgt97.html

SPAIN

Advanced Course on Statistical Inference for Mathematical Finance Centre de Recerca Matemàtica, Campus of the Universitat Autònoma de Barcelona, Bellaterra, Spain, November 17 – 22, 1997

Speakers: M. Sorenson, Aarhus University – "Statistical Inference for Diffusion-Type Models"
J. Nielsen, Aarhus University – "Pricing and Hedging in Continuous-Time Finance"

The lectures will be held in the morning; afternoons will be devoted to complementary activities (problem sessions, expository talks, seminars).

Coordinators: Joan del Castillo and Pere Vinyolas

Registration Fee: 20.000 pta.
Deadline: September 20, 1997
Grants: The CRM can offer a limited number of grants covering the registration fee. The deadline for applying is August 31, 1997.
Payment: Payment for registration should be made by September 20, 1997.
Further information: www http://crm.es or mail crm@crm.es

Workshop on Stochastic Processes in Financial Markets Dates: November 13 and 14, 1997 Borsa de Barcelona

Organisers: Centre de Recerca Matemàtica and Borsa de Barcelona

Symposium on Discrete Dynamical Systems in honour of Wieslaw Szlenk August 25 – 28, 1997 Centre de Recerca Matemàtica, Campus Universitat Autònoma de Barcelona, Bellaterra, Spain

Organising Committee:
Lluis Alsedà (Universitat Autònoma de Barcelona, Jaume Llibre (Universitat Autònoma de Barcelona), Michal Misiurewicz (Indiana University - Purdue University)

Tentative list of speakers: Alseda, Ll., Baldwin, S., Balibrea, F.,
Blokh, A., Boyland, P., Fagella, N., Krzyzewski, K., Ledrappier, F.,
Llibre, J., Los, J., MacKay, R., Manning, A., Nowicki, T., Nunes, A.,
Przytycki, F., Siani, Ya., Smital, J., Tresser, Ch., Franks, J., Manosas, F., Urbanski, M. Gambaudo, J.M., Melo, W. de, fan Strien, S.,
Guaschi, J., Miusiurewicz, M., Walters, P., Jakobson, M.V., Newhouse,
S., Wojtkowski, M., Katok, A., Nitecki, Z., Young, L.S., Keller, G.

Aim: The interest of the symposium will be focused on systems in spaces of dimension one (intervals, circles, trees and graphs) and higher (tori, spheres, discs and other manifolds). The aim of this symposium is twofold: on the one hand, we would like to summarise the progress made in this field, and on the other to explore new directions. People working in this area will have the opportunity to exchange ideas.

Information: Please contact to crm@crm.es or you can also use the web site: http://crm.es/info/sdds.htm

Problem Corner

Paul Jainta, Werkvolkstr. 10, D-91126 Schwabach, Germany

Drawing morals from orals

The special feature of the Leningrad Mathematical Olympiad

The problems facing Russia following the collapse of the Soviet Empire are well documented in the press. But we need have no fears that there remains little worth emulating! We can recognise many worthwhile aspects of their society, not least, for example, in the field of teaching and promoting students. Mathematics contests in Russia are still intellectually very demanding and held in high esteem. Previously, in the newsletter no 22, I outlined the essentials of the Leningrad Mathematical Olympiads (LMO) but I omitted one fundamental aspect: The Oral Rounds. These are a special feature and yet are hardly known in the rest of the (Western) mathematical community. This state of affairs should be altered, for the LMO is the only official competition in Russia (and perhaps the world) in which the final rounds are held viva voce. Adopting this idea could open up entirely new vistas elsewhere.

Before giving more details on these orals, it is necessary to discuss the structure of the LMO. The Olympiad is divided into four levels, or rounds:

1. School level for the top six grades, is held at local schools in December and January.
2. Regional level, takes place in each of the 22 Leningrad regions in February.
3. All-city level, the main round, runs in February and March.
4. Final level, the elimination round, brings the competition to an end in March.

The Olympiad certainly does not resemble an entrance exam with mountains of papers and dead silence. It resembles more a spontaneous conversation between contestants and jury members. Participants in the oral rounds of the LMO receive a written list of problems but are not obliged to write down their solutions. Instead, any competitor with a proposed solution to one or more problems elaborates this to a jury member orally (and must be prepared to answer all questions posed by the jury). There are usually 40-60 jurors, mostly students, graduates, and professors of the St. Petersburg State University waiting for the competitors. Each juror records a score of plus or minus for a right or wrong solution and the contestants have three chances to solve each problem. The high level of the problems, especially in the elimination round, requires the jurors to exercise extreme accuracy and precision in accepting solutions. They traditionally work in pairs. The contestants standing is based on how many problems they solve. It happens, sometimes, that the participants solve only a few of the problems, which is not the case in many other competitions.

Main Round

The overall main round consists of six or seven problems, and the complexity of the problems usually increases from first to last though not all problems are offered to all competitors. At the beginning of this round, all participants sit in preliminary classes, where the first four problems are written on the blackboard or presented on paper. Two or three additional problems are posed in an "outer" class only, after three preliminary problems have been solved. The first two problems - the so-called consolation problems - are chosen so that a majority of the contestants are able to cope with them. The last one or two problems are really tough nuts to crack. Nevertheless, at least one participant usually solves all the problems at that level.

Participants

The LMO jury invites many candidates to take part in the competition: the winners of the second- level (regional) contests of the current year; all students who received diplomas of the first three degrees of the previous year's junior Olympiad; and all the students who received diplomas of the first two degrees of the previous year's senior Olympiad. In addition the first-prize winners of the eighth-grade Olympiad are invited to participate at the ninth-grade Olympiad. Those contestants who achieve the best results in the main round are encouraged to compete in the elimination round.

Elimination Round

Unlike the main round, the elimination final level is not divided into preliminary and "outer" parts, and it consists of eight or nine problems instead of six or seven. Most of the contestants in this round are students attending special mathematics and physics schools, and who have taken part outside of school in an informal "maths circle". These are a kind of seminar devoted to problem solving or to investigating certain areas of elementary and higher mathematics that are not covered in the school curriculum. A maths circle is a standard form of out-of-school mathematics education in the former Soviet republics, and many mathematicians and teachers are identified in such coteries. This is why the problems in the elimination round of the LMO can be so challenging. Often, at this level some problems are not solved at all.

Upshot

The entire oral format of the LMO seems really tempting. And there isnt much that can be said against it: for example, any misjudgements made by jurors in accepting and erroneous solution cannot be altered once the Olympiad is over - the only chance to correct an unjustified score is during the course of the contest. But the following advantages of its construction surely outweigh its drawbacks:

- Direct communication between competitors and jurors demands the use of correct mathematical language;
- There is the possibility of rectifying mistakes during the Olympiad and even of changing one's point of view on a question;
- Time is not wasted in writing down solutions or in proving well-known facts used in explanations;
- Scores are obtained quickly and winners can be identified immediately after the end of the event.

I was most affected by another aspect of the contest: when I first came across this competition I was awe-struck by the novelty of the problems. When browsing through the questions, there were many times when I just had to stop reading because I wanted to work on the problem I had just read or I just had to drop everything to steal a glance at the solution. As an avid problemist as well as editor of two problem corners, I see hundreds of problems every year, but somehow these problems seemed different. They have some indescribable property that I can't put into words that somehow makes them different from most of the problems I stumble across in Western contests. Perhaps it is because we, in the Western part of the globe, have had insufficient contact in the past with the educational system of the former Soviet Union.

Mathematicians, problemists, students and educators should all benefit from these challenging questions. One difference that can be noted between these problems and those of contests in Europe (or overseas) is the large number involving mathematical games. (See question no. 69 in this issue.) Pedagogically, I feel such problems draw a student into trying to find the winning strategy and so help make mathematics fun, useful and interesting. Another difference is the dearth of problems involving probability or trigonometry. Is this some significant cultural difference or is it just an accident due to the small sample I possess?

Whatever makes these problems different from the usual, I am pleased to offer you now six representative types as an instance of each of the stages of the LMO.

Q. 69 A pile of 500 matches is given. Two players play the following game. In one turn, each player can take from the pile 1,2,4,8,... (any power of 2) matches. The player who cannot move loses. Assuming perfect play, who will win this game ? (Main Round 1987, Grade 5)

Q. 70 Several (but no fewer than two) nonzero numbers are written on a blackboard. One may erase any two numbers A and B and then write the numbers $A+\frac{B}{2}$ and $B-\frac{A}{2}$ instead of them. Prove that the set of numbers on the blackboard, after performing any number of the preceding operations, cannot coincide with the initial set. (Main Round 1989, Grade 6)

Q. 71 An astronomer added all the distances between 50 stars that he observed with a telescope. The result was S. Suddenly a cloud obscured 25 of the stars. Prove that the sum of the distances between the 25 visible stars is less than $\frac{S}{2}$. (Main Round 1987, Grade 9)

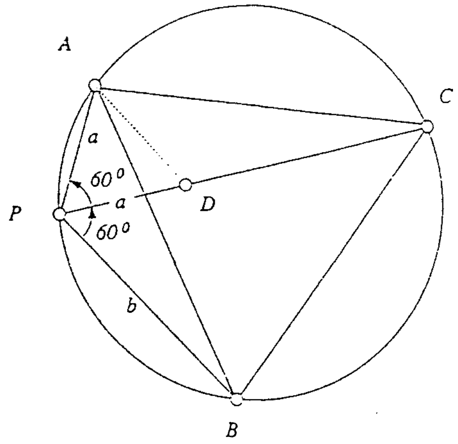
Q. 72 After a chess tournament was over, it was found that each pair of players had played together exactly k times and that the scores of the participants were the consecutive terms of a geometric progression with a common ratio equal to a natural number greater than 1. (Note: Each player received 1 point for a win, $\frac{1}{2}$ point for a draw).

How many chessplayers could have taken part in the tournament if a) $k=1989$ b) $k=1988$?
(Main Round 1989, Special Schools (Written Problems), Grade 9)

Q. 73 All possible sequences of seven digits are written down one after another in a row, in any order at all, to form a 70,000,000-digit number. Prove that this number is divisible by 239.
(Elimination Round 1989, Grade 9)

Maybe you have appreciated the Russian way to work out a problem. If so, then I am able to encourage you to pit your wits against the teasers from St. Petersburg. When you find you are successful with these problems, I hope you will then find a further challenge with the problems in this section in general. Actually, solutions do add piquancy to the problem corner in a way. So, there is no time for procrastination to talk about the problems taken from the newsletter no. 22. Yet before we commence discussion here

is another struggler to question 54 submitted by **Oddvar Iden**, Mathematisk Institutt, Universitetet Bergen, Norway. The Norwegian problemist shared an office for four weeks in '88 with *Claudio Bernardi,* who first solved this problem. Possibly that has nagged at him, so he gave a second and even simpler illustration of a proof without words.



Q 54. ABC is an equilateral triangle inscribed in a circle. The distances from a point X on the circle to A, B and C respectively are a, b and c, where $a \geq b$ and $a \geq c$. Prove that $a = b + c$.

Solution Consider the rotation of centre A and angle 60^0 that maps *PB* onto *DC*. See the figure.

Q 57.Let P(x) be a polynomial with integer coefficients.
Show that if $Q(x) = P(x) + 12$ has at least six distinct integer roots,then P(x) has no integer roots.

Solution (*I didn't receive any solutions to this problem from readers. So I've tried my hand at solving the open question.*)
The six integer roots of Q(x) are denoted $x_1, x_2, \ldots, x_6$.
Then we have $Q(x) = (x-x_1)(x-x_2)(x-x_3)(x-x_4)(x-x_5)(x-x_6)\cdot R(x)$ by the *Factor Theorem* (where R(x) is a polynomial with integer coefficients according to the *division algorithm*).
Suppose P(x) has an integer root x_0. Then $Q(x_0) = P(x_0) + 12 = 12 = y_1y_2y_3y_4y_5y_6 \cdot r$, with $y_i = x_0 - x_i$, $r = R(x_0)$, which contradicts the assumption that the y_i are distinct.

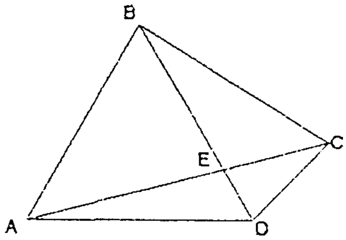
Q 58. Determine all natural numbers N whose decimal representation satisfies the following conditions:
(1) $N = (aabb)_{10}$, with $(aab)_{10}$ and $(abb)_{10}$ prime numbers ;
(2) $N = p_1 \cdot p_2 \cdot p_3$, where p_k $(1 \leq k \leq 3)$ is a prime consisting of k (decimal) digits.

Solution (Dr J.N. Lillington, *Winfrith Technology Centre,* Dorchester)
$(aab)_{10}$ and $(abb)_{10}$ prime $\Rightarrow b \neq 0,2,4,6,8$ or 5 (1) and
a and b do not have a common factor (2).
This gives $p_1 = 3$ or 7 the only possibility. Also $p_2 = 11$ since $(aabb)_{10} : 11 = 11\cdot(100a+b) : 11 = (a0b)_{10}$. Now $p_3 = (a0b) : p_1$ and $a \geq p_1$ since $(a0b)_{10} : p_1 \geq 101$.
Suppose $p_1 = 7$. Then $(a0b)_{10} : 7 = (91a+9a+b) : 7$ is an integer if and only if $9a+b \equiv 0 \pmod 7$ (3).
Now $a \in \{7,8,9\} \Rightarrow b = 0$ or 7, 5,3 by (3) which are all impossible by (1) or (2).
So $p_1 \neq 7$ and $\underline{p_1 = 3}$.
Then $(a0b)_{10} : 3 = (99a+a+b) : 3$ is an integer if and only if $a+b \equiv 0 \pmod 3$ (4).
$(a0b)_{10}$ prime $\Rightarrow$ $2a+b \neq 0 \pmod 3$ (5)
$(abb)_{10}$ prime $\Rightarrow$ $a+2b \neq 0 \pmod 3$ (6).
Now $a \neq 3,6,9$ otherwise $b \equiv 0 \pmod 3$ by (4), contradicts (5), (6).
In case of $a \equiv 1 \pmod 3$ $\Rightarrow a = 4,7$ $\Rightarrow b = 2,5$ or 8, contradicts (1).
So $a \neq 1 \pmod 3$ and $a \equiv 2 \pmod 3$, $b \equiv 1 \pmod 3) \Rightarrow a = 5, b = 7$ and $p_3 = 169 = 13^2$, impossible.

Thus $a = 8$, $b = 7$ and $N = 8877$ is the only solution. An easy check verifies that $(aab)_{10}$ and $(abb)_{10}$ are prime and $N = 3\cdot 11\cdot 269$. q.e.d.

Q 59.Prove: In a convex quadrilateral of area 1, the sum of the lengths of all sides and diagonals is not less than $4+\sqrt{8}$.

Solution (Dr J.N. Lillington)



We have $(BD+AC)^2 = 4BD\cdot AC+(BD-AC)^2 \geq 4BD\cdot AC =$
$4BD\cdot(AE+EC) \geq 8(0.5BD\cdot AE\sin E+0.5BD\cdot EC\sin E)$
$= 8(\text{area of } \Delta\ ABD + \text{area of } \Delta\ BCD) = 8.$ (1)
Similarly $(AB+BC+CD+AD)^2 =$
$4(AB+CD)(BC+AD) +[(AB+CD)-(BC+AD)]^2$
$\geq 4(AB+CD)(BC+AD) =$
$4(AB\cdot BC+CD\cdot AD+AB\cdot AD+CD\cdot BC)$
$\geq 8(0.5AB\cdot BC\sin B + 0.5CD\cdot AD\sin D + 0.5AB\cdot AD\sin A +$
$0.5CD\cdot BC\sin C)$
$= 8\cdot \text{area of}(\Delta ABC+\Delta ACD+\Delta ABD+\Delta BCD) = 8\cdot 2 = 16.$ (2)
(1) and (2) together give $AB+BC+CD+DA+BD+AC \geq 4+\sqrt{8}$. q.e.d.

Q 60.Find the greatest natural n for which there exist positive integers $x_1, x_2, \ldots, x_n$ and $a_1, a_2, \ldots, a_{n-1}$ with $a_1 < \ldots < a_{n-1}$ such that $x_1\cdot x_2\cdot\ldots\cdot x_n = 1980$ and $x_i + \frac{1980}{x_i} = a_i$ for $i = 1,2,\ldots,n-1$.

Solution (Dr Z Reut, London)
The positive integers $x_1,x_2,\ldots,x_n$ satisfy two given equations. In the first equation the product of all x_i, $i = 1,2,\ldots,n$ is equal to 1980; it follows that all x_i cannot be equal to unity. The second equation contains the term $\frac{1980}{x_i}$, and since each a_i, $i = 1,2,\ldots,n-1$, is also an integer, it follows that each x_i has to divide 1980. The second equation can be written with subscript $j = 1,2,\ldots,n-1$, and subtracted from its counterpart to give: $(x_i - x_j)\left(1-\frac{1980}{x_i\cdot x_j}\right) = a_i - a_j$. Since $a_i < a_j$ for $i < j$ by the given inequality condition, and $x_i\cdot x_j < 1980$ because of the first equation, it follows that $x_i > x_j$. The factoring in primes gives: $1980 = 2^2\cdot 3^2\cdot 5\cdot 11$. Since x_i have to be in a descending sequence, the factoring consistent with the stated conditions is:
$1980 = 1\cdot 1\cdot 2\cdot 3\cdot 5\cdot 6\cdot 11$ (for $x_{n-1}\geq 1$, $x_{n-2}\geq 2$, ..., $x_{n-7}\geq 7$, and hence $x_{n-1}x_{n-2}\cdots x_{n-7} \geq 7! > 1980$, a contradiction *The ed.*). Thus $x_1=11$, $x_2=6$, $x_3=5$, $x_4=3$, $x_5=2$, $x_6=1$, $x_7=1$, and $n = 7$. All a_i, $i = 1,2,\ldots,6$, can be calculated from the second given equation.

Q 61.For a nonnegative integer n let $a_n = \left[\left(3+\sqrt{11}\right)^{2n+1}\right]$ be the greatest integer not exceeding $\left(3+\sqrt{11}\right)^{2n+1}$ Find the greatest power of 2 that divides a_n .

First solution (Dr Z Reut)

We can write the basic expression in the form: $\left(3+\sqrt{11}\right)^{2n+1} = \left(3+\sqrt{11}\right)\left[\left(3+\sqrt{11}\right)^2\right]^n$, where n = 0,1,2,... .

Since $\left(3+\sqrt{11}\right)^2 = 9+6\sqrt{11}+\left(\sqrt{11}\right)^2 = 2\left(10+3\sqrt{11}\right)$, the basic expression is

$\left(3+\sqrt{11}\right)^{2n+1} = 3\cdot 2^{n+1}\left(\frac{1}{2}+\frac{\sqrt{11}}{6}\right)\left(10+3\sqrt{11}\right)^n$. The square root of eleven can be estimated by the inequality $3<\sqrt{11}<\frac{10}{3}$, since $\sqrt{11}>\sqrt{9}=3$, and $\sqrt{11}=\sqrt{\frac{99}{9}}<\sqrt{\frac{100}{9}}=\frac{10}{3}$. The factors in brackets are then estimated as follows: $1<\frac{1}{2}+\frac{\sqrt{11}}{6}<\frac{19}{18}$, and $19<10+3\sqrt{11}<20$; for the total factor we have

$19^n<\left(\frac{1}{2}+\frac{\sqrt{11}}{6}\right)\left(10+3\sqrt{11}\right)^n<\left(\frac{19}{18}\right)20^n$. It can be shown that the integer part of the total factor is an odd integer, and that 2^{n+1} is the greatest power of 2 which divides $a_n = \left[\left(3+\sqrt{11}\right)^{2n+1}\right]$.

Second solution (Dr J.N. Lillington)

Let $x = 3+\sqrt{11}$. Starting at $3+\sqrt{11}+(3-\sqrt{11}) = 6$, we find $3-\sqrt{11} = \frac{\left(3-\sqrt{11}\right)\left(3+\sqrt{11}\right)}{3+\sqrt{11}} = \frac{-2}{3+\sqrt{11}}$ or

$x - \frac{2}{x} = 6 = 2l_0$ where l_0 is odd (1) . Analogously we get $x^2 + \frac{4}{x^2} = 40 = 2^3\cdot 5$ (2).

$(1)\times(2) \Rightarrow x^3 - \frac{8}{x^3} + \frac{4}{x} - 2x = 240 = 2^4\cdot l_0\cdot 5 \Rightarrow x^3 - \frac{8}{x^3} - 2\left(x-\frac{2}{x}\right) = 2^4 l_0\cdot 5$

$\Rightarrow x^3 - \frac{8}{x^3} = 2^2 l_0 + 2^4 l_0\cdot 5 \qquad \Rightarrow x^3 - \frac{8}{x^3} = 2^2 l_1$ where l_1 is odd (3).

We shall have by induction on n that $x^{2n+1} - \left(\frac{2}{x}\right)^{2n+1} = 2^{n+1}l_n$ where l_n is odd.

The result is true by (1) and (3) for n = 0, 1 and so we can assume that

$$x^{2n-3} - \left(\frac{2}{x}\right)^{2n-3} = 2^{n-1}l_{n-2} \quad (4) \quad \text{and} \quad x^{2n-1} - \left(\frac{2}{x}\right)^{2n-1} = 2^n l_{n-1} \quad (5) \text{ where } l_{n-2}, l_{n-1} \text{ are odd.}$$

$(2)\times(5) \Rightarrow x^{2n+1} - \left(\frac{2}{x}\right)^{2n+1} - 2^2\left(\frac{2}{x}\right)^{2n-3} + 2^2 x^{2n-3} = 2^{n+3}\cdot 5l_{n-1}$

$\Rightarrow x^{2n+1} - \left(\frac{2}{x}\right)^{2n+1} - 2^2\left(x^{2n-3} - \left(\frac{2}{x}\right)^{2n-3}\right) = 2^{n+3}\cdot 5l_{n-1}$

$\Rightarrow x^{2n+1} - \left(\frac{2}{x}\right)^{2n+1} = 2^{n+1}l_{n-2} + 2^{n+3}\cdot 5l_{n-1}$

$\Rightarrow x^{2n+1} - \left(\frac{2}{x}\right)^{2n+1} = 2^{n+1}l_n$ where l_n is odd (6).

(6) implies the inductive hypothesis is true. Thus $a_n = [x^{2n+1}] = 2^{n+1}l_n$ and n+1 is the greatest power of 2 that divides a_n. q.e.d.

Q 62. Let **Z** be the set of all integers. Consider a function $f : Z \mapsto Z$ with the properties:

(1) $f(92+x) = f(92-x)$

(2) $f(19 \cdot 92+x) = f(19 \cdot 92 - x)$ and

(3) $f(1992+x) = f(1992 - x)$ for all $x \in Z$.

Is it possible that all positive divisors of 92 occur as values of f ?

Solution (*Again no solution was submitted to the editor, so he found himself compelled to attempt to solve the open question.*) If for two distinct integers a,b the function f satisfies the following reflection conditions $f(a+x) = f(a-x)$, $f(b+x) = f(b-x)$ for all $x \in Z$, then f is periodic, which is easily verified.

For, successively, we get $f(x) = f(b-b+x) = f(b+(x-b)) = f(b-(x-b)) = f(a-(x-2b)-a) = f(a-(x+a-2b)) =$

$$= f(a+(x+a-2b)) = f(x+2a-2b) = f(x+p)$$

$\Rightarrow f(x)$ is periodic with period $\mathbf{p = 2 \cdot (a-b)}$.

In this case first a = 1992, b = 92, and then a = 1992 , b = 19·92. The corresponding values of p are $p_1 = 2(1992-92) = 8 \cdot 475$ and $p_2 = 2(1992-1748) = 8 \cdot 61$. The greatest common divisor of p_1 and p_2, equal to 8, now can be represented in the form $k_1p_1 + k_2p_2$, for some suitable integers k_1, k_2 (that can be found by the Euclidean algorithm as is well known). So, since f is periodic with periods p_1 and p_2, it is also periodic with period 8. Thus its values on the 8-element segment {88,89, ... , 94,95} are periodically reproduced throughout all of Z. Since $f(91) = f(93)$, $f(90) = f(94)$, $f(89) = f(95)$, there can be at most five distinct values, while the number $92 = 2^2 \cdot 23$ has six positive divisors. Thus it is not possible that all positive divisors of 92 occur as values of f. q.e.d.

That completes the Corner for this issue. Please send me your contests, suggestions, and recommendations to help improve this feature.

Finally, propose problems for which readers can send in solutions. Proposals should, whenever possible, be accompanied by a solution, references, and other insights which are likely to be of help for the editor. The problems can be anything from elementary to advanced, from easy to difficult but should generally focus on contests and Olympiads and how to prepare for them. Original problems are particularly sought. So, please submit any interesting problems you came across, especially those from (problem) books and contests that are not easily accessible. But other interesting problems may be acceptable provided they are not too well-known and that references are given as to their provenance. I hereby invite my readers to share them with their colleagues and students. I welcome your input!

BRIEF REVIEWS

Edited by Ivan Netuka and Vladimír Souček. Books submitted for review should be sent to the following address: Ivan Netuka, MÚUK, Sokolovská 83, 186 00 Praha 8, Czech Republic.

J.W.S.Cassels, E.V.Flynn: Prolegomena to a Middlebrow Arithmetic of Curves of Genus 2, London Mathematical Society Lecture Note Series 230, Cambridge University Press, Cambridge, 1996, xiv+218 pp., GBP 24.95, ISBN 0-521-48370-0

Detailed knowledge of the arithmetic of curves has impact on many important mathematical problems. The rational and elliptic curves are mostly considered as understood and now the investigation of the arithmetic of curves of genus 2 is attracting growing interest. However, as the authors write in the foreword "For higher genus, existing theory is notoriously unadapted to the study of individual curves, and few have been elucidated. What is needed is a corpus of explicit concrete cases and a middlebrow arithmetic theory which would provide both a practicable means to obtain them and a framework to understand any unexpected regularities." This background philosophy is then realised as the following short characterisation of the book from its back side cover describes: "This book provides new insights into this subject; much of the material here is entirely new, and none has appeared in book form before. Included is an explicit treatment of the Jacobian, which throws new light onto the geometry of the Kummer surface. The Mordell-Weil group can then be determined for many curves, and in many non-trivial cases all rational points can be found. The results exemplify the power of computer algebra in diophantine contexts, but computer expertise is not assumed in the main text. Number theorists, algebraic geometers and workers in related areas will find that this book offers insights into the arithmetic of curves of genus 2." The book is written for beginning graduate students who have some experience of the fundamentals of algebraic geometry. It is divided into 18 chapters (and these into sections named and listed in the contents only when they start a new topic). Besides those whose contents can explicitly be deduced from the above characterisation, chapters about Weddle's surface, isogeny, and Chabauty's theorem among others can be found. As already indicated, the subject cannot be mastered without involved computation, so the authors make available programs written in MAPLE. Some of these are reproduced in the book (Appendix I), and for the rest there is a good description of how and from where they can be downloaded by ftp (Appendix II). The book is written in a very clear and fresh style; it is well worth careful reading and gives an excellent idea about the many directions and methods used in the subject. (šp)

R.Dedekind: Theory of Algebraic Integers, Cambridge Mathematial Library, Cambridge University Press, Cambridge, 1996, vii+158 pp., GBP 14.95, ISBN 0-521-56518-9

Dedekind's theory of ideals is a highlight of classical number theory. On the other hand, it was the beginning and the source of abstract algebra and it brought infinite sets to the very heart of mathematics. For these reasons, at least, it is really worthwhile to read its exposition by Dedekind himself. The present edition begins with a beautiful introduction to number theory by John Stillwell. Starting with the mathematics of Ancient Greece, it explains the problems in number theory solved by Fermat, Euler, Lagrange and Gauss. It explains how algebraic integers naturally emerged in these questions, provides an exposition of composition of quadratic forms and so on. Dedekind in his book speaks clearly about his motivation and the obstacles he had to overcome. Thus the theory emerges directly in front of you. After an introduction, the example of ring $Z[\sqrt{-5}]$ is studied and the theory is derived in this particular case. Then the general theory is evolved up to the point, when it becomes clear, what should be the definition of algebraic integers, so that the unique factorisation could be saved in ideal theory. In the meantime, concepts like a module, an ideal or a field come to existence. The book concludes with some examples taken from cyclotomic fields (including quadratic reciprocity), a proof of the finiteness of class number and representability of ideal numbers by adjoint quantities. The book is exciting and easily readable even for a beginning student and it should be exciting for experts as well. (pš)

L.Véron: Singularities of Solutions of Second Order Quasilinear Equations, Pitman Research Notes in Mathematics Series, vol.353, Addison Wesley Longman, Harlow, 1996, 377 pp., GBP 45.00, ISBN 0-582-03539-2

Let $\Omega \subset R^n$ be an open set, let Σ be a "small" subset of Ω, and consider a partial differential equation and a family F of its "singular" solutions on $\Omega \setminus \Sigma$. The singularity is called removable if the solution can be extended to a solution on Ω. The problems studied in this book are the conditions under which the singularity is removable and the asymptotic behaviour of singular solutions near Σ. The book collects results on singular solutions and removability of elliptic (Chapters 1–5) and parabolic (Chapter 6) second order quasilinear equations. The equations studied in Chapter 1 are either linear or in divergence form and their behavior is determined by the leading term, which for the general divergence form equation is of p-Laplacian growth or of mean curvature type. As removable sets, those of vanishing capacity or Hausdorff measure are examined. The appropriate kind of capacity or Hausdorff measure, respectively, depends on the growth and additional conditions to the class F (e.g. $F \subset L^q(\Omega \setminus \Sigma)$). The more particular the singular set, the more that can be said about the behaviour of singular solutions, and the results are very precise for isolated singularities. Chapters 2 and 3 investigate equations and inequalities with source or absorption terms, such as $-\Delta u \pm g(u) = f$. Chapter 4 is devoted to boundary singularities and removability results. Here a set $\Sigma \subset \partial\Omega$ is said to be removable for $-\Delta u + |u|^{q-1}u = 0$ if any solution u of the equation satisfying the Dirichlet condition $u = 0$ on $\partial\Omega \setminus \Sigma$ is the zero solution. In Chapter 5, the leading term of the p-Laplacian or mean curvature growth is combined with the source or absorption term. As mentioned above, Chapter 6 is concerned with parabolic equations. The equations studied here are similar to those studied in the elliptic part but with the additional term u_t, and the porous media equation. Besides counterparts to elliptic results, typically "parabolic" phenomena also appear. The book is a valuable guide to the variety of results on singularities and removability and methods used in this field. Some included results are classical, such as those by Serrin for example. The author is highly active in the field and a much of the material in the book comprises deep and interesting results due to him and his collaborators. The exposition is clear and well ordered. The book is strongly recommended for libraries and to specialists in elliptic and parabolic partial differential equations. (jama)

J.F.Humphreys: A Course in Group Theory, Oxford University Press, Oxford, 1996, xii+279 pp., GBP 17.50, ISBN 0-198-53453-1, ISBN 0-198-53459-0

This book is a clear and self-contained introduction to the theory of finite groups and is designed for undergraduates. The main theme of the book is the various classification problems in finite group theory. After introducing the necessary concepts, the author deals with the Sylow theorems, the Jordan-Hölder theorem, soluble groups, p-groups and group extensions. The last section contains a brief discussion of the classification of finite simple groups. Many exercises are included, most of them having been tested on students and complete solutions to the exercises are given in an appendix. Each chapter ends with a summary of the material covered and notes on the relevant history of group theory. (jt)

P.A.Gloor: Elements of Hypermedia Design. Techniques for Navigation and Visualization in Cyberspace, Birkhäuser, Boston, 1997, xvii+400 pp., DM 88.00, ISBN 3-764-33911-X, ISBN 0-817-63911-X

This book was written as a guide on how to design hypermedia documents. It covers both aspects of hypermedia - hypertext and multimedia. The first part describes tools and mechanisms for hypertext structuring: automatic comparison of documents, communication distinguishing user's knowledge level, automatic linking, searching, sequentialisation (building guides on documents), looking for similarities and building hierarchical structures and maps (including fish-eye view technology) of the text. WWW and favourite Internet searching engines are also mentioned. The second part deals with corresponding computer implementation issues. The author presents his own Cyber-Toolbox and demonstrates practical results on different documents. The Toolbox contains the Gloor/Dynes Hypertext Engine (document structuring tools) and the Cybermap (a system automaticaly generating maps of hypertext documents). Finally hierarchical maps and their reduction onto trees, both well complemented by examples, are dealt with. Part three describes algorithm animating as an example of hypermedia learning environments. The author participated in the project "Animated Algorithms" (hypermedia adaptation of the textbook Introduction to Algorithms), which is described. There are many hints on how to publish analogous documents. Some aspects of animation by scripting are also included. The fourth part presents the VideoScheme system - a LISP-like language arranged for algorithm-based multimedia editing. It contains a short overview, the main features and some simple examples that demonstrate the many uses of this tool. The final part describes the author's experience with publishing a hypermedia compilation of a scientific conference. Both versions - CD-ROM and WWW - are described with an emphasis on the comparison of these two standard platforms. With many hints and examples, this book will be useful to all people publishing or preparing to publish hypermedia (e.g. CD-ROM developers, Website designers). (dstan)

H.Salzmann, D.Betten, T.Grundhöfer, H.Hähl, R.Löwen, M.Stroppel: Compact Projective Planes. With an Introduction to Octonian Geometry, de Gruyter Expositions in Mathematics 21, Walter de Gruyter, Berlin, 1995, xiii+688 pp., 31 fig., DM 258.00, ISBN 3-110-11480-1

This book is an encyclopaedia on topological geometry. It includes the study of affine and projective planes, their incidence geometries and topologies compatible with the geometric structure. In the first part the classical projective planes (real, complex, quaternionic and octonionic) are studied in detail. The main role in the description of these planes is played by their groups of automorphisms (the collineation groups) and the structure of their subgroups. The other parts of the book are devoted to a systematic investigation and classification of general compact projective planes. One of the methods studied is that of the algebraic geometrical properties of compact connected projective planes. Important classes of planes are translation planes and Hughes planes having special geometrical properties with respect to the incidence geometry. The book contains an Appendix with a survey of facts and tools from topology, Lie theory and theory of transformation groups. There is also a comprehensive bibliography (43 pages). The theory is presented in a readable form and will be very useful for everyone interested in geometry and topology. (jbu)

O.Babelon, P.Cartier, Y.Kosmann-Schwarzbach: Integrable Systems . The Verdier Memorial Conference: Actes du Colloque International de Luminy, Birkhäuser, Boston, 1993, xii+366 pp., DM 198.00, ISBN 0-817-63653-6, ISBN 3-764-33653-6

J.-L. Verdier planned to organise a conference on integrable systems just before his tragic death. These plans were realised later: the conference 'Integrable Systems' was organised at CIRM, Luminy (France) in 1991. This book is the proceedings of the conference and it contains a high-level and representative sample of contributions covering several aspects of the theory of integrable systems. The book begins with a nice historical survey of the subject written by D.Bennequin. The tau functions of certain integrable systems are discussed in papers by L.Takhtajan, G.Wilson, L.Dickey and P. van Moerbecke. Hamiltonian formalism is used in the work by N.M.Ercolani, H.Flaschka and S.Singer, V.Guillemin and A.T.Fomenko; papers by A.Treibich, B. van Gemen and E.Previato, N.M.Ercolani, H.Knörrer and E.Trubowitz are devoted in turn to elliptic solutions of KP hierarchy, higher-order nonabelian theta functions, and to to immersed submanifolds in R^3 with constant mean curvature. The bihamiltonian approach is presented in papers by P.J.Olver and F.Magri, and by P.Casati and M.Pedroni. The contributions by E.Date and by M.Bellon, J.-M. Maillardand and C.Viallet are devoted to solvable lattice models. The final comprehensive paper by B.Dubrovin describes a connection between topological field theories and integrability of hierarchies of Hamiltonian systems. (vs)

A.Escassut: Analytic Elements in p-adic Analysis, World Scientific, Singapore, 1995, x+390 pp., \$ 94.00, ISBN 9-810-22234-3

The last decades are characterised by growing interest in p-adic techniques. p-adic analysis having its roots in number theory and algebra is no longer an amusing alternative to the world of classical analysis where no such thing as "conditional" convergence exists, with open and simultaneously closed disks and where given two disks having non-empty intersection one is inevitably contained in the other. Especially the last property of the non Archimedean fields prevents a straightforward extension of holomorphic functions. The way out was found by Krasner through Runge's theorem on approximation of holomorphic functions by rational functions. Krasner defined analytic elements as uniform limits of rational functions with no poles in given sets. The last forty years since this definition showed the usefulness of this idea and the present monograph is devoted to describing the beauty and unexpected possibilities of the development of this idea to which the author significantly contributed. The book is targetted at all who are interested in the theory of p-adic analytic functions having standard knowledge from algebra and topology (including manipulations with filters). The book is largely self-contained in the sense that no knowledge in p-adic analysis is required. However, it is hard to describe the wealth of topics covered in the book: there are 61 independently numbered sections into which the content of the book is divided. The reader will learn, for instance, about analytic elements defined as elements of the completion of rational functions with no poles in an infinite set with respect to uniform convergence, a variety of related properties of power series, Krasner extension of the Mittag-Leffler theorem, Motzkin factorization, maximum principle, p-adic analytic interpolation, p-adic Fourier transform, applications to the theory of differential equations, to mention some of them. The book can be recommended to all interested in p-adic analysis and its applications. (šp)

B.L.J.Braaksma, G.K.Immink, M. van der Put (Eds.): The Stokes Phenomenon and Hilbert's 16th Problem, World Scientific, Singapore, 1996, xii+327 pp., GBP 41.00, ISBN 9-810-22567-9

The problem of finding the number of limit cycles of polynomial vector fields in the plane is one of the unsolved Hilbert problems. This problem is closely related to the phenomenon of changes in the asymptotic behaviour of solutions of meromorphic differential equations in certain directions in the complex plane, which phenomenon was discovered for the first time by G. Stokes in 1857. A workshop held in Groningen (May 31 - June 3, 1995) was devoted to various aspects of these nice but difficult problems. The book contains 16 articles (both historically oriented and contemporary) based on the topic of the workshop. (ss)

B.C.Berndt, H.G.Diamond, A.J.Hildebrand (Eds.): Analytic Number Theory. Proceedings of a Conference in Honor of Heini Halberstam, vol.1, Progress in Mathematics, vol.138, Birkhäuser, Boston, 1996, vi+449 pp., DM 178.00, ISBN 3-764-33824-5, ISBN 0-817-63824-5

B.C.Berndt, H.G.Diamond, A.J.Hildebrand (Eds.): Analytic Number Theory. Proceedings of a Conference in Honor of Heini Halberstam, vol.2, Progress in Mathematics, vol.139, Birkhäuser, Boston, 1996, xii+442 pp., DM 178.00, ISBN 3-764-33933-0, ISBN 0-817-63933-0

These are the proceedings of an international conference held in May, 1995 at the University of Illinois to honour Professor H. Halbelrstam on the occasion of his retirement. There were nearly 150 participants, as well as invited one hour lectures given by G. Andrews, H. Halberstam, Ch. Hooley, R. Murty, J. Bourgain, R. Heat-Brown, H. Iwaniec, C. Pomerance, R. C. Vaughan, J. M. Deshouillers and, moreover, almost one hundred talks were given by collaborators, followers and friends of

Prof. Halberstam. (Most interesting from the reweiver's point of view are the contributions of P. T. Bateman, M. N. Huxley, M. Jutila and Y. Motohashi.) One of the ten invited lectures is not included in this two-volume proceedings (J. M. Deshouillers). This is a very useful publication which gives many new results in the analytic number theory. (bn)

A.Pfister: Quadratic Forms with Applications to Algebraic Geometry and Topology, London Mathematical Society Lecture Note Series 217, Cambridge University Press, Cambridge, 1995, viii+179 pp., GBP 22.95, ISBN 0-521-46755-1

This book is concerned with topics in the theory of quadratic forms that have been the research interest of the author during the past decades. The main theme is field invariants, such as: level, Pythagoras number, u-invariant. The author's aim is to show the interconnections of algebra, number theory, algebraic geometry and topology that are revealed by the theory of quadratic forms. Topics discussed include level of topological spaces, Borsuk-Ulam and Brower theorems, Tsen-Lang theory for quasi-algebraically closed field, Hilbert's 17th problem, systems of quadratic forms over arbitrary (resp. real) fields, and level of projective spaces. The author has produced a readable text, with mostly short and elegant proofs, that require little preliminary knowledge on the part of the reader. (tk)

C.Reid: Courant, Springer-Verlag, New York, 1996, vii+318 pp., DM 24.00, ISBN 0-387-94670-5

This book is a reprint of the 1976 book *Courant in Göttingen and New York* published by Springer Verlag. It presents the story of the complex personality of Richard Courant (1888 – 1972) on his way from Göttingen to New York. The mathematician as well as the organiser is described. A nice description of great mathematicians, historical facts concerning the times in Germany and the birth of the famous Courant Institute in New York is given in this fascinating and well written book. (ss)

W.Fulton: Algebraic Topology. A First Course, Graduate Texts in Mathematics, vol.153, Springer-Verlag, New York, 1995, xviii+430 pp., 137 fig., DM 48.00, ISBN 0-387-94327-7, ISBN 3-540-94327-7

This is an elementary introduction to algebraic topology based on problems related with geometry and analysis on low dimensional manifolds. The main topics discussed include a study of paths and winding numbers in the plane, vector fields on surfaces, the fundamental group and its relation to covering spaces of connected compact surfaces, classification of compact oriented surfaces, Riemann surfaces and their relation to algebraic curves and Riemann-Roch theorem. The algebraic methods of algebraic topology are used in a very restricted way. The homology and cohomology theory described are the de Rham and Čech theories. Only a small part of the book is devoted to higher dimensional algebraic topology and the general theory. The book is well written and is particularly recommended for its concrete examples. (jbu)

S.Gindikin, J.Lepowsky, R.Wilson (Eds.): Functional Analysis on the Eve of the 21st Century, In Honor of the 80th Birthday of I.M.Gelfand. Vol. I, Progress in Mathematics, vol.131, Birkhäuser, Boston, 1995, 292 pp., ISBN 3-764-33755-9,

S.Gindikin, J.Lepowsky, R.Wilson (Eds.): Functional Analysis on the Eve of the 21st Century, In Honor of the 80th Birthday of I.M.Gelfand. Vol. II, Progress in Mathematics, vol.132, Birkhäuser, Boston, 1995, 323 pp., DM 148.00 for both volumes, ISBN 3-764-33855-5

The influence of the work by Israel Moiseyevich Gel'fand on the evolution of mathematics after the second world war cannot be overestimated. Works published during these years in his famous journal "Functional analysis and its applications" gave a new and much wider content to the subject itself. The proceedings of the four-day conference held at Rutgers Unviersity in October 1993 in honour of Gel'fand's eightieth birthday bring a rich collection of excellent papers on chosen topics related to his recent interests. The main topics covered by these two volumes are recent progress in fields influenced by quantum field theory, certain topics in representation theory (especially for groups over local fields), combinatorics and hypergeometric functions and noncommutative geometry and quantum groups. Both volumes start with the list of speakers, curiculum vitae of I.M.Gel'fand, a list of his recent publications and a tribute to him written by I.M.Singer. The first volume contains contributions by K.Aomoto, R.Brylinski and B.Kostant, I.Frenkel and V.G.Turaev, M.M.Kapranov, D.Kazhdan, M.Kontsevich and S.Vishik, G.Lusztig, O.Mathieu, C.Moeglin, I.M.Singer, E.Witten. The second volume is more geometric in nature and contains papers by M.Gromov, M.Hanamura and R. MacPherson, L.C.Jeffrey and F.C.Kirwan and finally A.Klemm, B.H.Liam, S.S.Roan and S.T.Yau. This list itself is sufficient to indicate the broad scope, importance, and quality of both volumes. It can be warmly recommended to all. (vs)

L.C.Biedenharn, M.A.Lohe: Quantum Group Symmetry and q-Tensor Algebras, World Scientific, Singapore, 1995, x+293 pp., ISBN 9-810-22331-5

This is a book about quantum groups written for physicists. The authors write in the introduction that "the aim of this monograph is to develop and extend to quantum groups the symmetry techniques familiar from the application of classical groups to models in physics". It is written in such a way that it is accessible to postgraduate students, useful to physicists wishing to make themselves familiar with quantum groups and yet remains interesting to specialists in the field. The reader of this book will require background knowledge in physics, especially in quantum theory. However, it is a very clearly written book that will be welcomed by mathematicians having some knowledge of physics who wish to understand the role played by quantum groups in physics. The authors have chosen to approach the subject based on the notion of a tensor operator. The references extend to 222 items. (jiva)

R.M.M.Mattheij, J.Molenaar: Ordinary Differential Equations in Theory and Practice, J.Wiley & Sons, Inc., Chichester, 1996, xi+407 pp., GBP 22.50, ISBN 0-471-96530-8

This book is a textbook on ordinary differential equations. The basic fundamental theory (existence, uniqueness and continuous dependence of solutions) is presented together with the linear theory, stability, chaos, boundary value problems and singular perturbations. The numerical treatment of ordinary differential equations covers one - step methods (Runge - Kutta), multistep methods (predictor - corrector) and stiff systems. Applications to classical mechanics and to various other problems are given. The book can be recommended to beginners in the field of ODE's as well as to university teachers interested in the presentation of the basic theory together with effective numerical methods. (ss)

Ch.E.Praeger, L.H.Soicher: Low Rank Representations and Graphs for Sporadic Groups, Australian Mathematical Society Lecture Series, vol.8, Cambridge University Press, Cambridge, 1997, xi+141 pp., GBP 24.95, ISBN 0-521-56737-8

A subgroup G of the symmetric group Sym(Ω) of all permutations on a set Ω is called the permutation group on the set Ω. The group G is said to be transitive on Ω if for all $\alpha, \beta \in \Omega$ there is an element $g \in G$ such that the image α^g of α under g is equal to β. Defining the action of the permutation group G on $\Omega \times \Omega$ by $(\alpha, \beta)^g = (\alpha^g, \beta^g)$, we can define the rank of G on Ω as the number of orbits $(\alpha, \beta)^G = \{ (\alpha, \beta)^g \mid g \in G\}$. The book deals with the structural properties of permutation groups up to the rank 5. In the first three parts the basic definitions, results and methods are collected and in the fourth, divided into 39 items, the individual groups are treated. The final section gives the summary of representations and graphs. (lb)

M.A.Shubin (Ed.): Partial Differential Equations VIII. Overdetermined Systems Dissipative Singular Schrödinger Operator Index Theory, Encyclopaedia of Mathematical Sciences vol.65, Springer-Verlag, Berlin, 1996, vii+258 pp., DM 148.00, ISBN 3-540-57036-5, ISBN 0-387-57036-5

This volume consists of three parts. The first one, written by P.I.Dudnikov and S.N. Samborski, is devoted to linear overdetermined systems (a differential operator A is called overdetermined if there is a nonzero differential operator B such that $BA = 0$) and their application to the solvability of initial boundary value problems for elliptic, parabolic and hyperbolic systems. The problem is to find necessary and/or sufficient conditions on f, g in the form $\Phi(f, g) = 0$ such that $Ay = f, \Gamma y = g$ (Γ is a boundary operator) can be solved. Roughly speaking, algebraic-topological properties of KerΦ/Im(A, B) are studied. The second part, by B.S.Pavlov, concerns the spectral analysis of dissipative singular Schrödinger operators. The connections between such operators, their functional models and the theory of analytic functions in the Hardy classes are explained. The third part (B.V.Fedosov) is concerned with various forms of the Atiyah-Singer theorem on the index of elliptic operators and its generalization for almost periodic and stochastic operators. Recent results on deformation quantisation are also included. In all these articles classical and recent results are carefully explained (without proofs) and illustrated by means of examples. (jmil)

S.Hildebrandt, A.Tromba: The Parsimonious Universe. Shape and Form in the Natural World, Springer-Verlag, New York, 1996, xiii+330 pp., DM 48.00, ISBN 0-387-97991-3

This book, written by two outstanding scientists, can give a lot of joy to any perceptive person, interested in the history of development of human knowledge concerning the fact that "nature proceeds in the simplest, most efficient way". The authors say: "In this book we shall consider some of the theories that claim to explain form and motion in our world....In particular we shall emphasize the ***principle of the economy of means*** which throughout has served as a major tool for comprehending physical phenomena. Our goal will be to find an easy-to-understand link between mathematics and physics. The mathematical theory that provides this link is called the *calculus of variations.*" The numerous carefully chosen illustrations, the witty quotations opening each chapter, but especially a perfect way of explaining things - all these make the book really attractive. (oj)

Chuanming Zong (Ed. J.J.Dudziak): Strange Phenomena in Convex and Discrete Geometry, Universitext, Springer-Verlag, New York, 1996, x+158 pp., 10 fig., DM 44.00, ISBN 0-387-94734-5

In 1933, K. Borsuk raised the following problem: Is it true that every subset of R^n of unit diameter can be partitioned into $n+1$ subsets of diameter less than 1? The positive answer for dimension 3 was proved by J. Perkal (1947) and it has been believed for decades that the same holds in any dimension. Surprisingly, J. Kahn & G. Kalai (1993) proved that the answer is negative for large dimensions (e.g. $n > 21,800$). This is one of the famous geometrical problems described in the book of C. Zong. The common features of the seven (groups of) problems treated in the book are as follows: the problems are easy to formulate and understandable (often) even for non-mathematicians; their solutions are far from being trivial; the answers do not often agree with our intuition. The book is self-contained, the proofs of all assertions are included, together with the references, and it can be recommended to any mathematician with interest in classical geometry.

(jra)

N.Jacobson: Finite-Dimensional Division Algebras over Fields, Springer-Verlag, Berlin, 1996, viii+278 pp., DM 98.00, ISBN 3-540-57029-2

The first chapter is a source of examples. The author "develops the arithmetic" in the ring S of skew polynomials over a division ring and describes the rings obtained from S as homomorphic images and as localizations. The next two chapters contain a tool kit. The Brauer group B(k) is introduced to study central simple algebras over an arbitrary field k. The class of such an algebra A in B(k) can be described by two parameters, index and exponent; their relations are developed and Brauers examples are given to show that these relations are sharp. Chapt.3 is more geometric. The relations between three projective varieties assigned to a central simple algebra A and the corresponding generic splitting fields are studied. Although the author claims that "the required rudiments of algebraic geometry will be developed", he refers to several books on algebraic geometry in the text, without giving full bibliographical information. The fourth and fifth chapters bring a modern approach, to classical results. The fourth chapter is devoted to p-algebras, i.e. to central simple algebras A over a field of characteristic p such that the index of A is a power of p. Besides presenting a new approach to results of Albert, Saltman and Witt, a counterexample to the following conjecture is constructed: Is every division p-algebra cyclic? The final chapter is devoted to algebras with involution which has been studied since Albert (1939). Two concepts are introduced: "Norm similarity" can be used to determine whether two central simple algebras are either isomorphic or antiisomorphic. With analogy to the universal enveloping algebra for a Lie algebra, the "special universal envelope" is defined for the study of Jordan algebras arising from algebras with involution. The monograph contains many valuable examples and historical notes and is an enjoyable read for both novice and expert. (msc)

K.T.Arasu, J.F.Dillon, K.Harada, S.Sehgal, R.Solomon (Eds.): Groups, Difference Sets, and the Monster. Proceedings of a Special Research Quarter at the Ohio State University, Spring 1993, Walter de Gruyter, Berlin, 1995, xiii+461 pp., DM 198.00, ISBN 3-110-14791-2

This volume contains contributions by many of the participants in the Research Quarter on Groups, Difference Sets, and the Monster which took place at The Ohio State University in Spring 1993. The book is divided into three parts. The first part focuses on groups and geometries. The main topics are diagram geometries, 'sporadic geometries' and group actions on simplicial complexes and buildings. The second part of the book discusses difference sets. Besides a selection of papers on abelian and non-abelian difference schemes presented at the workshop, the volume contains also two survey articles - one on Hadamard difference sets by J. Davis and J. Jedwab, the other on relative difference sets by A. Pott. The third part of the book is devoted to the Monster, the largest sporadic group. Together with original research work a few expository articles are also included. (jt)

D.E.Edmunds, H.Triebel: Function Spaces, Entropy Numbers and Differential Operators, Cambridge Tracts in Mathematics, vol.120, Cambridge University Press, Cambridge, 1996, xi+252 pp., GBP 40.00, ISBN 0-521-56036-5

Both authors are well known for their fundamental contribution to the theory of function spaces and the spectral theory of differential operators. The present book is mostly based on their results and on results of their co-workers obtained in the last few years. The emphasis is on the relationship between three topics: function spaces on R^n and in domains, entropy numbers in quasi-Banach spaces, and the distribution of eigenvalues of degenerate elliptic differential and pseudodifferential operators. The book starts with a survey of elements of the spectral theory in quasi-Banach spaces and of basic properties of entropy and approximation numbers of bounded linear operators. Chapter 2 is devoted to function spaces. As preparation for later applications, the authors pay particular attention to limiting situations and besides the family of spaces B^s_{pq} and F^s_{pq} they study spaces of Orlicz type - in particular, weighted spaces $L_p(\log L)_a$ and related Sobolev spaces. In this sense the chapter can be considered as a continuation of Triebel's earlier books on function spaces. In Chapter 3, the authors use Fourier-analytic techniques to give upper and lower estimates for the entropy and approximation numbers of compact embeddings between the spaces of the scales B^s_{pq} and F^s_{pq} defined on bounded domains with smooth boundaries. The corresponding problems for weighted spaces on R^n are treated in Chapter 4. The last chapter is devoted to applications of the results of the previous chapters, in particular to the distribution of eigenvalues of degenerate elliptic differential and pseudodifferential operators with non-smooth coefficients. The authors present a largely self-contained treatment and the book can be recommended to both experts and non-specialists. (jrak)

A.M.Khludnev, J.Sokolowski: Modelling and Control in Solid Mechanics, International Series of Numerical Mathematics, vol.122, Birkhäuser, Basel, 1997, xiii+366 pp., DM 178.00, ISBN 3-764-35238-8, ISBN 0-817-65238-8

This book addresses selected areas in nonlinear mechanics of deformable bodies, nonlinearities arising from geometry or material characteristics. Special attention is devoted to qualitative properties of solutions to contact problems for elastic plates and shells, elastoplastic and viscoelastoplastic beams and plates, to determination of cracks, and to related optimisation problems including optimal control and shape optimisation together with existence of solutions, convergence and sensitivity analysis. After reviewing requisite tools from mathematical analysis, variational calculus and elasticity in Chapter 1, variational inequalities in both stationary and dynamic contact problems of elasticity and in plasticity are studied respectively in Chapters 2 and 3. Various optimisation procedures for the problems mentioned above are then studied from the viewpoint of the existence of solutions and necessary optimality conditions in Chapters 4 and 5, respectively. This well-written book will be appreciated by mathematicians interested in solid-phase continuum mechanics and optimization, as well as by engineers and advanced students. (trou)

P.J.Brockwell, R.A.Davis: Introduction to Time Series and Forecasting, Springer Texts in Statistics, Springer-Verlag, New York, 1996, xiii+420 pp., 122 fig., DM 98.00, ISBN 0-387-94719-1

Brockwell and Davis are well known authors of the book Time Series: Theory and Methods (TSTM) – a frequently cited monograph about time series analysis. The book under review differs from TSTM mainly by the emphasis on methods and the analysis of data sets. The reader need only be familiar with basic calculus, matrix algebra and elementary statistics. On the other hand, the benefit from studying the book will rapidly increase if the reader uses simultaneously a computer and analyses data sets using the time series package included on the diskette which accompanies the book. The installation and running of the package are very easy even for readers who are not very familiar with computers. The contents of the book: 1. Introduction, 2. Stationary processes, 3. ARMA models, 4. Spectral analysis, 5. Modelling and forecasting with ARMA processes, 6. Nonstationary and seasonal time series models, 7. Multivariate time series, 8. State-space models, 9. Forecasting techniques, 10. Further topics. There are four appendices: the most important is devoted to a description of how to use the software on the enclosed diskette. However, the book does not contain tests for periodicity, which are needed in some natural and technical sciences, although Fisher's test is available in the time series package. The book can be strongly recommended to teachers and students of practically oriented courses on time series and forecasting. (ja)

P.Wojtaszczyk: A Mathematical Introduction to Wavelets, London Mathematical Society Student Texts 37, Cambridge University Press, Cambridge, 1997, xii+261 pp., GBP 13.95, ISBN 0-521-57894-9, ISBN 0-521-57020-4

This book is basically a course of lectures aimed at students of mathematics, and provides a basic mathematical introduction to the theory of orthogonal wavelets and their uses in analysis of functions and function spaces, in both one and several variables. Each chapter ends with comments and with a set of exercises. The examples are carefully selected and illustrate many important ideas in the field, and the bibliography contains 199 items. The first four chapters discuss one-dimensional orthonormal wavelets associated with a given multiresolution analysis. The author presents in detail the most important wavelets - spline wavelets, Meyer's wavelets, compactly supported wavelets and periodic wavelets. There are also examples of wavelets not associated with any multiresolution analysis. To pass from one variable to several, the author uses tensors at different levels: for wavelets and for scaling functions. In Chapter 5 a genuinely multivariable theory of multiresolution is presented, together with many examples. The rest of the book deals with expansions. Wavelet decompositions in L_p-spaces, Hardy spaces and in Besov spaces are discussed, and wavelet characterisation of those spaces are provided. The book concludes with Chapter 9 where the author discusses, on R only, moduli of continuity and Besov norms and their connections with wavelets. The Appendix contains sections listing results used on Hilbert spaces, Fourier transforms and Banach spaces. This is a nicely written, stimulating book of great value which will actively stimulate students. It is strongly recommended to those wishing to learn about the mathematical foundations of wavelets. (kn)

A.Campillo López, L.Narváez Macarro (Eds.): Algebraic Geometry and Singularities, Progress in Mathematics, vol.134, Birkhäuser, Basel, 1996, xxi+407 pp., DM 138.00, ISBN 3-764-35334-1, ISBN 0-817-65334-1

The book is related to the Third International Conference on Algebraic Geometry held at La Rbida in Spain in December 1991. The contributions are divided into three parts devoted respectively to resolution of singularities, complex singularities and differential systems, and to curves and surfaces. The content of papers covers several different topics in complex and real algebraic geometry as well as in the algebraic geometry over the field of characteristic p, mainly related to singularities. There are 21 contributions altogether. Some examples: J.Stevens in the paper "On the classification of reducible curve singularities", describes invariants and classification of reducible singularities of complex curves of genus $g \leq 3$. The paper of M.Oka: "Geometry of plane curves via toroidal resolution", instead of resolution of singularities by ordinary blowings up uses the toroidal resolutions for determination of basic invariants of curves. In the paper of D.Mond: "How good are real pictures", the relations between complex curves and their real pictures and their stable pertubations are discussed. There are also contributions describing singularity problems in the algebraic geometry over a field of characteristic p. (jbu)

H.Clemens, J.Kollár (Eds.): Current Topics in Complex Algebraic Geometry, Mathematical Sciences Research Institute Publications, vol.28, Cambridge

University Press, Cambridge, 1995, xi+158 pp., GBP 24.95, ISBN 0-521-56244-9
This book is a collection of survey articles related to the programme of Complex Algebraic Geometry year organised by the Mathematical Sciences Research Institute in the academic year 1992/93. It consists of eight contributions on different topics of complex algebraic geometry - birational geometry, moduli spaces, vector bundles on curves and fundamental groups of smooth projective varieties. Among the contributions, there is an exposition by D.Arapura of recent results concerning the problem of which groups can be fundamental groups of smooth projective varieties (positive and negative results together with the description of used methods are presented); A.Beauville in his paper 'Vector bundles on Curves and Generalized Theta functions: Recent results and Open problems' treats the Verlinde formula on the dimension of the spaces $H^0(SU_x(r),\mathcal{L})$ of cohomology of the moduli space of semistable rank r vector bundles on a compact Riemann surface of genus g with coefficients in determinant bundle $\mathcal{L}$ (together with several open problems in the topic); the paper by R.M.Hain: 'Torelli groups and geometry of moduli spaces of curves', contains an exposition of Torelli groups and shows their usefulness in the study of properties of moduli spaces. (jbu)

R.Ablamowicz, P.Lounesto, J.M.Parra (Eds.): Clifford Algebras with Numeric and Symbolic Computations, Birkhäuser, Boston, 1996, xvii+322 pp., sFr 98, ISBN 0-817-63907-1, ISBN 3-764-33907-1
Clifford algebras have played an important role in mathematics and physics for many decades. Their importance is due to the fact that they are amongst the most important objects appearing naturally whenever we are working with a vector space equipped with a quadratic form. Their algebraic structure encode especially a lot of useful properties of orthogonal and spin groups and their representations and they offer a convenient language to use. Clifford algebras (as well as their generalisations) are used to reformulate some problems in mathematics and mathemtical physics, their use can make some computations more efficient. In recent years, quite a few new books treating different aspects of Clifford algebras have appeared. The book under review is special in its emphasis on the use of various computer programs to perform Clifford algebra calculations. The volume contains 20 contributions, mostly describing the use of computer systems in Clifford algebra calculations and applications. Several contributions treat also various theoretical aspects of (generalised) Clifford algebras. The book will be useful for readers interested in computational aspects of the theory. (vs)

J.C.Jantzen: Lectures on Quantum Groups, Graduate Studies in Mathematics, vol.6, American Mathematical Society, Providence, 1996, 266 pp., GBP 32.00, ISBN 0-821-80478-2
As the author mentions in the introduction, this book is based on his course on quantum groups in the spring quarter 1994. The aim of the course was to make the students acquainted with basic parts of the theory of quantum groups. The students had been previously introduced to the theory of complex semisimple Lie algebras from the textbook by Humphreys. The book under review represents an enlargement of the original lecture notes. The author has all the time in mind that the book is designed for students and for the beginners in the theory of quantum groups. It is very precisely written, the author does not try to reach at all costs the highest possible level of abstraction and also does not try to include as much material as possible. From time to time he leaves some computations to the reader. I appreciate the presentation of the theory and I think that the reader of this book will quickly feel at home in the theory and will like it. But this book can not be characterised only as a textbook. It is a monograph and it will be interesting also for specialists. I would say that the book can also help mathematicians reading papers on quantum groups written by physicists, where sometimes some mathematical notions are used but for various reasons are not defined or explained. Recently, many books on quantum groups have appeared, and I think this is one of the best. The main topics include: Gaussian binomial coefficients, the quantized enveloping algebra $U_q(sl_2)$ and its representations, $U_q(sl_2)$ as a Hopf algebra, the quantized enveloping algebra $U_q(g)$ and its representations, the center and bilinear forms, R-matrices and $k_q[G]$, braid group actions and PBW type basis, crystal bases. (jiva)

R.Ablamowicz, P.Lounesto (Ed.): Clifford Algebras and Spinor Structures. A special Volume Dedicated to the Memory of Albert Crumeyrolle (1919-1992), Mathematics and Its Applications, Kluwer Academic Publishers, Dordrecht, 1995, xx+421 pp., GBP 107.00, ISBN 0-792-33366-7
The main research interests of Albert Crumeyrolle were concentrated around Clifford and exterior algebras, various types of spinors and spin structures. A. Crumeyrolle died in summer 1992; the book contains papers dedicated to his memory. It begins with a description of his scientific activity and a short survey of Clifford algebra history. Research contributions are devoted to several topics connected with Clifford algebras and spinors. The first two parts are more algebraic - four papers discuss Clifford algebras, eight are devoted to spinors (from mathematical point of view as well as discussing their use in mathematical physics). The next two parts describe analytical side of the subject: Dirac and Maxwell equations and their conformal invariance together with applications to boundary value problems. The last chapter treats various generalisations of Clifford algebras. The whole volume brings together results in many different

branches of the field and complements other recent volumes on the same subject (Proceedings of the conference in Deinze - ed. F.Brackx et al.; the conference in Arkansas - ed. J.Ryan: the conference in Seiffen - ed. W.Sprössig). (vs)

H.Aikawa, M.Essén: Potential Theory - Selected Topics, Lecture Notes in Mathematics, vol. 1633, Springer-Verlag, Berlin, 1996, ix+200 pp., DM 54.00, ISBN 3-540-61583-0

The first part, written by M.Essén, starts with an introduction to potential theory based on the books L. Carleson: Selected topics on exceptional sets, Van Nostrand, 1967 and N. S. Landkof: Foundation of modern potential theory, Springer, 1972. Two definitions of capacity are discussed. Also α-capacity and α-potentials are considered. In the succeeding sections a survey of minimal thinness and rarefiedness at infinity in a half-space is given. These sets are characterised in terms of conditions of Wiener type criterion involving Green energy and Green mass and it is shown that this Green mass and Green energy may be replaced by ordinary capacity. The second part, written by H. Aikawa, starts with an introduction to semicontinuous functions. Then a general L_p-potential theory is studied. The main tool is Kerman-Sawyer inequality, which is used for estimates of the L_p-capacity of a ball. Then the Kerman-Sawyer inequality is used for the study of a Wolf type potential W_k^μ. A new proof of the capacity strong type inequality is given in later sections of the book and a countable quasiaditivity of capacity is studied for the Whitney decomposition. These results are used for the study of the boundary behavior of the Poisson integrals. Moreover, as an application of quasiaditivity of capacity, Wiener type criteria for α-thinness and minimal thinness are given. Nagel and Stein extend the classical Fatou nontangential limit theorem: their approach regions can contain a sequence of points with prescribed tangency. New fine limit theorems are proved in the book and it is shown that they yield the Nagel and Stein results. In the last section the integrability of superharmonic functions is studied. The book contains mainly recent results in potential theory, a majority of them discovered by the authors. A list of books on potential theory, sorted by topics, is given in the first part. Both parts contain a rich bibliography and a list of references about analytic capacity, given by Vladimir Eiderman, is included. The text is illustrated with nice pictures which really help to understand the theory. For the reader's convenience Choquet's capacitability theorem and minimal fine limit theorem are explained in appendices. As it is only supposed that the reader is familiar with the theory of of integration, distributions and with basic functional analysis and some basic potential theory (for which the references are given) and as quite recent and difficult results are explained here, the book is recommended to anybody interested in potential theory. (jran)

S.Rosenberg: The Laplacian on a Riemannian Manifold. An Introduction to Analysis on Manifolds, London Mathematical Society Student Texts 31, Cambridge University Press, Cambridge, 1997, x+172 pp., GBP 12.95, ISBN 0-521-46300-9, ISBN 0-521-46831-0

Global analysis on Riemannian manifolds is a beautiful subject containing many nice and fundamental results. One of the most important topics is the Gauss-Bonnet theorem and its generalisation to higher dimensions. These presented lecture notes are designed to explain to students a chain of important results starting with the Hodge theory of harmonic forms, heat kernels for Laplacians on forms, the Chern-Gauss-Bonnet theorem, the Atiyah-Singer index theorem and ending with a description of the zeta function of the Laplacians and Reidemeister and analytic torsions. As a prerequisite, a working knowledge of calculus of differential forms on manifolds is sufficient. The main tool used in the text is the heat flow associated with the Laplacians on forms. The main part of the book contains a detailed explanation, the latter (and more difficult) parts only explain results, without giving proofs. There is more than a hundred exercises, some of them just proofs of less important statements or complementary facts with hints. The book is written in a nice, understandable style which keeps a flavour of oral lectures and will be very useful for the preparation of lectures on this subject for graduate students. (vs)

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Journal of Group Theory
• ISSN 1433-5883
1998. Volume 1 (4 issues). Approx. 400 pages.
Approx. DM 328,–/approx. £ 120.00

Price subject to change

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