THE NEW ZEALAND
MATHEMATICAL SOCIETY (INC.)

NEWSLETTER

CONTENTS

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PUBLISHER'S NOTICE

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However, correspondence should normally be sent directly to the Secretary:

EDITORIAL

Whither Mathematics?

An alarming trend appears within the Local News section of this Newsletter. We read of some university Mathematics Departments and of the Applied Mathematics Group at IRL being "downsized" with departing staff not being replaced, and early retirement enticements. This is associated with reductions in student enrolments in mathematics courses, alterations to staff/student ratios, and on restructuring. Should we be alarmed? Can we identify the causes behind this trend? Is there any action we can take?

I don't wish to comment on the IRL situation, but being in a university mathematics department, I offer some personal observations and raise some questions in that arena, and invite comment and debate.

Should we be alarmed? Well, at least we should be concerned. Is there a national decline in the number of tertiary mathematics educators, which probably means a decline in the number of active mathematical researchers? Reductions in staff/student ratios must ultimately lead to an increase in workload per staff member and/or a decline in teaching quality. (Surely with all the so called "efficiency gains" there is little fat to be cut out of the system!) There is now a campaign, supported by the NZMS and university departments, to request a change in the funding band for mathematical sciences, recognising the changing nature of mathematics education as we move towards more computer based activities in our courses. This would bring us into the same category as subjects such as Psychology, Geography and Computer Science. However if successful it may well only be a zero sum game, and for internal redistribution, the funding bands are indicative only. That some of our Australian colleagues are campaigning for a reduction of their mathematics funding band on the grounds of consumer resistance, is a fact for sober reflection.

Is there a general decline in student demand for tertiary mathematics? Is there a perception that mathematics is less relevant, "difficult" or uninspiring? Are we seeing a reaction to insufficient well qualified mathematics teachers in the secondary schools? Perhaps the newer computing disciplines offer attractive alternatives to the quantitatively able new students and are

out competing us in the same market place? Is mathematics really so necessary as a prerequisite for the disciplines we service? Does the job market really require mathematically trained graduates to the extent we thought? For many years we had an enviable reputation of attracting a significant proportion of the most able seventh form students taking the Scholarship examinations. Do the challenges of those tough examinations still exist? Is mathematics so relevant in today's world? Is the mathematics culture dying?

We can take action to address some of these issues. By modifying our courses to better meet the needs of the incoming students we might reverse the popular negative image of our subject. Victoria University's new Humanist mathematics course may be a step in the right direction. Do we deliberately target the students that are going into secondary teaching, or retrain those already in that area? Are our curricula appropriate for today's students. In each of the courses I teach, the majority of the students are taking their last mathematics course, and yet much of the material within those courses is there as part of an ongoing development of the subject.

The Royal Society workshop: Research infrastructure for science and technology in New Zealand, [proceedings published in 1997 RSNZ Miscellaneous Series #37] which I attended last year, hinted at a demographic problem in the sciences in general. It is very likely that the same concern will arise in mathematics. As there is a long lead in time in training scientists, steps need to be taken early to alleviate the projective shortfall predicted to occur throughout the Western World in 10 - 15 years. We in New Zealand will be at the mercy of larger and more affluent economies competing for these new scientists. At the present time there appears diminishing opportunities for the newly trained research mathematicians gaining employment here.

Mike Hendy

LOCAL NEWS

AgResearch

Rowland Kao, Mick Roberts and Kumar Vetharaniam attended the ANZIAM 97 conference at Lorne, Victoria and gave contributed papers. Simon Woodward gave a seminar on 24 January at the Dairy Research Corporation in Hamilton, describing some work in progress on the modelling of pasture photosynthesis and growth in spring pastures.

In February Simon spent two days in Australia discussing this work with Dr Ian Johnson, one of the world's foremost modellers of pasture growth. Dr Johnson has a consultancy based in Armidale, and is also developing research software for the study of pasture processes.

At Lincoln, David Baird continues to work on the Windows version of Genstat, intermingled with frequent flights to Auckland in connection with the tussock moth spraying programme. Lesley Hunt takes a special interest in the summer students who work on campus, running her annual seminar explaining statistical concepts by way of a study of "Murphy's Law: the toast always lands honey side up." Dave Saville enjoyed a week-long visit from Graham Wood in November, when they made good progress on a trio of papers expounding their new angle on the t-test, its universality throughout linear models, and the light it sheds on whether normality is really necessary.

At Grasslands, Ken Louie et al. have a new MSc student, Tracey Flux, starting on a thesis titled "Dynamical Systems Models of Plant Growth". This is a joint project between AgResearch and the Maths Dept. of Massey University (supervisor is Robert McKibbin).

By the time you read this, your correspondent will have left for the RSS Workshop on Stochastic Modelling and Statistical Data Analysis for Epidemics, to be held from March 31 to April 12 on the Isle of Skye. The workshop is organised by Denis Mollison and Valerie Isham, recent NZMS lecturer.

Mick Roberts

UNIVERSITY OF AUCKLAND

SCHOOL OF MATHEMATICAL AND INFORMATION SCIENCES

Department of Computer Science

No reliable enrolment figures are yet available; except that 13 students are enrolled for PhD. Dr Peter Gibbons has taken over as Head of Department. Dr Pat Riddle and her husband Dr Mike Barley have been appointed as Lecturers. Professor Fridrich Sloboda (Bratislava University) is visiting the Tamaki Campus for the first semester.

Seminars

Professor Azriel Rosenfeld (College Park, Maryland), "Digital geometry - history and open problems".

Professor Fridrich Sloboda (Bratislava University), "Planar Jordan curves and arcs, and approximation by gridding techniques".

Professor Reinhard Klette, "3D digital object analysis - algorithms and applications".

Department of Mathematics

Provisional figures show the Mathematics Department will again have approximately 900 EFTSs this year, of which about 50 are postgraduate EFTSs (including 25 PhD students). Judy Paterson has been appointed as a part-time Lecturer.

Dr Eamonn O'Brien has arrived, as a Lecturer. Professor Graeme Wake has been appointed as Deputy Head of the Division of Science & Technology at Tamaki Campus. Dr Paul Hafner was one of the 3 people who received Science Faculty Distinguished Teaching Awards for 1996.

Dr Jianbei An was invited to spend 3 weeks in Japan in December, to give a lecture at a meeting of the RIMS in Kyoto, to visit the University of Kyoto, and to visit Chiba University to give advice on recent progress and new directions in verifying the conjectures of Alperin and Dade on modular representations of groups.

Dr George Joseph from the School of Economic Studies at Manchester University, is a British Council sponsored visitor until June. His particular interests are the history of mathematics with emphasis on non-European aspects, multi-variate analysis, and mathematical demography. He will teach part of the course 445.702FC on "Politics and History of Mathematics Education".

Professor Ian Stewart, from the Mathematics Institute at the University of Warwick, visited as the Forder Lecturer for 1997. He gave a public lecture on "Does God play dice?", and a seminar on "Hidden Symmetries in Partial Differential Equations".

Dr Dave Johnson (University of Nottingham) is here for the first semester, during which he will be teaching half of 445.720FC with Dr Eamonn O'Brien. Professor Richard Wilson (Universidad Autonoma Metropolitana, Mexico) is visiting for the first semester, during which he will teach the course 445.750FC.

Recent visitors include Professor Colin Maclachlan (University of Aberdeen), Professor Frank Gehring (University of Michigan) and Professor Andrea Peter (University of Münster).

Muriel Johnson (nee Ratcliffe) matriculated here in 1967, then in 1968 she went teaching and studied extra-murally with Massey University. She graduated as BSc here in 1972, majoring in mathematics; and subsequently she gained a PhD in Mathematics Education from Rutgers University. In the 1996 election, as Dr Muriel Newman, she was elected as MP on the ACT party list.

The 50th anniversary of the death of G. H. Hardy will occur on 1997 December 1. Is there anyone in NZ who remembers taking courses given by Hardy?

Seminars

Dr Jozef Siran (Slovak Technical University, Bratislava), "Cayley maps".

Professor Brian Alspach (Simon Fraser University, BC), "Isomorphisms of Cayley graphs".

Professor Vaughan Jones, "Planar Algebras".

Dr Norman Wildberger (UNSW), "An introduction to hypergroups".

Dr Andrew McIntosh, "Ignition of Hazardous Materials".

Sanja Todorovic-Vasiljevic, "Residually finite groups and infinite simple groups".

Dr David McIntyre, "Finite intervals between Hausdorff topologies".

Dr Michael Meylan (University of Otago), "Waves and the Marginal Ice Zone".

Professor R. Wilson (Universidad Autonoma Metropolitana), "In quest of Tychonoff maximal connected spaces".

Professor Ferencz Moricz (University of Szeged), "The Cesaro and Copton operators on some Lebesgue spaces".

Professor Boris Pavlov, "A remark on Wiener-Hopf operators with rational symbols".

Dr Andrea Peter (University of Münster), "The life and work of Johann Amos Comenius in the light of his impact on current issues in mathematics education".

Department of Statistics

Enrolments are estimated at 620 EFTSs, including 11 PhD students.

Associate-Professor Alan Lee has taken over as Head of Department.

Dr Geoffrey Pritchard and Dr Thomas Yee have been appointed as Lecturers at the Tamaki Campus, starting in June.

Professor Keith Worsley (McGill University) is visiting from February to July. Dr Brian McArdle is on leave for 1997 from the School of Biological Sciences. Associate-Professor Francois Perron (Montreal University) is visiting from January to March. Dr Stephanie Budgett (Glasgow University) is visiting until March 1998. Associate-Professor Yoon oh Suk (Sahmyook University, South Korea) visited from January 15 to February 15.

Seminars

Ross Alexander, "Analysis of local area network traffic".

Dr Sajeev Varki (Department of Marketing and International Business), "Estimating judgment accuracy in classifications of fuzzy data".

Dr Berwin A Turlach (ANU), "On the estimation of a convex set and its support function".

Garry J. Tee

UNIVERSITY OF CANTERBURY

The visit of the 1997 Forder lecturer, Professor Ian Stewart to Canterbury was a great success. His public lecture was attended by receptive audience of over 250 people of all ages. It was very well received, the equation free discussion of the different gaits of animals being perfectly pitched for the mixed audience.

Professor Gerhard Kristensson from the University of Lund, Sweden is visiting the department for a period of 6 weeks. Professor Kristensson is an Erskine fellow and will give a series of talks on precursive phenomena in dispersive media.

A number of people are currently visiting from Bielefeld, Germany, including Professor Andreas Dress (who last came to New Zealand as a New Zealand Mathematical Society visiting lecturer a few years ago, and is visiting us for 10 weeks as an Erskine fellow), Dr Daniel Huson, Dr Soeren Perrey, and Dr Vincent Moulton.

The visitors from Bielefeld joined other mathematicians and biologists from here and abroad for a week-long meeting in mid-February in Akaroa.

The meeting - "Akaroa'97: Trees, graphs, genes and models" - was organized by Mike Steel, under the auspices of the recently-formed "Biomathematics Research Centre" with the help of a $5000 "Profiles Programme" grant from MORST, and followed a similar meeting last year in Kaikoura. The participants included Dr Alan Cooper, from Oxford University, who has just published a controversial theory suggesting a very early radiation of birds and mammals.

Congratulations to Mark Hickman who was promoted to Senior Lecturer in the December 1996 promotions round. This correspondent was also promoted to Associate Professor in that round.

Congratulations are also due to several Honours III students from 1996 have been awarded University of Canterbury scholarships and are commencing postgraduate research. These are Jon Cherrie, Chris Hann, Paul Shorten, Heather Jenkins and Kahn Mason. Another former Honours III student Matt Wilkins is leaving us to do postgraduate studies at the Courant Institute.

Rick Beatson

APPLIED MATHS GROUP, IRL

1997 sees Applied Maths Group, reduced in size again. During 1996 we farewelled 4 staff. Rona Bailey left to study librarianship, Hugh Barr and Bruce Benseman left to form their own separate consultancies, and David Rhoades move to Nuclear and Geological Sciences to further his earthquake studies.

At the moment, Graham Weir and Kit Withers are overseas. Graham is attending a conference in Japan on deep geothermal systems. These are reservoirs of hot fluid, typically greater than 300 degrees C, at depths greater than 2 km. They are presently the focus of a major research project at Applied Maths. Kit is visiting the University of North Carolina as part of his work on climate changes and the theory of extreme values.

Last year, Graham and Stephen White were successful in an application to the Marsden Fund to study ore deposition. A new project that has been gaining momentum in the last year, is related to wind generation of electricity. Karen Garner is looking to apply optimisation techniques to improve decisions relating to design and location of windmills.

Over the university vacation we had two students working with us. Todd Nicholson from Victoria worked with Stephen White on equations of state of geothermal fluids, and Paul Shorten from Canterbury worked with John Burnell on modelling thermal radiation from heater panels.

John Burnell

MASSEY UNIVERSITY

Department of Mathematics

Staff update:

We welcome Dr Philip Burton to a one-year lectureship at the Albany campus. Most recently from the University of Queensland, where he completed a PhD last year in mathematical physics, Phil has experience in teaching both physics and mathematics. His computational skills will also prove most valuable.

Dr Glenda Anthony has been promoted to Senior Lecturer with responsibility for Mathematics Education. Gordon Knight is also continuing to help us out on the extramural Mathematics Education front - semi-retirement, it's called!

Our Graduate Assistants this year are Tammy Smith (PhD student, Postgraduate Scholar), Tracey Flux (MSc student), Margaret Walshaw (PhD), Nicholas Allsop (PhD) and Anton Raviraj (PhD).

Dr Marijcke Vlieg's one-year lectureship came to an end, but she is still involved in the Department with some teaching and supervision duties. Derek Christie, Senior Tutor, has left to take up a teaching position in Te Puke.

Students:
Enrolments in mathematics papers in 1997 on our Albany campus have exceeded expectations by about 10%. The postgraduate programme in mathematics there began this year with two students enrolled for the new MInfSc degree.

Postgraduate study in Mathematics, Mathematical Physics and Mathematics Education is strong on the PN campus with 14 PhD students and 14 Masterate research students enrolled this year.

Visitors:
The Forder Lecturer for 1997, Professor Ian Stewart, visited us during February. He delivered a public lecture entitled "Game, Set and Math" and also gave a more specialised lecture to members of the Department. Some were also able to share an evening of anecdotes with Ian and his wife over dinner.

Professor Henrik Bresinsky is currently visiting us from the University of Maine. He is helping out with some teaching and supervision as well as giving seminars and working with Dr Le Tuan Hoa, postdoctoral fellow.

Dr Sören Perrey has left us after more than a year working with Mike Hendy. But the University of Bielefeld is keeping its close contacts with us with visits or re-visits by Katharina Huber, Daniel Huson Vincent Moulton and Andreas Dress.

Phylogeneticists at it again:
Once again the local group of mathematicians and biologists that work together on the phylogenetic (evolutionary tree) analysis of nucleotide sequence data had their workshop at the end of February. Although this is organised for current and former students of David Penny and Mike Hendy, others do get to know of it and attend. This year there was a significant German contingent from Andreas Dress' group in Bielefeld. There were 20 scientific attendees, including 5 from Bielefeld. Also coming back from overseas were Alan Cooper (now in Oxford) and Mike Charleston (now in Glasgow). It is a continuing inspiration to see the coevolution occurring in this linking of disciplines; as more and more biological data is gathered, there is increasing awareness of the need for appropriate mathematical tools for their analysis, and for the mathematicians to become aware of the fascinating biological questions that they can help shed light on.

This year's venue, organised by Mike Steel, was set at the Mt Vernon Lodge overlooking Akaroa Harbour, a delightful venue for the families that also attended. Interspersing the four days of papers and discussions there was an excursion, either a halfday hike to the Hinewai Nature Reserve, a bold experiment in returning cleared farmland to the native forest vegetation via a canopy of gorse, or paddling in sea kayaks with the dolphins in the harbour.

Staff travel/conferences:
Robert McLachlan spent the second semester of 1996 at the Isaac Newton Institute, Cambridge, at a workshop on the Mathematics of Atmosphere and Ocean Dynamics. The pure mathematicians went into a huddle and came up with exotic systems with tenuous connections to the atmosphere. The geophysicists did much the same, arguing at length about the virtues of various reduced and balanced models. Finally, one model involved a four-dimensional Kahler structure which might have done well at Stephen Hawking's TQFT workshop. Everyone had a great time, except for the food.

Bruce van Brunt spent a period at the end of last year on leave in British Columbia, Canada, returning in December, while Mahyar Amouzegar returned in January from overseas leave in California.

A Massey contingent of Robert McKibbin (just out of the Mathematics in Industry Study Group held at the University of Melbourne), Adrian Swift and post-graduate students Chris Palliser, Anton Raviraj and Kim Hee Kyung attended and presented papers at the ANZIAM conference in February. This, the 33rd of these conferences, was held at the magnificent resort of Lorne, Victoria, right by a superb ocean beach and in (mostly) brilliant weather. In spite of this and other distractions of a gastronomic nature, the Massey contingent participated fully in all aspects of the conference.

After the ANZIAM conference Adrian Swift flew to Hobart to attend a very pleasant 2-day conference of 30 or so numerical analysts to mark the retirement of Prof David Elliott. Adrian was the sole NZ representative [unless one counts Alan Andrew who has been in Oz for 30 years] and gave a paper which discussed the importance of nonlinear equation solvers in path-following software. Unfortunately the weather in Tasmania was wet so Adrian was unable to see much of the country.
Francis Thio spent two weeks in March as an invited speaker and discussion panelist at two meetings on controlled thermonuclear research: the Innovative Confinement Concepts Workshop, held in Los Angeles, and the 2nd Symposium on Current Trends in International Fusion Research, in Washington, DC.

Charles Little is to be an Invited Speaker at a joint conference of the AMS and SAMS in Pretoria, South Africa, during late June 26-28.

NZAMT 5 Conference:
The call for papers/wrkshops information has been posted and registration forms will be sent to all schools and mathematics departments in May/June. Invited overseas speakers include Mary Barnes, author of the very successful calculus series "Investigating Change"; Associate Professor David Clarke, Melbourne University, and Anne Watson, University of Oxford, both with interests in assessment and mathematical thinking; and Associate Professor Sue Willis, Murdoch University, whose interests include gender reforms in schools, numeracy and assessment. [For further information please contact the conference convenor Glenda Anthony, e-mail: G.J.Anthony@massey.ac.nz]

Scholars:
We congratulate Tony van Dyk who has successfully defended his PhD thesis on "Formulation and numerical analysis of a model for corrosion of metal substitutes protected by polymeric coatings". Tony's supervisors were Graeme Wake, Alex McNabb and Colin Gooch.

Congratulations are also due to Allister Campbell (Massey Scholar) and Tammy Smith (MU Doctoral Scholar). Tammy is beginning a PhD programme modelling hydrothermal eruption phenomena, and is supervised by Robert McKibbin.

Dale Copeland, a PhD student of Chaos who moonlights as an artist, has been organising a real and virtual exhibition and art auction, both in a New Plymouth art gallery and at http://www.co.nz/puniho/avant.htm.

The world is a village: e-mail comments (and bids!) have been coming in from Israel, USA, Rumania, … . Dale reports that she will be back to a different sort of chaos when the auction is over!

Seminars:
Dr Charles Little, "Factoring 3-graphs into isomorphic rainbow 3-paths".
Professor Ian Stewart (University of Warwick), "Game, Set and Math", "Symmetry-breaking and polymorphism".
Dr Katharina Huber (University of Bielefeld, Germany), "Straight simplicial complexes of a finite set".
Professor Henrik Bresinsky, "Generating sets for polynomial ideals and their radicals".
Dr Daniel Huson (Bielefeld University, Germany), "Tiling space by Platonic solids".
Professor Andreas Dress (Bielefeld University, Germany), "Visualization in the Sciences - more than pretty pictures?"

Mathematical Physics Seminars:
Professor Paul Callaghan (Physics), "Generalised approaches to restricted diffusion in NMR spin echo experiments".

Robert McKibbin

UNIVERSITY OF OTAGO

Several differences are evident in the Mathematics and Statistics Department at the University of Otago. Firstly there have been changes to the established staff. Three academic staff members have taken enhanced early retirement - although two of these are working half time for 1997, and one of the secretaries has chosen to be voluntarily severed. Our Teaching Fellows are no longer subject to fixed term contracts, and there have been some promotions. Second, the entire curriculum structure is new and quite different. We now teach combined algebra/calculus papers at 100-level, and most papers are taught in one semester. Third, Dr John Clark has accepted further administrative responsibility, and now manages the University's Diploma for Graduates Programme. A lot of change in just a few months.

Research has been helped considerably by the award of major grants. Together with Dr Colin Fox of Auckland University, the Head of Department, Professor Vernon Squire, was awarded a 3-year Marsden grant of $415,000 to study new models of the marginal ice zone that take into account its heterogeneity and use granular flow theory. This will support a postdoctoral fellow and a PhD student (Mr Oliver Watzke from Germany). Colin Fox is visiting the Department for the first few months of 1997. Professor Derek Holton has been granted a two-year Ministry of Education Contract for the development of curriculum materials for schools that will assist in the implementation of the problem solving approach inherent in the curriculum statement Mathematics in the New Zealand Curriculum. The project will also look at methods for professional development and study the way students interact in groups. Dr Laimonis Kavalieris received some support from Dunedin Electricity.

Many staff have been spreading the mathematical word abroad. Dr Robert Aldred returned from a highly successful Study Leave working with Professor Carsten Thomassen at the Danish Technical University, Dr Nick Wormald at the University of Melbourne, Mike Plummer of Vanderbilt University, Dr Peter Jipsen in Cape Town, and Dr Brendan McKay at ANU. We are told that as well as graph theory he was interested to observe how Universities generally are being hacked around by funding cuts and novel managerial approaches. Vernon Squire spent some of November in Antarctica cooling off from the stress of running the Department. There the phone didn't ring so often but it did ring, believe it or not. In March Vernon attended a Gordon Research Conference in Ventura, California, where he presented an invited paper on 'Marginal Ice Zone Processes Impacting the Biological

Environment' - a topic he freely admits he knows absolutely nothing about and suspects that there is an ecologist somewhere who has the same name as he. Nevertheless, armed with a new vocabulary and abusing folk with expressions like `you nutrient-limited autotroph' the talk was given and some challenging questions were asked, e.g. where did you get that awful tie? Professor Bryan Manly, who is officially on Study Leave from July 1996 to June 1997, is taking the opportunity of making several short trips overseas during this time. In November 1996 he went to Argentina to visit Arturo Kehr, a biologist working for the government research organization CONICET, and gave two workshops for Argentinian scientists. In February Bryan was overseas again, this time in the United States. He spent a week at Los Alamos, New Mexico, and gave talks at the University of New Mexico at Albuquerque and the Aquatic Sciences meeting in Sante Fe. He also contributed to two workshops at the University of Wyoming, Laramie. Laimonis Kavalieris attended the Long Range Dependence International Workshop in Brisbane in late January, as well as visiting QUT to continue research with Dr V V Anh. Derek Holton participated in the Mathematics Association of Victoria Annual Conference at Monash University in December 1996.

1996 was a good year for visitors. Towards the end of the year we were visited by Professor Gary Roach of Strathclyde University and Professor Valerie Isham (NZMS Visiting Lecturer). And we have many visitors scheduled for 1997. So far, as well as Colin Fox, Mrs Ruth Mitchell from Fort Collins, Colorado will be here for the year teaching several statistics papers; Professor Thomassen from Denmark and Dr Kevin McAvaney of Deakin University joined Dr Aldred, Derek Holton, and Dr Michael Albert for an intensive graph theory workshop; Professor Ian Stewart (Forder Lecturer) visited in March.

4 new postgraduate students have joined the department: Athene McGregor-Macdonald (MSc); Rob Broadly (MSc); Oliver Watzke (PhD); and Aaron Bruhn (MSc). Ms Joanne McKenzie and Mr Alastair Duffy have been appointed as teaching assistants while each is registered for higher degrees.

Seminars

Dr Nihal Yatawara, "Analysis of Smooth Threshold Autoregressive Models: A Bayesian Approach".

John Enlow, "Mathematical Modelling of Surfacants in the Human Lung".

Dr Bruce McMillan, "Assessment".

Professor Valerie Isham, "Spatial Processes: Point Process Models and Some Applications".

Dr Josef Schicho (Linz, Austria), "Rational Parametrization of Surfaces".

Dr Ben Martin (Kings College, London), "Varieties of Representations of Finitely Generated Groups".

Professor Garry Roach (Strathclyde), "An Introduction to Scattering Theory".

Vernon A. Squire

VICTORIA UNIVERSITY OF WELLINGTON

We are now the Mathematics Group in the School of Mathematical and Computing Sciences, comprising the former Mathematics Dept, Computer Science Dept, Institute for Statistics and Operations Research, and the Mathematics and Science Education Centre. Administration is being centralised as I type this, and construction work on a central office/reception area and a large central tea/common room is planned for Easter. Otherwise life is as usual for the beginning of term (hectic). Your humble correspondent had forgotten how much preparation is needed to lecture, having just returned from 8 months Research and Study Leave, most recently in Berkeley, Los Angeles and Vancouver.

Geoff Whittle was an invited speaker at ACCOTA 96, a conference on combinatorics held in Taxco Mexico, 24 - 28 November 1996. Geoff also visited Louisiana State University from 14 - 28 February 1997.

Philip Rhodes-Robinson is at the University of Manchester for 14 months on Research and Study Leave.

Peter Donelan is to take over as convenor of the Mathematics Group from Lindsay Johnston in 1998, after a year of gentle introduction to the responsibilities of the position.

Following a drop in student numbers last year, we have been asked to give the university a plan showing a reduced number of mathematics courses and the impact on mathematics teaching. Hmmm, are clouds gathering on the horizon, or is that just my eyesight failing?

Victoria University Offers a New Course on Humanistic Mathematics

The School of Mathematical and Computing Sciences is offering this year a new course on Humanistic Mathematics, called the Mathematical Experience. The course is offered at the 200 level, and is the result of a major recommendation of the team which reviewed the University's Mathematics courses in 1995.

This new course, MATH 271, will link up with two other courses already being offered: MATH 371 Mathematics Education, and MATH 471 Mathematics Education. And it is hoped that

eventually MATH 171 will be offered to make a full stream of courses.

What is Humanistic Mathematics? This area of research, scholarship and teaching is the result of cross fertilisation between studies in Mathematics Education, and the Philosophy, Sociology, Anthropology and History of Mathematics. Alvin White, in the Preface to the book Essays in Humanistic Mathematics (MAA, 1993) observes that although the concept has not been formalised, there have been several conferences, symposia and contributed paper sessions under this banner and that the Humanistic Mathematics Network Journal and the book containing the Preface indicate the vitality of the concept.
"Humanistic Mathematics", according to White, "carries with it an awareness of and a sensitivity to those things mathematics shares with the humanities such as literature, art, and music," and "has now become a major part of mathematical culture." He identifies two major sub-themes which have emerged: (i) Teaching Mathematics humanistically; and (ii) Teaching Humanistic Mathematics.

Under the first sub-theme students are placed more centrally in the role of investigator and re-creator of mathematics, and greater acknowledgment is made of the emotional and social factors affecting the learning of mathematics. Mathematics is presented as socially constructed rather than as an arbitrary discipline independent of human reasoning and experience, and students are encouraged to approach their learning of mathematics in this light.

Under the second sub-theme the focus is on the reconstruction of the curriculum and the discipline of mathematics itself. "This reconstruction relates mathematical discoveries to personal courage, discovery to verification, mathematics to science, truth to utility, and mathematics to the culture in which it is embedded."

Thus Humanistic Mathematics includes: "An appreciation of the role of intuition in understanding and in creating concepts that appear in their finished versions to be 'merely technical' [and an] understanding of the value judgments implied in the growth of any discipline. Logic alone never completely accounts for what is investigated, how it is investigated, or why it is investigated."

What does the new course cover by way of content? It has five strands.

1. Humanistic Mathematics
Humanistic Mathematics will be the overriding theme throughout the course. The teaching approaches used will be aimed at placing the learner in the role of active investigator. In addition, topics on Humanistic Mathematics will be chosen for specific study. The book, The Mathematical Experience, by Philip Davis and Reuben Hersh, will be used as a major resource.

2. Mathematical Processes
Mathematical Process understanding, skills and orientations will be the principal set of qualities which students use to become more confident with, and competent at, mathematics. The ideas developed in this strand will increase in complexity to the situation where the students are learning: (i) the thinking, reasoning and communication skills used by research mathematicians and other expert users of mathematics; and (ii) related ideas from recent developments in the philosophy and sociology of mathematics.

3. Topics in Mathematics
Students will study two significant topics from standard mathematical content. These topics will be presented using one or some of the following approaches: (i) based on the use of Mathematical Processes; (ii) using a Context Base (e.g., by using video, or accessible problem situations from which mathematical structures can be constructed); (iii) adopting an Historical Perspective; and (iv) using New Technologies as a means of mathematical exploration.

4. New Technologies in Mathematics.
The students will learn to use and critically evaluate some of the latest developments in computer and calculator technology in mathematics.

5. Mathematics Education
Inevitably the study of the material in the other strand will lead to questions about the teaching and learning of mathematics. Where this occurs these issues will be explored.

For further information contact Jim Neyland.

The Mathematics and Science Education Centre within the School of Mathematical and Computing Sciences is responsible for offering this new course. The Centre is principally sponsored by BP New Zealand and Mitsubishi Motors.

Mark McGuinness

UNIVERSITY OF WAIKATO

Department of Mathematics

As members of the New Zealand mathematical community will probably know, the structure of our department is being reviewed by the Dean of our School. At time of writing (end of first week of March), the draft report has just been released. Final decisions will be made by the Vice-

Chancellor at the end of April, so we should have a better idea of what is happening by early June.

Later this year we will be saying farewell to three long standing members of the department. Heather Rae and Mark Schroder will be finishing their university duties at the end of the first semester while Graham French will do so at the end of the year. We wish them well for the future. Appropriate recognition of their contribution to the department and to the University will be given later.

The department and the Centre for Discrete Mathematics and Theoretical Computer Science hosted a one-day meeting on `Computability and Related Matters in Mathematics and Physics'. Speakers included faculty and graduate students of the Centre as well as Fred Richman (Florida Atlanta University) and Karl Svozil (Vienna University of Technology).

Ernie Kalnins is away overseas on study leave. He left in late January and plans to spend about a month in each of Dubna (Russia), Stuttgart, and Minnesota. Before going away, he had Ray McLenaghan from the University of Waterloo as a visitor.

Your local correspondent has also been away on study leave. He is writing this column from the University of NSW and will be there until the end of March. He plans to go there again for another 6 weeks in early May.

Also crossing the Tasman were Alfred Sneyd, Ian Craig, Paul Watson, and a postgraduate student, Richard Fabling. In early February, they all attended the ANZIAM conference held in Lorne.

Douglas Bridges has had Fred Richman from Florida Atlanta University visiting him since January while Jan Awrejcewicz from the Technical University of Lodz visited Kevin Broughan last December.

For the first time, our department offered summer courses. They were the courses 'General Mathematics' and 'Management Mathematics'. Graham, Kevin, and Alfred were the three members of the department working hard when the rest of us were enjoying our holidays (or recreation leave as it's now apparently called).

Seminars

I. Stewart (Warwick University), "Symmetric chaos", "Does God play dice?"

J. Awrejcewicz (Technical University of Lodz), "Periodic and chaotic oscillations exhibited by nonsmooth dynamical systems".

Stephen Joe

Department of Statistics

Nye John and David Whittaker, in conjunction with CSIRO, are about to release a Windows version of a computer program CycDesign, which generates efficient designs for variety and other trials.

Dr Ken Russell, from the Department of Applied Statistics at the University of Wollongong is currently visiting the department and working with Nye. He has given a seminar on "Examining the robustness of crossover designs to error mis-specification".

Bill Bolstad has returned from study leave. While overseas Bill visited the University of Connecticut and has continued his work on Markov Chain Monte Carlo methods.

Jocelyn Dale has returned to fulltime work following a period of parental leave.

Judi McWhirter has recently submitted her DPhil thesis entitled "Modelling Pulsatile Data: Estimation of Parameters and Dispersion Matrix". Students, Joan Wood submitted her DPhil thesis on "School Timetabling" late last year and Kim Bannon, submitted a dissertation for her MSc entitled "The Benefits of Residual Maximum Likelihood (REML) over ANOVA for Combining Information".

The department is pleased to have the services of Jane Andrew as a tutor for our first year statistics course, for another year. She is also working with Ray Littler, on some of the consultancy work undertaken by the Waikato Centre for Applied Statistics (WCAS).

Other upcoming seminars include:

Professor Jim Durbin, (formerly Professor of Statistics, London School of Economics), "Time Series Analysis of Non-Gaussian Observations based on State Space Models".

Associate Professor Francois Perron, (University of Montreal), "An MCMC approach to nonparametric regression".

Judi McWhirter

NEW COLLEAGUES

Dr Jennifer Brown, a Canterbury School of Forestry graduate and specialist in biological statistics, started as a lecturer in the Department of Mathematics and Statistics, Canterbury University on 1 December last year.

A recipient of the Royal Society Young Scientist Award in 1993, Dr Brown was most recently a visiting lecturer at Massey University. There she taught and carried out research which included developing a sampling scheme for butterflies, quantifying respiration rates and surface behaviour of Hector's dolphins and improving stock assessment of giant bluefin tuna in New England.

Dr Brown finished her B.ForSc (Hons) at Canterbury in 1985 and then studied for a Postgraduate Diploma of Science in statistics at Massey. Her PhD in statistics was undertaken at the University of Otago and investigated the development of efficient sampling strategies for spatially-aggregated populations.

She has variously been a Department of Foreign Affairs adviser, a scientist with the New Zealand Forest Service, a senior conservation officer for the Department of Conservation and a biometrician for Landcare Research Ltd.

Between 1992 and 1994 she was a course co-ordinator and tutor for the School of Forestry and was also a tutor in mathematics and statistics at Otago University in 1994. In 1995 Dr Brown worked as an associate research specialist at the University of Wisconsin, developing an

environmental monitoring programme for the US Fish and Wildlife Service for Karner blue butterflies. Dr Brown was manager of the first overseas expedition of New Zealand Women's Climbing to the Indian Himalayas. She is a fully-qualified outdoor instructor in mountaincraft, bushcraft, abseiling, leadership training and risk management, and holds a Level 1 scuba-diving certificate.

Michael J. Dinneen has been appointed as Lecturer in the Department of Computer Science at the University of Auckland, beginning in June 1996. Michael grew up in Idaho, and there he obtained two BSc degrees (Mathematics and Computer Science). After studying at Washington State University, he obtained his MSc and PhD degrees from the University of Victoria (British Columbia). He has also worked at Los Alamos National Laboratory (New Mexico) for several years.

Michael's interests include combinatorial and graph algorithms, algebraic network designs, and history of computer science. His current research focusses on developing a practical theory for computing forbidden minors (obstruction sets).

Dr Mike Barley has taken a one-year visiting lecturer position in the Department of Computer Science at the University of Auckland. Born in the USA, he received a BA in Mathematics at the University of California at San Diego, an MSc in Cybernetics at Brunel University in England, and a PhD in Computer Science at Rutgers University in the USA. His industrial experience includes working for Burroughs Machines in England and for Boeing in the USA, and running a small consulting company in the USA. His research interests include automated planning and problem-solving, machine learning and datamining, and automatic programming.

Professor Urban Cegrell, a recognised leader in the field of several complex variables, took up the Chair of Pure Mathematics in the Department of Mathematics and Statistics, Canterbury University, late in December.

He succeeds the late Emeritus Professor Gordon Petersen, who retired as head of department and holder of the Chair late in 1983.

Professor Cegrell comes to Canterbury from the University of Umea, Sweden, where he has been since 1984. During his time there he established the Complex Analysis in Several Variables Research Group, which among other topics studied removable singularity sets and domains of existence for plurisubharmonic functions, capacity theory, the complex Monge-Ampere operator, ideals of analytic functions, boundary values for analytic functions, and diffusion on manifolds.

Prior to 1984 Professor Cegrell held tenure as an academic at the University of Uppsala. He was also a student at Uppsala - in 1968 he received his BSc there and seven years later completed his PhD. Between the Swedish academic years of 1976 and 1979, 1980 and 1983, and 1986 and 1996, his research was supplemented by the Swedish Natural Science Research Council.

He was a member of the Swedish National Committee for Mathematics in the mid-1980s and president of the Swedish Mathematical Society from 1987 to 1989.

Dr Darlene Heuff, an applied mathematician and specialist in boundary layer meteorology, took up her lectureship in the Department of Mathematics and Statistics, Canterbury University, on 1 January.

Dr Heuff's main research interests are fluid mechanics and dynamics, and she has worked on a number of applications of fluid flow theory relating to aerodynamics, engineering flows and atmospheric phenomena. She finished her PhD in applied mathematics and atmospheric science at the University of British Columbia late last year. Entitled *Scale Selection within the Convective Planetary Boundary Layer as Influenced by Coupled Interactions with an Induced Tropospheric Gravity Wave Field*, her thesis investigated horizontal roll vortices in the boundary layer.

In 1988 she graduated with a BSc in physics and mathematics from the University of New Brunswick and gained her MSc in mathematics at Carleton University, Ottawa, two years later. In 1993 she finished a Diploma in Meteorology at the University of British Columbia.

A member of the American Geophysical Union and the Canadian Meteorological and Oceanographic Society, Dr Heuff has also been involved in research into ozone distribution over British Columbia, the molecular mechanics of ice failure, the hypersonic flow around a half-cone delta wing combination, and the potential flow around a split-flap airfoil, including the effects of the trapped vortex.

Professor Reinhard Klette (aged 46) took up in June 1996 his position as Professor of Information Technology in the Department of Computer Science at the University of Auckland, Tamaki Campus. Born in Germany, Reinhard studied mathematics initially at Halle University. Then at Jena University he received his master degree and Doctor of Natural Science degree in mathematics, and became a Docent in Computer Science. Before he came to Auckland he was a Professor of Computer Vision at Berlin Technical University, and he is still a member of that University.

His research interests include theoretical and applied topics in image processing, pattern recognition, image analysis and image understanding. He has published books about image processing and shape reconstruction (surface reconstruction based on visual information), and he has been chairman of several international conferences and workshops on computer vision. Recently his research interests have been directed at 3-dimensional object analysis (e.g. biomedical image analysis), with digital geometry and computational geometry as major subjects in that field. For more information consult his home page - http://www.tcs.auckland.ac.nz/~rklette/.

Dr Christopher Price, recently involved in underwater acoustics research at the Auckland Naval Base, took up his lectureship in the Department of Mathematics and Statistics, Canterbury University, on 10 February.

A specialist in applied mathematics, particularly optimisation, Dr Price is a Canterbury graduate, gaining a BE(Hons) in electrical engineering and completing a PhD on non-linear semi-infinite programming in 1992.

In December 1993 Dr Price began as a mathematician with the Defence Scientific Establishment at the Auckland Naval Base, researching underwater acoustics and sonar systems. Specific projects included passive and active sonar, signal processing, and accoustic parameter estimation problems.

Dr Price has been a contract lecturer in the Mathematics Department at Massey University and in the University of Auckland's Engineering Science Department.

Dr Patricia Riddle

has recently taken up an appointment as Lecturer in the Department of Computer Science at the University of Auckland. Born in the United States, she received her BS. degree in Computer Science from Pennsylvania State University and her PhD in Computer Science from Rutgers University. After graduating, she spent 6 years working for Boeing (the US. airplane manufacturer) as a Senior Principal Scientist. Her research interests include artificial intelligence, machine learning, datamining, and adaptive computer-based training.

BOOK REVIEWS

Riemannian Geometry and Geometric Analysis by Jürgen Jost

(Universitext), Springer-Verlag, Berlin-New York-London, 1995, 401pp, DM 78.00.
ISBN 3-540-57113-2

Classical differential geometry was inevitably local, either in the strong sense of dealing with local properties, or at least in the weaker sense that it studied only surfaces or curves in 3-space and could use the coordinate system of R^3. Certainly there were results which foreshadowed later developments, such as the Theorema Egregium, with its suggestion of coordinate-free invariants, and others, such as the Gauss-Bonnet Theorem, which are always now quoted in a clearly global guise.

But the most basic conceptual apparatus for "global" differential geometry, that is, the idea of an object described only by sets of local coordinates, none of which need be sufficient on its own for the description, scarcely existed before Riemann's 1854 Habilitationsschrift, and remained largely unrealized for many years thereafter. In fact, the first clear definition of a manifold in the modern sense is usually ascribed to Weyl in 'Die Idee der Riemannschen Fläche' (1913), although of course he treated only the case of a 1-dimensional complex manifold. The lack of a formal and general definition had not prevented Klein, Poincaré, and Koebe from prosecuting the theory of Riemann surfaces with great success, and, similarly, much of the formal machinery of Riemannian geometry had already been invented by Ricci and Levi-Civita in 1901. When Einstein picked up their ideas to invent general relativity, it was, in effect, in terms of local coordinates.

It was left to Cartan to formulate Riemannian geometry on manifolds as we know it. Even so, in his work the Riemannian manifolds were not arbitrary, but given. The first genuinely global general results - in which the properties of the manifold as a whole are central, and the manifold is not the product of an explicit construction - such as de Rham's, Hodge's and Chern's, date from the 1930s and early 1940s. (In relativity theory, I believe the first really global results came even later, around 1958.)

It is a symptom of changes in fashion that, in the first pages of Hodge's book (1940), he still expected his readers to be thoroughly familiar with Riemann surfaces but to be suspicious of Riemannian manifolds; these days, I imagine the converse would be nearer the truth for most. In fact, differential geometry seems to have finally come to maturity only in the last thirty-five years. Its concepts and terminology have been settled, and have permeated so many other branches of mathematics that it is often awkward to place a particular result. Is the Index Theorem a result in geometry, or in differential equations, or in algebraic topology, or even in functional analysis? Jost's title reflects this difficulty: 'Geometric Analysis' means geometrical results obtained by analytical means, or, possibly, analytical results in whose proofs or statements geometry is important. However, his mention of 'Riemannian geometry' is also significant. The immense development of global differential geometry in the past thirty-five years has had many aspects, and some of them are not Riemannian. You will find no direct mention of symplectic or Poisson geometry in Jost's book (although there are references to Witten, Floer, and Conley and Zehnder, in connection with Morse theory). There is only a very brief introduction to Kähler manifolds. Even for Riemannian manifolds, there is nothing on spectra. The longest chapter by far (over 100 pages) is devoted to the topic to which Jost himself has made distinguished contributions, that of harmonic maps.

The book is described as a textbook, based on the author's lectures (a three-semester course, 'somewhat expanded'; at four hours a week for 45 weeks, this is just conceivable) at the University of Bochum. Its declared and laudable purpose is to bring a student new to differential geometry to an understanding of the main ideas of geometric analysis on Riemannian manifolds, and so it is, fittingly, dedicated to S.-T. Yau. There are two parts, with an interlude and appendices. The first four chapters, constituting slightly less than half the book, form an introduction to Riemannian geometry, which I have read fairly carefully. The remaining four, which I have browsed but not studied systematically, discuss Morse theory (up to the theorem of Lyusternik and Fët on closed geodesics), Kähler geometry and symmetric spaces, the Palais-Smale condition C and the closed geodesic problem in general, and harmonic maps. They are not, of course, exhaustive, but they take the reader to sighting

distance of research papers. The declared character of a textbook is sustained by fairly reasonable exercises at the end of each chapter.

The first thing to be said is that the book, despite the range of its material, is remarkably readable, far more so than the recent books by Chavel or Klingenberg with which I have compared it. This is principally due to its still bearing a discernible resemblance to lectures. Elucidatory remarks, sometimes very elementary, are not infrequent, and little time is wasted on alternative definitions of, let us say, connections or bundles. As I read, I often applauded the presentation of some topic or other which other authors make unnecessarily difficult for 'ideological' reasons; Jost uses local coordinates when that is easiest, and avoids them when they are messy. In a subject whose main ideas often seem either drowned by a sea of notation or clouded by a fog of geometrical elaboration, he delineates them with admirable clarity. And, unlike most textbooks, this introduces not one, but many topics of current interest. There is a section on the Yang-Mills equation (followed by a brief informal discussion of Donaldson theory). There is some talk about minimal surfaces. Or, as another instance, I can recall being puzzled when I first heard mention of Ricci curvature in seminars, and could not find it in the standard references I had to hand; well, here it is defined, there is a proof of the Weitzenböck formula, and there is considerable discussion of the Bochner method.

Most substantial sections are followed by a disquisition entitled 'Perspectives' which gives some description of further progress, with references, some of them very fresh. Jost seems to have read, or at least to be aware of, everything that has been going on that bears on his subject; I imagine that most readers outside his circle would discover quite a lot they did not know in these 'Perspectives'. Did **you** know that Günther had given a simplified proof of the Nash embedding theorem in 1989? Could you say anything intelligent at a party about the relations between Margulis's results on superrigidity and the theory of harmonic maps? Jost will help you.

So far - for its aims, its choice of material, its wealth of information, its emphasis on essentials, its contemporaneity, its readability - I have high praise for the book. But I also have serious reservations. This is something like the fourth book Jost has published in five years, quite apart from his difficult and technical research, and it is scarcely conceivable that it should be flawless. Indeed, the text has been neither edited nor proof-read as carefully as it deserves, and exhibits the defects as well as the merits of lectures.

There is no cumulative bibliography at all, and authors or concepts which appear in the Perspectives are not even indexed. The text seems to have been set in LaTeX, with its idiotic system of automatic numbering according to which, to make cross-reference frustrating, Lemma 3.7.7 may precede Proposition 3.7.3 which precedes Remark 3.7.1 which precedes Theorem 3.7.3.

There are plenty of misprints; some are rather charming, as when, for whatever reason, 'und', 'mit', or 'ist', now and then appear in place of 'and', 'with', and 'is' (in general, however, the text is in excellent American, down to capital letters after colons), others are readily corrected, - and some matter: for example, on p. 26, l. 6, $\rho_1 \le r = t_0$ should be $\rho_1 \le r - t_0$, and similarly on l. -3 the = should be a -. More worrying, in a way, are the errors in indices, which are quite common; on p.109, l. -9 ∇_{e_k} should be ∇_{e_l}. It might be said that such errors, of which there are many, keep the reader awake. On the other hand, they raise the question of the 'target audience'.

For if this, or even its first half, is just a textbook, it is in many ways an odd one. The beginning reader is given a definition of tensor products (on p. 35), but is expected to know about exterior powers (on p. 38). The definition of pull-backs (Def. 1.5.5), Whitney sums (Def. 1.5.8), and local 1-parameter subgroups (Def. 1.6.2) are simply wrong. One may suspect that Jost finds these elementary topics boring, and therefore, after Chapter 1 ("Foundational Material"), we are plunged into, or at least lightly sprinkled with, Hodge theory; there is a sketch of the proof of Hodge's theorem via the Rellich compactness theorem (rather than the less flexible parametrix method of Hodge or de Rham) which I suspect the inexperienced student reader would find fairly baffling. Stokes's theorem is assumed without explicit reference, and the regularity results stated in Appendix A.2 are obviously essential to the proof but are not mentioned. Similarly, the treatment of the Yang-Mills functional in Chapter 3 is - perhaps customarily - not as lucid as it might be; here, for instance, the equality on p. 83, l. 17, should be an inclusion, and contraction is rightly mentioned on p. 90, l. 15, but without any explanation what it is. Or, for more advanced material, Lemma 5.2.2 is proved on the assumption that ∂M_0 is of codimension 1 and without any need for M_0, and stated with an otiose compactness hypothesis. (A diagram would have helped the reader, and perhaps the author too). These are merely samples, chosen as relatively manageable and immediately convincing, of the kinds of error that occur rather often in the earlier part of the book. As it proceeds, it approximates more and more to a monograph on Jost's own interests, in which such mistakes are unlikely, and the reader may more

appropriately be expected to fill in the details anyway.

Thus, in sum, this is a book which, in some or all of its parts, will be both interesting and profitable reading for almost anyone who already has some knowledge of differential geometry. It is enjoyable to browse, and contains much useful information which is not available in so digestible a form elsewhere. Furthermore, it, or at least parts of its first half (from Chapters 1, 3, and 4), could well serve, if carefully signposted by the lecturer, as a supplementary text for an introductory course in Riemannian geometry; and selected topics from its second half (or Chapter 2) might well form an advanced course. But, despite its admirable intentions and its appetizing contents, it is not really suitable as an unsupported textbook. It has too many lapses of various kinds, both in logic and in notation, and it has undeclared and uncertain prerequisites.

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Finite Model Theory, by Heinz-Dieter Ebbinghaus and Jörg Flum

(Perspectives in Mathematical Logic). Springer-Verlag, 1995, 327pp, DM 148.00.
ISBN 3-540-60149-X.}

Model Theory is a branch of mathematical logic, concerned with the relationship between algebraic structures (groups, vector spaces, linear or partial orderings, graphs, categories, ... and the formal symbolic languages that are used to express their properties. If a sentence σ describes a property that is possessed by a structure $\mathfrak{A}$, then σ is said to be *true of* $\mathfrak{A}$, and $\mathfrak{A}$ is a *model of* σ. A *first-order* sentence is one whose quantifiers $\forall x, \exists x$ apply to a variable x that ranges over the *elements* of a structure $\mathfrak{A}$, while a second-order sentence may have quantifiable variables ranging over *subsets* of $\mathfrak{A}$, or over relations between elements. Consider for instance the Peano postulates

$\forall x\ [s(x) \neq 1]$
$\forall x\ \forall y\ [s(x) = s(y) \Rightarrow x=y]$
$\forall X[1 \in X \text{ and } \forall x\ (x \in X \Rightarrow s(x) \in X) \Rightarrow \forall x\ (x \in X)]$

The first two sentences are first-order, while the last is second-order because it has the variable X taking subsets as values. There is (up to isomorphism) only one model of this collection of sentences: its elements are the set 1,2,3, ... of positive integers, with $s(x) = x+1$. This reveals that second-order logic has much greater expressive power than first-order: there is no collection (not even an infinite collection) of first-order sentences in this language that has the positive integers as its only model.

Most of the work on model theory of the last half-century has concerned first-order languages and has emphasised infinite models. *Finite* model theory, concerned with the study of models that have finitely many elements, has a very different character. Thus the *Completeness Theorem* guarantees, through the existence of a proof calculus, that there is an algorithm for generating a list of those first-order sentences that are true of all models; but there is no such algorithm for enumerating the sentences true of all *finite* models. The *Compactness Theorem* asserts that a collection of sentences has a model if each of its finite subsets does. This cornerstone of first-order model theory (which was used in the creation of Nonstandard Analysis) also fails when restricted to finite models.

In recent years there has been a flourishing of interest in finite models, stimulated largely by connections with the theory of computability and complexity of computation. This book introduces and surveys this subject, taking as its model of computation the well-known *Turing machine*. Such a machine *accepts* an input if there is a run of the machine, starting with this input, that terminates in the "accepting state" (think of a green light being switched on at termination). A finite model can be completely specified symbolically by a finite number of assertions which can be presented as the input to a machine. Thus it makes sense to talk of a Turing machine accepting, or failing to accept, a given finite model. The machine is *deterministic* if at each stage there is only one instruction that it can execute next, and *non-deterministic* if, on the contrary, there are situations where it has a choice of its next action. The machine is *polynomially time-bounded* if the number of steps it takes to reach the accepting state is bounded by an integer polynomial function of the length of the input.

CENTREFOLD

Gordon Knight

In December, 1996, farewells were held at both the Albany and Turitea campuses of Massey University for Associate Professor Gordon Knight retiring after 37 years of secondary and tertiary mathematics teaching and research. Teaching was a vocation did not Gordon consider when he completed his honours degree in mathematics at London University in 1956. Gordon initially went into the design office in the aircraft manufacturing industry in Coventry, a job that he had previous experience in a vacation job. There, he was in the Design Office, the only mathematician among engineers, doing both stress calculations and modelling stress with the

Research Section. However after 3 years sitting at the same desk in the same office every day, doing similar tasks, Gordon sought a change. He went to the Coventry Technical College as a Lecturer, where he taught mathematics to a variety of students in vocational courses. It was there that he discovered that he really enjoyed teaching.

Gordon was born in Kenilworth, Warwickshire, England, and attended secondary school in Warwick. In 1962, Gordon and his wife Margaret were seeking to move away from Coventry and were attracted by the recruitment drive for teachers to New Zealand. Gordon accepted a 3 year contract to come to New Zealand on a trial basis. He accepted appointment to Southland Boys' High School, were he found he was the only teacher with a degree in mathematics. (Jack Alabaster, the senior maths teacher was on tour in South Africa with the New Zealand cricket team.) Without consciously deciding to stay, they delayed returning to Britain, as they found New Zealand a good place to raise a family.

In his second year at Southland Boys', he became HoD, applied for the school to be a pilot school for the "New Maths" syllabus, and commenced involvement in in-service training courses for teachers. After 7 years, he found the normal advancement route into administration not appealing, and succeeded in his application for a senior lectureship at Wellington Teachers' College. After one year he was recruited to a senior lectureship in mathematics at Massey University by Brian Hayman, who valued his school teaching experience for the development of the first year teaching programme.

Thus in 1970, Gordon began his association with Massey University. He took the opportunity to update his qualifications, enrolling in courses in statistics, computing and education, to complete a BA in education. The late Clem Hill, Professor of Education at Massey, encouraged Gordon to enrol for a PhD in the Education Faculty. Supervised by Dr Don McAlpine his topic was "Why some very able students find mathematics so difficult". Thus in 1982 Gordon was awarded the first New Zealand PhD in mathematics education. Gordon was continuing a full lecturing load within the Mathematics Department during this period.

During this time Gordon was asked "If you had the responsibility of designing a syllabus for Maori students how would you do it?" This question appealed to Gordon, but he realised he did not have the background to approach it. Over several years he took 6 courses up to the 300 level

in Maori language and culture. He then teamed up with Monte Ohia of the Department of Education and Mihi Maloney, a mathematics teacher in a secondary bilingual unit, to conduct a survey of the mathematics teaching in that area. He also wrote several articles analysing the Geometry behind Maori art. He was also involved in other team contracts in mathematics education such as with the IEA International Studies of Mathematics, looking at how students learnt fractions, the mathematics needs of NZ school leavers, and the implementation of the (current) new curriculum.

Although he has been a leading figure in mathematics education research, Gordon emphasises that it is the teaching of mathematics that has given him the greatest satisfaction. However, he was also involved in wider university activities. He served 6 years on the University Council as staff representative, 2 years as local chairperson of AUT, and 11 years as university mediator. In 1993 he undertook the oversight of the introduction of teaching in mathematical and computing sciences at Massey's new Albany campus. This he saw as new challenge at the end of his career, becoming the Associate Dean of FIMS and Head of the Mathematics Section. This group is now well founded with 16 full time academic staff continuing at Gordon's retirement.

Gordon and Margaret have returned to Palmerston North, but retirement is in name only. He continues with the supervision of 6 graduate students, and with active mathematics education research projects, and he maintains a close contact with the department.

His love of restoring old houses and cars continues, having bought the 90-year old farmhouse on the hill above the main Massey campus and he has parts of a 1903 Wolesley stored in the garage. This is their 13th home, having restored old houses in locations as diverse as Thorndon and Devonport, and Woodville and Kiwitea in the Manawatu, as well as several in Palmerston North city. This restoration alternated with the restoration of a number of old cars and taking a polytech course in panelbeating to enhance his skills. An active sportsman for many years, he played and coached Rugby in his earlier days, and continued with Basketball and Tennis. He enjoyed participation above being a spectator.

Mike Hendy

Now if K is a class of finite linearly ordered models, it turns out that the following are equivalent:

(i) K belongs to the complexity class NPTIME, which means that there is a non-deterministic polynomially time-bounded Turing machine that accepts exactly those finite models that belong to K.

(ii) K is the class of all finite models of some second-order sentence of the form $\exists X_1 ... \exists X_m \psi$ with ψ being first-order.

The complexity class PTIME, defined similarly by deterministic machines, corresponds in this way to another extension of first-order logic called Inflationary Fixed-Point Logic, obtained by adding logical constructs to describe the behaviour of some iterative procedures. Thus the famous "P=NP" problem corresponds to a certain (unsolved!) problem about the relationship between the expressive capabilities of two different logical formalisms.

There are many results like these, making up the topic of *descriptive complexity theory*, establishing a remarkable connection between the computational complexity of various problems and the logical complexity of the way we describe them. That topic is but one chapter of what is an excellent book that covers many fascinating themes, including the game-theoretic account of truth of sentences; laws about the probability of a finite structure being a model of a given sentence; logic programs; optimisation and approximation problems; sentences with infinitely long conjunctions and disjunctions; and the model theory of logics that can define fixed points, transitive closures of relations, and various generalised quantifiers ("there exist at least n ...", "there exists a Hamilton circuit ..."). The authors are experienced writers in the area, having previously produced (with W. Thomas) the very sound text *Mathematical Logic*, now in its second edition (Springer-Verlag, 1994). They succeed in presenting a concise exposition that is at the same time comprehensive and lucid, providing good motivations and clear examples. The book can be thoroughly recommended for self-sxtudy and reference, or for an advanced course on this vital new subject.

Rob Goldblatt
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The Heritage of Thales by W. S. Anglin and J. Lambek

(Undergraduate Texts in Mathematics), Springer-Verlag, 1995, 282pp, DM 58.00. ISBN 0-387-94544-X.}

This book is about the history, philosophy and foundations of mathematics. It is divided into two sections: Part I, History and Philosophy of Mathematics, consists of 31 short chapters dealing with the development of mathematics from about 1800BC through to about 1800AD; Part II has 35 equally short chapters devoted to the Foundations of Mathematics. The book is aimed mainly at mathematics majors, but also offers an invitation to science, arts and education students.

Thales lived around 600BC and is the first person known by name in the history of mathematics. He is generally assumed (without any concrete evidence, it must be admitted) to have been the first person to justify a mathematical result by logical reasoning, rather than by intuition or experiment. He was also a philosopher, so the authors quite naturally see him as a good patron saint for their book.

Any attempt to cover 3600 years of mathematical history in 170 pages is bound to be superficial, and Anglin and Lambek warn us that theirs is not a scholarly history. Some mathematicians seem to be mentioned merely for mentioning's sake, and even Newton gets only two pages with almost no mathematical content. Every now and then, however, we pause to catch our breath and take a closer look. The classical construction problems

(doubling the cube, trisecting angles, squaring the circle and constructing a regular polygon) are discussed in some detail. The first two, and the heptagon case of the last one, amount to solving cubic equations using only square roots, and the authors give a simple proof that this is impossible. (Even here, I was a bit disappointed with the treatment of the positive side of the last problem. The construction of the regular pentagon is described as one of the highlights of Euclid's Elements but we are not given the chance to appreciate it. On the other hand of course, there is already an excellent discussion of this construction available in Aaboe's superb book "Episodes from the early history of mathematics").

Anglin and Lambek also show us how Cardano and Ferrari solved cubic and quartic equations, and how Napier constructed his logarithms. Although the text is sometimes little more than a recital of names and dates, there are lots of interesting comments about related modern developments and about the philosophical (or even religious) ideas which have affected mathematicians through history. In particular, they trace the roots of the dominant mathematical philosophies of our century: formalism, intuitionism and classical Platonism, themes which are taken up again in Part II.

Part II discusses number systems (from the positive integers through to quaternions and cardinal numbers), recursion and logic, and even some (unnecessarily abstract) category theory. Again some topics are dealt with in more detail than others. The highlights for me were the proofs of the Theorem of Algebra and of Gödel's Incompleteness Theorem (though I was disappointed in the latter case that they did not point out the diagonal nature of the proof, especially after they had spelt out the same argument when discussing cardinality). The philosophical discussions reach their peak here, when Anglin and Lambek describe what Gödel's result means to mathematicians of various persuasions. Certainly my own students are quite intrigued when I discuss how mathematicians of other persuasions would view a result we have just studied. The idea of philosophical controversy in mathematics is quite novel to them. (Such discussions are particularly appropriate if you have prospective teachers in your class, as it prepares them for the philosophical divide which separates many mathematicians and mathematical educators.)

Most of the material in this book should be within the capabilities of third year students at a New Zealand university. However, some proofs are "tricky": convincing without being illuminating. Sometimes such proofs might benefit from further background discussion. For example, a discussion of Fermat's infinite descent argument could ease the students into their quaternion proof that every positive integer is a sum of four squares.

Reading this book feels like reading a colleague's lecture notes, and I would be glad to use it as such, leaving out bits I don't like, and adding extra material where there seem to be gaps. I would deviate more in Part I than in Part II, but that probably reflects the fact that I am more familiar with the history than with foundational issues. A good bibliography points the novice lecturer towards some of the more scholarly literature, and most chapters have a good range of exercises aimed at developing the mathematical or philosophical ideas of the chapter.

John Hannah
University of Canterbury

Linear Algebra Done Right by Sheldon Axler

Springer-Verlag, Berlin-New York-London, 1996, 238pp, DM 42.00. ISBN 0-387-94596-2 }

Despite its title, this is basically an old fashioned book. The author's first paragraph sets the scene:

"This is a text intended for a second course in linear algebra. A first course in linear algebra usually focuses on matrices; a second course should use the language of vector spaces and linear maps. A first course in linear algebra usually attracts students from all areas of science and engineering; a second course should be geared toward math majors and graduate students who can work with proofs. A first course in linear algebra usually emphasizes computation; a second course should lead students to a deeper understanding of the central ideas of the subject."

The result is a rather pure mathematical view of linear algebra (but only over the real or complex numbers). There is no mention of applications, and no discussion of computational problems. There isn't even much attempt to show how the subject connects with other branches of advanced mathematics. Linear algebra stands here in

splendid isolation. Although we don't actually have any courses like this at Canterbury, I still think that Axler has some interesting things to say.

What has Axler done right which the rest of us have been doing wrong? He advertized his viewpoint in an article in the American Mathematical Monthly (February 1995) called "Down with determinants!" His thesis is that the

main results of linear algebra (for example, the existence of eigenvalues, the various canonical forms for linear maps) can be proved simply without using determinants. Furthermore these proofs, using invariant subspaces, give us more insight than the ones based on determinants. So we don't need determinants and hence, as they are also useless from the computational point of view, we should avoid them (or at any rate leave them until the last chapter of the book).

Does it work? Generally speaking, yes. Particularly at the beginning, where Axler is trying to make his point, the proofs are simple and very clearly laid out. He is justifiably proud of his simple proof that every operator on a (finite-dimensional) complex space has an eigenvalue. As the proofs become more complicated, Axler uses sketch proofs to motivate the rigorous ones which follow. As he says (page 84), "You can read and verify every line of a proof without gaining any insight. Usually an informal sketch provides the insight." There are also lots of exercises where the student can check calculations from the text, see how the results apply to specific examples, or even try his hand at producing his own proofs or counterexamples.

As his first paragraph indicates, Axler prefers the language of spaces and linear maps to that of matrices. An interesting consequence is that the word "similarity" is never used, and he doesn't need to mention change-of-basis matrices (the bane of many students) until his final chapter on trace and determinants. On the down side, his attitude does make the transition from complex to real spaces more complicated. In a matrix approach, you can often prove a result for the real case by embedding it in the complex case and making small adjustments. In a linear map approach, this same idea becomes the messy idea of complexification of a space and its maps. Interestingly, Axler adopted this latter approach in his Monthly article, but has dropped it for his book. Instead he has chosen to work out separate proofs for the real cases of his main results. These new proofs are quite attractive, but they aren't always as simple as the corresponding matrix proof. This applies, for example, to his proof that every self-adjoint operator on a (finite-dimensional) real space has an eigenvalue.

Axler leaves his treatment of the determinant until the final chapter. Here his approach is less successful. Only with the advantage of hindsight, or some previous experience of determinants, are you likely to find his motivational introduction to the formula very convincing. His antipathy towards determinants even leads him astray: the determinant may well be useless computationally, but this has nothing to do with the size of $n!$ (page 217). As before, Axler handles the real and complex cases separately, but the real case is complicated enough for him to suggest that students leave it until a second reading. So despite his marginal comment to the contrary (page 220), I still came away feeling that Strang's approach to determinants (essentially as alternating bilinear forms) is simpler than Axler's, and it is certainly easier to motivate.

John Hannah
University of Canterbury

Nonstandard Analysis in Practice, by Françine Diener and Marc Diener (eds.),

Springer-Verlag, Berlin-New York-London, 1995,
250pp, DM 68.00. ISBN 3-540-60297-6.}

Nonstandard analysis, for some reason, has won the bizarre reputation of a "controversial" branch of mathematics. It seldom leaves mathematicians indifferent: I even dare claim that a researcher chosen at random would on average know more of nonstandard analysis than, say, of differential geometry. You either love NSA or you hate it. Every nonstandard analyst can name a few prominent mathematicians on either side of the fence.

In fact, NSA is not so much a separate branch of mathematics as a mode of thought. A researcher can think of every possible mathematical problem in terms of internal and external objects, monads and galaxies, infinitesimals and infinitely large numbers, and after a solution is obtained, write the result up in perfectly standard terms - as is a regular practice for the present reviewer, to cite one modest example. Nonstandard analysis is a way of viewing Plato's universe of mathematics,

and it provides intensity, clarity, and unusually bright colour vision.

One possible reason hampering the universal acceptance of NSA is the wrong but wide-spread belief that it takes an expert in model theory to handle the nonstandard machinery fluently. This perception might have been correct in the sixties and seventies, but the major efforts of nonstandard analysts over the last two decades were aimed at working out versions of NSA making any knowledge of its model-theoretic foundations unnecessary. I would have likened the situation with that in modern-day programming: one does not need to know about

the assembly language in order to write perfect Java applets. In a somewhat similar way, nonstandard analysis has by now evolved into an extremely user-friendly environment for doing mathematics - just *any* mathematics.

The aim of the volume under review is to introduce the reader to the present-day status of nonstandard analysis as a user-friendly collection of mathematical tools. One would not find in the collection of surveys under review anything about ultrafilters, ultraproducts, higher-order languages, saturated models, or compactness, the concepts forming the inside "hard core'" of NSA accessible these days only for "regular maintenance" by professionals in model theory. Instead, the authors concentrate on showing how NSA works.

Both editors and all the authors either belong to the French school of nonstandard analysis, created by the late George Reeb, or are closely associated with it. The healthy state of mathematical research in France assures that the nonstandard analysts' community in that mathematical superpower number two of our days is of sufficiently large capacity and breadth to cover basically all facets of NSA. (There are perhaps only two notable omissions in the present book: nonstandard functional analysis and nonstandard methods in quantum physics.) The approach adopted is that of Nelson's Internal Set Theory. It is not so important of course which approach one starts with as any accomplished nonstandard analyst can move not only between the two major versions of NSA but also over an entire spectrum of their less drastic modifications each of which offers its adantages in different situations. Mastering one of them means mastering all at no extra cost.

Françine and Marc Diener start with a *Tutorial*, providing a gentle introduction to nonstandard analysis for a beginner, including the transfer principle, idealisation, standardisation, S-continuity, shadows, and permanence principles. I find this introduction very elegant, polished and smooth.

In the second chapter, *Complex Analysis,* Augustin Fruchard presents the infinitesimal theory of analytic functions. This chapter captures quite a lot of a remarkable lecturing style of its flamboyant author, which impressed the present reviewer back in 1990. Equally striking was the fact that a graduate lecture course on the nonstandard theory of analytic functions, given in a small mathematics department in France not much larger than one in an average New Zealand University, attracted an enthusiastic and actively engaged audience of between 30 and 40, many if not most of whom attended the lectures in their spare time. Since this chapter culminates in the work of the late Jean-Louis Callot, it deals largely with iterations and Julia sets.

Pierre Delfini and Claude Lobry wrote Chapter Three, *The Vibrating String*, which shows how effective NSA can be in dealing with dynamics with small parameters, as envisaged by G. Reeb.

Of course, probability theory provided an excellent setting for some of the deepest and most spectacular applications of nonstandard analysis to date as well as for some of the most intensive work efforts invested by nonstandard analysts, and in Chapter Four Eric Benoît writes about *Random Walks and Stochastic Differential Equations*. The chapter extends so far as to cover Ito's calculus. There is also another chapter on nonstandard probability theory, Chapter Eight, *An External Probability Order Theorem with Applications* by Imme van den Berg.

Michel Goze, who is one of the younger leaders of the French school of nonstandard analysis, writes about *finitesimal Algebra and Geometry* in Chapter Five, covering such topics as his own famous Decomposition Theorem for vectors in a finite-dimensional space (a result having no "standard" analogue), infinitesimal riemannian geometry, moving frames, perturbations of linear operators, and nonstandard theory of deformations of Lie algebras. (It is worth recalling that back in the 80's Michel Goze solved a number of hard "standard" problems in deformation theory applying his nonstandard approach.)

Tewfik Sari presents nonstandard approach to *General Topology* in Chapter Six. The nonstandard view of general topology is based on Willem Luxemburg's Theory of Monads which he developed in the early sixties soon after becoming acquainted with Abraham Robinson's discovery of nonstandard analysis. A monad (or, as the French analysts prefer to call it, halo) of a point x in a topological space is the collection of all points that are infinitely close to x.

The monad of a point fully captures the neighbourhood filter of it, yet is in a sense easier to visualise and possesses a beautiful internal structure offering new insights into topological properties. One of the features of Sari's presentation is an abundance of exercises with the answers supplied at the end of the chapter.

The subject of Chapter Seven, *Neutrices, External Numbers, and External Calculus*, is slightly more special: it deals with those subsets of the nonstandard real line that are external, that is, are not elements of standard sets. Among the examples of external sets, are monads of standard points. The collection of all such monads, or else some other sets of a similar kind, has certain properties mimicking those of real numbers, and the authors argue that calculus of those sets can be useful in formalising such classical concepts as, for example, "the order of magnitude".

Chapter Nine, *Integration over Finite Sets* by Pierre Cartier (who is one of those present-day mathematical heavyweights actively interested in and involved with nonstandard analysis) and Yvette Perrin, lays out foundations for nonstandard integration theory, which fascinating subject gained so much in depth and popularity after the discovery of Loeb's measure.

Slow-fast differential equations and the corresponding vector fields, which are the darlings of the French school, are treated in Chapter Ten, *Ducks and Rivers: Three Existence Results*, by the two Editors themselves.

The concluding Chapter Eleven, by André Deledicq, is called *Teaching with Infinitesimals*, and it provides extremely interesting prospects of introducing infinitesimals and infinitely large quantities into a wide range of undergraduate subjects starting with the first-year Calculus. It is argued that nonstandard analysis provides a framework which is much more natural and conductive for learning than the traditional and much confusing ε - δ approach.

It is the deep conviction of the present reviewer that nonstandard analysis should not be judged according to standards of "practical use" whatever that means, but rather according to standards of beauty. In many aspects it is in fact closer to art than to science. There is something Nabokovian in the mysterious, fragile, ethereal grace of this prodigy child of mathematical logic - something, paradoxically enough, appealing to our emotions rather than our logic. The French, with their profound sense and appreciation of refined beauty, are well-poised to capture and explore the nonstandard way of doing things in mathematics - and to explain it to others. I highly recommend the book under review to all readers, whatever their attitude to nonstandard analysis be.

Vladimir Pestov

SPRINGER-VERLAG PUBLICATIONS

Information has been received about the following publications. Anyone interested in reviewing any of these books should contact: David Alcorn, Department of Mathematics, University of Auckland (email: alcorn@math.auckland.ac.nz)

Adamson IT, Data structures and algorithms. A first course. 419pp.
Andradas C, Constructible sets in real geometry. (Ergebnisse ..., 33) 270pp.
Bouwknegt P, The W3 algebra. 204pp.
Buechler S, Essential stability theory. (Perspectives in Math. Logic) 355pp.
Engeln-Mullges G, Numerical algorithms with Fortran. 602pp.
Fuhrmann PA, A polynomial approach to linear algebra. (Universitext) 350pp.
Galambos J, Bonferroni-type inequalities with applications. (Probability and its applications) 270pp.
Gardner M, The universe in a handkerchief. 200pp.
Gaylord R, Modeling nature. 210pp.
Goss D, Basic structures of function field arithmetic. (Ergebnisse ..., 35) 422pp.
Hairer E, Solving ordinary differential equations II, 2nd ed. (Springer Series in Computational Mathematics, 14) 614pp.
Heck A, Introduction to Maple. 720pp.
Hildebrandt S, The parsimonious universe. 350pp.
Holmgren RA, A first course in discrete dynamical systems. (Universitext) 240pp.
Kannan , Advanced analysis: on the real line. (Universitext) 260pp.
Lorentz GG, Constructive approximation. (Grundlehren ..., 304) 649pp.
Lozansky E, Winning solutions. (Problem Books in Mathematics) 270pp.
Morandi PJ, Field and Galois theory. (Graduate Texts in Mathematics, 167) 290pp.
Nathanson MB, Additive number theory: the classical bases. (Graduate Texts in Mathematics, 164) 380pp.
Nathanson MB, Additive number theory: inverse problems and the geometry of sumsets. (Graduate Texts in Mathematics, 165) 315pp.
Struwe M, Variational methods. (Ergebnisse ..., 34) 272pp.
Taylor M, Partial differential equations: basic theory. (Texts in Applied Mathematics, 23) 585pp.
Verhhulst F, Nonlinear differential equations and dynamical systems. (2nd ed) 303pp.
Zong C, Strange phenomena in convex and discrete geometry. (Universitext) 190pp.

CONFERENCES

**** 1997 ****

June 30 - July 4 (Melbourne, Victoria) **3rd International Conference on Combinatorial Mathematics and Combinatorial Computing**
Contact Nick Wormald, Department of Mathematics, University of Melbourne, Parkville, Victoria 3052, Australia.
email: nick@maths.mu.oz.au

July 3-4 (Clayton, Victoria) **International Conference on Computational Fluid Dynamics in Mineral and Metal Processing and Power Generation**
Contact Dr Phil Schwarz, CSIRO Division of Minerals, Box 312, Clayton South, Victoria 3169, Australia.
email: Phil.Schwarz@minerals.csiro.au

July 7-11 (Auckland, New Zealand) **Joint Meeting of the Australian and New Zealand Mathematical Societies** (incorporating the New Zealand Mathematics Colloquium)
Contact Professor Gaven Martin, Department of Mathematics, University of Auckland, Private Bag 92019, Auckland, New Zealand.
email: martin@math.auckland.ac.nz

July 7-11 (Canberra, ACT) **Workshop on Quasi-Two-Dimensional Turbulent Motion**
Contact Robert Dewar.
email: robert.dewar@anu.edu.au

July 9-13 (Auckland, New Zealand) **New Zealand Statistical Association 48th Annual Conference**
Contact David Scott, Division of Science and Technology, University of Auckland, New Zealand
email: d.scott@auckland.ac.nz

July 13-19 (Brisbane, Queensland) **XIIth International Congress of Mathematical Physics (Triennial Meeting of the International Association of Mathematical Physics)**
Contact Professor Tony Bracken, Department of Mathematics, The University of Queensland, Brisbane 4072, Australia.
email: icmp97@maths.uq.oz.au

July 21-August 22 (Canberra, ACT) **Extended Workshop on Statistical Mechanics and Integrable Models**
Contact M.T.Batchelor.
email: murrayb@pell.anu.edu.au

August 25-29 (University of Mons-Hainaut, Belgium) **Analysis and Logic Congress**
Contact Catherine Finet and Christian Michaux, UMH, Institut de Mathematique et d'Informatique, 15 Avenue Maistriau, B-7000 Mons, Belgium
email: analog@sun1.umh.ac.be WWW: http://sun1.umh.ac.be/~boffa/logicumh.htm

October 5-8 (Palmerston North) **NZAMT biennial conference: Get in the Know**
Contact Dr Glenda Anthony, Department of Mathematics, Massey University, Palmerston North, New Zealand.
email: G.J.Anthony@massey.ac.nz

November 30 - December 4 (Melbourne, Victoria) **4th Conference of the Association of Asian-Pacific Operational Research Societies (APORS'97)**
Contact APORS'97, PR Conference Consultants Pty Ltd, P O Box 326, Balwyn, Victoria 3103, Australia.
email: APORS97@sci.monash.edu.au

December 8-9 (Adelaide, South Australia, **Workshop on Quantum Coherence and Information Processing**
Contact Murray Hamilton, Department of Physics and Mathematical Physics, University of Adelaide, Adelaide, SA 5005, Australia.
email: mwh@physics.adelaide.edu.au

December 13-17 (Macquarie University, New South Wales) **Algebraic Methodology and Software Technology - AMAST 6, 1997**
Contact Dr Michael Johnson, School of Mathematics and Computing, Macquarie University, Sydney, New South Wales 2109, Australia.
email: amast97@mpce.mq.edu.au

**** 1998 ****

February 9-13 1998 (ETH Zurich, Switzerland) HYP-98 **Seventh International Conference on Hyperbolic Problems, Theory, Numerics, Applications**
Contact HYP-98, c/- Seminar for Applied Mathematics, ETH Zentrum, CH-8092, Zurich, Switzerland.
email: hyp98@sam.math.ethz.ch WWW: http://www.sam.math.ethz.ch/~hyp98/index.html

June 21-26 (Singapore) **5th International Conference on Teaching Statistics (ICOTS-5)**
Contact Brian Phillips, School of Mathematical Sciences, Swinburne University of Technology, P O Box 218, Hawthorn, Victoria 3122, Australia.
email: bphillips@swin.edu.au

July 6-10 (Brisbane, Queensland) **23rd Australasian Conference on Combinatorial Mathematics and Combinatorial Computing**
Contact Elizabeth Billington, Department of Mathematics, University of Queensland, Brisbane, Queensland 4072, Australia.
email: ejb@maths.uq.oz.au

The 5th Australasian Mathematics Convention
(Incorporating the New Zealand Mathematics Colloquium)

7-11 July , University of Auckland
Auckland , New Zealand
WWWeb Site:http://www.cce.auckland.ac.nz/maths/

Invitation

The New Zealand and Australian Mathematical Societies together with the Department of Mathematics at the University of Auckland and the New Zealand Institute for Mathematics invites all interested persons and members to attend the 5th Australasian Mathematics Convention in Auckland, July 7-11.

The Conference

The focus of the conference is research in the Mathematical Sciences in Australasia. Contributions are invited from all disciplines and areas of the Mathematical Sciences. We will provide a format of concurrent sessions incorporating various themes that will allow participants to present their work to the most appropriate audience and for attendees to focus on the most relevant presentations and material. All those wishing to present their research are encouraged to attend, regardless of topic or discipline within the Mathematical Sciences.

Plenary Speakers

A number of top international mathematicians, many of whom are based in Australia and New Zealand and others visiting the region, will provide overviews of the current status and

future directions of their chosen areas of research. These lectures are intended for a general audience and those wishing to experience the depth and breadth of mathematical research in Australasia are strongly urged to attend.

Annual General Meetings

Two separate late afternoon venues will be reserved for the Annual General meetings of both the Australian and New Zealand Mathematical Societies.

Social Program

On the evening of Sunday 6 July there will be a Wine and Cheese Welcoming reception at O'Rourke hall, where it is expected a majority of the attendees will be staying. This will provide a chance to catch up with colleagues in an informal atmosphere. This in included in the registration fee for participants. There will be a conference dinner for attendees and partners at a yet to be finalised venue and a number of outings set aside for the free afternoon. Information on these will be updated as it becomes available.

Invited Speakers: (Not all speakers have confirmed)

J. Butcher, The University of Auckland (Auckland)
U. Cegrell, Canterbury University (Christchurch)
J. Fauvel, Open University (England)
A. Hinkkanen, The University of Illinois (Urbana-Champaign)
P. Hilton, SUNY (Binghampton), Mahler Lecturer
K. Horadam, RMIT (Melbourne)
A. Jaffe, Harvard (Cambridge)
N. Kopell, Boston University (Boston)
A. Ram, Princeton University (Princeton)
H. Rubinstein, Melbourne University (Melbourne)
N. Trudinger, ANU (Canberra)
R. Weber, Aust. Defence Forces Acad. (Canberra) ANZIAM speaker
G. Weiss, Washington University (St. Louis)
H. Wilf, Pennsylvania University (Philadelphia)
K. Worsley, McGill University (Montreal)

Prizes

The following Prizes of the Australian and New Zealand Mathematical Societies will be presented at the meetings: Aitken Prize, Bernhard Neumann Prize, Australian Mathematical Society Medal and the New Zealand Mathematical Society Research Award

Accommodation
Ample good quality single accommodation has been reserved at student colleges very close to campus and the central city area (O'Rourke Hall, Mount Street). These are available at very good rates for the evenings 6-12 July (Dinner, Bed and Breakfast). There is a wide variety of hotels in downtown Auckland and close to campus and we will endeavour to accommodate delegates according to their budgets.

For further information regarding the scientific program etc please contact martin@math.auckland.ac.nz(Gaven Martin)

First International Conference on UNCONVENTIONAL MODELS OF COMPUTATION CDMTCS,

Universities of Auckland and Waikato, NZ, Santa Fe Institute, USA
5-11 January 1998, Auckland, New Zealand

Call for Papers

Original papers are solicited in all areas of unconventional computation, especially in quantum computing, computing using organic molecules (DNA), and various proposals for computation that go beyond the Turing model. Authors are invited to submit papers either in hard copy by post, or electronically by email, to the address below.

Electronic submissions should be in PostScript format, printable in a standard Unix environment. LaTeX source of final versions of accepted papers will be required.

Joint submissions to other conferences are not permitted. Authors of accepted papers are expected to present their work at the conference. The proceedings will be published by Springer-Verlag, Singapore in the DMTCS Series, and will be made available during the conference.

Invited Speakers:
J. Casti (Santa Fe), A. Ekert (Oxford),
J. Hartmanis (Cornell University and NSF),
I. Hunter (MIT),
H. J. Kimble (Caltech),
S. Lloyd (MIT),
I. Prigogine (Solvay Institute),
A. Salomaa (Turku University),
D. Wineland (NIST).

Conference Committee
C. Calude, Univ. of Auckland, Chair
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R. Doran, Univ. of Auckland, Treasurer
P. Gibbons, Univ. of Auckland
U. Guenther, Univ. of Auckland
H. Guesgen, Univ. of Auckland
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A. Salomaa, Turku University
K. Svozil, Vienna Technical Univ.

Proceedings Committee
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J. Casti, Santa Fe
M. Dinneen, Auckland

Important Dates
Submissions Due: 15 July 1997
Notification: 15 Sept. 1997
Final Copies Due: 1 Nov. 1997

Address For Submissions:
Unconventional Models of Computation,
Department of Computer Science,
University of Auckland, Private Bag 92019,
Auckland, New Zealand,
umc@cs.auckland.ac.nz.

Poster Sessions:
During the conference, there will be a number of poster sessions. If you are interested in presenting a poster, please contact P. Hertling at hertling@cs.auckland.ac.nz.

Cost of Participation:
The registration fee is NZ500 (which includes the excursion, dinner and proceedings), or NZ100 for students (including only the proceedings).

For More Information:
See the conference home page at http://www.cs.auckland.ac.nz/CDMTCS/docs/news.html, or contact the secretary M. Dinneen at mjd@cs.auckland.ac.nz.

Peter B Gibbons
p_gibbons@cs.auckland.ac.nz

New Zealand Statistical Association 48th Annual Conference
University of Auckland

Wednesday July 9 - Friday July 11, 1997

Themes of the Conference are Bayesian Statistics including Markov Chain, Monte Carlo and Statistical Ecology. It is expected that there will also be sessions on Official Statistics, Biostatistics, Statistical Theory, and Statistical Education. Contributed papers in any area of statistics will however, be accepted for the conference program.

Keynote speakers who have accepted invitations to speak at the Conference are Peter Hall (ANU), Luke Tierney (Minnesota), Steve Buckland (St Andrews), Keith Worsley (McGill), and Richard Huggins (La Trobe).

Peter Hall's talk will be presented jointly with the joint meeting of the Australian Mathematical Society and the New Zealand Mathematics Colloquium, which is being held in Auckland from July 7 to July 11.

Steve Buckland is to present a workshop on Line Transect and Distance Sampling for Estimation of Wildlife Populations on the morning of July 11. The Workshop and the sessions on Statistical Ecology are intended to be interdisciplinary, bringing together researchers from Biology, Ecology and Statistics.

Accommodation has been reserved for participants in the student residence Grafton Hall which is close to the University.

The deadline for submission of abstracts is May 23, 1997.

For further details concerning the Conference, or to register your interest, there is a link on the home page of the Statistics Department at the University of Auckland (http://www.stat.auckland.ac.nz/).

Alternatively, contact Associate Professor David J Scott, Department of Statistics, Tamaki Campus, The University of Auckland, PB 92019, Auckland. Phone 64 9 373-7599: Fax 64 9 373-7177. Email: d.scott@auckland.ac.nz or dscott@scitec.auckland.ac.nz

VISITORS

The main purpose of this list is to enable other institutions to invite visitors to spend time with them. Anyone wishing to issue such an invitation should do so through the principal contact person.
The information for each item is arranged as follows:
Name of visitor; home institution; whether accompanied; principal field of interest; dates of visit; principal host institution; principal contact person; comments.

An up-to-date version of this list is maintained available on the Worldwide Web, at the URL

http://www.math.auckland.ac.nz/~mcintyre/Visitors

This site also contains a form for convenient submission of information about forthcoming visitors.

Professor David Armitage; The Queens University of Belfast; - ; Potential Theory and Harmonic Approximation; July and August 1997; University of Canterbury; Neil Watson; Erskine Fellow.

Mary Barnes; University of Melbourne; -; Mathematics Education, teaching of calculus, graphic calculators; October 97; New Zealand Mathematics Teachers Association; Dr Glenda Anthony.

Professor Len Bos; University of Calgary; - ; approximation theory; probably July-August 1997; University of Auckland; Norm Levenberg.

Professor Henrik Bresinsky; University of Maine; - ; algebraic geometry; February - July 1997; Massey University; Assoc Professor Dean Halford.

Professor Jean-Paul Cavi; Universite Paul Sabatier (Toulouse, France); - ; several complex variables and polynomial interpolation; probably July-August 1997; University of Auckland; Norm Levenberg.

Assoc Professor David Clarke; University of Melbourne; - ; Mathematics Education, assessment, teacher education; October 97; New Zealand Mathematics Teachers Association; Dr Glenda Anthony.

Professor Satya Deo; Allahabad University, India; - ; topology; February-June 1998; University of Auckland; David Gauld.

Dr Max Ganster; Technische Universitat Graz, Austria; unaccompanied; topology; Nov-Dec 1997; University of Auckland; Ivan Reilly.

Assoc Professor Le Tuan Hoa; Institute of Mathematics, Hanoi; unaccompanied; algebraic geometry; September 1996 - August 1997; Massey University; Assoc Professor Dean Halford; Postdoctoral Fellow.

Dr David Johnson; University of Nottingham; wife; combinatorial group theory; March-May 1997; University of Auckland; Professoressor Marston Conder.

Dr George Gheverghese Joseph; University of Manchester; wife Leela; author of 'Crest of the Peacock: The Non-European Roots of Mathematics', social and historical aspects of mathematics; March-June, 1997; University of Auckland; Bill Barton; British Council LINK funded visit.

Professor Gerhard Kristensson; Department of Electromagnetic Theory, Lund University, Sweden; unaccompanied; inverse problems; March-mid April 1997; University of Canterbury; Dr David Wall; Erskine Fellow.

Dr Kevin McLeod; University of Wisconsin at Milwaukee; - ; theory and application of (partial) differential equations; July 1996-July 1997; University of Auckland; - ; Honorary Research Fellow.

Dr Peter Olver;- ; - ; - ; 24 March to 24 April 1997; University of Canterbury; Dr Mark Hickman; Erskine Fellow.

Professor James Oxley; Louisiana State University; unaccompanied; matroid theory; sometime in June-July 1997; Victoria University, Wellington; Geoff Whittle.

Visitors

Professor Mikael Passare; University of Stockholm (Sweden); accompanied (perhaps) by a PhD student, Lars Filipson (Polynomial interpolation); several complex variables; unknown; University of Auckland; Norm Levenberg.

Professor M.J.D. Powell; Cambridge University; wife Caroline; Optimisation and Approximation; (approx) August-Sept 1997; University of Canterbury; Rick Beatson.

Professor R. M. (Bob) Raphael; Concordia University, Montreal; unaccompanied; ring theory; 5 March - 30 April 1997; University of Canterbury; Kevin O'Meara.

Professor Greg Reid; University of British Colombia; Unaccompanied; Algebraic Computing and Symmetries of PDEs; Jan-Jun 1997; University of Canterbury; Mark Hickman.

Professor Fred Richman; Florida Atlantic University; wife (Sue); constructive mathematics, infinite abelian groups; January-May 1997; University of Waikato; Professor D.S. Bridges.

Professor David Riley; University of Alabama; wife (Tima); Noncommutative algebra (groups/rings/Lie algebras); 25 May-12 July 1997; University of Auckland; Mark Wilson.

Dr Fridrich Sloboda; Academy of Sciences, Bratislava; son; geometric and topological problems in image analysis; 24 January-31 May 97; University of Auckland; Professor Reinhard Klette.

Professor David Tall; The University of Warwick, UK; wife (Sue); Mathematics Education - using computers for learning mathematics; June 14-July 14 1997; The University of Auckland - Foundation Visitor; Mike Thomas; supported by the British Council.

Professor Dirk Vertigan; Louisiana State University; unaccompanied; matroid theory; sometime in June-July 1997; Victoria University, Wellington; Geoff Whittle.

Anne Watson; University of Oxford; - ; Mathematics Education, assessment, mathematical thinking; October 97; New Zealand Association of Mathematics Teachers; Dr Glenda Anthony; British Council Link funded visit.

Professor Guido Weiss; Washington University in Saint Louis; wife Barbara; Harmonic Analysis; 13 July-23 August 1997; University of Canterbury; Qui Bui; Erskine Fellow.

Assoc Professor Sue Willis; Murdoch University; - ; Mathematics Education, numeracy, gender issues; October 97; New Zealand Mathematics Teachers Association; Dr Glenda Anthony.

Professor Richard Wilson; Universidad Autonoma Metropolitana, Mexico; wife Elda; topology; February-June 1997; University of Auckland; David Gauld.

Professor Keith Worsley; McGill University, Montreal, Canada; - ; Statistics; December 1996-July 1997; University of Auckland; Alan Lee.

Please note: Production of these lists is dependent on me receiving information. When you know about a visit (whether it be definite, very likely, or possible), would you please forward the details to me at the earliest convenient time. Thank you.

David McIntyre, N.Z. Mathematical Society Visitors' Co-ordinator
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Private Bag 92019, Auckland, New Zealand
mcintyre@math.auckland.ac.nz+, fax: (09) 373 7457

NOTICES

NOTICE OF ANNUAL GENERAL MEETING

The Annual General Meeting of the New Zealand Mathematical Society will be held at the 1997 New Zealand Mathematics Colloquium at the University of Auckland during the week 7-11 July 1997. The exact time and place of the AGM are currently being arranged.

Items for the Agenda should be forwarded by 27 June 1997 to the NZMS Secretary, Dr. Stephen Joe, Department of Mathematics, The University of Waikato, Private Bag 3105, Hamilton (fax number: (07) 838 4666, email address: stephenj@math.waikato.ac.nz).

CALL FOR NOMINATIONS FOR NZMS COUNCIL POSITIONS

The terms of office of two Council members (Dennis McCaughan and Mick Roberts) come to an end in 1997, and nominations are called for the resulting vacancies.

According to the New Zealand Mathematical Society By-laws, at least two Council members shall be resident in the South Island. Accordingly, no more than one of the vacancies may be filled by a resident of the North Island.

The term of office of a Council member is three years. Council members may hold office for two (but no more than two) consecutive terms.

Nominations should be put forward by two proposers. The nominee and the two proposers should be current Ordinary or Honorary members of the NZ Mathematical Society. The nominations, including the nominee's consent, should be forwarded by Monday 9 June 1997 to the NZMS Secretary, Dr Stephen Joe, Department of Mathematics, The University of Waikato, Private Bag 3105, Hamilton (fax number: (07) 838 4666, email address: stephenj@math.waikato.ac.nz). If nominations are sent by email, the two proposers and the nominee should each send separate email messages to the Secretary.

FINANCIAL SUPPORT FOR STUDENTS TO ATTEND THE 1997 NZ MATHEMATICS COLLOQUIUM

The 1997 New Zealand Mathematics Colloquium will be held at The University of Auckland during the week 7-11 July 1997. This Colloquium is a joint meeting with the Australian Mathematical Society. Students who wish to apply for financial assistance to attend this Colloquium should do so when they register. The Colloquium organisers are empowered to distribute funds on behalf of the NZMS.

AITKEN PRIZE (NZMS STUDENT PRIZE)

The New Zealand Mathematical Society offers a prize for the best contributed talk by a student at the annual New Zealand Mathematics Colloquium.

Known as the Aitken Prize, in honour of the New Zealand born mathematician Alexander Craig Aitken, this prize will be offered for the third time at the 1997 Colloquium to be held at the University of Auckland during the week 7-11 July 1997. This Colloquium is a joint meeting with the Australian Mathematical Society.

The prize will consist of a cheque for NZ$250, accompanied by a certificate.

Entrants for the prize must be enrolled (or have been enrolled) for a degree in Mathematics at a university or other tertiary institution in New Zealand in the year of the award. During the Colloquium, they should give a talk on a topic in any branch of the mathematical sciences.

A judging panel will be appointed by the NZMS Council, and make recommendations to the NZMS President and Vice-President for the prize. Normally the prize will be awarded to one

person, but in exceptional circumstances the prize may be shared, or no prize may be awarded.

Entrants should clearly indicate their willingness to be considered for the prize when they register their intention to contribute a talk at the Colloquium.

1998 NZMS VISITING LECTURESHIP

Each year the New Zealand Mathematical Society coordinates and provides some financial support for a tour of NZ universities by a visiting mathematician. Usually this person-known as the NZMS Visiting Lecturer-will spent two to three days at each of the six main university centres, and give at least two lectures at each place: one for a general audience, and one more closely tied to his or her own particular research interests.

Recent NZMS Visiting Lecturers have included Professor John Loxton (Macquarie University), Professor Andreas Dress (University of Bielefeld), Dr. Colin Maclachlan (University of Aberdeen), Professor Roger Grimshaw (Monash University), and Professor Valerie Isham (University College London). The 1997 NZMS Visiting Lectureship is currently being arranged.

Nominations for the 1998 NZMS Visiting Lectureship are now being requested by the NZMS Council. Names of suitable candidates, along with a brief description of their current position and field(s) of interest, should be sent by 29 August 1997 to the NZMS Secretary, Dr. Stephen Joe, Department of Mathematics, The University of Waikato, Private Bag 3105, Hamilton (fax number: (07) 838 4666, email address: stephenj@math.waikato.ac.nz).

NZ INSTITUTE OF MATHEMATICS

This notice is to announce the formation of the New Zealand Institute of Mathematics, by those who have been involved in the organisation of successful Mathematics summer research workshops at Huia and Tolaga Bay since 1994.

The goal of the Institute is easily stated: to promote mathematical research in New Zealand, leading to an increase in the store of knowledge in mathematics and to pass on this advanced knowledge to professional mathematicians and students of mathematics in New Zealand.

The Institute aims to complement and cooperate with existing activities which promote mathematical research in New Zealand, especially the New Zealand Mathematical Society and the Royal Society of New Zealand.

There is a particular need in this country for constant interaction with international mathematicians and one of our intentions is to be able to have as many such people as possible spend time in New Zealand, to pass on their insights and knowledge to local mathematicians.

This is to be achieved by a series of meetings on specific themes of significant and topical interest, at which talks on all levels are given. In the longer term it is envisaged that on a regular basis an invited "Institute Professor" would spend an extended period in New Zealand, not attached to any particular University.

We have found there is a substantial interest in visiting New Zealand among world mathematicians and we do not anticipate having difficulty attracting mathematicians of the highest quality. In the long term we would like to see the Institute have its own premises, which could be used (among other things) as a retreat for New Zealand mathematicians to work on research unhindered by the usual constraints of academic life. This will depend on available financing and we would consider seeking sponsorship in this venture.

The Directors of the Institute are Professors Marston Conder, David Gauld, Vaughan Jones FRS FRSNZ and Gaven Martin of the University of Auckland, and Professor Rod Downey FRSNZ of Victoria University of Wellington. The next summer workshop run by the Institute will be held at Napier from 3-10 January (inclusive), on the topic "Analysis and Geometry" in the broadest possible sense, and organised by Gaven Martin (Email: martin@auckland.ac.nz).

REPORTS

MATHEMATICS SUMMER WORKSHOP AT TOLOGA BAY

Following successful workshops at Huia in December 1994 and Tolaga Bay in January 1996, the 3rd Mathematics Summer Workshop was held at Tolaga Bay from 3 to 11 January 1997.

The theme of this Summer Workshop was "Discrete groups and hyperbolic manifolds". Courses of lectures were given by Colin MacLachlan (Aberdeen), Martin Bridson (Oxford), David Singerman (Southampton), Andre Haefliger (Geneva), Linda Keen (CUNY, New York), and Walter Neumann (Melbourne), and individual lectures were given by Milagros Izquierdo (Malardalen, Sweden), Fred Gehring (Michigan), and Jonathan Hillman (Sydney).

The workshop was attended by 45 mathematicians including 15 from overseas and 15 students, and together with family members the number of participants totalled 80. Lectures were held in the mornings and evenings, with afternoons free for recreation and discussion. Participants were accommodated in motels and homestays, and meals were provided by a local catering group. On free afternoons and a day off in the middle of the workshop, participants enjoyed exploring the locality, and some took part in a bus tour of sites near Tolaga Bay of cultural and historical interest.

The workshop was run under the auspices of the New Zealand Institute of Mathematics (Directors Marston Conder, David Gauld, Vaughan Jones and Gaven Martin), with financial support from Marsden Fund grants and from the Department of Mathematics of the University of Auckland.

Marston D. Conder

Garden Party

Walter Neumann

Mark McGuinness: Victoria University of Wellington

Thanks partly to a generous travel grant from the New Zealand Mathematical Society, I attended the 5th International Heat Pipe Symposium at the Royal Melbourne Institute of Technology, from 17 to 20 November.

About 90 scientists and engineers attended, from Australia, New Zealand, China, Japan, USA, Thailand, Russia, Korea, South Africa, Canada, Malaysia, Czech Republic, Georgia, Taiwan, Republic Belarus and Hong Kong. Heat pipes are used to move heat, and are usually more efficient than conductive methods, and can operate without gravity or against gravity. They are used in melting snow, cooling or heating gloves, cooling nuclear power reactors, space technology, cooling multicomponent chips in computers especially where compactness is important, modelling steam and liquid movement in geothermal reservoirs, and recovering waste heat in air conditioners and bakers' ovens. They operate at temperatures ranging from 4K to 1200K, and involve working fluids like water, sodium, and liquid helium. Mostly they involve flows of the liquid and vapour phases of the working fluid, and take advantage of the latent heat associated with the phase change.

Talks ranged from the detailed engineering of heat pipes to the mathematical modelling of their behaviour. The organisers were able to arrange for talks to be given without any parallel sessions, where heat pipe research is going. I had some reservations about attending such an engineering oriented conference at first, but found it very useful for pinpointing where there is a need for mathematical modelling. Applications tend to rely on an empirical engineering approach, based on experiment, because the two-phase fluid flows involved are often turbulent and the geometries are complicated. The physical processes limiting heat flow are not always clear, and when they are clear they are not easy to model. There is room here for several applied mathematicians!

I gave a talk about how phase plane analysis helps understand solution behaviour in the geothermal context, with a short video of computer-generated visualisations to illustrate. I am told that when the video started, complete with a music sound-track, one very concerned gentleman from Russia raced out and button-holed a conference organiser, saying that he must do something quickly, there was some music coming over the sound system that was ruining my talk!

Oh well, back to the drawing board...

Thanks, New Zealand Mathematical Society, for the opportunity to attend this very worthwhile conference.

John Hannah: University of Canterbury

In January this year, I attended the joint AMS-MAA meeting in San Diego. As you'd expect at such a large conference (about 3000 participants, I think) there were lots of parallel sessions and it was impossible to do everything I'd have liked to do. Still, I managed to split myself five ways reasonably successfully!

One of my themes was teaching linear algebra. I took part in an MAA mini-course which introduced the NSF-funded Linear Algebra Modules Project based in Seattle. The authors are writing an interactive text, using Maple's notebook facility. Although I still think Maple's matrix algebra is clumsy (compared with Matlab's), the text has some promising geometric ideas. The authors haven't yet decided what form the final product will take. Presumably a publisher would prefer to sell each student their own copy. But, for me, an attractive option would be to have an instructor's copy which I could modify to my own tastes and then leave as a library resource for my students (publishers would no doubt want a lot of money for this option!) If you want find out a bit more, try the Web site (under construction!)
http://www.math.grin.edu/~herman/lamp/

There were also three sessions devoted to innovations in teaching linear algebra, and I gave a short talk about the problems of trying to visualize row, column and null spaces when we really want students to be thinking about systems of linear equations. My view is that the correct "picture" of the row space is as a set of equations rather than a set of points in the domain of the transformation $\mathbf{x} \varnothing A\mathbf{x}$. (Copies of my paper are available on request!) I also got some good Matlab codes!

Calculus Reform is still a contentious issue and there were talks about it at several (sometimes simultaneous) sessions. My own interest is in how the reform is being evaluated, and I

THE NEW ZEALAND MATHEMATICAL SOCIETY (INC.)

APPLICATION FOR FINANCIAL ASSISTANCE

Please fill in where appropriate

Name of applicant: .....

Address: .....

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e-mail: .....

Academic affiliation / Official status / Present position:

.....

NZMS status: Ordinary member ..... Student member .....

Other (give details) .....

Signature: ..... Date: .....

Type of assistance sought	Amount
(a) Student Travel Grant	.....
(b) Research Grant: conference/travel/visitors/other	.....
(c) Grant from South Pacific Fund	.....
(d) Conference/Workshop Organisation	.....
(e) Other (please specify below)	.....

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Estimated total expenditure: .....

Other sources of assistance sought/approved (please specify below):

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Please describe your reasons for making this application and the plans you have for spending the grant if your application is successful:

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Please list any supporting documents or other evidence (attached to your application):

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Supporting statement from supervisor or Head of Department (for student applicants only):

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Please send this application (and any supporting documents or other evidence) to:

Dr Stephen Joe, Secretary, N.Z. Mathematical Society,
Department of Mathematics, The University of Waikato, Private Bag 3105, Hamilton.

The NZMS Council normally considers these applications at its meetings in July and November each year, but applications may be considered at other times in exceptional circumstances.

Reports cont'd...

renewed my contact with Jack Bookman of Duke University who is one of the leading workers in this area. As for the reform itself, I got the impression that it has reached a stationary point. 30% of calculus courses use the Harvard reform text, but it's proving difficult to expand beyond this point. Part of the problem is that, by and large, the courses are run by nontenured staff who then move on, leaving the new staff to start all over again. (Does this mean that such staff spend so much time on calculus reform that they fail to gain tenure?)

Another strand was about teaching abstract algebra. Most talks clung to a very traditional approach, even when advocating the use of computers. Bourbaki still rules here, whereas some English texts (by Burn or Armstrong, for example) have gone back to a more concrete (and historical) approach based on geometry and permutations. Nevertheless there were nice ideas I'd like to try out on my classes this year, and there was a package "Exploring Small Groups" which I'd like to get in for next year.

I also attended a MAA mini-course about teaching the history of maths (more with a view to the distant future, as Canterbury doesn't yet have such a course, alas). The discussions were very interesting, but my main gain here was a reliable guide to the resources available. The experts seem to doubt the value of an exhaustive introductory course (there's too much to cover, as I've said in a book review elsewhere in this Newsletter), and the trend now is to give topic-oriented courses and to include history in the normal maths courses.

Finally there was the book display!! This has to be worth the trip by itself! Luggage and financial constraints meant that I came back with references rather than actual books (with a couple of important exceptions), but it gladdened my heart to see so much maths in print. There was also a new graphics calculator from Texas on display (and competition from Casio and Sharp, but not Hewlett-Packard, oddly enough). Some powerful machinery here for about $70(US) ... almost in the region where I'd think about making it a course requirement.

A huge thank-you to the New Zealand Mathematical Society for their contribution to my expenses. If you want exposure to lots of teaching ideas, try the next AMS-MAA joint meeting yourself!

MATHEMATICAL MINIATURES

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