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NEWSLETTER

OF THE

NEW ZEALAND MATHEMATICAL SOCIETY (INC.)

Contents

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PUBLISHER'S NOTICE

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The homepage of the New Zealand Mathematical Society with URL address:
`http://www.math.waikato.ac.nz/NZMS/NZMS.html` (Webmaster:
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The newsletter is available at: `http://IFS.massey.ac.nz/mathnews/NZMSnews.html`
Editorial enquiries and items for submission to this journal should be submitted as text or LaTeX files to
`r.mclachlan@massey.ac.nz`

EDITORIAL

NEW INITIATIVES

This society is small, but its purpose is vital to all its members. It also has a moderately large endowment of about $160,000. The activities funded by membership fees and interest income (the biennial NZMS Lecturer, inviting a speaker to the Colloquium, subsidising the Journal and the Colloquium, and providing modest travel and research grants to members) have been set in place for many years and clearly further the cause of mathematics in New Zealand. The endowment has accumulated through royalties (now declining) and interest. Thanks to former treasurer Kee Teo, we are registered as a charity and so pay no income tax.

The question of whether the Society should mount any new initiatives has been discussed as the last two AGMs with widespread support but few specific details. At some point we have to act. The council will be discussing this this year and I'd like to encourage everyone to talk to their council members and write to the Newsletter.

The research environment for those with established careers (but not too established, or you might be threatened with early retirement) is relatively good now—see the views in the last newsletter. The reports in this issue from 6

specialized conferences held over the summer are also very encouraging, reports that could not have been made even a few years ago.

But all of us at universities constantly face the risk of being undermined by falling student numbers. Every March we anxiously watch the enrolment figures: the service courses (for our jobs) and the maths majors (for our sanity?). New Zealand already has an unusually low percentage of mathematical science graduates; not only are these graduates essential to the long-term position of our country, but if numbers fall any more, and your university is also facing a deficit, your job could be at risk very soon. What can the Society do to prevent this?

My ideas for new initiatives all revolve around publicity.

We could prepare publicity material for undergraduates, updating the *Maths Adds Opportunities* pamphlet produced in the mid-90s at Auckland.

We could maintain a national database of career profiles and interviews with graduates. Other professional bodies do this.

We could run a national undergraduate competition.

We could publicise mathematics directly through the media.

We could promote contact with high school students, with publicity material, speakers, or by exploring joint projects with the NZ Association of Mathematics Teachers.

We could award some undergraduate scholarships. We can already afford a small one out of our existing income, but we could consider fundraising to create a separate endowment. This issue has been floating around for years without going everywhere, and certainly everyone I've talked to who's tried it has come away discouraged. How different from the US, where my alma mater has tracked me down effortlessly over the years, gleefully reporting on new donations (3 figures seems to get your name in print, but 6-8 is better), and soliciting more. My own view that a big maildrop is worth the risk: fundraising expenses usually run to 10 or 20% of the amount raised, and the database could be used again in the future.

What do you think?

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A long time ago I was sharing an office at the Centre for Nonlinear Studies, Los Alamos with Mark, a Russian mathematician. He was out, and I noticed that the shelves over his desk were groaning with an impressive collection of maths books. Three shelves, it must have been nearly 5 metres of books, with a liberal sprinkling of yellow. All the classics were there. On closer inspection I saw that they were all library books. The other mathematicians must have been continually frustrated to find their books out. At that moment Mark came into the office. "Ah, Robert, I see you like my library," he said, nodding thoughtfully. "I think with such a library, I make big discovery."

My apologies for giving the name of the Associate Dean of Engineering at Auckland, Liz Godfrey, incorrectly in the last Newsletter.

PRESIDENT'S COLUMN

The 2000 NZ Mathematics Colloquium was a welcome occasion, thanks to the excellent arrangements of the Waikato team (Kevin Brougham and his colleagues did a great job). Many participants said it was one of the best (of the 35 so far) colloquia to date. Clearly the change of timing to late November/December was acceptable to many and it looks like it will happen at this time this year too. Congratulations are due to the three Aitken prize winners,

Barbara Holland	Massey	*"Median networks: A visual representation of ancient Adelie penguin DNA"*
Patrick Rynhart	Massey	*"Static liquid bridges"*
Sivajah Somasundaran	Waikato	*"Cover semi-complete topological groups"*

with honorable mention going to Frances Kuo of Waikato. There were about 25 student talks which was extremely heartening.

The Forder Lecturer 2001 (Dr Tom Körner of Cambridge) is due here in July 3–31 and we welcome him warmly. Dr Peter Fenton (Otago) is the national coordinator of this tour and arrangements are in hand. We are pleased that he has been able to accept the opportunity of speaking at "A Mathematics Odyssey", the NZ Association of Mathematics Teachers conference in Wellington (3–6th July) which occurs conveniently at the beginning of his tour. This is a

lucky outcome of the timing. We are currently involved in the selection of Forder Lecturer 2003.

There are 70 Marsden applications in the Mathematical and Information Sciences grouping this year, up from 61 last year. 19 of these new applications are “fast-starts”. Clearly there will be a lot of disappointed applicants again if the success rate is still about 15%. The case for the introduction of smaller grants, to spread the grants a little more widely, is very strong. Our Australian cousins operate a small grants scheme very well.

The University system is under continuing pressure, with the TEAC reports still on the horizon. A different funding pattern is being canvassed but details are sketchy. We await developments with interest.

For me, I am facing a lot of travel this year (Oman, Durham and Oxford in three separate trips). I attended the Maths in Industry Study Group in Australia as a project moderator (along with Mark McGuinness) which was fascinating. The suggestion that we host this here in New Zealand in a couple of years is being pursued actively. We are hopeful that we can build an infrastructure to support it adequately.

The Mathematics Institute summer workshop (Nelson) and ANZIAM 2001 (Adelaide) both received good reports by participants. Future events include the Symposium in honour of (our founding President’s 65th birthday) David Vere-Jones, 19–21st April in Wellington (Victoria University of Wellington). This is in association with the 2nd International Workshop on Statistical Seismology, also an area to which David has contributed. (Further details from `http://www.statsresearch.co.nz`). We extend to David our congratulations and best wishes. Details also appear elsewhere in this issue.

Graeme Wake
President

LOCAL NEWS

AGRESEARCH

The only news to hand appears to be about visits across the Tasman. David Baird, Peter Johnstone, Roger Littlejohn and Dave Saville attended and all presented papers at the 6th Australasian Genstat Conference at Surfers Paradise. David gave invited talks on “Data manipulation in Genstat: enhancements and strategies" and “Linking Genstat to GIS and Bioinformatics databases"; Peter and David gave a joint paper on “An implementation of Haley-Knott least squares method for mapping QTLs in half-sib populations"; Roger spoke on “Calculating standard errors for finite mixture distribution parameters"; and Dave’s talk was entitled “Parameters, contrasts, hypotheses, directions in N-space and Genstat". Glenn Fulford and Mick Roberts attended the ANZIAM 2001 meeting in the Barossa Valley, Glenn spoke on “Models of Tb transmission in possums" and Mick on “Diabetes, sloth and obesity: models of population health". Glenn attended MISG in Adelaide before the meeting, and Mick visited Murdoch University in Perth and gave a seminar after the meeting.

Mick Roberts

UNIVERSITY OF AUCKLAND

Department of Computer Science

The Department of Computer Science started on 1980 February 1, with Professor John Butcher as the Foundation Professor of Computer Science. Dr Phil Cox, Alan Grace, Dr Bruce Hutton, Dr Richard Lobb, Garry Tee and John Whale were the other full-time foundation academic staff, with four part-time lecturers. Richard Lobb had been appointed to the Department of Mathematics in 1978 as the University’s first Lecturer in Computer Studies before he became a foundation Lecturer in the Department of Computer Science, where he is now a Senior Lecturer.

Already in 1981, Computer Science became the second-largest Department in the Science Faculty. Now it has become the largest department of the University of Auckland, in terms of EFTS.

The Department celebrated its 21st Birthday on 2001 February 14, sponsored by the New Zealand Computer Society and several computing companies. The celebration was held at the Auckland Club (founded in 1853), starting with a Breakfast Meeting where the Vice-Chancellor Dr John Hood spoke on “IT Research—University and Industry”. John Butcher attended the Anniversary Dinner that evening.

Between the Breakfast and the Dinner, the Anniversary Symposium (with Lunch) consisted of 12 lectures (presented in 2 parallel sessions) by people from several departments of the University of Auckland:

Dr Nevil Brownlee (IT Systems and Services), “Internet development and measurement”.

Professor Ananth Srinavasan	(Management Science & Information Systems), "Supporting organizational decision making".
Dr Richard Lobb	(Computer Science), "Computer graphics and image rendering".
Associate Professor Richard Mugridge	(Computer Science), "Software engineering".
Professor Reinhard Klette	(Computer Science), "Computer vision", and "Unconventional approaches to computation".
Professor Clark Thomborson	(Computer Science), "Software security".
Dr Hans Guesgen & Dr Ian Watson	(Computer Science), "Artificial intelligence".
Professor John Fraser	(Molecular Medicine), "Bioinformatics".
Professor Pip Forer	(Geography), "Geographic information systems".
Professor Peter Hunter	(Engineering Science), "Bioengineering".
Dr Bruce Macdonald	(Electrical & Electronic Engineering), "Robotics and embedded systems".

Professor Peter Hunter leads the Bioengineering research group, with members from diverse departments of the University of Auckland. They model biological activity, particularly heart action, with systematic experiments to check and refine their mathematical and computer modelling. The group started in 1986, with computer power which was quite substantial for that period. Computer power generally has increased rapidly since then; but within that Bioengineering group the increase has been even more rapid so that now, after 14 years, they use a million times their initial computer power!

Dr Mark Wilson has returned from the University of Montana on a three-year contract as Lecturer, 60% in the Department of Computer Science and 40% in the Department of Mathematics.

Professor John Casti (Santa Fe Institute, USA & Technical University of Vienna) was an Auckland University Foundation Visitor from 27 February to 11 March. His visit was sponsored by the Auckland University Foundation and the Departments of Computer Science and of Philosophy.

Seminars

Professor John Casti	(Santa Fe Institute, USA & Technical University of Vienna), "The simply complex: the science of surprise in nature and in life".
Dr Larry Carter	(University of California, San Diego), "AC/DC - Architecture-Cognizant Divide and Conquer".
Dr Mark Titchener,	"Deterministic chaos & information theory".

Department of Mathematics

The New Zealand Journal of Mathematics (v. 29 no. 2) for October 2000 is dedicated to John Butcher, with articles contributed by several of his friends and colleagues.

At the Faculty of Science Line Managers Meeting on February 28, the Dean of Science announced that Gaven Martin had been awarded a James Cook Research Fellowship. These fellowships, which are widely regarded as New Zealand's most prestigious science and technology awards, allow the recipients to concentrate on their chosen research for two years.

The conference ANODE 2001 (Auckland Numerical Ordinary Differential Equations) was attended by about 50

delegates, on January 8–12. The Invited Speakers were:

Wayne Enright	(University of Toronto)
Francesca Mazzia	(Universit di Bari)
Gustav Söderlind	(Lund University)
Peter van der Houwen	(University of Amsterdam).

The 4th Devonport Topology Festival was held on February 9. David McIntyre was the invited speaker, talking about "Reflections on Set-Theoretic Topology". The participants included four people from Waikato University.

A mini-conference on groups was held on March 1, with 50-minute lectures given by:

Colin Maclachlan	(Aberdeen), "Splitting Klein-ian groups";
Gunter Malle	(Kassel), "Recognising matrix groups";
Steve Wilson	(Flagstaff), "Semi-transitive and bi-transitive graphs"; and
Laci Kovacs	(Canberra), "Profinite presentations".

TIME 2000, an International Conference on Technology in Mathematics Education, was held at the University on December 11–14 2000, and ATMGT 2000, on Algebraic and Topological Methods in Graph Theory, on December 11–15. Reports can be found later in the Newsletter.

Leslie John Comrie FRS was born at Pukekohe in 1893, he attended Pukekohe High School and Auckland Grammar School, and he studied at Auckland University College from 1912 to 1916. Throughout the second quarter of the 20th century, scientists worldwide acknowledged Comrie as the leader in scientific computing. He died in London on 1950 December 11, and many of the leading scientists in Great Britain attended his funeral. A crater on the far side of the Moon is named Comrie, and in 1982 Alan Gilmore and Pam Kilmartin (Department of Physics, University of Canterbury) discovered asteroid 3521, which they named after Comrie. As a student here, Comrie was active in student societies—in particular he founded the Auckland University College Scientific Society. That is now called the Comrie Astronomical Society, and it sponsors the annual Comrie Lecture.

The Comrie Lecture 2000, on "Leslie John Comrie", was delivered by Garry Tee at ATMGT 2000, on the 50th anniversary of Comrie's death. The delegates registering for TIME 2000 were also invited, and some of them attended that lecture. Several relatives of Comrie were present, including his elder son John Comrie and John Comrie's daughter Dr Margie Comrie (Massey University). There were some representatives of societies which had honoured Comrie for his work in scientific computing: Auckland Astronomical Society, Royal Astronomical Society of New Zealand, Royal Society of New Zealand, Institute of Physics, Royal Astronomical Society, Royal Statistical Society and the Royal Society of London.

After the lecture, the audience was led to the undergraduate computing laboratory of the Departments of Mathematics and of Statistics, where Garry Tee invited Comrie's son John to withdraw a silken veil on the door. John Comrie withdrew the veil, and revealed a bronze plaque naming the Comrie Computing Laboratory.

Inside that laboratory, a poster about Comrie and a photograph of him are mounted on the wall.

Cabinet displays about Margaret Morton and about Leslie John Comrie were exhibited in the Science Library, from 2000 December 11 to 2001 February 12.

In the promotion rounds Jianbei An was given a Special Increment in the Senior Lecturer scale, Bill Barton was promoted over the Senior Lecturer Bar plus a Special Increment, Rod Gover was promoted to Senior Lecturer, Eamonn O'Brien was given a Special Increment, Arkadii Slinko was promoted over the Senior Lecturer Bar plus a Special Increment, Moira Statham was promoted over the Senior Tutor Bar, Wendy Stratton was promoted to Senior Tutor, Steve Taylor was promoted to Senior Lecturer, and Mike Thomas was promoted over the Senior Lecturer Bar

plus a Special Increment. Barbara Miller-Reilly earned a Science Faculty Distinguished Teaching Award.

Sina Greenwood has been awarded a New Zealand Science and Technology Post-Doctoral Fellowship, which she will take up at the University of Auckland. Abdul Mohammad, now at Sultan Qaboos University in Oman, had intended to teach a topology course here in the second Semester. But he has now won a New Zealand Science and Technology Post-Doctoral Fellowship, which he will take up with Paul Gartside at the University of Pittsburg.

Mark Phillips (Maclean's College) and David Godfrey (Selwyn College) are our Teaching Fellows for 2001 (replacing Martine). Mark will be on the MATHS 108 and STAR (152 for secondary students) teaching teams, and David will be on the MATHS 101 and MATHS102 teaching teams. David is the new father of twins who have recently enrolled in CRECHE.101, where both are doing well. They occasionally come to the Department for tutorials. Jessie Autagavaia (Lynfield College) and Albert Polecki (Massey High School) are two teacher/researchers on Ministry of Education Study Awards, who will be working with Bill Barton on the Mathematics Enhancement Project in Manukau schools. Nicky Roper (Diocesan School) is this year's Royal Society of New Zealand Fellow. She will be working on a project designed to produce materials linking applications of research mathematics, through the mathematics at university, back into school mathematics.

Dr Catherine Hobbs, a geometer from Brookes University of Oxford, is visiting for this year. Professor Colin Maclachlan (Aberdeen University) is visiting for six months. Professor Steve Wilson (Northern Arizona University) will be here until August, working on graph theory and geometry. Dr Frédéric Mynard (Université de Bourgogne, Dijon) is here as a post-Doctoral Fellow. He will be working with the Topology group, and will teach a section of MATHS 108.

Recent visitors include Dr J. Andres Christen (CIMAT, Guanjuato, Mexico), Dr Alan Graham (Open University), Helge Jorgensen (Odense University, Denmark), Dr Jari Kaipio (Kuopio University, Finland), Dr Laci Kovacs (Canberra), Dr Gunter Malle (Kassel University), Dr Jesper Moller (Aalborg University, Denmark), Professor Vladimir Oleinik (St Petersburg University), Dr H□avard Rue (Trondheim University, Norway), Dr Alan Feldstein (Arizona State University) and Professor Gustav Söderlind (Lund University).

Tamsin Meaney had her oral examination with the result that she is to be awarded her PhD degree, subject to minor editing corrections to her thesis on "Mathematics classroom development in indigenous communities".

At the NZ Mathematics Colloquium 2000, at the University of Waikato on November 27–29, Vaughan Jones gave an Invited Address on "Planar algebras". David Gauld was a judge for the Aitken Prize. Members of this Department gave the following Contributed Talks:

Alona Ben-Tal,	"Crises and explosions in a symmetric forced oscillator".
John Butcher,	"Some new A-stable methods for ordinary differential equations".
David Gauld,	"The Baire category theorem for separately open sets".
Rod Gover,	"Electromagnetism, elliptic systems and tractor calculus".
Allison Heard,	"Stability of numerical methods for ordinary differential equations".
Andrei Korobeinikov,	"A family of Lyapunov methods for epidemiological models".
David McIntyre,	"The point-countable base problem".
Alastair McNaughton,	"Generalized iterative roots".
Nicolette Moir,	"Identifying efficient ARK methods".
Alannah O'Sullivan,	"Hybrid methods in Nordsieck representation".
Philip Sharp,	"N-body simulations and the solar system".
Garry Tee,	"Eigenvalue bounds for band matrices".
Daniel Timarac,	"The influence of the satellite galaxies on the disk of M31".
Dejan Timarac,	"A comparison of a class of methods for calculating the orbit of an asteroid".
Will Wright,	"Stiff and non-stiff general linear methods for ordinary differential operators".

Bill Barton was the Convenor of the Working Group on Language and Communication in Mathematics Education, at the 9th International Congress of Mathematics Education ICME-9 in Tokyo in August 2000. And in November he

was an invited speaker at the First Brazilian Ethnomathematics Conference at Sao Paulo. John Butcher attended the IMACS Conference in Lausanne 2000 August 21–25, the Symposium to celebrate the 60th birthday of Roswitha März held in Berlin 2000 October 20, and the ANZIAM meeting at Barossa Valley 2000 February 3–7. John Butcher, Allison Heard and Will Wright attended the Research Symposium on Geometric Numerical Integration, held at Melbourne 2000 December 10–16. Bruce Calvert attended the Conference on Decision and Control 2000 at Sydney in December, where he gave a talk on our KWTA network and chaired a session on new applications of networks. In January 2001 he went to the Villa Serbelloni in Bellagio to continue working with C. Marinov, courtesy of the Rockefeller Foundation. Colin Fox pitched his customary camp on the ice off Antarctica, to observe its break-up in the spring. David Gauld presented a talk on "Covering properties and metrisability of manifolds" at the Devonport Topology Festival on February 9. Andrei Korobeinikov gave a talk on "Disease-induced mortality and stability of infectious disease models" at the 5th International Complex Systems Conference at Dunedin, 2000 November 19–22. Norm Levenberg attended the AMS Regional Meeting at Notre Dame University in April, NORDAN Complex Analysis Meeting in Sweden in May, NATO Conference on Complex Analysis, Potential Theory and Approximation Theory in July, Midwest Several Complex Variables Meeting at Purdue University in October, and Wabash Analysis Conference in November, all in 2000. Alistair McNaughton attended the 35th Operational Research Society Conference 2000, at Victoria University Wellington. Geoff Nicholls attended the Australasian Archaeometry Conference 2001 at Auckland and the Second MaPhySto Workshop on Inverse Problems at Aalborg in Denmark. Boris Pavlov gave a talk at the Fock Seminar, at St Petersburg in November 2000. Philip Sharp visited the NASA Jet Propulsion Laboratory at Pasadena in December 2000, where he had discussions with Dr Kevin Grazier about the efficiency of numerical methods for N-body simulations and with Dr Myles Standish about the planetary and lunar ephemerides produced by JPL. Shayne Waldron went to Singapore in December 2000, to continue his collaboration with Z. Shen.

Jianbei An announced that on December 8 Xiaosong bore a healthy boy, weighing 3600 g.

Seminars

Dr Tsukasa Yashiro,	"Lifting immersions of 3-manifolds in 4-space to 5-space".
Professor Nathaniel Friedman	(University of Albany—SUNY), "Construction of mixing transformations for ergodic theory".
Professor Celia Hoyles	(University of London), "Students' conceptions of proof".
Professor Richard Noss	(University of London), "How can the study of mathematics in work advance our understanding of mathematical meaning-making in general?".
Professor Vaughan Jones,	"Operator algebras" (3 lectures).
Dr H□ avard Rue	(Department of Mathematical Sciences, The Norwegian University of Science and Technology), "On Gaussian Markov random fields".
Dr Jari Kaipio	(Kuopio, Finland) & **Dr Erkki Somersalo** (HUT, Finland), "Imaging moving objects with electricity".
Professor Kengo Hirachi	(University of Tokyo), "The Szegö kernel and the index theorems for complex domains".
Dr Alan Graham	(Open University), "Targetting ñ: a strategy going in the wrong direction?".
Professor Nanhua Xi	(Chinese Academy of Science), "Kazhdan-Lusztig cell of Coxeter group".
Professor Paul Fong	(University of Illinois at Chicago), "Shintani descent and Broue's conjecture".
Dr Marilyn Frankenstein	(State University of New York), "Critical mathematical literacy: teaching through real real-life mathematics applications", and "Making adult numeracy intellectually challenging: clarity and confidence through complexity".
Dr Petar S. Kenderov	(Bulgarian Academy of Sciences), "Weakly continuous mappings into Banach spaces".
Dr Laci G. Kovacs	(Canberra), "Symmetries and free Lie algebras".
Dr Colin Fox,	"Direct measurement of the dispersion equation in fast ice and pack ice".

Professor Eli Glasner (Tel-Aviv University), "The topological Rohlin property and topological entropy".

Dr John Holt (Harvard), "A rigidity result for limits of hyperbolic 3-manifolds".

Department of Statistics

Chris Wild is the President-elect of the International Society for Statistics Education.

Alan Lee has returned from a year's leave, during which David Scott had been Acting HOD. Alistair Scott has been on leave in Iran, San Francisco and London, Chris Wild has been on leave at the University of Waterloo, and Chris Triggs is on leave at Seattle and at Washington State University.

Joss Cumming, Ross Parsonage and Matt Regan have been promoted within the Senior Tutor scale.

Renate Meyer has been promoted within the Senior Lecturer scale.

Ross Ihaka has been promoted above the Bar in the Senior Lecturer scale.

Dr John Neuhaus (UCSF) has been visiting for three months.

Seminars

Dr John M. Neuhaus (University of California, San Francisco), "Methods for fitting generalized linear mixed models".

Professor Gad Nathan (Hebrew University), "Imputation for wave nonresponse—a time series approach".

Dr J. Andres Christen (CIMAT, Guanjuato, Mexico), "Sequential stopping times for accumulation curves".

Garry J. Tee

Department of Engineering Science

Andrew Pullan has been promoted to Associate Professor and Piaras Kelly to Senior Lecturer. Poul Nielsen is on leave and Ian Collins is back from leave, most of which he spent at Kyushu University in Fukuoka and at Qinghua (Tsinghua) University in Beijing.

We have accepted 44 (an increase of about 10 over the average in recent years) students, all of high quality, into our Year Two courses. To cater for them we have crammed a 44th desk into our computer laboratory and brought the number of computers there from 38 up to 44. In terms of numbers of undergraduate students, we are no longer the smallest Department in the Engineering School. It is pleasing that engineering students are recognising the potential opportunities of a course based on mathematical modelling and computational techniques.

Don Nield

UNIVERSITY OF CANTERBURY

Department of Mathematics and Statistics

Professor Malcolm Faddy and Dr Darlene Heuff have both departed the department for greener pastures. Malcolm is now a full Professor at Birmingham University. Darlene's move took her less far afield: she is now in the Physics and Astronomy Department of the University of Canterbury. Dr David Robinson has taken semi-retirement, and is now working half time in the department.

The department would like to congratulate Professor Douglas Bridges, who has been made a fellow of the Royal Society of New Zealand.

Professor Graeme Wake (Professor of Applied Mathematics) has been elected a Visiting Fellowship at All Souls College of the University of Oxford for the academic year 2001–2002. All Souls is unique in Oxford in that it has no undergraduate students, but has about 70 Fellows across all disciplines, and 28 are elected as Visiting Fellows each year. Graeme will be collaborating with colleagues in the well-known Oxford Centre for Industrial and Applied Mathematics in addition to commitments at All Souls.

Professor Wake was also project leader at the Mathematics in Industry Study Group 2001 in Adelaide, and also presented two talks at ANZIAM 2001 in the Barossa Valley, South Australia.

Andy McKenzie submitted his PhD thesis "Stochastic speciation models for evolutionary trees" just before Christmas. His oral defense was on February 28.

Andy presented his results at an international mathematical evolutionary biology conference, held at the Skotel, Whakapapa. Inspired by the "Lord of the Rings" film set backdrop of Mt Ngauruhoe, the meeting was called DOOM-01, and attracted 45 participants, mostly from overseas. Mike Steel and Charles Semple from this department also gave talks. The meeting was organised by Pete Lockhart from Massey University, and partly funded through a Marsden grant to our Biomathematics Research Centre, which organised similar meetings in this series in Kaikoura and Akaroa in previous years. There was considerable media interest in some of the biological talks, with two of the speakers appearing on Kim Hill's Radio NZ talkback show, and other reports in the Dominion, Herald and TV3. A highlight for many participants was the excursion of hiking the Tongariro Crossing. Next year's meeting is being held in the Coromandel and will be organised by Allen Rodrigo.

Last year's annual Australasian Conference on Combinatorial Mathematics and Combinatorial Computing was held at the University of Canterbury (4–8 December 2000). Charles Semple and Mike Steel organised the conference which included 68 participants, almost half of whom came from places outside Australia and New Zealand. The invited speakers were Joan Hutchinson (Macalester College), Chris Rodger (Auburn University), Ralph Stanton (University of Manitoba), Robin Thomas (Georgia Institute of Technology), Geoff Whittle (Victoria University of Wellington), and Nick Wormald (University of Melbourne).

Seminars

Professor Ray Mines	(New Mexico State University), "Nought nowhere was never reached".
Professor Laszlo A. Szekely	(University of South Carolina), "Crossing numbers of graphs".
Dr Paul Barrett	(Liverpool University), "The new psychometrics: a choice between enhanced test technology vs the greater understanding of what is hypothesised as being measured".
Dr Ronald Christensen	(University of New Mexico), "General prediction theory and the role of R^2".
Associate Professor RJCW Rayner	(University of Wollongong), "Recent advances in statistical model assessment".
Associate Professor Chris Triggs	(University of Auckland), "Statistical problems in the use of DNA in forensic science".
Associate Professor David Scott	(University of Auckland), "The second largest eigenvalue of an empirical Markov transition matrix".
Dr David Eichler	(Ben Gurion University), "Slow reproduction as a survival advantage: an attempt to resolve immunological paradoxes".
Associate Professor Neil Watson	"A characterization of heat balls by a mean value property of temperatures".
Associate Professor Vo V Anh	(Queensland University of Technology), "Stochastic multifractals and fractional diffusion".
Dr Anthony R Olsen	(USEPA Western Technology Division), "National environmental statistics importance of monitoring: designs based on probability surveys".
Dr Rod Downey	(Victoria University), "Randomness and reducibility".
Dr Raylene Marberley	(Texas A & M University), "Mathematics as a second language: looking for a bridge between mathematical language and the language of thought".
Dr Glenn Fulford	(Agresearch), "Common brushtail possum trichosurus vulpecula".

Professor David Penny	(Massey University), "Birds, mammals, DNA, dinosaurs and mathematics: evolution from DNA sequences".
Professor John J Deely	(Purdue University), "A robust Bayesian approach to Pr (treatment A is better than treatment B)".
Dr Mark I Nelson	(Australian Defence Force Academy), "Multiplicity behaviour for an oxidations reaction in an adiabatic continuously stirred tank reactor".
Professor David Carlson	(San Diego State University), "Extremal patterns of distinct entries in vectors in the range of a matrix".
Professor Greg Reid	(University of Western Ontario), "Differential equations".

Chris Price

INDUSTRIAL RESEARCH LIMITED

Applied Mathematics Team

We had a strong contingent at ANZIAM in the Barossa Valley in early February this year. Graham Weir gave a talk on fracture in plasticity theories, Warwick Kissling talked about modelling brine flows in porous media and Shaun Hendy talked about light scattering in glass ceramics. Shaun also attended the 25th Annual Marlborough Sounds Condensed Matter meeting at the Portage in late January, giving a talk on first principles modelling of the passive oxide film on iron.

Dominique Baechler from the Geochemistry Department at ETH Zurich visited Steven White for a month over January and February. Steve is also off to the US again in May for a DOE conference on carbon sequestration, as he continues his collaboration with the University of Utah.

This year it is the turn of Wellington to host the Manawatu-Wellington regional Applied Mathematics meeting. Although still in the early stages of planning, the meeting has been pencilled in for the 11th of June and will be held at the IRL site in Gracefield, Lower Hutt. All are welcome. Further details will be circulated at a later stage. In the meantime, any enquiries should be directed to Mark McGuinness (`Mark.McGuinness@mcs.vuw.ac.nz`) or Graham Weir (`g.weir@irl.cri.nz`).

Shaun Hendy

MASSEY UNIVERSITY

Institute of Fundamental Sciences - Mathematics

We are pleased to welcome Mike Hendy back from 11 months in Germany and to have him take up the role of "Leader for Mathematics".

Several people attended conferences and workshops during the summer. John Hudson, Padma Senarath and Gillian Thornley attended the NZ Mathematics Research Institute Meeting on Operator Algebras at Tahunanui Beach and enjoyed a week of the famous Nelson sunshine.

Bruce van-Brunt and Igor Boglaev attended the Maths in Industry Study Group (MISG) meeting in Adelaide in late January/early February. The problems ranged from predicting large gold deposits, analysing eye movement for spectacle design, through to describing wear on railway carriage bearings. Both Bruce and Igor presented papers at the annual ANZIAM conference in the nearby Barossa Valley. Igor also visited the School of Computer Science and Software Engineering at Monash University in Melbourne where he gave a colloquium lecture and had very fruitful discussions with Peter Tischer and Carlo Kopp.

Barbara Holland and Paul Gardner attended DOOM01 at Whakapapa, which is reported on elsewhere in this Newsletter.

Our youngest internal student, Shona Yu, has now completed her BSc degree which she began from school as an extramural student in 1995. In November she was awarded a Vacation Research Scholarship by the University of Sydney. She writes:

> "During Summer, I spent eight weeks at University of Sydney, under a Vacation Research Scholarship,

doing research on Coxeter Groups and topics related to them with Associate Professor Bob Howlett as my supervisor. We investigated whether the symmetric bilinear form of a graph had a non-zero radical or the contrary. From this valuable experience, I also picked up some tips on the important technique of writing reports in a textbook manner.

I am honoured to have met other mathematicians in a well-known Australian University; besides this, it was a great pleasure to experience the multi-cultural and active lifestyle of Sydney, which made a big impression on me.

I hope to pursue further research in this fascinating area in the near future."

Robert McLachlan, Brett Ryland (a new M.Sc. student), Seung-Hee Joo, and Matt Perlmutter went to the ANU Symposium on Geometric Integration at La Trobe University in December. Like the NZMRI, the afternoons were kept free for "informal discussions", and an evening reserved for a barbecue in the university's 100 ha wilderness area, cooked by identical twin ZZ top lookalike barbecuers, complete with boxing kangaroos.

Matt Perlmutter, who has been with us since September 1999, will be taking up a two year postdoc at the Center for Mathematical Analysis, Geometry and Dynamical Systems of the Department of Mathematics of the Instituto Superior Tecnico in Lisbon, Portugal, from late 2001.

Seminars

Lutz Grosz	(Institute of Information and Mathematical Sciences, Massey University, Albany), "Preconditioning of linear systems by incomplete block factorisation".
Milton Fuller	(Mathematics Learning Centre, Central Queensland University), "The impact of graphics calculators on undergraduate mathematics".
Sverker Edvardsson	(Mid-Sweden University, Sundsvall), "Climatic variations over one million years before present from an astrophysical viewpoint: ice ages and global temperatures".

Graduate Seminar Series

Dr Kee Teo,	"Chromatic Polynomials".
Professor Mike Hendy,	"Mathematical Biology, BioMathematics and BioInformatics".
Dr Charles Little,	"Planarity in Graphs".

Gillian Thornley

Institute of Information Sciences and Technology

Statistics

As a result of the university's repositioning exercise we are soon to lose 2.6 staff. Terry Moore and Bruce Dunning will be leaving us early in 2001. Greg Arnold, or at least 60% of him, has already moved to Landcare. They have all contributed hugely, in different ways, to what used to be the Department of Statistics, and will be greatly missed. But the administrators say we were over-staffed, and they are all honourable men.

Steve Haslett went to the Office of National Statistics UK in August/September, and can report that Len Cook is well and is working hard at explaining NZ vernacular to the locals. He also went to Trinity College Dublin, and the Bureauof Labor Statistics in Washington DC, and gave a seminar to the Washington Statistical Society. Research covered during his leave centred on generalized linear models and sample surveys. He attended the WinBUGs course (along with Barry and our resident Bayesian, Howard) at QUT in late November.

Chin Diew Lai has been on sabbatical this year, a highlight of which was to attend and present at the International Conference in Mathematical Models in Reliability at Universite Victor Segalen in Bordeaux.

Doug Stirling in still away on sabbatical, currently visiting Larry Weldon at Simon Fraser University in Vancouver. He has also spent some time with David Griffiths at Wollongon.

Two new visitors have arrived. Chungui Qiao arrived in August after completing his PhD at the University of Queensland. He has considerable experience in agricultural science, and is working on genotype by environment problems. Roger Peck is here on sabbatical from California State University in Bakersfield. His main interest is the

use of technology in statistical education.

Congratulations to Mark Bebbington who has secured Marsden funding to continue his work on stochastic modelling of earthquakes, and to honours student Ryan Sherriff who has been awarded an AGMARDT Doctoral Scholarship to work on statistical genetics.

Geoff Jones

Institute of Information and Mathematical Sciences

Mathematics

The mathematics group at Albany has continued to grow. Robert McKibbin has transferred from the Palmerston North campus and his arrival has further strengthened the group, especially in applied mathematics. He has also brought with him valuable experience as head of mathematics at Palmerston North and he is now the group leader at Albany.

James Sneyd and Lutz Grosz were successful in obtaining $34,000 to develop a parallel computer. They also organised a three day course on parallel computing for interested students in the week before teaching started. The course was notable for the enthusiasm and achievement of the students; James and Lutz were forced to give them ever more challenging problems.

James Sneyd organised a Short Course for the American Mathematical Society Annual Conference (in January in New Orleans). He is giving a plenary talk at the SIAM Dynamical Systems Conference (May, USA) and he is on the committee to write a proposal for the creation of a new Mathematical BioSciences Institute at Ohio State University.

Shaun Cooper has returned from six months of sabbatical leave. He was based in Minneapolis at the University of Minnesota, where he worked with Prof. Dennis Stanton. He also attended the International Conference on the Works of Srinivasa Ramanujan in Mysore, India; the Conference on q-series and Applications to Combinatorics, Number Theory and Physics at the University of Illinois, USA; and visited Wolfram Research Inc. in Champaign, Illinois, USA. Mike Hirschhorn, from the University of New South Wales, is visiting Shaun for a month. He is research area is q-series and Ramanujun.

Mike Meylan visited the Ship research Institute in Tokyo for a month in November. The visit was to investigate the connection between his research on the wave induced motion of ice floes and the Japanese research on the construction of a floating runway. It turns out that the mathematics of the two problems are virtually identical. His only regret was not visiting earlier because the field has developed very rapidly and has attracted many researchers in Japan. Makoto Ohkusu, from Kyushu University, who is one of the Japanese researching floating runways visited Albany briefly in early March. Mike also received an ISAT linkage award to visit Paris for two weeks in April.

Seminars

Professor Makoto Ohkusu (Kyushu University, Japan), “Hydroelastic Analysis of Floating Airports”.

Mike Meylan

UNIVERSITY OF OTAGO

Department of Mathematics and Statistics

In the last Newsletter Vernon Squire, our HoD, was away visiting family and friends in the UK. Now having returned wetter (the wettest autumn in England on record) and poorer (the weakest dollar for a while) he is supposedly fully refreshed and raring to start another four years as HoD. (Perhaps “raring” is a little too strong!) He is back anyway.

With the resignation of Dr Tony Dixon, Vernon has appointed Gareth Hegarty from a strong field as a Postdoctoral Fellow on his new Marsden Grant, which began officially at the beginning of March 2001. Gareth is an ex Otago student who is currently completing his PhD at Auckland. Tim Williams, a graduate of Victoria University of Wellington, will also join the team as a PhD student. The project also includes Colin Fox at Auckland and Mike Meylan plus a student at Massey (Albany).

John Enlow, a PhD student in the Department, has accepted a full time fixed term lectureship and will teach COMO 102 for the new BAppSci and MATH 131 this year.

Warren Palmer has accepted a full time Teaching Fellowship in the Department as well as being enrolled for an MSc

and administering the National Bank Junior Mathematics Competition. He's a busy man!

Ari Samanayaka has transferred from his Teaching Assistant position to a full time Research Assistant position working on a statistical research project with Richard Barker and David Fletcher. Ari is also working part time on his PhD.

Two new Teaching Assistants have been appointed to replace Ari and Warren. Rohan Maheswaran is studying for his PhD and the second candidate has yet to arrive.

The 12th Hands-On Science Camp was successfully run in January 2001. 206 secondary school students attended this year with the continuing trend of one third male to two thirds female. Jeanette Trotman and John Enlow each ran sessions for this Department. Jeanette's contribution was entitled "Measurement Means Maths" which involved collecting data, analyzing them statistically and doing experiments in physics, biology and chemistry with results analysed using the graphics calculator. John's contribution was entitled "Mathematics, Music and the Fourier Transform" with a focus on using computers and discrete Fourier transforms to modify recorded sounds. Students also had an opportunity to explore some of the capabilities of Matlab, a numerical computation software package, and particularly enjoyed experimenting with three dimensional graphics.

Robert Aldred gave a keynote address on Hamiltonian Graphs at the Fall 2000 Workshop on Combinatorics at Kuwait University in November 2000. On the return journey he presented a paper at the 25th Australasian Conference on Combinatorial Mathematics and Combinatorial Computing at Canterbury University.

Richard Barker has been awarded an Otago Research Grant in 2001 for "Estimating density dependence in survival and recruitment rate from mark-recapture studies".

Richard visited Hobart February to review the Australian Antarctic Division's elephant seal mark-recapture study.

Austina Clark visited the National Tsing Hua University in Taiwan for a month during our summer break. There she worked with the University's Professor Anne Chao, Dr Paul Yip from Hong Kong University, and Professor Richard Huggins from La Trobe University on population size estimation problems.

In August, 2000, Coralie Daniel attended the HPM Meeting in Taipei, Taiwan, as one of the sixty-two co-authors celebrating the publication of the book "History in Mathematics Education: the ICMI Study" edited by John Fauvel and Jan van Maanen and published by Kluwer Academic Publishers as Volume 6 of the New ICMI Study Series. She also attended the Mathematics Education into the Twenty First Century Conference in Amman, Jordan, and was invited to visit a women's college in Jeddah, Saudi Arabia, in order to make an assessment of the mathematics teaching there. The materials she prepared for the workshops that she gave at these three places will form the basis of the mathematical art exhibition that she has been invited to hold in the Marshall Seifert Gallery in Dunedin in April of this year.

For four weeks in January and February Derek Holton worked at the University College Chichester with Afzal Ahmed, Honor Williams and other colleagues. In that time they were able to write a chapter Developing Active Learners for a book on tertiary mathematics teaching. He also ran a master class for upper primary children in Reading.

Seminars

Kaye Stacey	(University of Melbourne), "Creating an adaptive computer system to improve conceptual understanding of decimals".
Dave Elkin,	"Paths in Forests".
Greg Sise and Matt Woods	(Dunedin based company Energy Link Ltd), "Optimising the Electricity Industry".
Professor Peter Horak	(Kuwait University), "Graph Theory as an Integral Part of Mathematics".
Greg Reid	(University of Western Ontario), "Algebraic-Geometric Algorithms for Differential Equations".
Michael Lavine	(Duke University), "Statistical Modelling of Seedling Mortality".

Lenette Grant

UNIVERSITY OF WAIKATO

Department of Mathematics

Our newest lecturer, Dr Sean Oughton, is expected to take up his position in our department in early August. Sean is currently at University College London and he has research interests in turbulence and nonlinear dynamics in conducting fluids.

Dr Paul Watson, who has been a postdoctoral fellow in the department for the past five years, has accepted a Research Fellowship which will last until the end of the year. He will continue to work with Ian Craig and Alfred Sneyd on magnetic reconnection and astrophysical MHD.

Petar Kenderov from the Bulgarian Academy of Sciences in Sofia visited Warren Moors from the 26th of January through to the 27th of February. They continued their work together on fragmentability and separate and joint continuity. During his visit Petar gave a seminar (see below) and was also involved in the Devonport topology festival held in early February. Also attending this festival from our department were Warren, Kevin Broughan, and Warren's PhD student, Sivajah Somasundaram.

Seminars were also given by Pavel Winternitz from the Centre de Recherches Mathématiques at the University of Montreal. As was already mentioned in the previous column, Pavel visited Ernie Kalnins for about three weeks in December.

Your local correspondent is currently on study leave. He is making two six-week trips to the University of New South Wales where he is collaborating with Ian Sloan on shifted lattice rules and their tractability for numerical integration. On his current trip, he has also been able to meet up with another collaborator, James Lyness from Argonne National Laboratory.

Seminars

P. Kenderov	(Bulgarian Academy of Sciences, Sofia), "Well-posedness of optimization problems".
R. Corless	(Ontario Research Centre for Computer Algebra), "On the Lambert W function".
P. Winternitz	(University of Montreal), "Superintegrability, superseparability and exact solvability in quantum mechanics".
P. Winternitz	(University of Montreal), "Continuous symmetries acting on difference equations and lattices".

Stephen Joe

VICTORIA UNIVERSITY OF WELLINGTON

School of Mathematical and Computing Sciences

Hideki Omori of the Science University of Tokyo has visited Vladimir Pestov and Finlay Thompson for a week in November, and Eli Glasner of the Tel-Aviv University has come to visit Vladimir for two weeks in February. Finlay and Vladimir have spoken at the Australian National Symposium on Lie groups and their representations (Adelaide) and Vladimir has spoken at a similar Symposium on Banach algebras and operators in Banach spaces (Canberra).

Jim Geelen from the Department of Combinatorics and Optimization, University of Waterloo, and Bert Gerards from CWI Amsterdam are currently visiting Geoff Whittle for a three week research trip.

In November last year Geoff Whittle visited the University of Waterloo for two weeks, attended the discrete maths conference ACCOTA 2000, in Merida Mexico, where he gave an invited talk, and the conference of the conference of the Combinatorial Society of Australasia, where he also gave an invited talk.

Last year three students from Statistics and Operations Research completed MSc's. Sue Paul and Al Merrifield both earned Distinction and Simon McGregor-Macdonald a Merit. Darren Upton left us to take up a Commonwealth Scholarship at Cambridge where he will undertake a PhD.

We have been joined by Dong Wang on a two year contract while John Haywood has taken a permanent position with us—both in statistics. Peter Smith has resigned from the statistics group and will take up a position in the engineering school at Canterbury University in May.

Professor Tony Vignaux and Dr Tapas Sarkar both in Operations Research retired on 31 January after giving exceptional service to OR and the University. A retirement function was held to mark the occasion on 31 January which was heavily attended by current colleagues from both the School of Mathematical and Computing Sciences and the Faculty of Commerce along with members of the NZ Operations Research Society and past and present students and colleagues. Tapas will continue to do some teaching for us this year and Tony will keep his hand in with

some graduate supervision.

John Randal and his partner had a lovely daughter last year and have been kept busy ever since. Cheers.

Rob Goldblatt has been appointed an editor of the Journal of Symbolic Logic, the leading research journal in the logic field. Rob has recently completed a period of leave spent partly in Wellington, with visits to conferences and colleagues in Chicago, Urbana, Barcelona, Venice, Amsterdam and Paris—tough work, but someone has to do it! He completed several papers on the equational logic of coalgebras and wrote a lengthy history of the mathematical analysis of systems of modal logic since the late nineteenth century. This article was commissioned for a "handbook" of the history of mathematical logic. Until it appears (sometime this century) a draft is available from Rob's webpage.

Mark McGuinness and Young Hong attended the Mathematics-in-Industry Study Group in Adelaide in January, and moderated a problem from Toowoomba Foundry on the design of tall tapered feeders in iron castings. They and John Harper also attended and spoke at the ANZIAM meeting held in the pastoral Barossa valley early in February. Mark goes on Study Leave in the UK and Australia from July for seven months.

Seminars

Bernhard Thalheim,	"Internet services—living in the split between theory and pragmatics".
Neal Glew	(InterTrust, Santa Clara), "Digital Rights Management: Research Questions and Practical Implementations".
Mark Moir	(Sun Microsystems Laboratories, Burlington, USA), "Fun with Non-Blocking Synchronization in Shared-Memory Multiprocessors".
Professor Vaughan Jones	(University of California, Berkeley), "Operator Algebras".
Neville Davies	(Professor of Applied Statistics, Nottingham Trent), "Detecting outliers in time series without having to fit models".
Kev Salikhov	(Kazan Physical-Technical Institute), "Quantum Computing".
James M Oliver	(Oxford, UK), "Shallow-water slamming".
Eli Glasner	(Tel Aviv University), "The topological Rohlin property and topological entropy".

Mark McGuinness

SPEAKING OF MATHEMATICS …

Background

My involvement in a review of applied mathematics in 1995, and ongoing discussions with professional pure and applied mathematicians, has convinced me that there is a potentially serious capability issue in both pure and applied mathematics in New Zealand. This issue is not new, and was the subject of an article by Graeme Wake, professor of mathematics at Canterbury University, in Science Review in 1997 (Science Review, Vol. 54, 1997, pp 5–9).

This letter is intended to bring this issue to light to the New Zealand research, science and technology community again, and perhaps generate some debate which might lead to a workable solution. In this letter I focus primarily on applied mathematics, but pure mathematics has almost certainly undergone a similar decline over the last ten years, and other areas of theoretical research such as theoretical physics and chemistry may have suffered similarly. Some possible solutions are proposed which I hope will serve as a basis for further discussion.

Capability Issues in Pure and Applied Mathematics and Theoretical Physics

Recently, I left my position in science evaluation at the Foundation for Research, Science and Technology (FRST) in order to take up a position at the Ministry of Agriculture and Forestry. On reflection, I regard my years at the Foundation as professionally very exciting, enabling me to gain an interesting overview of issues relating to scientific research around New Zealand.

One of my first jobs at the Foundation in early 1995 was to commission a review of capability issues in mathematics at a large CRI, a review which in fact looked wider than this CRI alone. It quickly became apparent from the review that the theoretical sciences in New Zealand, including pure and applied mathematics and possibly theoretical physics and theoretical chemistry, had experienced difficulties since the science reforms of the late 80's and early

90's. In particular, there had been a decline in the mathematical sciences infrastructure since the days of the DSIR in that the viable DSIR group had been dispersed and some of its research activities curtailed.

The Scope of Mathematics and Other Theoretical Research in New Zealand

Applied Mathematics

Around 1987 the Applied Mathematics Division of the DSIR employed some 60 applied mathematicians, addressing a range of research activity that included fluid dynamics, numerical solution of engineering problems, geophysical work including seismology and statistical modelling for earthquake prediction, continuum mechanics, meteorology, ecological modelling and theoretical statistics. New Zealand still has excellent people in each of these areas and in other areas such as discrete mathematics, flow of granular materials and mathematical biology.

New Zealand's applied mathematical R&D has demonstrated convincingly that it can match and even beat the rest of the world's. Proof? - the America's Cup resides in Auckland! It's not there because the New Zealand skipper or crew were any better than the others. It resides in Auckland because the boat and sail designers used mathematics effectively!

Theoretical Physics and Chemistry

In theoretical physics and theoretical chemistry, disciplines strongly related to applied mathematics, work covered (and still does) theoretical studies in particle and nuclear physics, astrophysics, reflection theory, nanotechnology, opto-electronics, statistical mechanics, quantum chemistry and related fields.

As for applied mathematics, New Zealand has produced some outstanding theoretical physics and chemistry. To name but one example, the late Professor Dan Walls and his group at Auckland University were regarded as world leaders in theoretical quantum optics, frequently arriving at significant findings that would underpin later experimental work by other scientists around the world. Other New Zealand theoreticians are similarly regarded.

Pure Mathematics

New Zealand has also had strong researchers in key areas of pure mathematics, including geometry, abstract algebra and topology. For example, Professor Vaughan Jones, a New Zealander, is a recipient of the Fields Medal, the mathematical equivalent of the Nobel Prize. His work in knot theory is now being applied to biology and physics, and he draws a $1.6 million grant from the US National Science Foundation to work on knotting in DNA and other molecules. Professor Jones acknowledges his New Zealand training up to Masters degree level as crucial to his development as a mathematician, possible only because of a high level of eclectic mathematics available here while he was a student. However, there are others.

From the funding perspective, pure mathematics is perhaps in a slightly different position to applied mathematics. Largely funded either through Vote: Education and, to a lesser extent, the Marsden Fund, pure mathematics is less able to attract commercial revenue than applied mathematics and perhaps requires a longer time frame for eventual application. However, it is notable that the National Science Foundation has implemented major new initiatives to increase mathematics funding to pure mathematics research, in addition to applied. Why? Surely because of potential benefit to the USA! And should not New Zealand be doing the same?

It has been pointed out many times that today's pure mathematics is tomorrow's applied mathematics, with future applications that are unknowable today. It's also worth pointing out that only ten years ago computer science was a sub-discipline in university mathematics departments and that most of the key developers of computer science were in fact pure mathematicians. But pure mathematics is important for its own sake and for the culture, scientific infrastructure and understanding that comes with a full range of mathematical activities. If we look around us at the high-technology world we live in, how much do we see that is not in some vital way underpinned by mathematics?

First Class People

New Zealand has up to now produced outstanding people in many areas of applied mathematics. In the 1960s New Zealand researchers made substantial contributions to cosmology and general relativity and developed the 'Kerr metric', a particular configuration of space-time. In applied mathematics and theoretical physics, leading edge work has been carried out over the last thirty years at Auckland University (numerical solution of differential equations, quantum optics and fluid mechanics); Waikato University (quantum optics); Victoria University (statistical mechanics, reflection theory, nano-technology, superconductivity, fluid dynamics and geophysics); Massey University (protein sequence analysis, magnetic resonance imaging, geothermal modelling, modelling of calcium waves in cells, dynamical systems, geometric integration, mathematical biology); IRL (geothermal modelling, corrosion modelling, granular flows and theoretical statistics); GNS (statistical earthquake prediction and seismic modelling); Otago University (polar marine modelling and physics, non-Newtonian materials including granular media, mathematics in health, geophysical modelling, nonlinear modelling, numerical analysis, mathematical engineering, theoretical physics, environmental mathematics), and Canterbury University (modelling of biological systems). This list is by no means comprehensive, and several individuals and teams have been identified as world

leaders in their own branches of research.

Clearly, New Zealand has had a number of very capable researchers in the above areas and in others, but we're slowly losing them and some retiring senior mathematicians are not being replaced. For example, Auckland, Victoria and Canterbury Universities have lost one chair each in applied mathematics in recent years. Professors John Butcher (Auckland) and John Harper (Victoria) were not replaced at all when they retired. Professor Graeme Wake (Canterbury) in effect replaced two retiring professors, Kerr and Woods, and was himself not replaced when he left Auckland University. Interestingly, in spite of continuing decline in funding and in numbers of professional researchers, New Zealand mathematicians continue to publish papers in peer-reviewed international journals in numbers comparable to the early 1990's but this cannot go on for ever!

About the Problem

The 1995 review found that we were losing capability in applied mathematics at an alarming rate. In that year, the applied mathematics group at the CRI in question comprised fourteen staff, derived mainly from the Applied Mathematics Division of the DSIR. Unfortunately, though highlighting the issue of declining capability, the review did not lead to a solution, and today that team has dwindled even further to nine staff through the loss of its operations research capability. Though New Zealand's CRIs and Universities do employ skilled mathematical modellers and statisticians (e.g. biometricians working with scientists in agriculture, forestry, fisheries and other areas) in addition to this particular CRI group, New Zealand continues to lose vital capability. Why?

A big part of the problem has been that throughout the history of FRST applied mathematics has never had a clear funding home (i.e. an output class) in which it clearly belongs. Instead, applied mathematicians are often seeded into larger groups of experimental physicists, chemists and biologists, but then are often the first to get dropped off when the funding actually provided turns out to be insufficient to support all of the proposed research (in fact, this situation also occurs in the UK and the USA). The problem suggests that in New Zealand's cross-disciplinary, outcome-driven science system, systemic funding problems can occur within disciplines that can lead to critical capability loss. Mathematicians around the country vary in their assessment of the seriousness of the problem for mathematics, but most or all are agreed that there is indeed a mathematics capability issue.

Mathematics may not be the only discipline to suffer in this regard, and I have been informed of declining capability in some areas of chemistry, for example. However, capability decline may not be purely an artefact of funding policies, but may also reflect decision-making within CRI and University management that doesn't appear to fully recognise the very valuable contribution that mathematics can make to the work of other scientists.

A secondary issue could be that talented students who thirty years ago might have opted for mathematics and theoretical physics degrees today find the prospects more attractive at the end of a degree in computing or electronic engineering. However, from discussions with university mathematicians it seems that mathematics departments continue to attract students in reasonable numbers and that their graduates are usually able to secure appropriate employment.

Contributions of Applied Mathematics and Theoretical Physics

In addition to being worthwhile endeavours in their own right, applied mathematics and theoretical physics can deliver several major benefits to the work of other scientists. In particular:

1. **They assist other scientists to understand and solve their problems, often by bringing expertise, gained in what may appear to be unrelated fields, to bear on the current difficulty.**
2. **They often obviate the need for costly experimentation, or else point the way for experimentalists.**
3. **They can indicate promising research areas for general investigation and those to be avoided.**

Some examples of how mathematics has assisted the work of other scientists and led to significant benefits for New Zealand include the following five:

(i) *The Epidemiology and Control of Measles*
A mathematical model, developed for the Ministry of Health in 1996, successfully predicted the 1997 measles epidemic. A control policy, initiated in response to the model, swiftly contained the epidemic. The model predicted that further epidemics would occur unless the timing of the second measles vaccination was changed from eleven years to five years of age, and as a result of this finding the vaccination schedule was amended for 2001.

(ii) *Physiological Models of Reproduction*
In collaboration with biologists, New Zealand mathematicians have constructed physiological models that are being used to study how genes act. The number of human genes has recently been found to lie between 30,000 and 40,000, and it has become apparent that it is interactions among the components of living organisms that essentially drive the diversity, relationships and structure which characterises biology. A mathematical model of the growth of ovarian follicles showed how the ESR gene in pigs works by acting on the stage where the

follicles are committed to growth. Previously, traditional methodology and routine measurements completely failed to find the action of this gene.
This work also suggested how a nonlinear interaction between biological processes, that might be associated with other genes, acts to destroy the heritability of ovulation rate as measured by traditional population genetics. Application of this research has already led to significant success in livestock breeding regimes.

(iii) *Optimal Scheduling of Aircraft Flight Crews*
An operations research project resulted in the development of a software package for a major airline that optimises tours-of-duty flown by international flight crews. The work used novel and sophisticated mathematical techniques to solve complex crew scheduling problems and prepare high quality, cost-effective rosters.
Until this development, planning flight crew routines had been carried out manually, but with numerous variations in crew compositions, aircraft type and flight schedules, the computations were becoming increasingly complex, time-consuming and expensive to formulate and implement. The new optimisation solution gives cost savings of approximately 5% for the airline. The airline is now able to crew a standard week of international flight schedules in 90 minutes using the optimisation solution, whereas the manual solution usually takes one week.

(iv) *Mathematical Modelling of Geothermal Fields*
Mathematical modelling of the Kapuni and Maui gas fields carried out by CRI mathematicians has helped to maximise field productivity and life. Similar techniques have also been applied to the exploitation of geothermal fields, resulting in sustainable energy use and enabling the development of this resource by Maori. A geothermal chemical transport modelling technique developed by the same group has been used by the Bay of Plenty Regional Council as a basis for its field management strategy. Earlier modelling work on the springs and geysers at Whakarewarewa also contributed to the management plan. The application of the plan led quickly to a resurgence of spring and geyser activity at Rotorua, directly benefiting the tourism industry.
The expertise gained by the group has also been applied to resource development of new geothermal fields at Tauhara and Mokai by local iwi and management groups. Related modelling work on deep geothermal processes will lead to practical benefits which will include the eventual tapping of the deep geothermal resource within New Zealand. This pioneering work is part of an international effort coordinated by the UN International Energy Agency to access the deep geothermal environment.

(v) *Timber Processing*
Research into timber processing has led to improvements in kiln drying techniques, leading to increased commercial returns for New Zealand timber companies. These improvements include the application of computational fluid dynamic models to investigate air flow in lumber kilns. Moisture movement and stress development in high-temperature drying of softwoods has also been modelled. Models accounting for stack width and airflow patterns are leading to advances in kiln design and have helped to produce a more uniformly dried product at reduced cost. These techniques allow New Zealand timber companies to add capacity to existing facilities economically, making New Zealand quality kiln-dried softwood more competitive in world markets. The research also assists operators to modify their schedules through enhanced understanding of kiln-processes.
However, in spite of numerous examples such as those above, it appears that the contribution to be made by mathematics is greatly underestimated within New Zealand's science system.

What Can We Do About It?

Solution One: Set Up a Special Fund?

My first reaction to this problem was that one or other of New Zealand's science funding bodies should set up a special fund (a 'Theoretical Sciences Fund', for the want of a better name) in order to foster vital skills in key theoretical areas. Since little expensive apparatus and little technical support would be required except computing facilities, full time equivalents would be correspondingly inexpensive by comparison with the experimental sciences, and thus a relatively small allocation of $2–$3m annually (i.e. much less than 1% of FRST's current annual disbursements) could achieve a great deal. Such a fund could:

1. Ensure continuity of mathematical skills, both for its own sake and in order to support first-class science for the future.
2. Contribute directly to a range of economic, environmental and other benefits for New Zealand through research in areas of need.

This is in principle a nice solution but will be politically difficult to achieve, requiring the backing of key people such as senior university and research institute officers, senior executives within New Zealand's funding bodies, the Minister of Research, Science and Technology and, of course, Treasury and Cabinet. A very compelling rationale would need to be presented, and a long and demanding political and policy process followed in order to achieve this ideal. However, it's not impossible if the will is there! Of course, such a process might establish a precedent for other scientific groups who might wish to obtain a similar set up for their own research areas, but this should not be a reason for closing the door on a possible solution to a genuine problem.

Solution Two: Ringfence Money within Existing Funds

A second option is to ringfence funds within the Foundation's research portfolios specifically for the support of underpinning theoretical work (the Marsden Fund does of course support 'blue-skies' theoretical research, but theoreticians must here compete with experimentalists for scarce funds). Such a solution would perhaps be less politically onerous than developing a fund dedicated for theoretical work, but may also set a precedent for anyone and everyone to lobby for similar treatment.

Solution Three: Work Harder to Promote the Value of Mathematics and the Theoretical Sciences within Relevant Communities

This is certainly a straightforward option. However, it will be time-consuming, and per se may not lead to the desired outcomes in full. However, if there is an under-appreciation of the power of mathematics, both within the scientific community as a whole and specifically within the ranks of university and research institute management, then this will not be resolved without effort. Various mathematical groups have in fact attempted to state the case for mathematics over the last few years but without real success. It's been done before, but perhaps a unified group of high profile mathematicians around the country needs to try again, prove the worth of engaging in mathematical and other theoretical research, and seek meetings with the minister and funding body executives in order to bring home the point.

Conclusion

Without doubt, there is a capability issue in mathematics and possibly other theoretical sciences in New Zealand which has been around for over a decade now and with no remedy in sight. Therefore, New Zealand's funding bodies should consider commissioning a review of the current status of these disciplines this year. If a review demonstrates convincingly that mathematics and other theoretical disciplines continue to decline, then we should then consider initiating procedures for setting up a fund in order to guarantee the future vitality of these vital research areas. However, it could also be argued that in 2001 we don't need such a review. We had one a few years ago and the situation is now very well known. Instead, we need action!

Why now? Firstly, action is already long overdue and we continue to lose capability. Secondly, more than ever before New Zealand's science system understands the value of human capital creation and retention. Thirdly, we have new people in leadership roles at key agencies who are there to think strategically and should be capable of seeing the long term implications of the loss of vital capability. Fourthly, over the last year New Zealand has set up several new research funds, including the New Economy Research Fund and the Grants for Private Sector Research and Development fund. Thus, we now have both the recent experience and the mindset for developing new funding instruments where we perceive a compelling need.

Whether any positive action will be taken by those in key decision-making roles to address this issue remains to be seen, but what is for sure is that acceptance of the current status quo will not lead to the restoration of New Zealand's level of mathematical activity of the 1980s.

Acknowledgements

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David Lillis

REPORT ON THE COLLOQUIUM HOD/COD LUNCH

A meeting of representatives of mathematics departments, programmes and discipline areas was held at the University of Waikato in room GG.12 on Tuesday 28th November 2000, as part of the NZ Mathematics Colloquium 2000. At this meeting a number of issues were discussed including the advisability or otherwise of sharing information and the proposal that a joint application should be made to TEAC relating to the cost category funding for mathematics. The main part of the meeting consisted of information sharing, and a report on this is given in summary below.

Robert McKibbin (Massey: currently Palmerston North, Albany from 2001) Repositioning was based on budget savings. Science had suffered large reductions in overall funding, but Mathematics was now secure. Robert would be moving to Albany and one staff member was to move to a 0.8 contract, leaving Maths 1.2 FTE down at PN, but it

was hoped that Robert would be replaced if EFTS numbers rose. Morale was extremely strained, but positions had all been confirmed. There was a recent review, leading to a reduction of papers at graduate level and a restructuring of all papers to fit into the uniform pattern of 12.5 points per paper, with eight papers per year at all levels. A BA for example would be 24 papers. Internal student numbers had dropped a little, but extramural numbers were up by about 35% for the 2000–2001 summer semester. There were three or four honours students at PN and eight or nine PhD students. No new developments. The staff to student ratio is about 18 or 20 to 1.

Dean Halford (Massey Palmerston North) has recently been full-time Acting Head of the Institute of Fundamental Sciences and has now resumed his 40% contract as Deputy Head split about 50/50 between teaching mathematics and administration for the Institute. The number of papers in the mathematics major has been honed to a minimal core that is not expected to change within present resources. Mike Hendy is to be Mathematics Discipline Leader from February 2001. Physics is vulnerable because of low student numbers. Staffing in the Institute is partially supported by external funding.

Jeff Hunter (Massey Albany) There were 87 EFTS in mathematics. This was expected to rise significantly with service teaching for the BE. Overall the Institute for Information and Mathematical Sciences had 710 EFTS, with FTE staff having increased from 24 to 49 in a short period of three years. Each discipline area offers a minimal major, with no choice of papers, and four at each of levels two and three. There is a strong focus on applied mathematics. Students seeking specialisation in pure mathematics are recommended to consider the Mathematics Department at The University of Auckland. Cooperation with Auckland at the graduate level to give students additional choices has been available for the past two years. The flexibility of the new institute style structure is attractive, especially when it comes to staffing, where the need for joint appointments is avoided.

At Albany Mathematics is staffed slightly ahead of levels justified by existing EFTS. The university has mathematics placed in the Institute for Fundamental Sciences at PN together with Chemistry and Physics while at Albany the Institute for Information and Mathematical Sciences has academic staff in Mathematics, Computer Science, Information Systems, Statistics, Electronics and Information Engineering. Jeff Hunter was the Head of this institute, which had more than doubled in size during his tenure. He will be stepping down within a short period of time.

Gerrard Liddell (Otago) Indeed he was the only person at the Colloquium from that University. Vernon Squire was up for renewal as HOD. He had recently obtained a large Marsden grant. Members were pleased he was prepared to bear another term, but were anxious about the loads placed on HODs. A management environment that personalized responsibility and in which budgetary arrangements retained some opacity added to the load, and that mathematics was effected by the inappropriate cost category. Four staff had left including three statisticians. Their replacement was proceeding but was clouded by budgetary uncertainties.

Mathematics is optimistically participating in the new Bachelor of Applied Science degree, but its risk is limited by a commitment to only one new 1st year paper, Scientific Programming, in 2001.

EFTS were for 1999 maths 185 and stats 296 with maths 205 and stats 254 in 2000. Statistical Methods paper being taught for the Medical School makes up a large proportion of these enrolments. Changes that would jeopardize enrollments in this key paper had been of concern this year. Mathematics had not offered any summer school papers because the Department was not informed as to which papers would be appropriate. In 2000 there was a stronger 4th year class with nine involved with maths papers and six with stats papers, but 2001 looks like a much smaller group. There were three MSc and eight PhD students in 2000 and perhaps slightly fewer in 2001.

David Alcorn (Auckland) Gaven Martin is in the second of a three year term as HoD. The Dept has responded to an initiative from the VC to become a Centre of Excellence but funding allocations within the Faculty of Science for mathematical and information sciences remain a concern and plans to advertise vacant chairs and additional senior positions may be jeopardised by a Faculty budget shortfall. The University has moved to a process of leasing capital items including computers and is working on a new course costing budget model. There has been a substantial increase in Library funding for 2001. Student numbers in Physics and Chemistry continue to fall while enrolments in Computer Science have soared—particularly in the new software engineering programme. The Dean of Science has become Pro-VC in charge of the Tamaki campus, but will continue as Dean until a new appointment is made. Future directions for Tamaki are still not entirely clear. However the vacant chair in Industrial Mathematics may be advertised soon.

The Dept has around 950 EFTS including about a dozen MSc/BSc(Hons) students and more than 20 PhD students. The staff to student ratio is about 1:22. Core papers have been restructured into a three paper sequence to better meet the needs of applied mathematics and physics and a second year paper has been added as a foundation for stage three papers in pure mathematics. Formal prerequisites have been abolished as part of a move to simplify enrolment procedures. Pass rates of 60%-70% compare unfavourably with overall University figures and ways of improving the performance of weak students are being explored. A summer school programme is now well established and will be supplemented by a special course for disadvantaged students. There will also be a STAR course for accelerated high school students during the year. The Physics Dept is introducing jointly taught ‘Mathematics for Physics’ papers which may impact on enrolments in Mathematics. There is a similar arrangement with Computer Science for a paper in Discrete Mathematics.

The Dept was grieved by the death of Margaret Morton during the year.

Douglas Bridges (Canterbury) The University is catching up with its NZ counterparts in many aspects of administration. The (non-executive) Deans at Canterbury have relatively little power. For example, funding comes directly to Departments from the VC. There were currently 496 undergraduate EFTS with 208 in statistics, with about nine 4th year students and 12 PhD's. They are managing well with a staff to student ratio of about 1:22–24 (depending on how the computation is carried out). A $100,000 departmental budget cut has been announced for 2001, as part of a 3.6% cut for each department. The 3rd year programme has been semesterised; the 2nd year programme will be semesterised from 2001, with a slight reduction in the number of courses. In addition to existing specialised honours programmes in "Computational and Applied Mathematics" and "Mathematical Physics", a new honours programme in "Mathematics and Philosophy" will begin in 2001. The Department has run a STAR course for outstanding 6th and 7th form pupils in local schools for several years; from 2001, this will also be available as a web-based distance-learning course.

Mark McGuiness (Victoria) Mark is the programme director for mathematics. The staff to student ratio is about 1:19 or 20. Physics is 1:10. The University deficit of $12M is to be reduced and positions are being lost. Statistics and OR have lost staff—David Vere-Jones and Tony Vineaux. John Harper and Thora Blythe have not been replaced. Mathematics teaching for architecture and commerce has been lost. A new bachelor of information technology is to be introduced with some 100 level mathematics teaching included. The 3rd year offerings are being repackaged. Work load is about 100 lectures per year per staff member. The VC position is to be advertised.

Kevin Broughan (Waikato) Kevin has been COD for mathematics for five years. The staff to student ratio is about 1:24 and numbers have been rising steadily for about four years, now being at about 210 EFTS. Two new appointments were made in 1998 and another position is currently being filled. Further positions are expected when the BE (recently approved by CUAP) at Waikato is established. New papers are being considered in mathematical biology and some additional service teaching for computer science. A new third year paper in number theory has been established. Small BSc specified programmes are being removed from the start of 2002.

Jeff Hunter: Jeff reported also that there have been submissions to TEAC regarding more appropriate funding for Category A funded disciplines such as mathematics. There was considerable support for a level higher for the mathematical sciences than arts/humanities but lower than computer science.

K. A. Broughan
Convenor: NZMC 2000
14 December 2000

THE CRAWLER

Just one entry this time: a very nice interactive geometry poster at `http://mam2000.mathforum.com`, from the Math Awareness Month 2000, designed by Thomas Banchoff. You can click on people and topics from 0 to 4 dimensions: paleoecology, choreography, animation, crystals, hyperspace. The Awareness Month is held every April in the US, their group has fostered an impressive range of activities since 1986. The theme for 2001 is Mathematics and the Ocean, and the poster (`http://mathforum.com/mam/01/images/poster.html/`) shows tidal amplitudes around the world.

Robert McLachlan

CENTREFOLD

A. Bruce Robson 1945-2000

It is with much sadness that we report the death of a friend and colleague, Dr Bruce Robson. Bruce died suddenly on the 25 of October 2000 aged only 55.

Bruce was a person with wide and passionate interests and was gifted with great insight into these interests. Applications of mathematics and statistics to biology, education in science, vintage cars, breeding dogs, or politics were just some of the interests and enthusiasms I knew about; Bruce had time for all. He was a most valuable colleague and friend whom we will now have to learn to do without.

Born in Auckland, his family moved to Christchurch as a very young child, and he lived in Christchurch all of his adult life. He was raised in a household of educators; both his father and mother were teachers. He was educated at Linwood North Primary, Linwood Intermediate School and Shirley Boys' High School. He then went on to do a Honours degree in science, majoring in Physics, at Canterbury University. By then he had developed a passion for research, and carried on to do a Masters degree in solid state physics. A two year stint of postgraduate research working with John Andreae on artifical intelligence then followed in the Electrical Engineering Department at Canterbury University, before he obtained a job as a Biometrician/Statistician at the Forestry Research Institute in Rangiora.

With his interests in computation, system design and programming he then worked as an Analyst Programmer, Systems Analyst and Electronic Data Processing Coordinator with Business Computers Ltd, Computer Bureau Canterbury Ltd and the Department of Health, respectively. This industry training equipped him well for the position of Lecturer in Statistics at the Lincoln University in the then Centre for Computing & Biometrics in 1982. The Centre for Computing has subsequently been subsumed into the Department of Applied Management & Computing Division and he became an Associate Professor there in 1999. The biological aspects of his previous employments had obviously had a part to play in his fervour for biological problems when he enrolled to do a staff PhD on mathematical modelling in Animal Science with Andrew Sykes. He obtained his PhD in 1992 with his submitted thesis titled *Magnesium in Sheep Metabolism*.

His research was applied in nature, covering a wide range of interdisciplinary areas with the focus on the mathematical modelling of natural systems. He developed a strong interest in physiology and developed a fine ability to express physiological processes in a mathematical form. He was working towards the development of a monitoring package for on-farm use which would indicate the magnesium status of individual cows. This would allow predictions through a computational model of any magnesium insufficiency and provide the signal to deliver mineral supplements to the cow's diet. His interests in mineral metabolism was extended in recent years with his interests in calcium signaling processes, in particular for corticotroph cells of the pituitary gland.

He was a supervisor, or associate supervisor, for five PhD students and one Masters student, mainly in topics of mathematical biology, but also financial mathematics. He left one PhD student and one Masters student still to complete.

After an early publication during his postgraduate period in electrical engineering Bruce's major publications appeared from 1990 with over twenty refereed publications in biological statistics and mathematical biology. His coauthors in the mathematical world for his work on cell modelling and population dynamics include Nigel Barlow, Andrew LeBeau, Alan McKinnon, Paul Shorten, James Sneyd, David Wall and Marijcke Vlieg-Hulstman. His co-authors for his work on magnesium metabolism modelling included D.E. Dalley, A.R. Isherwood, and Andrew Sykes, among others.

Bruce felt strongly about science and mathematics and their importance in education. This lead to his extensive involvement with Science Alive, as a trustee, and with The National Roadshow Trust representing the Royal Society of New Zealand. He was earnest about the role of the university as being a place where people should receive a genuine education preferably in a broad range of disciplines. Bruce's skills did not stop at scientific research, and his other activities at Lincoln were consistent with his wide interests. He held many posts in Lincoln University committees, including President of the Association of University Teachers (Lincoln Branch) as it was then called, involvement in the Lincoln Music Society, membership of the Committee responsible for purchasing and displaying original art works around the university. Latterly he was a staff representative on the University Council at Lincoln. He was also a member of The New Zealand Mathematical Society, ANZIAM, The New Zealand Statistical Society and the The Royal Society of New Zealand.

Bruce's interests in motor sports are well known amongst his colleagues; he obtained a Canterbury University Blue for this in 1972, and he carried on these interests in the restoration of and motoring in vintage cars for the rest of his life. He also was a dog breeding enthusiast.

One story highlights part of Bruce's multi-interest character particularly well. While he was in the employment of FRI, and also maintaining his research links with the Electrical Engineering Department, he could be a difficult man to find at either. One bright spark replaced Bruce's nameplate on his office with the title *The Scarlet Pimpernel*. The stories about Bruce's colourful character abound, and this will always ensure he remains close to our hearts.

He is survived by his wife Alyson Gardner.

The University of Lincoln has established a scholarship fund in commemoration of Bruce's contribution to the University, and donations can be made to the Scholarships Office, P O Box 84, Lincoln University.

David J.N. Wall

Centrefolds Index

BOOK REVIEWS

Introduction to mechanics and symmetry

by Jerrold E. Marsden and Tudor S. Ratiu, *Texts in Applied Mathematics, 17*, 2nd ed,
Springer-Verlag, 1999, 515pp, DM 119.00. ISBN 0-387-98643-X.

The second edition of Marsden and Ratiu's "Introduction to Mechanics and Symmetry" aims to introduce the reader to the field of geometric mechanics, the modern mathematical view of classical mechanics. A unifying theme throughout the book, as suggested by the title, is the role of symmetry in the analysis of mechanical systems.

Other texts that develop similar topics include "Foundations of Mechanics" [2], "Mathematical Methods in Classical Mechanics" [1], "Symplectic Techniques in Physics"[5], and "Symplectic Geometry and Analytical Mechanics" [7].

The first chapter presents the case for "why geometric mechanics ?" The reader gets an overview of the unifying geometric themes of mechanics with symmetry, namely the idea of reduction and its applications to stability analysis, geometric phases, and control theory to such wide ranging problems as fluid mechanics, the KdV equation, plasma dynamics, nonlinear optics, falling cats, and microswimmers like amoeba and parameciums. The falling cat theorem is a particularly beautiful application of geometric mechanics explaining a dynamical result that is familiar to any cat owner, namely the cat's ability to land on its feet when dropped with its back to the ground. In the language of geometric mechanics, the cat is solving the isoholonomic problem (see [8]). It is finding a closed curve in "shape space", the base space of a principal bundle, that lifts horizontally (determined by the condition that the angular momentum is zero) to a curve with holonomy equal to π. While the book under review does not cover the solution to this problem, which involves the topic of symplectic reduction, it provides the needed background to get there. Symplectic reduction theory and its applications will be the subject of Mechanics and Symmetry volume II.

The fifth chapter develops the essential geometry of classical phase space, symplectic geometry. Symplectic geometry arises naturally from either the Lagrangian or Hamiltonian description of mechanics since the intrinsic geometric invariant of the flow of such systems is the symplectic two form, a differential form that lives on classical phase space. The authors first review, in the preceding chapter, basic notions from the theory of manifolds such as differential forms and vector fields, Lie derivatives, the Jacobi-Lie Bracket, and the Hodge star operator. The authors then provide an introduction to the theory of symplectic manifolds. This begins with the proof [10] of the Darboux theorem providing canonical local coordinates and demonstrating that the only local invariant for symplectic manifolds is their dimension. Next, they define Kähler manifolds and construct the symplectic structure on complex projective space as an example of this class of symplectic manifolds. The chapter concludes by defining the Poisson bracket structure on symplectic manifolds and establishing the fundamental facts that the flow of a hamiltonian vector field is an automorphism of the symplectic and Poisson structures. This Poisson bracket, turning the space of smooth functions on the manifold into a Lie algebra, is obtained by sending any pair of functions to the function obtained by evaluating the symplectic form on the hamiltonian vector fields of the functions. This natural operation satisfies Jacobi's identity precisely because the symplectic form is *closed*.

The canonical mechanical example of a symplectic manifold is a cotangent bundle, T^*Q and it enjoys many special properties being an *exact* symplectic space. For example any diffeomorphism of the base Q lifts in a natural way to be a *symplectic* diffeomorphism of T^*Q. This is crucial for later developments when momentum maps are introduced later in the text.

Having introduced Hamiltonian mechanics, the authors next describe Lagrangian mechanics. The Lagrangian, or variational approach to mechanics has always been of greater importance to physicists, as it is the natural starting point of numerous physical theories, including for example, quantum field theory. In recent times it has proved to be very useful to the field of geometric integration, a relatively new branch of numerical analysis that is concerned with numerical algorithms that exactly preserve the geometric structure associated with the continuous equations they model. In the realm of integrators for mechanical systems discretizing the variational principal of mechanics has led to variational integrators which preserve symplectic structure and, in the case where the system has a symmetry, momentum.

After introducing Hamilton's principle of critical action, the Euler-Lagrange equations are obtained and shown to be second order equations on TQ. There follows a detailed exposition linking, via the Legendre transformation, Lagrangian and Hamiltonian dynamics on TQ and T^*Q respectively. It is shown, using local charts on TQ, that for Lagrangians arising from a kinetic energy metric, the solutions of the Euler-Lagrange equations, projected to Q, are the geodesic equations for the Levi-Civita connection associated to the metric. This is a standard result, but seen from a mechanical, and hence historical, perspective. Most texts on Riemannian geometry begin with the abstract definition of a connection and then derive the link to a variational principle. It is nice to see this established in the other direction.

It is possible to derive symplecticity of the flow of a Lagrangian system directly from the variational principle, without appealing to the fiber derivative to link the dynamics to the corresponding Hamiltonian system on T^*Q. This is done by first considering all variations of a path, not just those that fix the end points. Computing the derivative of the action functional on such variations, one then obtains a boundary term which is the pairing of a one form on TQ with the variation at the end points. If one then restricts this derivative of the action to the curves that satisfy the Euler-Lagrange equations, one derives that the flow preserves the exterior derivative of the boundary one forms, which is a statement that the flow preserves the symplectic form. From the point of view of variational integrators, it is crucial to have a variational proof of a geometric property, in this case symplecticity of the flow, in order to obtain the discrete equivalent of the conserved geometry.

The remaining half of the book is dedicated to introducing the theory of hamiltonian systems with symmetry. Since the book is pitched at a modest mathematical level, this story begins in Chapter 9 with an introduction to the theory of Lie groups. Again addressing the central mechanics theme of the book, the chapter begins with a list of examples of mechanical systems that live on various Lie groups as geodesic equations with respect to a metric which is either left or right invariant. The configuration manifold for these mechanical systems is naturally identified with a Lie group. For example, in the rigid body, the configuration space is simply $SO(3)$, the rotation group of $\mathbb{R}^3$, whereas for incompressible fluids, the configuration space is the infinite-dimensional group of volume-preserving diffeomorphisms of a given region in $\mathbb{R}^3$. What follows is a systematic development of the internal geometry of a Lie group, from the definitions of left and right invariant vector fields, to their integral curves generating the exponential map from the tangent space at the identity into the group. From here, the Lie algebra structure is obtained, as well as the adjoint representation of the group on its Lie algebra. More difficult results, such as the fact that closed subgroups are Lie subgroups, and that subalgebras correspond to Lie subgroups, are relegated to standard references.

The next section contains a detailed description of the matrix subgroups of $GL(n, \mathbb{R})$ and $GL(n, \mathbb{C})$, including $SL(n, \mathbb{R})$, $SL(n, \mathbb{C})$, $SO(n, \mathbb{R})$, $SU(n)$ and $Sp(2n, \mathbb{R})$. Special emphasis is given to $SO(3)$ due to its importance in the mechanics of rigid bodies. The authors prove that $SO(3)$ is topologically equivalent to $\mathbb{RP}^3$ and that its Lie algebra is isomorphic to $\mathbb{R}^3$ with the cross product, from which the Rodrigues formula for the exponential map is easily deduced.

$Sp(2n, \mathbb{R})$ arises naturally in symplectic geometry as the *linear* symplectic automorphisms of $\mathbb{R}^{2n}$ with its constant symplectic form. Furthermore, the jacobian of a nonlinear symplectic map must be an element of this group. For each element of this group, the eigenvalues of complex conjugate pairs and their reciprocals are constrained to have equal multiplicities. There is a corresponding result for the matrices of the Lie algebra of $Sp(2n, \mathbb{R})$.

The section concludes with a nice exposition of the Hopf fibration $S^3 \to S^2$, obtained by first showing that the unit quaternions form a Lie group isomorphic to $SU(2)$, and then considering the conjugacy classes of $S^3 \simeq SU(2)$, which are shown to be 2-spheres. The Hopf fibration is then simply the quotient map taking a unit quaternion to its conjugacy class. The chapter concludes with the basic facts about smooth group actions on manifolds, crucial to defining the cornerstone of geometric mechanics, the momentum map.

The basic generalization of a symplectic manifold is a Poisson manifold, which is a space equipped with a Poisson bracket, from which one can associate to every function a hamiltonian vector field. A fundamental example of a Poisson manifold (which is not symplectic) is the dual of any Lie algebra, known as a Lie-Poisson manifold, so named after it was found by Alan Weinstein (see [11]) that Lie had discovered them. The Poisson bracket is uniquely characterized by a Poisson tensor which maps, at any point, the cotangent space into the tangent space over the same point, given by the span of the hamiltonian vector fields. The image of this map is in general not onto, but in fact defines a distribution on the manifold which, although not of constant rank, can be integrated to foliate the space into symplectic leaves. For example, the symplectic leaves of the Lie-Poisson manifold are its coadjoint orbits, which in the case of $\mathfrak{so}(3)^*$, for instance, are the concentric 2-spheres with one degenerate rank zero leaf at the origin.

A natural way to obtain Poisson manifolds, including for example the Lie-Poisson manifolds, is to quotient a Poisson manifold by a group which acts by Poisson maps, that is, by maps which preserve the Poisson tensor. The resulting quotient space, if it is a manifold, inherits a Poisson structure from the original space. If one applies this construction to T^*G for any Lie group G, one obtains the Lie-Poisson bracket on $\mathfrak{g}^*$.

Chapters 11 and 12 are devoted to the definition, existence, and properties of the momentum map, the fundamental object of a Hamiltonian system with symmetry, and a crucial tool in symplectic geometry and geometric mechanics. Momentum maps arise when symmetry groups, acting on Poisson manifolds, are not only Poisson maps but in fact are generated by hamiltonian vector fields. Precisely, a Lie group action is *hamiltonian*, synonymous with admitting a momentum map, when its infinitesimal generators are hamiltonian vector fields. In this case, we can associate to each Lie algebra element its hamiltonian function, forming a linear map $\hat{J} : \mathfrak{g} \to C^\infty(P)$, from which one can

define, through evaluation, a momentum map $\mathbf{J} : P \to \mathfrak{g}^*$. Mechanically, this map is significant because its level sets are invariant under the flow of a symmetric hamiltonian system, which is the content of Noether's theorem. However, this map has remarkable properties with far-reaching consequences even beyond mechanics. To name one, which has been exploited to prove deep theorems about moduli spaces in algebraic geometry, and more recently in [6] to solve Horn's problem, is the fact if a torus acts on a compact symplectic manifold M admitting a momentum map, then the image of the momentum map is a convex polytope. In fact the image is the convex hull of the images of the points in M that are fixed by the action. This was proved by Atiyah in [3] and independently by Guillemin and Sternberg in [4].

There are two interesting extreme cases in which the existence of this map is guaranteed. One case is that of a cotangent lifted action of a group on a cotangent bundle, and the other is a group acting on any symplectic manifold whose Lie algebra satisfies $[\mathfrak{g}, \mathfrak{g}] = \mathfrak{g}$, for example any semisimple Lie algebra.

Chapter 13 introduces the reader to the canonical example of a reduction theorem in mechanics, the Lie-Poisson reduction theorem. The phase space is the cotangent bundle of a Lie group and the given hamiltonian function is invariant with respect to the cotangent lifted action of the group on its own cotangent bundle. Making use of properties of the momentum map developed in the previous chapter, and the notion of quotienting a Poisson manifold by a Poisson action, one arrives at the following beautiful result. The quotiented Poisson structure on $T^*G/G \simeq \mathfrak{g}^*$ is the Lie-Poisson structure and the derivative of the quotient map takes the hamiltonian vector field on T^*G to the hamiltonian vector field for the quotiented hamiltonian function relative to the Lie-Poisson bracket. From the solution to this differential equation on the linear space $\mathfrak{g}^*$ it is possible to reconstruct the solution to the hamiltonian system on T^*G by solving a differential equation on the group G determined by the reduced system on $\mathfrak{g}^*$. The exposition of this result is very clear and greatly improved from the first edition of the text.

It is not shown here, but is elucidating, that Weinstein's dual pair (see [12]) applied to the case of a Hamiltonian group action encodes not only the Poisson reduction of a symplectic manifold by a group action, but also the relationship between the symplectic leaves of the dual of the Lie algebra, on the one hand, and the Marsden and Weinstein symplectic reduced spaces [9] on the other.

Finally, the book ends with a discussion of the free rigid body where all the abstract machinery developed for cotangent bundles of Lie groups is applied to integrate the equations of motion for a freely moving body in $\mathbb{R}^3$. One sees that the system is left invariant and that the quotient map sends a point in phase space to its corresponding angular momentum in a body frame. Mathematically this is left translation to the fiber over the identity in $T^*SO(3)$. Right translation to the identity is then the momentum map for the *left* symmetry action which is seen to be the conserved spatial angular momentum. The reduced equations in $\mathfrak{so}(3)^* \simeq \mathbb{R}^3$ are the well-known Euler equations for the body angular momentum. This vector field is tangent to the spheres, which is not a coincidence, since the spheres are none other than the coadjoint orbits of $\mathfrak{so}(3)^*$, the symplectic leaves of the reduced Poisson manifold. Intersecting these spheres with the levels of the energy completely integrates the hamiltonian system.

To summarize, this book takes the reader on one of the great journeys in modern mathematics that has as its roots a subject that is more than 300 years old. Armed with this knowledge a reader is ready to pursue numerous topics of active mathematical research, from the more pure domains of symplectic geometry and topology to the geometric analysis of the limitless supply of examples from mechanics.

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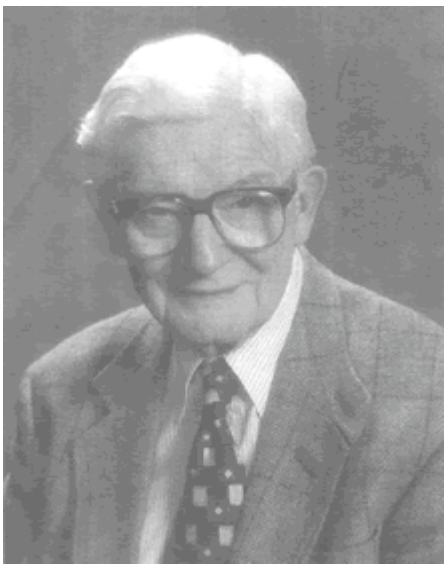
Against The Tide: An autobiographical account of a professional outsider

by Leslie C. Woods, Institute of Physics Publishing,
Bristol and Philadelphia, 2000, 16 + 320 pages, £26. ISBN 0-7503-0690-4.



Leslie Colin Woodhead was born on 1922 December 7 at Reporoa, a small settlement between Rotorua and Taupo. As Les Woods he became Chairman of the Oxford University Mathematical Institute from 1984 to 1989. When his eldest daughter Coral was dying of cancer at the age of 49, he wrote for her a brief account of his early life in New Zealand. She urged him to continue writing the story of his life, and he has dedicated this autobiography to her memory.

When Leslie was 4 years old his father became a fisherman at Mercury Bay, with the family living in an isolated tent by the mouth of Purangi creek, 5 km from Whitianga. His younger brother soon died and he met no other children, his clothes were made by his mother and he had few toys. But there was much to interest a small boy by the creek and along the beach, and the family always had fish to eat. After a year the family moved to Whitianga so that Leslie could attend school — he was disconcerted by the bustling hubbub of Whitianga, with 400 people. Sometimes he went on fishing trips with his father, as far away as the Aldermen Islands 46 km from Whitianga, and lasting 3 days. His father had to take the fish which he caught to Auckland in order to sell them, and so when Leslie was 9 years old the family moved to Auckland.

The family lived briefly in Parnell and then at Panmure Basin, where Leslie did well at school, despite frequent bullying by other boys. His bare feet felt cold in winter, but he spent much time in solitary walking though the bush, swimming, cycling and reading. The family moved to Dominion Road, and in 1934 and 1935 he attended Brixton Road Primary School, where he began wearing boots. He began a paper round, distributing newspapers to earn some pocket money. At the end of 1935 he got top marks in the Standard 6 examination, and his teachers urged him to go to a grammar school. But his father had attended Auckland Grammar School, and "he used to boast that he was the only fisherman in Auckland with a knowledge of Latin and Greek, and he was certainly not going to let his son waste time learning such useless dead languages!" (p.24). Accordingly, Leslie's father sensibly sent him to Seddon Memorial Technical College in 1936, to train as a mechanic. The boys in the engineering classes were taught some mathematics, by rote. Cyril Maloy taught those classes, where he recognized Leslie's potential, and in 1937 he suggested that Leslie should transfer to accountancy and prepare for the Matriculation examination. Leslie had no objection, and his father was not consulted.

Leslie enjoyed scouting, and he became a troop leader in the Boy Scouts. In Whitianga and Auckland he attended a succession of Bible Classes, but his experience of a revivalist Easter Camp at Ngaruawahia made him a confirmed atheist.

In 1938 he easily passed the Matriculation examination and he hoped to enrol at Auckland University College the following year, but his father refused to pay the fees. Cyril Maloy then suggested that he return to Seddon Tech for a year and try for one of the 30 entrance scholarships. Leslie's father agreed reluctantly, on condition that Leslie increase the amount of family work that he did, including assisting on some fishing trips. He gave up his paper

round, but he took on various odd jobs. He sat the Entrance Scholarship examination in December 1939 and came 26th on the list of 30 winners — the first winner from Seddon Tech. He was jubilant and so were his teachers, and he looked forward eagerly to starting University study — but then his father refused to provide board for him. Thereupon Cyril Maloy declared that he would pay Leslie's board, and that noble offer shamed Leslie's father into agreeing to provide board for his exasperating son.

Leslie enrolled to study engineering, and when he found that he was familiar with the material in first-year Pure and Applied Mathematics and in Physics he attended some second-year classes in mathematics. He devoted much time to music and to sport, and in each vacation he worked at various labouring jobs. At the end of 1940 he failed the Chemistry examination: he was permitted to enter the engineering course but had to repeat Chemistry 1. He enjoyed the mathematics lectures by Professor Henry Forder and by Cecil Segedin, but was bored by Keith Bullen's lectures.

Leslie's home life became increasingly miserable, and in 1941 he told his father that he was going to leave home. His father responded "Don't slam the door after you" (p.48). Leslie became reconciled with his parents only when they had grown old.

Leslie resigned his scholarship, and volunteered to join the RNZAF. Ordinarily, parental consent was required in writing for volunteers under 21, but he explained his family circumstances and he was accepted at the age of 18. He underwent flight training at RNZAF bases at Levin, Taieri and Woodbourne, starting on the Tiger Moth biplane and progressing to the Harvard II monoplane. He was deeply disappointed to be kept in NZ as an instructor on Tiger Moths, at Tauranga and Ashburton. At a dance in Ashburton he met Betty, and they married on 1943 August 21. He decided to resume extramural study for a B.Sc.; and Cecil Segedin gave him very helpful advice. An embarrassing minor accident on a training flight on 1943 May 2 ended his career as an instructor on Tiger Moths, and he was demoted to flying obsolete Vickers Vincent biplanes at Woodbourne, towing drogue targets. In November 1943 he went to Auckland and passed examinations in Pure and Applied Mathematics, giving him 7 of the 8 units required for B.Sc. A few months later he was invited to apply for a B.Sc. immediately, under special regulations for servicemen, and so he gained his first degree.

In December 1943 Leslie applied successfully for active service in the Pacific War, where RNZAF pilots flew American aircraft under US command. He was trained on Kittyhawks at Ohakea for 2 months, and then on leave in Auckland he enrolled as an extramural student for M.Sc. in Mathematics and also for B.A. On 1944 March 7 his Kittyhawk squadron flew from Whenuapai, and arrived at Guadalcanal after 5 one-day flights. On 1944 March 26 his squadron flew to Bougainville Island, part of which had been captured by Americans, but most of that island was still occupied by Japanese troops. By then the Japanese had few aircraft left in the Southwest Pacific, and so the Kittyhawk fighters were used mainly as dive-bombers. The major Japanese stronghold was at Rabaul, heavily protected by anti-aircraft guns. In 3 tours of duty, Flying Officer Leslie Woodhead flew 76 missions, with many dive-bombing raids from Bougainville on Rabaul. Nine of his close friends were killed during that period, mostly in flying accidents.

During home leave after his first tour of duty, with his first child due in 3 months, Leslie Woodhead changed his surname to Woods, to spite his father.

On his second leave Les Woods saw his first daughter—eventually he had a family of 5 daughters. He sat his examinations and gained second-class Honours in Mathematics for his M.Sc., and he passed Philosophy 1. Thus, he could look forward to a career as a teacher of mathematics. He had flown Corsair fighters on his second and third tours of duty. He transferred to Whenuapai as a trainer on Corsairs in March 1945, and he was promoted to Flight Lieutenant in May 1945. He was able to attend some lectures at Auckland University College. His unit transferred to Ohakea, where his wife and daughter joined him at Marton. The Government announced generous provisions for rehabilitation of servicemen, and he decided to study for a B.E., which he was qualified to complete in 2 years. In November 1945 he sat further examinations (at Christchurch) for his B.A.; and he was discharged from the RNZAF on 1945 November 17.

In 1946 Woods resumed studying at Auckland University College School of Engineering, in the "temporary" tin shed built in 1908. (It was finally demolished in 1979.) He got a small house built in Hillsborough Road, and his family were able to settle there late in 1947. He augmented his income by teaching some evening classes at Seddon Tech. He applied for a Rhodes Scholarship to undertake research at Oxford for a D. Phil. in Engineering Science, and on 1947 November 25 he was awarded that prestigious scholarship. At the end of 1947 he completed his B.E., and Professor Leech appointed him as Temporary Junior Lecturer to teach Fluid Dynamics and Aeronautics. The tin shed had ceased to be usable, and Professor Leech abruptly shifted the School of Engineering to the RNZAF base at Ardmore Airfield. Woods lectured there until August 1948, initially travelling by motorbike 50 miles each day. In July his wife and 2 daughters went to stay with her parents in Ashburton, while he camped in the barracks at Ardmore.

In August 1948 the Woods family flew from Auckland to Sydney on a Sunderland flying-boat, taking $8\frac{1}{2}$ hours for the flight. After a week in Sydney the family boarded the SS *Orion* for a 5-week journey to London, travelling with Cecil Segedin who was going to Cambridge on study leave.

Woods had been accepted by Merton College, where the Secretary provided a room for him, but was bewildered by his request for accommodation for his family. Food was still rationed in the U.K., and accommodation was desperately short around Oxford. In desperation, he took his wife and daughters to stay temporarily with a cousin of hers in West Bromwich. His encounter with the English class system, manifested in the hideous slums of the Black Country, was a startling experience for anyone coming from a tent by Purangi creek. Eventually his family joined him in a semi-detached house in Upper Wolvercote, and he splurged his funds to buy a motorcar.

Woods joined the University Air Squadron, after negotiating the obstacles of his interview by a panel of RAF officers, one of whom surprised Woods by asking what his father did. The answer "He was a fisherman" nonplussed the officers, and so Woods explained that "He owns his boat". "Ah, a fishing *manager*", one them said smiling! The Wing Commander asked Woods about the games that he played, and he replied that he had played football in NZ and now played for Merton College. "Football?". "Yes". "He means *rugger*, Sir!". More smiles of approval, and he was accepted in December 1948. Initially he flew Tiger Moths, but on 1950 July 13 he flew a Meteor jet. The next day he gave instruction on a Harvard, on his final flight as a pilot of powered aircraft. He had joined the New Zealand Defence Corps, which supported his further study and research, but he had to resign from the University Air Squadron.

At the Engineering Laboratory, Woods worked on transonic flow around a 2-dimensional aerofoil, laboriously solving finite-difference equations with the aid of a Brunsviga calculator. He earned some much-needed money by teaching Mechanics at Oxford Technical College. In 1950 he was awarded a D.Phil. for his thesis on *The flow of a compressible fluid about a body*, which resulted in 7 publications and an auspicious start for his academic career. In preparation for the degree ceremony he met the Dean of Degrees, who asked Woods whether he had a degree. He explained that he had a Master of Science and a Bachelor of Engineering from the University of New Zealand; to which the Merton Dean responded flatly "You have no degree"! (p.169). Woods then created something of a precedent by taking an Oxford B.A. after gaining his D.Phil.—the First Class which he gained in 1951 obscured his Second-Class M.Sc. (N.Z.). After the farce of his unearned M.A. (Oxon) he gained a D.Sc. (N.Z.) and D.Sc. (Oxon), and in 1983 the University of Auckland awarded him an honorary D.Sc. at its centennial celebrations.

In 1951 the NZDC seconded Woods to the National Physical Laboratory at Teddington, where he worked on aerofoil theory and published many papers. He applied for a Senior Lectureship in Applied Mathematics at Sydney University, and he was appointed to start in February 1954. Only after he had accepted did he learn of the internecine warfare in that Mathematics Department, between the Professor of Pure Mathematics T. G. Room and the Professor of Applied Mathematics Keith Bullen. The Woods family greatly enjoyed living in Sydney, but the fraught conditions within the Department made working there very difficult. The relations between Woods and Keith Bullen steadily deteriorated, culminating in March 1956 in a blazing row in Bullen's office. Woods finished by telling Bullen that he would take the first available university post at whatever level, to leave his petty domination.

In May 1956, at the age of 33, Woods became the second Nuffield Research Professor of Mechanical Engineering at the University of Technology at Sydney. When the Australian Mathematical Society was founded in 1956 he was elected a member of the first Council, and in 1958-1959 he became the vice-president. His extensive research on aerofoil theory was summarized in his treatise **The Theory of Subsonic Plane Flow** (CUP, 1961), which remained in print for 25 years. In 1958 he became acquainted with plasma physics, and gave some lectures on controlled thermonuclear fusion in his nuclear engineering course. His lecture notes on reactor physics got published as the Methuen monograph **An Introduction to Neutron Distribution Theory**.

At the end of 1959 the Woods family sailed cheaply to England, where he was to become an associate of the Controlled Thermonuclear Reaction Division of the Atomic Energy Research Establishment at Harwell, for 1960. Enormous sums of money have been spent since 1950 by many governments on attempts to generate power by controlled thermonuclear fusion, with plasma confined by magnetic fields. Woods started work at Harwell on investigating the basic magnetoplasma problem of why, in all attempts to confine plasma, it escaped across the magnetic field at *thousands* of times the rate predicted. The early optimistic forecasts of the imminence of power production by controlled thermonuclear reactions looked increasingly improbable, as physicists failed to cope with that fundamental problem. Then Balliol College invited him to become their Foundation Fellow in Engineering. That provided the opportunity to continue in plasma physics research, perhaps with a consultancy at Harwell; and so he accepted the invitation. There were then 3 other New Zealand Fellows of Balliol: Dan Davin (Assistant Secretary of OUP), Don Harris (Law) and the philosopher Arthur Prior.

Woods returned to Sydney to make the (very difficult) arrangements for his departure, and then visited his parents and friends in Auckland. The *New Zealand Herald* published a story (1960 November 30), in which Woods estimated that "It might be 50 years before the enormous energy in the hydrogen bomb can be brought under control". He now considers that to be an underestimate.

Woods began his duties as Balliol Tutor in January 1961, and he was appointed as a consultant in plasma physics for Harwell. Until 1977 he spent one day a week at the Laboratory (situated at Culham from 1963), studying mostly instabilities in plasmas. In 1965 he was promoted to Reader in Applied Mathematics, and in 1969 he was appointed as Professor of the Mathematics of Plasma. From 1953 Woods had attended some international conferences, and the frequency with which he attended conferences increased steadily from 1960 to 1980. Also he accepted many visiting professorships and visiting fellowships at universities around the world, including visits to NZ.

The marriage of Les and Betty had mostly been happy, but he had persistent difficulties with her mother. In 1973 those problems escalated and the marriage broke down, with an expensive divorce in 1977. And 2 later marriages also ended in divorce for Woods.

The favourite device for fusion research is the Tokamak, with the Joint European Tokamak (JET) at Culham being the largest, looking like a set designed for an extravagant science-fiction film. It was designed to generate power by heating deuterium and tritium to 3×10^8K and confining it for 25 minutes, so that the nuclei would react to produce helium and neutrons. The use of tritium introduced significant radiation hazards, since all isotopes of hydrogen diffuse through iron and other metals. If that D-T reaction ever did occur, then it would produce a flux of neutrons at least as dangerous as that from a fission reactor of comparable power. But, after several European governments have provided several hundred million pounds over 40 years, only in recent years has JET succeeded in confining plasma for a period approaching 1 second. Many types of instability have been discovered by Woods and others, and attempts were made to patch up the apparatus to cope with them.

Woods wrote **The Thermodynamics of Fluid Systems** (OUP, 1975). In 1979 he found that a basic equation used by plasma physicists is incorrect—the pressure used in that formula does not correspond to the collision of particles. He explained that to the Director of Culham Laboratory, who told Woods that he was wrong, and refused to renew Woods' consultancy. Woods then wrote 3 major texts on plasma physics: **Magnetoplasma Dynamics** (OUP, 1987), **Kinetic Theory of Gases and Magnetoplasmas** (OUP, 1993) and **Thermodynamic Inequalities with Applications to Gases and Magnetoplasmas** (Wiley, 1996). Those texts were reviewed dismissively by the thermonuclear establishment, but many other physicists have appreciated them. Woods comments (p.296) that "The evident failure of the fusion programme will never be admitted by those whose careers and livelihoods depend on maintaining the myth of 'steady progress' ".

In 1984, Woods became Chairman of the Mathematical Institute at Oxford University—he describes that as simply being his turn, as the most senior professor available. In 1985 and 1986 he was in Muscat to create a mathematics department, as the Foundation Professor of Mathematics for the Sultan Qaboos University. He resigned as Chairman of the Mathematical Institute in October 1989, and his Professorial Fellowship in Balliol terminated in 1990. He has continued with some consultancy work and with visiting appointments at various universities. He resumed playing his clarinet, and in 1996 (aged 73) he took up gliding as a hobby. He continues research into solar physics.

In 1998 Woods was the NZMS Lecturer at the Mathematics Colloquium at the Victoria University of Wellington, where his memorable lecture on "The Tokamak disaster" was much appreciated. He then gave lectures at other universities in NZ. Auckland Institute of Technology (which later became the Auckland University of Technology) was a successor to Seddon Memorial Technical College, and in 1998 the AIT fêted Woods as *their* Rhodes Scholar. He gave there a seminar on the philosophy of science, and he was delighted to be able to pay tribute to his patron Cyril Maloy, who was in the audience. This candid memoir is illustrated with many interesting photographs—the most touching shows Cyril Maloy (p.311) with Les Woods, whose potential he had realized 62 years previously.

Nothing quite like this book has been published previously.

Every library in New Zealand should get this book.

Garry J. Tee
University of Auckland

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)

Aigner M, Proofs from THE BOOK. (2nd ed) 216pp.
Anderson I, A first course in discrete mathematics. (Springer Undergraduate Texts in Mathematics) 200pp.
Armitage DH, Classical potential theory. (Springer Monographs in Mathematics) 333pp.
Bang-Jensen J, Digraphs. (Springer Monographs in Mathematics) 754pp.
Dewdney AK, The planiverse. 245pp.
Engquist B, Mathematics unlimited-2001 and beyond. 1250pp.
Fadell ER, Geometry and topology of configuration spaces. (Springer Monographs in Mathematics) 313pp.
Farenick DR, Algebras of linear transformations. (Universitext) 238pp.
Fenn R, Geometry. (Springer Undergraduate Mathematics Series) 314pp.
Gallier J, Geometric methods and applications. (Texts in Applied Mathematic, 38s) 565pp.
Kreuzer M, Computational commutative algebra I. 321pp.

Lang J, Adaptive multilevel solution of nonlinear parabolic PDE systems. (Lecture Notes in Computational Science and Engineering, 16) 160pp.
Nikolaev I, Foliations on surfaces. (Ergebnisse der Mathematik und ihrer Grenzgebiete. 3. Folge, 41) 450pp.
Phillips GM, Two millenia of mathematics: from Archimedes to Gauss. (CMS Books in Mathematics, 6) 223pp.
Pressley A, Elementary differential geometry. (Springer Undergraduate Mathematics Series) 332pp.
va Rienen U, Numerical methods in computational electrodynamics. (Lecture Notes in Computational Science and Engineering, 12) 375pp.
Smith KE, An invitation to algebraic geometry. (Universitext) 155pp.
Steele JM, Stochastic calculus and financial applications. 300pp.
Szasz D, Hardball systems and the Lorentz gas. (Encyclopaedia of Mathematical Sciences, 101) 458pp.
Weihrauch K, Computable analysis. (Texts in Theoretical Computer Science) 285pp.
Wesseling P, Principles of computational fluid dynamics. (Springer Series in Computational Mathematics, 29) 530pp.
Wilson R, Mathematical conversations: selections from the Mathematical Intelligencer. 488pp.

CONFERENCES

2001 COLLOQUIUM

The 2001 New Zealand Mathematics Colloquium will be held during December 3–6 at the Turitea campus of Massey University in Palmerston North. Contributed papers are sought in all areas of pure and applied mathematics and statistics. They will be of 25 minutes duration, with an extra 5 minutes allowed for questions and movement between rooms.

Further information is available from the web site

http://ifs.massey.ac.nz/NZMC2001/.

Online registration will be possible through this site. Please submit the title and abstract for your talk by October 15, either through the web site or directly to Mike Carter (M.R.Carter@massey.ac.nz).

NEW ZEALAND MATHEMATICS RESEARCH INSTITUTE SUMMER WORKSHOP 2001 Nelson, 4–11 January 2001

The theme of the meeting was Operator Algebras and interactions with Mathematics and Physics. As usual some preliminary lectures were delivered in Auckland, while copies of a typescript on C*-algebras by Philippe de la Harpe & Vaughan Jones were circulated more widely. Vaughan also gave a series of lectures in Victoria University of Wellington.

Most of us converged on the Tahuna Beach Holiday Park on the morning of Thursday 4 January, and talks began that afternoon. Thereafter the typical daily programme was lectures in the morning and again in the evening after dinner, with the afternoon free to work on mathematics or enjoy the vast beach or other tourist attractions in the area. The one exception was Saturday 6th, when the hall where we had our lectures and meals was needed for a wedding; so on that day we dispersed in all directions, seaward for windsurfing and swimming, landward for tastes of the local wines, arts and crafts and mountainward for those who preferred thin air.

We had a stellar collection of speakers, who covered a range of topics from within and outside the central theme of Operator Algebras. The speakers were: Jorgen Andersen (Aarhus, currently at Berkeley/MSRI); Dietmar Bisch (UCSB); Alan Carey (Adelaide); Ed Effros (UCLA); Roger Fenn (Sussex); Vaughan Jones (Auckland and Berkeley); Adrian Ocneanu (Penn State); Paul Pearce (Melbourne); Sorin Popa (UCLA); Jacqui Ramagge (Newcastle); Dale Rolfsen (UBC, Vancouver); Thomas Schucker (Marseille-physics); Colin Sutherland (UNSW) and Antony Wassermann (CNRS, France).

The meeting was attended by about 50 mathematicians (both academics and students) from throughout New Zealand. There were also a number from Australia in addition to the Australian speakers, including a record number of Australian students. It was also pleasing to note the attendance of the President of the Australian Mathematical Society and of an official representative of the Pacific Institute of Mathematical Sciences, both of whom gave talks.

David Gauld

TIME 2000

During the period 2000 December 11–14, 215 delegates from a number of countries, including UK, USA, Canada, Germany, Japan, Singapore, Hong Kong, Finland, Sweden, Australia, and New Zealand, converged on Auckland University's Mathematics Department for TIME 2000, an International Conference on Technology in Mathematics Education. The conference, which was one of the official events for World Mathematical Year 2000, was jointly hosted by the Mathematics Education Unit (MEU) in the Mathematics Department at The University of Auckland and the Applied Mathematics Department at Auckland University of Technology. The convenors were Mike Thomas of MEU and Murray Black of AUT.

The conference attracted a good number of well-known international experts in Mathematics Education, and it was pleasing to see a good number of New Zealand mathematics teachers present as well. Sadly, Professor Jim Kaput (University of Massachusetts at Dartmouth) was unable to attend at the last moment, due to the death of his father on the weekend before the conference. The plenary speakers were: Professor Celia Hoyles and Professor Richard Noss (London Institute of Education), Professor Richard Lesh (Purdue University), Professor David Tall (Warwick University), Barry Kissane (Murdoch University), Pam Bishop (Birmingham University), Professor Neville Davies (Nottingham Trent University), Professor David Ryan (Engineering Science, Auckland University), and Dr Beth Chance (California Polytechnic State University, USA).

Notable among those also attending were Professor Claude Gaulin (Laval University, Canada), Professor Kaye Stacey (University of Melbourne) and Associate Professor John Olive (University of Georgia, USA). The conference was a great success, with many of those present commenting during the conference and since on their enjoyment of the presentations and the social events. Among these the conference dinner, which was held at the Royal New Zealand Yacht Squadron's headquarters at Westhaven marina, was a highlight. We were able to eat good food, and the visitors were impressed by both the America's Cup on display inside the building and the full moon shining across the water outside. MEU hope to host another TIME conference in the future.

Mike Thomas

REPORT ON THE 25TH AUSTRALASIAN CONFERENCE ON COMBINATORIAL MATHEMATICS AND COMBINATORIAL COMPUTING

The 25th Australasian Conference on Combinatorial Mathematics and Combinatorial Computing was held at the University of Canterbury from 4–8 December 2000. Inundated with abstracts and registrations at the last minute, we had 68 participants altogether, almost half of whom came from places outside Australia and New Zealand.

The conference's invited speakers were Joan Hutchinson (Macalester College), Chris Rodger (Auburn University), Ralph Stanton (University of Manitoba), Robin Thomas (Georgia Institute of Technology), Geoff Whittle (Victoria University of Wellington), and Nick Wormald (University of Melbourne). Speaking on a wide range of combinatorial topics, all of the invited speakers had obviously gone to some effort in preparing their talks—the presentations were excellent.

This year, we decided to have the "pre-conference" reception on the Monday evening (held at the University of Canterbury Staff Club). Holding the reception on Monday evening turned out to be one of our better ideas. Having had a day to recover from travel and to get into the swing of things the atmosphere was relaxed, but noisy!

The conference excursion was to Arthurs Pass, which is one of the three passes through the Southern Alps linking the East and West Coasts of the South Island. Because of the distance (four hour round trip), we made it a day trip.

Arthurs Pass is a treasure trove for local trampers and mountaineers. With this in mind, everyone set off on one of the many scenic walks in the area. One such walk was to the top of Avalanche Peak. We must have looked like a trail of ants has we grunted our way to the top. The views were spectacular although perhaps hard to see under the dripping of sweat. Some people may be pleased to hear that every summer there is an organised race from Arthurs Pass township to the top of Avalanche Peak and down the other side. From memory, the race record to the top is about an hour—scary really!!

Although we all went to Arthurs Pass in mini-buses, some of us went to extraordinary lengths to travel back to Christchurch via helicopter. Participants will be pleased to hear that Carol Moon is recovering well back home.

The conference dinner was held at Trents Winery, a small winery about 11 km from the university. Luckily the bad weather held off, so that pre-dinner drinks and chat could be done outside. Of course, it being summer and all, we had a barbeque which included venison sausages, chicken, steak, and mussels. The BBQ ended with the NEW ZEALAND invented dessert—pavlova.

Lastly, we'd like to thank all participants for the effort they made in getting to the conference, their excellent and varied talks, and their happy faces. We hope everyone enjoyed the conference as much as we enjoyed hosting it.

Charles Semple and Mike Steel

ALGEBRAIC AND TOPOLOGICAL METHODS IN GRAPH THEORY ATMGT2000

December 11–15, 2000
Department of Mathematics, University of Auckland, New Zealand

ATMGT2000, a conference on algebraic and topological methods in graph theory was hosted by the Department of Mathematics, University of Auckland, December 11–15, 2000. This was the first conference in, what is hoped to be, a series of graph theory conferences timed to occur around the middle of the four-year Slovene graph theory conference cycle. The organisers were particularly pleased that many Slovenes managed to participate in this Auckland conference.

The organisers wish to thank the Department of Mathematics (University of Auckland), the Marsden fund (administered by the Royal Society of New Zealand) and the Centre of Discrete Mathematics and Theoretical Computer Science (University of Auckland) for their generous financial support of the conference.

The invited speakers were:

* Bruce Richter, University of Waterloo, Canada
* Joan Hutchinson, Macalester College, St Paul, Minnesota
* Dragan Marusic, University of Ljubljana, Slovenia
* Tomaz Pisanski, University of Ljubljana, Slovenia
* Cheryl Praeger, University of Western Australia, Perth, Australia
* Jozef Siran, Slovak Technical University, Bratislava, Slovakia
* Robin Thomas, Georgia Institute of Technology, Atlanta, Georgia
* Tom Tucker, Colgate University, Hamilton, New York
* Mark Watkins, Syracuse University, New York

Dr Margaret Morton was instrumental in the organisation of this conference. Margaret passed away on August 31, aged only 55, after a short battle with cancer. The organisers decided to dedicate the conference to Margaret, and to hold a half-day special session on the Tuesday in her honour. The speakers during this session included collaborators and colleagues: Joan Hutchinson, Cheryl Praeger, Marston Conder, Neal Brand and Paul Bonnington.

The social events included a Monday night reception in "Old Government House", on the University grounds, and an excursion (on a glorious sunny day) to the vineyards and beaches of Waiheke Island in the Hauraki Gulf. (However, we understand that many theorems were proved during this excursion while sitting on Oneroa Beach, and so it's "social" aspect is debatable.) The conference dinner was a very popular kiwi-style BBQ held at Dianne and Gaven Martin's home situated in an area of beautiful native bush (complete with glow-worms) north of Auckland.

A total of 50 people from New Zealand, Australia, Slovenia, Canada, United States, Iran, Mexico, South Africa, Slovakia, and the Sultanate of Oman registered for the conference. From all reports, the participants thoroughly enjoyed the conference, and had a stimulating week of mathematics!

Paul Bonnington and Marston Conder

ANODE 2001

Anode 2001, in the series of Auckland conferences on the numerical solution of ordinary differential equations, was held in Auckland from 8–12 January this year. Following the theme of software for ordinary differential equations, the invited speakers were:

Wayne Enright, University of Toronto, Canada, on the design and development of effective and usable ODE software for an expanding community of users; Francesca Mazzia, University of Bari, Italy, on boundary value methods for the solution of ODEs; Gustaf Soderlind, Lund University, Sweden, Automatic control and adaptive time-stepping; and Peter van der Houwen, Korteweg-de Vries Institute for Mathematics, Netherlands, Parallel aspects in the numerical solution of IVPs.

Another 35 participants, many from overseas, also presented talks on a wide range of topics in numerical differential equations.

Included in a full social programme were an afternoon on the Auckland Harbour, an opening gathering and a conference dinner at the Hyatt and an informal dinner at John Butcher's home.

The conference concluded with a lively panel discussion on the challenges facing differential equation software and the difficulties of producing software to cover the wide variety of equations and requirements for interpolation.

Gustaf Soderlind stayed on in Auckland for a month and gave a series of seminars on the use of control theory in setting step sizes in automatic solvers.

Allison Heard

DOOM01

DOOM01, the annual New Zealand phylogeny workshop, was held at the Skotel, Whakapapa in the second week of February. The workshops have been running every year since 1996 and attract mathematicians and biologists from all over New Zealand and abroad. Organiser Pete Lockhart (of the Institute of Molecular BioSciences, Massey University) liberally sprinkled great photos of the central plateau all through the workshop web page, which succeeded in tempting a large overseas contingent. In all there were about 40–45 attendees with backgrounds ranging from maths to biology, statistics and computer science. The Skotel proved to be an excellent venue, providing all those essential conference facilities such as a bar, pool table, sauna and spa, not to mention fantastic views.

Highlight talks of a mathematical flavour included Mike Steel's discussion of his theorem on the number of multi-state characters required to fully resolve a tree. Susan Holmes, of Stanford, gave a talk on the geometry of tree space. Having a statistician like Susan along proved to be very useful, many people received advice on statistically appropriate ways to validate their models.

Nature or Science readers will be aware that Celera Genomics and the public funded effort have both recently published their versions of the human genome. We were lucky to have Daniel Huson along to give an account of Celera's efforts. He explained that their version of the genome has far more 'happy mates' than the public funded effort. A 'happy mate' is where two pieces of sequence that you know should be facing each other and certain distance apart actually do appear to be facing each other the correct distance apart in the completed genome. If you find too many 'unhappy mates' then one can conclude that the giant jigsaw puzzle that is the human genome has still got some glitches in it.

Alan Cooper was another attendee who has been in the news lately as he has just published the complete mitochondrial moa genome, a first for an extinct animal. He gave an excellent talk on the moa sequence, bird phylogeny in general, and what it all meant for different theories on continental drift.

Next year the workshop will be hosted by Allan Rodrigo of Auckland University somewhere in the Coromandel. Thanks Pete, good luck Allan, we're looking forward to next year!

Barbara Holland

Conferences in 2001

May 28–29 (Sydney) **Conference in Honour of George Szekeres**

email: szekconf@maths,unsw.edu.au

July 1–5 (Kruger National Park, South Africa) **Warthog Delta'01: Third Southern Hemisphere Symposium on Undergraduate Mathematics Teaching**

email: samern@scientia.up.ac.za
homepage: http://science.up.ac.za/delta01

July 1–6 (Great Keppel Island, Queensland) **International Conference on Optimization in Industry**

contact Dr Victor Korotkich
email: v.korotkich@cqu.edu.au
homepage: http://optimization.cqu.edu.au/

July 16–18 (Brisbane) **The 10th Biennial Computational Techniques and Applications Conference**

homepage: http://conference.maths.uq.edu.au/ctac2001/

August 19–24 (Palm Cove Resort, Queensland) **International Conference on New Ideas in Mathematics Education**

email: arogerson@vsg.edu.au

September 26–28 (Brisbane) **Australasian Association for Engineering Education 12th Annual Conference**

homepage: http://www.icms.com.au/aaee2001/

NOTICES

ANZIAM NEWS

MISG

There is a chance that the Maths in Industry Study Group (MISG), previously held exclusively in Australia, could come to New Zealand in 2004 and 2005. The New Zealand Branch of ANZIAM has written to the ANZIAM Executive, expressing support for MISG being located in NZ in the near future. This is a great opportunity for NZ mathematics, as typically over 100 mathematicians attend MISG, working in a team environment, on problems set by industry.

ICIAM2003

A highlight of 2003 will be the 5th International Congress on Industrial and Applied Mathematics, held in Sydney over 7 to 11 July. Both the NZ Mathematics Colloquium and the ANZIAM meeting will be embedded into ICIAM2003. All ANZIAM members are encouraged to attend ICIAM2003.

FUNDING

The NZ Branch of ANZIAM has received about $2000 from ANZIAM to encourage Applied and Industrial Mathematics within New Zealand. We are seeking ideas on how this may best be achieved.

WELLINGTON-MANAWATU ANZIAM MEETING

This will be held in the IRL Conference Centre, Gracefield, Lower Hutt on Tuesday, June 12. Mark McGuinness is doing the initial planning for this meeting. Please diarise June 12.

MARGARET MORTON ANNUAL PRIZE FUND

At the ATMGT2000 Graph Theory conference, held at the University of Auckland in December 2000, we announced our intention to establish a prize fund in Margaret Morton's name.

We invited conference participants to contribute to this fund, and the response was very generous. It appears that interest on the fund accrued annually will be enough to support a book prize, at the very least.

While the final specifics have not been established, we believe that Margaret would have supported the prize being awarded to the woman student who has (in the opinion of the Department of Mathematics) exhibited the most potential to succeed, in Mathematics Education and/or Graph Theory-Discrete Mathematics.

We now invite colleagues and friends to contribute to this fund to help make the Morton prize a substantial offering in our annual prizes. Contributions to "The Margaret Morton Fund" can be passed on to Barbara Miller-Reilly or Paul Bonnington.

"She made us all sit up and re-think what we do in the Department. She helped us learn to see things from many perspectives (not just our own), and was a wonderful advocate for students and for younger staff. She did a fantastic job as Teaching Coordinator, helping introduce much better feedback mechanisms and well thought out processes for maintaining and improving our teaching resources. She was also a champion for new appointments, and especially the need for mentoring of new and especially younger staff." (NZMS Centrefold No. 80)

[Note that contributions to universities are tax-deductible as charitable donations–Ed.]

Paul Bonnington
Barbara Miller-Reilly
Marston Conder

NZ MATHEMATICAL SOCIETY RESEARCH AWARD 2000

The President of NZ Mathematical Society recently announced that the NZ Mathematical Society Research Award for 2000 was awarded to **Dr Graham Weir, Leader of the Applied Mathematics Group, Industrial Research Ltd, Wellington**. This was announced at the 2000 NZ Mathematics Colloquium held in the University of Waikato, Hamilton.

The citation read by the President of NZMS, Professor Graeme Wake, said that the award is **"for his wide-ranging in-depth contributions to applied mathematical modelling covering a diverse range of phenomena including geosciences, structure of materials, corrosion theory, and the flow of granular material"**.

This annual award was instituted by the Society in 1990 to foster mathematical research in New Zealand and to recognise excellence carried out by New Zealand mathematicians.

Other recipients to date have been Professor John Butcher (Auckland) and Professor Rob Goldblatt (Wellington) 1991, Professor Rod Downey (Wellington) and Professor Vernon Squire (Dunedin) 1992, Professor Marston Conder (Auckland) 1993, Professor Gaven Martin (1994), Dr Vladimir Pestov (Wellington) and Dr Neil Watson (Christchurch) 1995, Dr Mavina Vamanamurthy (Auckland) and Dr Geoff Whittle (Wellington) 1996, Professor Peter Lorimer 1997, Dr Jianbei An (Auckland) 1998, and Dr Mike Steel (Christchurch) 1999. This is the first time the award has been awarded to a recipient outside the University system. Earlier this year the University of Canterbury, at which Dr Weir originally studied, awarded him a Doctor of Science degree in recognition of his achievements.

GRANTEE REPORTS

I was privileged to participate in the "Mathematics for Living" conference in Amman, Jordan from the 18–23 November 2000. The conference was small by international standards, with only 100 or so, but was special in all aspects. It was a place where at least one Jewish and one Palestinian person, together with other people from some 24 countries, expressed their mutual concerns and problems related to the delivery of mathematics education.

Gila Hanna (from the Ontario Institute for Studies in Education) and I co-shared a plenary on "Gender Equity in Mathematics Education". Gila's analysis of results obtained on the International Association for Education mathematics tests showed that, in most countries, equity between male and female students has now been reached in mathematics achievement at entry to secondary schooling and that the gap in favour of males seen at the end of secondary schooling has narrowed. She also discussed that, while gender equity has not yet been reached, enormous strides have been made and many educators are now concerned about the level of participation of males in mathematics and science courses. I suggested the need for 'equity' to be measured both cross-sectionally (in one level of education, examination, or point-of-time) and longitudinally (by tracking cohorts of students as they progress through different levels of education). I presented a measure that combined mathematics achievement and participation over time and used this to show that, while the differences between male and female non-Maori New Zealand mathematics students were small at the end of secondary schooling, these were related to whether the assessment used by school-based or by external examination. This was not the case for Maori (indigenous) New Zealanders and their combined performance compared to non-Maori students decreased markedly over the final three years of secondary schooling.

Gila and I also ran a working group on gender and social barriers to mathematics learning. The papers presented, and the resulting discussion, covered the difficulties involved in delivering mathematics education equitably to both males and females and to other social groups, through distance learning to the partially sighted or blind, to maximum security prisoners, to children injured by war or in prison, and to students who are, or have been, political prisoners. Farouq Almeqdadi talked about his research results indicating the non-readability (to children) of the fifth-grade Jordanian mathematics text.

Other interesting papers I attended were on the use of fractals in art and architectural design, on the establishment of

an interactive internet site for use by Canadian seventh to ninth grade mathematics students (designed by Natalie Sinclair), and on data driven mathematics (in a workshop led by Gail and Jack Burrill from the USA). Gail has been invited to be a speaker at the NZAMT conference in Wellington in July next year and I recommend this session to teachers in particular.

One of the most personally rewarding experiences was the interaction with people from very different cultural, religious and political backgrounds who had a common concern for mathematics education generally, and that of girls in particular. The conference "package" also included two special tours. One was to the ancient city of Petra situated in a natural rift in mountains, with now-empty tombs carved into red sandstone cliffs leaving caves which until recently were lived in by Bedouin. One of the Bedouin has been married to a New Zealand woman for 22 years. I met her in Petra and had an interesting discussion. The other tour was to the Dead Sea where we covered ourselves in mud and floated in the dying sun, on the water separating Jordan and Palestine.

The four days were full of memories and I'm extremely grateful to have had the opportunity to take part in this conference. I thank both the Wellington Mathematics Association and the New Zealand Mathematical Society for their financial assistance which made attendance at this conference possible.

Sharleen Forbes
Statistics New Zealand

With the generous support of the Research Committee of the University of Auckland, the New Zealand Mathematical Society and the Department of Mathematics of the University of Auckland, I recently attended the 2000 SIAM Annual Meeting held July 10–14, 2000 at Rio Grande, Puerto Rico.

About five hundreds of scientists from around the world came together for this meeting. The majority were North Americans, but Europe, Asia and South America were well represented too. Unfortunately, I was the only Kiwi at the Conference and there were no Australians either. Under the circumstance, I tried to do my best to represent Australasian Science at the Meeting.

The meeting themes of the Conference comprised almost all areas of Applied Mathematics, from Non-Linear PDEs to Imaging and Information Technology. The program included three special lectures and twelve invited plenary talks: Nancy Kopell, Rhythms in the nervous system; J.-M. Morel and F. Guichard, PDEs in image processing; P.M. van Dooren, Model reduction of large-scale systems; Ken Kennedy, Long-term information technology research; Noga Alon, Polynomials in discrete mathematics; Warren M. Washington, Global climate modeling; Paul R. Woodward, Simulating turbulent compressible flows; Ronald A. DeVore, Nonlinear approximation; Vladimir Rokhlin, Numerical techniques and real-life problems; Randolph E. Bank, Multigrid: from fourier to gauss; Michael Crandall, The mysterious infinity laplacianl Yin Zhang, Interior-point method and semidefinite programming.

The Conference program was extensive. Apart from the invited talks and special lectures, the program comprised seventy mini-symposia and twenty-two sections of contributed presentations, plus a posters session—in total more that 350 presentations.

My talk entitled "Is a Hopf Bifurcation Responsible for Ice Ages?", a work made in collaboration with Dr Alex McNabb, was presented on 11 July. The talk attracted more people than an average contributed talk. The only other talk on the subject, climate modelling, was the invited talk given by Dr W.M. Washington from National Centre for Atmospheric Research, which dealt with global climate modeling using powerful computers.

This was my first conference overseas, a new and extremely useful experience for me. I would like to express my gratitude to the Research Committee of the University of Auckland and the New Zealand Mathematical Society, whose financial support make my participation in this conference possible.

Andrei Korobeinikov
University of Auckland

MATHEMATICAL MINIATURE 14

Sums of two squares revisited

I was at one time an amateur numerical analyst; then I found, almost by chance, that I could make a living out of it. However, I am still an amateur number theorist with no expectation of ever getting anything from it except sheer enjoyment. Hence, I am displaying my arrogance by again letting number theory find its way into these Miniatures. However, my lack of any deep knowledge will force me to stick to questions accessible to other amateurs. In Miniature number 7, I showed using a pigeon-hole proof, that primes of the form $4n+1$ can be written as sums of two squares. Today I will give a constructive argument drawn to my attention by Alf van der Poorten of Macquarie University. But is the 'Hermite-Serret' algorithm, as it is known, really constructive? It depends on whether you regard the discovery of an $x \in \{1, 2, \ldots, p-1\}$ such that $x^2 \equiv -1 \pmod{p}$ to be a trival problem or not, because this is the starting point for the construction. Start with two relatively prime positive integers, a_0 and a_1 with $a_0 > a_1$ and with the property that there exists b_1 such that $a_0 b_1 = a_1^2 + 1$. Of course a_0 has the role of p, but is not necessarily assumed to be prime, and a_1 has the role of x. In this slightly generalized version of the Hermite-Serret construction, use the Euclidean algorithm to form a sequence $a_0, a_1, a_2, \ldots, a_{m+1}$ and identify the first two members of the sequence, say a_k, a_{k+1} which are each less than $\sqrt{a_0}$. Then the theorem belonging to the algorithm, states that $a_k^2 + a_{k+1}^2 = a_0$. Let $n_1, n_2, \ldots, n_m$ denote the quotients arising in the Euclidean algorithm so that

$$a_{i+1} = a_{i-1} - n_i a_i, \qquad i = 1, 2, \ldots, m.$$

Along with the a sequence, introduce a b sequence that satisfies exactly the same relationship between successive members, starting with $b_0 = a_1$ and with the b_1 already introduced. Thus, we have

$$\begin{bmatrix} a_i & a_{i+1} \\ b_i & b_{i+1} \end{bmatrix} = \begin{bmatrix} a_{i-1} & a_i \\ b_{i-1} & b_i \end{bmatrix} \begin{bmatrix} 0 & 1 \\ 1 & -n_i \end{bmatrix}, \quad i = 1, 2, \ldots,$$

which we will write in the form $X_i = X_{i-1} N_i$. Because $\det(N_i) = -1$ and $\det(X_0) = a_0 b_1 - a_1 b_0 = a_0 b_1 - a_1^2 = 1$, it follows that $a_i b_{i+1} - a_{i+1} b_i = \det(X_i) = (-1)^i$. Coming back to the n sequence we see that

$$\frac{a_0}{a_1} = \frac{a_0}{b_0} = \left[\, n_1, \quad n_2, \quad \ldots, \quad n_m \,\right] = n_1 + \frac{1}{n_2 +} \frac{1}{n_3 +} \cdots \frac{1}{n_m},$$

where we can force the length m of the continued fraction to be even because if $n_m > 1$ then

$$\left[\, n_1, \quad n_2, \quad \ldots, \quad n_m \,\right] = \left[\, n_1, \quad n_2, \quad \ldots, \quad n_m - 1, \quad 1 \,\right].$$

Let $k = m/2$. We will show that $a_{k-1} > \sqrt{a_0} > a_k$ and that $a_k^2 + a_{k+1}^2 = a_0$, thus justifying the Hermite-Serret algorithm.

It is useful to look at the *reversed* continued fraction $\left[n_m, \; n_{m-1}, \; \ldots, \; n_1\right]$. The numerator and denominator of convergent number m are the elements in the first row of the matrix product

$$\begin{bmatrix} n_m & 1 \\ 1 & 0 \end{bmatrix} \begin{bmatrix} n_{m-1} & 1 \\ 1 & 0 \end{bmatrix} \begin{bmatrix} n_{m-2} & 1 \\ 1 & 0 \end{bmatrix} \cdots \begin{bmatrix} n_1 & 1 \\ 1 & 0 \end{bmatrix}.$$

Thus, if convergent number m is N/D, then

$$\begin{bmatrix} N & D \end{bmatrix} = \begin{bmatrix} 1 & 0 \end{bmatrix} N_m^{-1} N_{m-1}^{-1} N_{m-2}^{-1} \cdots N_1^{-1},$$

or, what is equivalent,

$$\begin{bmatrix} 1 & 0 \end{bmatrix} = \begin{bmatrix} N & D \end{bmatrix} N_1 N_2 N_3 \cdots N_m,$$

implying that $N = a_0$ and $D = a_1$. Thus, the value of $\left[n_m, \; n_{m-1}, \; \ldots, \; n_1\right]$ is a_0/a_1 and the reversed sequence is identical to the forward sequence. Now calculate $a_k^2 + a_{k+1}^2$. We find

$$a_k^2 + a_{k+1}^2 = \begin{bmatrix} a_k & a_{k+1} & v \end{bmatrix} \begin{bmatrix} a_k & a_{k+1} \end{bmatrix}^T = \begin{bmatrix} a_0 & a_1 \end{bmatrix} N_1 N_2 \cdots N_k N_k^T N_{k-1}^T \cdots N_1^T \begin{bmatrix} a_0 & \end{bmatrix}$$

Because each of the N matrices is symmetric and because the sequence of such matrices is palandromic, this expression can be written as

$$\begin{bmatrix} a_0 & a_1 \end{bmatrix} N_1 N_2 \cdots N_k N_{k+1} N_{k+2} \cdots N_m \begin{bmatrix} a_0 & a_1 \end{bmatrix}^T = \begin{bmatrix} 1 & 0 \end{bmatrix} \begin{bmatrix} a_0 & a_1 \end{bmatrix}^T = a_0.$$

The inequality $\sqrt{a_0} > a_k$ is an immediate consequence and $a_{k-1} > \sqrt{a_0}$ follows from $a_{k-1}^2 = (n_k a_k + a_{k+1})^2 > a_k^2 + a_{k+1}^2 = a_0$. There is room for a single example: $a_0 = 29, a_1 = 17$. The continued fraction is $\left[1,\ 1,\ 2,\ 2,\ 2\right]$, which is stretched to the palandromic sequence of even length $\left[1,\ 1,\ 2,\ 2,\ 1,\ 1\right]$. The a and b sequences are $\left[29,\ 17,\ 12,\ 5,\ 2,\ 1,\ 1,\ 0\right]$ and $\left[17,\ 10,\ 7,\ 3,\ 1,\ 1,\ 0,\ 1\right]$, giving a sequence of approximations to $29/17$ and the solution to the sum of squares problem: $29 = 5^2 + 2^2$.

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