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NEWSLETTER

OF THE

NEW ZEALAND MATHEMATICAL SOCIETY (INC.)

Contents

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PUBLISHER'S NOTICE

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Web Sites

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

EDITORIAL

NZMS Newsletter Centrefolds

The August 1980 newsletter reports that Mr M. D. E. Conder has been appointed to a postdoctoral fellowship at Otago University; and that Canterbury is looking for a new lecturer, with the Lecturer's scale beginning at $15,149 (equivalent to $52,745 today). Auckland reports one visitor and one mathematics seminar, on "Mathematical Models in Biology". And the newsletter ran its first *Centrefold*, on John Butcher, who had just been elected FRSNZ, joining Professors Davidson, Forder, Kerr, Lawden, and Peterson as Fellows. The idea, presumably due to then editor Brent Wilson, was a good one, and more than 60 centrefolds later they are still going strong. The informal 2-page, no-repeats limits are still in place (with a few exceptions) but the profiles have gradually become more and more detailed. With the help of Fiona Richmond and Judy Edwards, all previous Centrefolds have now been collected on the web,

at

http://ifs.massey.ac.nz/mathnews/centrefolds/

When I became editor I inherited a hand-written sheet from the previous editor listing the centrefold subjects, authors, and a column headed 'Reason'. There under Vaughan Jones (August 1986 Centrefold) was entered the reason 'possible Fields medalist', with a note added later in different coloured pen, 'didn't win'. Proof-reading the transcriptions explained a striking event I witnessed in the 7th form. The finalists in the BNZ maths competition and their parents all got together to hear a lecture from Brent Wilson (August 1989 Centrefold). The subject was Rubik's Cube, then at the height of its popularity. Brent took a random-looking cube from his bag, passed it to the audience who made 3 moves without him watching. He then proceeded to solve the cube *behind his back* while continuing to recount the life story of Niels Henrik Abel. Not only that, but he couldn't stop laughing. How did he do it? The cube could have been set up in the nontrivial element of the centre of the cube group (each side cube flipped), but what then? Was it specially marked or something? I just couldn't figure it out. Now I know.

Robert McLachlan
Massey University

PRESIDENT'S COLUMN

For many of us this time of year means the return of students and the resumption of lectures. Gone are the days of summer and traveling from conference to conference. I spent the last week of January at the Mathematics in Industry Study group in Auckland, and the first week of February at the ANZIAM meeting in Hobart. Others have attended the NZMRI and NZIMA meetings in Nelson, and VIC 2004 in Wellington. The contents of these events are reported elsewhere, but the two that I was at received very different treatment from the local media.

The New Zealand Herald ignored MISG, but the Dominion Post reported it under the heading 'Industry problems for the boffins to solve'. My dictionary says that a boffin is a research scientist, especially in a technical or military area (20th century, origin unknown). Mr and Mrs Boffin appeared in 'Our Mutual Friend', apparently Dickens saw the name in the register of St. Andrew's, Holbourn, and thought it amusing. Opinion appears to be divided over whether it is derogatory or derisory. The Dominion Post went on to describe the participants of MISG as 'number-crunchers'. The front page of the same issue had a picture of Peter Jackson with one of his many awards, and a measured report on the event that avoided references to 'film fans' or 'movie maniacs'.

The Mercury (Hobart) had a reporter at the ANZIAM meeting. For three consecutive days the paper ran articles about the conference, covering applications of mathematics in epidemiology, MRI scanning, cell growth and migration, election strategies and aerodynamics. They carried a photo of me looking mean enough to scare away any infectious disease, and a much more flattering one of Ernie Tuck throwing a Frisbee. The reports were factual and interesting, and avoided making any facetious comments. It is fine to be world famous in Tasmania, and a pity that our news media find it difficult to give mathematics serious treatment in New Zealand.

Incidentally, the website 'World Wide Words' says that the surname Boffin is derived from the Welsh name Baughan. It is too much to hope for a front page picture of Vaughan Jones kissing his Fields Medal.

Accountants must tire of being referred to as 'bean-counters', an appellation that describes their insistence on mapping everything onto one dimension. Although Oscar Wilde's jibe "A man who knows the price of everything and the value of nothing". was made about a cynic, it is often used in this context. At the time of writing, the release of the results of the PBRF exercise is held up in the court because of their use to compare our universities with those in the UK. The damage that an inappropriate comparison could do is considerable. For example, I have just succeeded with an application for a UK fellowship. Would the outcome have been different if the committee had been able to look up a comparison of NZ and UK universities on the internet? Even if caution was advised because the criteria used were different, the relative rankings of institutions would still be (mis)used as a guide. In this case the criteria say that preference is given to candidates from Stanford University. An alphabetical merger with the USA would put Massey next to the Massachusetts Institute of Technology, one hopes that the comparison with the UK was not equally arbitrary.

In the last newsletter I congratulated members of the society who had received honours, but the editorial deadline meant that I failed to mention some others who were acknowledged elsewhere in the same issue. I would like to add my congratulations to David Ryan and Mike Steel on being elected Fellows of the Royal Society of New Zealand, to Charles Semple on being awarded the Hamilton Memorial Prize and to Robert McLachlan on being awarded the New Zealand Association of Scientists Research Medal. Another Fellow of the NZMS, Charles Pearce of the University of Adelaide, is also to be congratulated

on being awarded a personal chair. Our society's fellowship scheme is a means by which we can recognize those that have made a substantial contribution to the objectives of the society, and hence to New Zealand mathematics. Its rules are enshrined in the constitution, so any change needs to be put to the membership. You will find a ballot paper for a wording change elsewhere in this issue. Further details of the scheme, and of the application process may be found on the Society's website. I would encourage our members who are not fellows to consider the criteria, and whether they should be applying for this recognition from the NZMS.

Mick Roberts
Massey University, Auckland

LOCAL NEWS

AGRESEARCH

Professor John Casti from the Santa Fe Institute and Technical University of Vienna visited the Ruakura campus on an AgResearch Senior Fellowship from February 17th to March 15th. Whilst here, he gave two seminars "Concepts and Problems of Complex Systems" on February 27th and "(M, R) Metabolism-Repair Systems" on March 1st. He also visited our Grasslands campus in Palmerston North, giving a seminar on "The Geometry of Data" on March 3rd. John also begun some collaborative work with our social researchers during a four day retreat at Whitianga, looking at introducing mathematical techniques into their research, particularly those areas involving issues of trust. Whilst there, he and Tanya Soboleva were introduced to the joys of beach cricket, though apparently theoretical knowledge of the perfect strategy did not translate into a practical victory!

Ken Louie (Ruakura) has received the Humphry M. Russell Award for 2004. This award is for research conducted on the Ruakura campus in the area of animal health, and will allow him to complete extra case studies using modelling to examine the effect of nematode parasites on sheep productivity.

Ken Louie

THE UNIVERSITY OF AUCKLAND

Department of Computer Science

Peter Fenwick has been promoted to Associate-Professor.

In February Dr Richard Lobb and Dr Robert Berks were farewelled, when they resigned from the Department. In 1979, The University of Auckland appointed Richard Lobb as the first Lecturer in Computer Science—in the Department of Mathematics! In February 1980 the Department of Computer Science was founded and Richard became a Lecturer in that new department, and then a Senior Lecturer. He made Image Processing a significant topic within the Department. After 25 years here, he has decided that it is now time for him to apply his expertise to commercial computing. The University of Auckland hosted the first New Zealand Software Engineering Subject Conference on 1 –2 December 2003. It was attended by 37 academics from tertiary institutions in New Zealand. The aim of the conference was to establish and strengthen links between tertiary Software Engineering educators. Day 1 of the conference addressed Software Engineering teaching, and day 2 focused on Software Engineering research. Dr David Socha, a staff member of the Department of Computer Science and Engineering at the University of Washington, Seattle, gave the keynote address on Teaching. He is also involved in project management of the UrbanSim project. Professor Leon Sterling, who holds the Adacel Chair of Software Innovation and Engineering at the University of Melbourne, delivered the keynote address on Research.

The first batch of graduate students in Software Engineering have now commenced study.

Seminars

Professor Ralf Reulke, "Multi-sensor data fusion for traffic applications."

Professor Moshe Y. Vardi (Rice University), (Jointly with Mathematics) "Logic begat computer science: when giants roamed the Earth."

Professor Barbara Kitchenham, "Lessons learnt from 20 years of software cost estimation."

Hal Berghel, "Internet forensics."

Bodo Rosenhahn, "Pose estimation of free-form objects."

Ian Munro, "On the competitiveness of linear search."

Juergen Nehmer, "Software development based on system families."

Rainer Spittel, "Using graph-based spatial models for spatial reasoning."

Wolfgang Merkle, "Kolmogorov-Loveland stochastic sequences with additional properties."

Neal Glew, "LIL: An architecture-neutral language for virtual-machine stubs."

Ludwig Staiger, "Martingales, Lyapunov Exponent and Kolmogorov Complexity —An alternative view to *s*-gales and constructive dimension."

Miklos Szilagyi, "Agent-based simulation of nonlinear stochastic systems," and "Computer simulation of multi-person prisoners' dilemmas."

Yuman Huang, "Length and area estimation in digital picture analysis."

ChaoLi Ou, "Curvature estimation for voxel sets."

Byung Doo Lee, "The application of neuro-fuzzy reasoning to the opening game of 19 by 19 Go."

Helmut Juergensen, "Codes with synchronization."

Mukesh Mohania, "Maximizing realized revenue in a web-based Dutch auction."

Dr Greg Chaitin, "Leibniz, information, math and physics," and "Against real numbers."

Garry J. Tee

Department of Mathematics

Associate-Professor Josef Siran arrived, on February 24.

Dr Sina Greenwood, who has been a Post-Doctoral Fellow, has now been appointed as a new Lecturer on the permanent staff.

Ivan Reilly has signed a contract as half-time Professor from 2004 February 1 until 2008 January 31.

Mike Thomas has been promoted to Associate Professor.

Congratulations to the Mathematics 102/202 Team for winning a Faculty of Science Teaching Excellence Award.

Team Leaders: Greg Oates, Moira Statham, Bill Barton.

Team members: Alan delos Santos, Willy Alangui, Ivan Reilly, Mike Thomas, YeYoon Hong, Hannah Bartholomew, Garry Nathan, Viliami Latu, Sina Greenwood, Wiremu Solomon, Glen Bryant.

The citation reads "This team has made a strong contribution to the EO aspirations of the Faculty through the provision of opportunities for Maori and Pacific Island students to succeed in tertiary education. The team demonstrates a strong commitment to recruiting and retaining Maori and Pacific Island students. The strong course design and specific attention to learning styles and mechanisms which enhance learning for this cohort of students is the hallmark of this mathematics course. A measure of the success of this programme in launching students into academic life is the continued success which they enjoy in Mathematics in subsequent years."

We took advantage of the presence of a number of international visitors to the Department to run a series of lectures on January 15:

Burkhard Kuelshammer (University of Jena), "Cartan matrices of symmetric group and Hecke Algebras."

Vaughan Jones (Auckland/Berkeley), "Skein theory and permutation groups in planar algebras".

Akos Seress (Ohio State University), "Polygonal graphs."

John Conway (Princeton University), "The 184 uninteresting and 35 interesting crystallographic space groups".

The MISG (Mathematics in Industry Study Group) was held here on 26 –30 January 2004. Several industry groups brought along problems for which mathematics may be useful, and the members of the group presented helpful ideas about those problems.

On February 5 and 6 the Department of Mathematics, together with the Department of Economics, hosted an International Workshop on Game Theory and Social Choice. The invited speakers at this workshop were: Robert Aumann (Jerusalem), Herve Moulin (Rice), Anna Bogomolnaia (Rice) and Murali Agastya (Sydney). The local participants included Andy Philpott (Engineering), Ilze Ziedins & Geoff Pritchard (Statistics), John Hillas (Economics), Marston Conder, John McCabe-Dansted, Simon Marshall and Arkadii Slinko (Mathematics).

The 7th Devonport Topology Festival was held on February 13. The scheduled speakers were: Jiling Cao on "Semitopological groups," David Gauld on "Continuity and differentiability," Chris Good on "Monotonizations of countable paracompactness," Mark Harmer on "Spectral properties of the triangle groups," Vladimir Pestov on "Oscillation stability in topological groups," and Grant Woods on "One-point metric extensions and zero-sets of Stone-Cech."

John Butcher and Helmut Podhaisky attended the ANZIAM Conference at Hobart, in January –February.

David Gauld was on leave in December and January, concentrating on research with Frederic Mynard (University of Mississippi). David Alcorn was the Acting Head of Department—except for the first week of January when he was at Nelson, and Mike Thomas was then the Acting Acting Head.

Norm Levenberg attended the Oberwolfach meeting on Funktionentheorie in February.

Geoff Nicholls has a Visiting Associate Professorship in the Department of Mathematical Sciences at the University of Aalborg, Denmark, from March to June 2004.

Recent visitors include: Professor Len Bos (University of Calgary), Professor John Conway (Princeton University), Dr John Crisp (Université de Bourgogne), Professor Carl de Boor (University of Wisconsin-Madison), Dr Stefano De Marchi (University of Verona), Dr Charles Eaton (UMIST), Dr Ruhana Even (Weizmann Institute), Professor Hershel Farkas (Hebrew University of Jerusalem), Associate Professor Valentin Gutev (Kwazulu-Natal University), Dr George Havas (University of Queensland), Professor Zdzislaw Jackiewicz (Arizona State University), Dr Ville Kolehmainen (Kuopio University, Finland), Professor Burkhard Kuelshammer (Jena University), Dr Hendrik Lenstra (Leiden), Professor Dany Leviatan (Tel Aviv University), Dr Steve Linton (St Andrews University), Associate Professor Kevin McLeod (University of Wisconsin - Milwaukee), Professor Herve Moulin (Rice University), Professor Peter Neumann (Oxford University), Professor Mike Newman (ANU), Professor Allan Pinkus (Technion, Haifa), Professor Zbigniew Piotrowski (Youngstown State University, Ohio), Dr Cheryl Praeger (UWA), Professor Robert Raphael (Concordia University, Canada), Steffen Schulz (Humboldt University, Berlin), Dr Akos Seress (Ohio State University), Professor Charles Sims (Rutgers University), Dr Gustav Söderlind (Lund University), Dr Caren Tischendorf (Humboldt University, Berlin), Dr Marco Vianello (University of Padua), Professor Grant Woods (University of Manitoba), Dr Will Wright (Université de Genéve), and Professor Zvi Ziegler (Technion, Haifa).

The University's Graduate Research Fund has awarded grants to the following doctoral students in our Department:

Willy Alangui (& supervisor Bill Barton), "Rice terracing practice in Philippine indigenous communities: an ethnomathematical investigation," $2750.

Debasish Roy (& supervisor Geoff Nicholls), "Simulation-based methods in Bayesian inference for physical inverse problems," $3000.

Shehenaz Adam (& supervisor Bill Barton), "Ethnomathematics in the Maldivian curriculum," $2750 .

Jamie Sneddon received a PhD for his thesis on "Minors and Planar Embeddings of Digraphs," supervised by Paul Bonnington and Marston Conder.

Seminars

Professor Szymon Dolecki (Université de Bourgogne), "Convergence theory: convenient abstraction level."

Dr Melissa Rodd (University of Leeds), "Ways ahead: successful mathematics students at two universities."

Dr John Crisp (Université de Bourgogne), "Notions of curvature for 2-dimensional groups."

Professor David Smith (Duke University), "Reusable tools for creating interactive online learning environments."

Professor Frederic Mynard (University of Mississippi), "Sequentiality and Frechetness of finite products of topological spaces."

Professor Stephen Watson (York University), "Selection theorems through the notion of coherence."

Dr Stuart Scott, "The z-constrained conjecture."

Dr Tsukasa Yashiro (Osaka City University), "On some invariants of knots and surface-knots."

Professor Zbigniew Piotrowski (Youngstown State University), "Quasi-continuity, Baire 1 and separate continuity of functions."

Dr Heinz Bauschke (University of Guelph), "Hundal's alternating projections counterexample and the proximal point algorithm."

Dr Antonio Terlizzi (Lecturer in Applied Zoology), "Scales of spatial variation, environmental impacts and experimental designs. An overview from Mediterannean rocky subtidal."

Dr Christine Hunter (Woods Hole Oceanographic Institution), "Simplifying construction and analysis of multi-regional population models using the vec-permutation matrix."

Professor Hershel Farkas (Hebrew University of Jerusalem), "Theta functions: conformal mapping through combinatorial number theory."

Professor Bettina Eick, "Classifying p-groups by co-class."

Dr Mark Clements, "Prediction of lung cancer mortality using generalized additive models and Bayesian age-period-cohort models."

John Chambers, "Current research in statistical computing."

Professor Grant Woods, "Using group 'research projects' in the teaching of introductory calculus."

Kevin Wang, "Effects of cell-phone towers on housing prices."

Dr Ruhama Even (Weizmann Institute), "Preparation of providers of professional development for teachers of mathematics."

Mark Maunder, "Ecological modelling: information and uncertainty."

Michael Bulmer, "Virtual worlds for teaching mathematics and statistics."

Dr Kevin Grazier (Jet Propulsion Laboratory, Caltech), "The Cassini mission to Saturn."

Applied Probability Seminars

James Russell, "A recent survey of small mammal trapping methods."

Lara Jamieson (University of Cambridge), "Bayesian modelling of spatial and temporal spread of an epidemic."

Professor David Brillinger (University of California - Berkeley), "Some experiences with random effect (generalized) linear models."

Dr Mark Clements (ANU), "Prediction of lung cancer mortality using generalized additive."

Professor Hal Caswell (Woods Hole Oceanographic Institution), "Stochastic demography of a threatened floodplain plant."

Dr Ken Brewer (ANU), "Combined survey inference: compromise or consummation?"

Dr Susan Pitts (Cambridge University), "Estimation for risk models."

Professor Herve Moulin (Rice University), "The random allocation of indivisible units: an axiomatic approach."

Dr Anna Bogolmonaia (Rice University), "A new solution to the random assignment problem."

Garry J. Tee

Department of Statistics

(Reprinted from the NZSA Newsletter 59)

We have enjoyed a lively stream of visitors in the City Campus over the summer. Hal Caswell and Christine Hunter joined us for three months from Woods Hole Oceanographic Institution near Boston. Many readers will remember Hal from the 2002 SEEM4 conference in Dunedin, where he presented a workshop on matrix population models. His visit was funded by a MacLaurin Fellowship from the NZIMA Centre for Research Excellence.

Susan Pitts, from the University of Cambridge, spent a month visiting Ilze Ziedins. Other members of the department were quick to appreciate the value of having two experts in queuing theory on-site, and we haven't had to wait for our coffees all summer!

Statistical computing is thriving with the visits of John Chambers, from Bell Labs, and Masayuki Jimichi, from Kwansei Gakuin University in Japan. John Chambers, the designer of *S* and 1999 winner of the prestigious Software System Award of the ACM, will give a series of five talks through March on his recent research on statistical computing. Masayuki Jimichi is here until September. Over the summer we also welcomed a former student of the department, Jonathan Reeves, who now lectures in financial econometrics at the University of New South Wales in Sydney.

The new semester is starting again, and we welcome Steven Miller to the department as a PhD student. Steven will work with Rachel Fewster on a Marsden funded project to investigate rat invasions through the NZ archipelago from genetic records.

Many department members spread their wings in November and December. Ross Ihaka and Paul Murrell were invited speakers at the Modern Statistical Visualization workshop at the Institute for Statistical Mathematics in Tokyo. They each gave three talks on R and Visualisation. Rachel Cunliffe gave a keynote presentation at the Australian Conference on Teaching Statistics (OZCOTS) in Melbourne, where she gave a workshop on narrated powerpoint presentations. After a job well done, she slept soundly through Melbourne's 100-year storm that night. Chris Wild, Matt Regan, and Maxine Pfannkuch attended the Delta Conference in Queenstown on undergraduate teaching in mathematics, and Chris was a plenary speaker. Ilze Ziedins gave an invited talk at the Annual Allerton Conference on Communication, Control and Computing in Illinois in October. In March she is travelling to Minnesota as an invited participant at the IMA programme on Probability and Statistics in Complex Systems.

After 33 years in the department, Alastair Scott has decided to retire at the end of the year. When Alastair joined the Department of Mathematics in 1972, university funding was booming and he was given an entire new seven-storey building all to himself! Unfortunately the honeymoon lasted only a couple of days before the rest of the department moved in. Alastair was the first head of the Statistics Department when it was established in 1994, and his wise vision and ever-cheerful manner have been a constant inspiration to generations of students and staff. We have reluctantly granted him retirement leave on the sole condition that he continues to visit the department five days a week. To mark Alastair's achievements, he was last year made an Honorary Life Member of the NZSA. This honour was also accorded to George Seber, who retired from the department in 1998. To fill the positions left open by Alastair and George, we are expecting to advertise two Chairs (full Professor positions) early this year. Watch this space!

And finally, Arden Miller and his wife Melissa celebrated Christmas last year with the birth of their first baby, Abigail Jada. Congratulations!

At the Tamaki Campus the new School of Population Health building is almost finished and is already occupied. This has dramatically increased the number of staff and students on campus. With it we gain additional services, such as a third cafeteria and (at last) an EFTPOS machine. The Landcare building in the southwest corner of the campus is also showing good progress, and not far from that, the extended and refurbished student cafeteria will be open in a couple of weeks.

The stats group moved from building 723 to 721. This was to make room for folk associated with commerce and the Bachelor of Business and Info Mgmt program. Despite a move of a mere 50 metres, it was a nightmare due to the logistics, and many staff and students lost belongings. Most, but not all, were

later found in the wrong offices. Some items, particularly computer peripherals, have never been found. Thanks heaps to the moving company, which I had better not name! Anyway, important thing is that we are nicely settled into 721, the admin building. We have a few mathematicians for company, and 721 is joined to the new Population Health building by a sky bridge.

Thomas Yee is nearing the end of his year-long leave to Singapore and will be back with us by midyear. Marti Anderson and Russell Millar went on their annual fish survey dive trips in January, and were lucky to enjoy the period of good weather before it all turned to custard. This time they got in a few extra dives at some offshore islands, including the Poor Knights, Aldermans and Mayor Island.

On the business front, everyone is doing well, pumping out research, hosting visitors, getting loads of grants, and coping with the rigours of the new semester of teaching. Enough said.

Marti Anderson preparing for a dive at Northern Arch, Poor Knights Islands marine reserve

Rachel Fewster & Russell Millar

UNIVERSITY OF CANTERBURY

Department of Mathematics and Statistics

The department welcomes four new appointments: Prof. Satish Iyengar (Professor of Statistics) (stochastic models, multivariate analysis, meta-analysis, applications to neuroscience); Dr Alex James (modelling of problems in combustion and ecology including larval fish growth and the role of environmental stochasticity); Dr Arno Berger (dynamical systems, ergodic theory, applied probability and stochastic processes, stability and bifurcation theory, symmetry and scaling, classical mechanics; and Dr Carl Scarrott (spatial statistics, extreme value methods and spectral analysis with application to problems in industry, ecology, environment and science).

In addition to these appointments, Dr Mike Plank began a two year Post-doc in the department at the start of this year. Mike did his PhD on models of tumour progression at Leeds University in the UK. He did three months postdoc at Leeds before moving to Canterbury, where he is now working on mathematical models of cell signalling events in the circulatory system that are linked to the onset of heart disease with David Wall.

Dr Britta Basse has won a prestigious Alexander von Humboldt Fellowship to continue her research in Cancer modelling in Leipzig, Germany (see *Notices*).

Also congratulations to Douglas Bridges for being elected as a Corresponding Fellow of the Royal Society of Edinburgh.

Douglas Bridges returned to the fold in February, after a year as a DAAD Gastprofessor in the Mathematical Institute of the University of Munich. During the year he taught graduate courses in his research speciality of constructive mathematics, participated in several conferences, did lots of research, and visited thirteen countries. He strongly recommends Munich as a place to spend sabbatical leave: it's a city full of history and culture, and the Bavarians really know how to enjoy themselves (not just at

Oktoberfest).

Seminars

Sukanto Bharracharya (Bond University), "Computational application of Benford's first digit law to financial fraud detection."

Jaunty Ho (Australian National University), "A quick simulation method for wireless communication systems."

Dr Carl Scarrott (Centre for Ecology and Hydrology, Wallingford part of NERC), "Spatial random effects modelling, spectral analysis, extreme value statistics."

Associate Professor Hajime Ishihara (Japan Advanced Institute of Science and Technology, Ishikawa), "A constructive theory of integration—a metric approach."

Dr Stephen McDowall (Western Washington University), "An inverse problem for the transport equation in the presence of a Riemannian metric."

Dr Sergey Tikhonov (Moscow State University), "Moduli of smoothness of fractional order and some applications."

Dr William Joyce, "Beyond non-associativity."

Dr Ben Martin (University of Kent), "Character varieties, geometric invariant theory and finite groups of Lie type."

Professor C. Vinsonhaler (University of Connecticut), "Approximately simultaneously diagionalizable matrices."

Professor Allen Rodrigo (University of Auckland), "The mathematics of HIV evolution and population dynamics."

Professor M J D Powell (University of Cambridge), "A new algorithm for unconstrained minimization without derivatives."

Tobias Thierer, "A characteristic function approach to perfect and imperfect phylogenies."

Professor Andreas Dress (Max Plank Institute for Mathematics in the Sciences Leipzig), "Valuated matroids, phylogenetic trees and tropical geometry."

Dr Michael Burns (Victoria University, Canada), "Subfactors and planar algebras."

Professor Horst W. Hamacher (Univ. Kaiserslautern), "Consecutive-1 matrix decomposition of integer matrices and applications."

Murthy Mittinty, "Imputation by propensity matching."

Professor Joe Perry (Rothamsted Experimental Station, UK), "Measuring spatial pattern for counts in ecology."

Marian Baroni, "Constructive suprema and infima."

Dr Magnus Bordewich, "Quantum computation, topology, and approximate counting."

Charles Semple

INDUSTRIAL RESEARCH LIMITED

Applied Mathematics Team

Warwick Kissling handed in his PhD thesis in February. Warwick has been studying part-time for his PhD (entitled "Deep hydrology of the geothermal systems in the Taupo Volcanic Zone, New Zealand") at The University of Auckland over the last few years. A new PhD student, Jade MacKay, will be joining us in July. Jade has been awarded a Top Achiever Scholarship by FRST and will work with Shaun Hendy on "The Electrochemical Growth of ZnO Nanostructures".

In February we were joined by another French intern, Celine Cattoen, from Toulouse. Celine is working

with Graham Weir on modelling cryogenic refrigeration systems for use with superconducting coils. Graham attended MISG in Auckland and acted as facilitator on the problem of modelling earthquake damage to tunnels.

Finally, John Burnell has been presenting evidence in March at a resource consent hearing about applications to develop new generation capacity at Wairakei.

Shaun Hendy

LINCOLN UNIVERSITY

Applied Computing, Mathematics and Statistics Group

In the research community Lincoln University is best known for work in biosciences and environmental fields, so it may come to some surprise that there is also a growing activity in applied mathematics.

Evidence of that, is the publication of a new book "Stochastic Dynamics" by Lincoln authors Don Kulasiri and Wynand Verwoerd, as volume 44 of the prestigious North Holland series on Applied Mathematics and Mechanics. The book, subtitled "Modelling solute transport in porous media" is both a research monograph and a down to earth introduction to the esoteric field of stochastic differential equations, aimed at practical applications to physical systems.

Don Kulasiri comes from a background in theoretical engineering, and since he joined Lincoln in the early 1990's he has worked on a wide spectrum of modelling projects covering both mathematical and computing aspects, such as the root morphology of trees, strength of wool yarns, and inverse problems, to name a few. When an experimental program on solute transport in aquifers was established at Lincoln, he developed an interest in this field and its modelling using Ito calculus and other stochastic methods.

In 1999 he was joined by Wynand Verwoerd, a theoretical physicist who has worked extensively on quantum chemical modelling of semiconductor surfaces. At Lincoln, he joined the solute transport project and has developed a theoretical model using the Dynkin equation approach from stochastic PDE theory, to explain the observed scaled dependence of dispersivity in natural porous media. The first part of this development is covered in "Stochastic Dynamics", with further work being prepared for publication in the near future.

Together with other active researchers at Lincoln, Don and Wynand established the Centre for Advanced Computational Solutions (C-fACS) in 2000 and the centre has meanwhile performed contract research on applying artificial intelligence to network fault diagnosis for Transpower, the parallelization of computational models of river flooding events, and of mathematical dairy farm modelling for Dexcel.

Don and Wynand are presently members of the Applied Computing, Mathematics and Statistics group, and several other colleagues in this group also have interests in the application of mathematical methods.

Wynand Verwoerd

MASSEY UNIVERSITY

Institute of Fundamental Sciences (Palmerston North) Mathematics

Kee Teo took up his role as subject leader in the beginning of January. He has been busy allocating portfolios and nobody escaped.

Charles Little attended the 28th Australasian Conference on Combinatorial Mathematics and Combinatorial Computing, held at Deakin University, Burwood, Victoria, Australia during December 15 –19, 2003, and spoke on "A new proof of a characterization of Pfaffian bipartite graphs".

Robert McLachlan and John Hudson went to Nelson to soak up the sun and to participate at the NZMRI meeting on Computational Algebra, Number Theory and Geometry held on January 3 –11.

Igor Boglaev also decided to seek the sun and crossed Cook Straight to attend the Workshop on Logic and Computation in Nelson (January 11 –16).

Bruce van Brunt has been very busy as far as conferences are concerned. He first attended the MISG 2004 at the University of Auckland (January 26 –30). Then he crossed the Tasman Sea to catch up with friends and colleagues at ANZIAM 2004 held at Hobart, Tasmania (February 1 –5) followed by VIC 2004 at Victoria University (February 9 –13).

Robert McLachlan also went to the capital to give a plenary lecture at VIC 2004 (9 –13 February).

Then the rains came. Large parts of the Manawatu were flooded. The Manawatu River turned into a raging, angry and thundering river. It was quite a spectacular sight to drive over the bridge to work on the 16th of February. The walking tracks and adjacent low-lying farmland had become part of the river. Then the rumours started. It was conjectured that the flow had become too much for the bridge and that there were concerns regarding the structural integrity of the Fitzherbert Bridge. Another was that the bridge was going to be closed to pedestrians. All these rumours started about 11.00 am. The upshot was that schools were closed so that pupils and staff could get home. Even Massey staff was allowed to leave so most went home. Unlike Hamilton we have only one bridge so a collapsed bridge would have been disastrous. The need for a second bridge has been an ongoing saga for two decades or so and a decision is not in sight. Two mathematicians were affected namely Bob Richardson and Bruce van Brunt.

Professor Bob Richardson from Appalachian State University, Boone, North Carolina returned to New Zealand in December for another six months. As he lives in Pahiatua (on the other side of the hills), he became an isolated singularity for one day when the three roads connecting west and east were closed on the 16th. Currently two roads are still closed. Heavy traffic that used to go through the Manawatu Gorge now crosses the Tararua Ranges via the Pahiatua track, a road not at all suitable for milk tankers and articulated trucks. It took Bob a good two hours to cover a distance of 35km and the only way to get to Massey on time is to leave Pahiatua before the heavy traffic starts.

Bruce was an isolated singularity for two days. He lives in the Pohangina Valley north of the village. Bruce set out to go to Palmerston North on the 15th but wisely decided to return home when he saw the rapidly rising Pohangina River. Trouble was evident as it still rained hard. As it happened a big part of the road had been washed away causing a very big hole in the road. The road on the other side on the valley was also impassible. On the Wednesday Bruce managed to scramble down into the hole, walked through mud and debris and climbed got out of it again. From climbing mountains (maxima) a reversal to crawling into and out of holes (minima). Luckily he managed to hitch hike to Massey.

Robert has supervised for six months Bård Skaflestad, a PhD student from the University of Trondheim. While he was here he witnessed many extreme climatic weather conditions get broken. His home is well north of the Polar Circle and he could tell us all about the dark, long winter. B\aa rd went back to Norway early March.

We welcome Matthew Hardy as a Massey University Postdoctoral Research Fellow. Matthew has commenced a postdoctoral research project in computational mathematics. Working with Igor, Matthew will investigate the parallel implementation of monotone methods for singular perturbation methods. Matthew's PhD, undertaken at Oxford University, comprised numerical studies of gas-powered micro-particle propulsion devices. Previously, Matthew completed a BSc(Hons) in Pure Mathematics at the University of Sydney.

For the Allan Wilson Centre Mike Hendy reports:

Doom04

The mathematicians of the Allan Wilson Centre joined with the biologists at their annual workshop in phylogenetics, which this year was held at Whakapapa (Mount Doom)—participants queried whether it should be renamed "Gloom04" —as we were in rain or mist for most of the five days, or "Boom04", as the venue was struck by lightning on the last night. For most of that week we were isolated from the lower North Island by the torrential rains and high winds that devastated the region at that time. However the consolations included that we were able to witness spectacular waterfalls (overflowing gutterings) and swollen rivers (across the walkway between the accommodation block and the meeting room) and enjoy some excellent science. This year's participant numbered 54, and included a number of old friends as well as new vistors from overseas, including some new-comers, from France, Germany, Sweden, Israel, Russia, Australia, Canada, and United States. (Details, including abstracts can be viewed at http://www.math.canterbury.ac.nz/bio/doom04/doom04_programme.pdf.)

Helix

Our High Performance Computer, Helix, is currently being expanded with the addition of 12 Opteron (64-bit) nodes, and we are planning further expansion in the near future. Although usage is growing, there is still an opportunity for other NZ researchers to buy time on our facility. (For details contact Mike Hendy (m.hendy@massey.ac.nz).

INCOB

The International Conference on BioInformatics 2004 is being hosted jointly by the Allan Wilson Centre, and the Bioinformatics Institute, The University of Auckland, and is to be held at the Aotea Centre,

Auckland from September 5 –8, 2004. More details, including registration, are given at http://www.incob.org/. Preceding the conference, there will be a 2-day hands-on parallel BioComputing workshop, Sept 2 –3, at the Albany campus of Massey University, which will include a general purpose introduction to parallel computing on Helix.

Seminars

Dr Henning Koehler (Information Systems, Massey University), "On skew polynomial rings".

Dr Bhalchandra Thatte (Post-doctoral Fellow in the Allan Wilson Centre), "Reconstruction problems in Graph Theory".

Dr Vadim Kuznetsov (University of Leeds, UK), "Bäcklund transformations for integrable Hamiltonian systems".

Professor Robert McLachlan, "Arranging points on a sphere".

Associate Professor Igor Boglaev, "Robust monotone iterates for nonlinear singularly perturbed problems".

Dr John Hudson, "Evolutionary trees and likelihood saddle point".

Dr Matthew Hardy, "Biolistics".

Marijcke Vlieg-Hulstman

Institute of Information and Mathematical Sciences (Albany)

Institute members were heavily involved with the Mathematics-in-Industry Study Group (MISG) and ANZIAM meeting in late summer.

MISG is reported upon elsewhere in the newsletter. Participants from the Institute included: Graeme Wake (director), Robert McKibbin, Mick Roberts and Tasos Tsoularis (who were all problem moderators), and Amanda Elvin, Jeff Hunter, Carlo Laing, Leng Leng Lim, Barry McDonald, Jo Mann and Winston Sweatman. It was an interesting and enjoyable week. We are looking forward to MISG2005 which will be again held locally under the direction of Graeme Wake on 24 –28 January 2005.

Robert McKibbin, Graeme Wake, Mick Roberts, Carlo Laing and Leng Leng Lim all participated in ANZIAM 2004 in Hobart in early February. Graeme spoke on the challenge of micromechanics modelling of hair, as well as reporting on the success of MISG2004 which had taken place the week before in Auckland. Mick talked about some of his infectious diseases modelling while Carlo presented some results on pattern formation in integral equations. Leng Leng spoke on modelling volcanic ashfall, joint work with Robert and Winston Sweatman

Robert McKibbin has taken up the Chair of ANZIAM for a two-year period. He thereby also becomes an ex officio Vice-President of the Australian Mathematical Society for that time.

It is the NZ Branch's turn to host the next ANZIAM meeting which will be held in Napier, 30 January –3 February 2005. The Convenor is Alfred Sneyd from the University of Waikato.

Our Data Mining Centre is up and running with Denny Meyer orchestrating. We also have a new Data Mining Major on the horizon, which is pooling resources widely across our institute by combining papers in statistics, computer science and information systems. Denny is also organising (with Ganesh, and Tim Ball from the Institute of Information Sciences and Technology, Massey University (Palmerston North)) a data mining workshop 28th to 30th June at Albany.

Our statistics major went under review last year (both internally and externally). One net result of the review, and various cross-campus debates, is that the Albany campus is now introducing R to second year students via two papers 'Probability Modelling' (161.230) and 'Statistical Modelling' (161.231). We are hoping that the inclusion of more statistical programming at second year will work well for our BInfSc students.

Shaun Cooper spent seven weeks in India over the summer break. He attended the joint Indian –American Mathematical Society Conference in Bangalore, and was an invited speaker at the Jangjeon Mathematical Society Conference in Mysore. Christmas Day was spent listening to mathematics lectures at a retirement function for a staff member at University of Mysore. On Boxing Day Shaun met his wife in Delhi, and they spent two weeks traveling in northern India. Shaun's running shoes were stolen at the Taj Mahal (the socks were not taken however) and he is finding out how difficult it is to run again after having had three

months off. He also experienced reduced bargaining power upon entering a shoe store wearing only socks on his feet. After the holiday, Shaun spent a week at the Harish Chandra Institute in Allahabad, two weeks at University of Mysore, and two days at Bangalore University. He was pleased to finally meet three of his co-authors for the first time.

Paul Cowpertwait says that he is still beavering away at stochastic rainfall modelling; he had a successful trip to the Bureau of Meteorology in Melbourne, where they plan to implement his algorithms into a software package for use by engineers throughout Australia. He says :"Why they need a rainfall model for that barren wasteland over there still beats me! I suppose it just makes my job easier: 00000..."

Mick Roberts spent 25th November to 6th December visiting Geoff Aldis at the University of New South Wales (ADFA) in Canberra. During this time he was an invited speaker at both the annual ACT ANZIAM meeting and the Australasian Region Conference of the International Biometric Society, which were both held at ANU.

Congratulations are due to Jo Mann for her MInfSc with first class honours for her thesis `Modelling repeated epidemics with general infection kernels' and for her Massey University PhD scholarship.

We said farewell to Paul Bracewell who has left to join OffLode, a Wellington-based Data Mining company. We wish him all the best for his future career. We welcome our new arrivals in Mathematics and Statistics: Dr Claire Jordon (Lecturer) (see *New Colleagues*), Marie Fitch (Senior Tutor) and Nicoleen Cloete (Tutor). Heung Yeung Lam (Frederick) has also joined the teaching team as a tutor.

Marie Fitch joins the team as a Senior Tutor to assist in particular with the first year statistics teaching. Marie has plenty of invaluable teaching experience having spent the last 10 years teaching maths and stats at Corran School (Auckland City), where she was also a careers advisor.

Nicoleen Cloete has taken up a temporary Tutorship in Mathematics until the end of Semester 2, and will contribute to the teaching programmes in both Mathematics and Statistics. Nicoleen is currently completing a PhD in stochastic processes and probability theory from the University of Auckland.

Frederick Lam is a familiar face within the institute as he is completing his PhD studies.

On the subject of baby news, Winston Sweatman is enjoying less sleep following the happy arrival of son Iain.

Visitors

James Wallace from Bradford University, England, visited Tasos Tsoularis in March for research collaboration.

Seminars

Horst Hamacher (Technical University of Klauserlauten), "Consecutive-1 Matrix Decomposition of Integer Matrices and Applications."

Shaun Cooper, "Confessions of a Mathematician."

Claire A. Jordan, "Bayesian Classification using Product Partition Models."

Winston Sweatman

Institute of Information Sciences and Technology

Statistics

The Massey statisticians at Palmerston North have finally relocated from the Social Sciences Tower to the AgHort Building, thereby joining the computer scientists and information engineers who make up the rest of our Institute. Our arrival coincided with that of our new Head of Institute Professor Janina Mazierska, formerly of James Cook University in Australia. The week before the start of the first semester saw us frantically packing and unpacking boxes while simultaneously trying to prepare for a new academic year. The drama of the occasion was heightened by the floods and high winds which hit the Manawatu at this time. Ganesh's house came closest to being flooded, but his vantage point near the swollen river did enable him to take some stunning photographs of cows swimming to safety, which later appeared in the local newspaper.

Steve Haslett managed to avoid the trauma of moving by the simple expedient of being somewhere else, although as the "somewhere else" in this case was Dhaka it might have been less traumatic staying here.

Steve was giving the final presentation of the results of a project which he and Geoff Jones carried out for the World Food Programme and the Bangladesh Bureau of Statistics during October to December, involving small-area estimation of poverty and malnutrition incidence. They describe the experience of living and working in Dhaka as one not to be missed.

Earlier in the year Steve was in Uganda, providing sample design and implementation advice to the Global Entrepreneurship Monitor (GEM) programme. This is one of 37 international surveys (representing 62\% of the world population) that is carried out by GEM, which has both strong academic links and connections with the United Nations Business Council. Steve returned to learn of his promotion to full professor, for which we congratulate him.

Dongwen Luo successfully defended his thesis in October and has now been awarded his PhD. Alasdair Noble and David Alexander have submitted theirs and are awaiting further developments.

Geoff Jones

UNIVERSITY OF OTAGO

Department of Mathematics and Statistics

Associate Professor Peter Fenton has taken up the reins as new Head of Department from the beginning of February. The following item is contributed by Dennis McCaughan.

Over the summer Vernon was leaving to move upstairs as AVC Sciences. By late January, as the suspense reached breaking point, the (former) AVC finally spoke and our new HOD appeared as in a puff of white papal smoke. Wine buff, cyclist extraordinaire, francophile (close friends address him as Pierre), debonair, erudite and suave, Peter Fenton is a new style HOD for the next three years of the 21st Century.

He has instituted much more frequent department meetings, a new hands-up rather than hands-on management style, and more working parties on specific issues. He is also promoting contacts with other departments.

Vernon is now looking down from Olympus and brandishing thunderbolts in the traditional way. The present outlook is somewhat stormy, but Peter has ensured a threefold supply of departmental umbrellas.

With Vernon Squire's departure to the Division of Sciences, the Department now has a vacant Chair of Applied Maths.

Dr Amal Amleh joined the staff in February as a Fixed Term Lecturer in Applied Mathematics. Amal is a native of Palestine whose academic career has included two years at Auckland University and one year at University of Michigan-Dearborn. A chance visit to the South Island and Dunedin happened at a very opportune time!

Dr Markus Neuhäuser resigned his Senior Lecturership in Statistics at the end of February and has returned to his home country of Germany with his family, which has doubled in the time he has been in NZ! Markus' input to the teaching and research of the department will be sorely missed.

Mr Jason Rabbitt has joined the staff as a Teaching Assistant. Jason is a familiar face around the Department as an Honours student and tutor last year. He is also working towards his MSc in Statistics.

Between November 2003 and January 2004, Robert Aldred gave invited talks at meetings in Nyborg, Denmark, Nashville, USA, Muscat, Oman, Yokohama, Japan and Tokyo, Japan. He also visited with colleagues (including Professors Carsten Thomassen, Mike Plummer, Mark Ellingham, Richard Anstee, Kevin McAvaney, Akira Saito, Ken-ichi Kawarabayashi and Katsahiro Ota) for collaborative research purposes. More talks were given at departmental seminars at various universities along the way. Although hectic the time away was very productive and several projects are under way with promising results.

Gerrard Liddell, Jonni Bidwell and Dennis McCaughan spent an idyllic week 3 –10 January at Tahunanui motor camp in sunny Nelson (it did rain a little) at the NZMRI workshop on Computational Algebra and Number Theory. A stellar lineup of speakers was presented by Eamonn O'Brien and Marston Conder: John Conway talked about inaudible shapes, Hendrik Lenstra about primality testing, Karl Rubin about elliptic curves, Peter Neumann about matrix groups and Charles Sims about algebraic algorithms. Evening lectures included a very entertaining account by Lenstra of some of Escher's artwork. A great time was had by all, and Jonni distinguished himself by being (he says) the only grad student to make the Saturday 9 am lecture after the conviviality of the barbecue on Friday night. A wonderful, stimulating week.

In January, David Fletcher ran a week-long mathematics and statistics project as part of the University's

Hands-On-Science program for high school students. The focus of the project was on the use of population models in conservation. As well as considering the practical aspects of models that are used to help organisations like the Department of Conservation, the students also found out about the mathematics underlying some of the models. The first day was spent learning about an example of a population that is in need of conservation: Hector's dolphin. The students got to know something about where these dolphins live and roughly how many there are. The focus for the rest of the day was on modelling the number of dolphins in the population that lives around Banks Peninsula. They looked at simply exponential models, and then those that involve density dependence and stochasticity. This naturally led on to ideas of chaos and of risk assessment. Later in the week, discussion of chaos led on to using software to draw fractal images such as SierpinskiÕs Gasket and Barnsley's Fernleaf. Overall, a good time was had by all!

A MARK workshop sponsored by The Wildlife Society Biometrics Working Group. This advanced workshop was held at Canterbury University, Christchurch, New Zealand, in December 2003 as part of the 3rd International Wildlife Congress in Christchurch. Led by Gary White and Richard Barker, the aim of the workshop was to update experienced MARK users on some of the latest developments in MARK.

Seminars

Dr Michael Bulmer (University of Queensland), "Virtual Worlds for Teaching Mathematics and Statistics".

Dr Margaret Walshaw (Department of Technology, Science & Mathematics Education, Massey University), "Explorations of girls and mathematics".

Professor Bruce Reed (McGill University), "1,2,3, *C*".

John Shanks, "Horner in the Corner".

Richard Barker, "McMC, WinBUGS and the Bayesian *r*Evolution".

Amal Amleh, "A Basic Introduction to Very Interesting Nonlinear Difference Equations".

Lenette Grant

THE UNIVERSITY OF WAIKATO

Department of Mathematics

The summer break is usually a time for travelling and this was certainly the case for members of the department. Within New Zealand, Kevin Broughan and a PhD student Vasile Sinescu attended the workshop on "Computational Algebra and Number Theory" held in Nelson, while Alfred Sneyd attended the "Mathematics-in-Industry Study Group" held in Auckland. In early February, Ernie Kalnins and Rua Murray attended the "Victoria International Conference" held in Wellington.

Ernie was also an international traveller. He spent most of January visiting Linköping University in Sweden. While there, he gave a talk at the conference on "State of the Art of Classical Separability Theory for Differential Equations". He then participated in the workshop held directly after the conference. This workshop was focused on current research problems in separability theory. He also had the opportunity to give some lectures to students at the university.

Recently appointed lecturer Tim Stokes returned to Australia for two months over summer for a combination of work and rest. He worked in Melbourne for a fortnight with Marcel Jackson (Latrobe University) on semigroup theory. Later, he attended the ANZIAM conference in Hobart in early February, where he presented a talk. In fact he stayed in Hobart for several weeks, mostly working with colleagues Larry Forbes (University of Tasmania) and Graeme Hocking (visiting from Murdoch University, WA) on withdrawal problems for free surfaces in fluid mechanics. He reports that the weather was a lot drier in South-Eastern Australia than in Hamilton on his return!

Sean Oughton spent two weeks at his alma mater, the University of Delaware, where he was collaborating on magnetohydrodynamic turbulence problems, including applications to the question of why the sun's atmosphere is so much hotter than its surface. Solar heat in Delaware, however, was rather lacking. The visit coincided with an unusually cold winter period with typical daytime temperatures of -10C.

In March Ian Craig spent a week at the Yukawa Institute of Kyoto University when he gave an invited review talk on magnetic reconnection as part of the workshop on "Explosive Phenomena in Magnetized Plasmas—New Developments in Reconnection Research".

Seminars

E. Kalnins, "Separation of variables for spaces of constant curvature.

T. Stokes, "Internalized equality and modal logic.

A. Windsor (University of Manchester), "Exactly realizable sequences are smoothly realizable.

V. Kuznetsov (University of Leeds), "Jack polynomials: integral equation, factorization and representation.

J. Cao (University of Auckland), "Automatic continuity.

G. Rickard (NIWA, Wellington), "Ocean modelling at NIWA."

Stephen Joe

Department of Statistics

Recent activity in the Statistics Department has included a one-day workshop conducted by Professor Peter Green. Professor Green has just completed his term as President of the Royal Statistical Society and is Professor of Statistics at the University of Bristol. He has recently been elected a Fellow of the Royal Society. The theme of the workshop, which was very well attended, was "Structure and uncertainty: statistical modelling, stochastic systems and Bayesian computation."

Bill Bolstad's book "Introduction to Bayesian Statistics" is now with the publishers and is due for release in April, 2004.

Carole Wright, one of our PhD students, has submitted her thesis entitled "Variety Trials in 2-dimensional layouts." Another PhD Student, Khangelani Zuma, has also submitted his thesis. The title of his thesis is "Sexual Network Random Effects Model of Migration and Spread of HIV and other STIs in South Africa." We have recently welcomed a new PhD student, Oday Theodore, who joins us from Iraq.

Khange has returned to South Africa, where he has taken up an appointment with the Human Sciences Research Council, in Pretoria. Carole is working temporarily as a field technician at Food and Crop in Hastings, and is off on her OE later this year. At the recent International Biometric Society (Australasian Region) Conference, (held in Canberra) Carole was the winner of the best student presentation prize and also, at last year's New Zealand Statistical Association Annual Conference in Palmerston North, she was the winner of the Hoare Research Software prize for the best student paper presented at the conference for her presentation titled "Quick Generation of Row-Column Designs." Second place (for best student presenter at the NZSA conference) went to ex-student, Katarina Domijan who graduated in with a Masters degree, in October 2002 and now works as a statistician at AgResearch in Hamilton. Katarina's paper was "Semi-mechanistic modelling in Nonlinear Regression: a case study." Further adding to the accolades received by Waikato, was Harold Henderson, Biometrician at AgResearch and Honorary Lecturer to the Statistics Department at Waikato. Harold was the recipient of the Campbell Award. This is the second time the award has come to Waikato, as it was presented the previous year to Murray Jorgensen, also from the Statistics Department.

Finally, it is with sadness that we announce the death of Mrs Faye Sharples. Faye, who died suddenly at the end of March, was a Senior Lecturer in the Mathematics and Statistics Department for twenty years, before her retirement in 1995.

Seminars

Lyn Hunt "Unsupervised learning from incomplete three-way data using a mixture model approach.

James Curran "Two problems in forensic science.

Ian Westbrooke (Science and Research Unit, Department of Conservation, Christchurch) "Meeting statistical needs in a conservation management organisation.

Emlyn Williams (CSIRO Forestry and Forest Products, Canberra) "Statistical consulting and research in CSIRO forestry and forest products.

Carole Wright "Row-column designs and their contractions.

Dave Saville (Statistics Group, AgResearch, Lincoln) "Multiple comparison procedures: consistency and

family-size robustness.

Neil Cox (Biometrician, AgResearch, Hamilton) "What role does Excel have in the practice and teaching of statistics?

Nicholas Longford (De Montfort University, Leicester, England) "Stability of household income in European countries.

Megan Jowsey and Rachel Cunliffe (Project Coordinator and Web site/Publicity Developer) "CensusAtSchool NZ: a statistical experience for children.

Chris Wild (Department of Statistics, The University of Auckland) "Regression problems with missing data.

Graham McBride (Senior Scientist, NIWA, Hamilton) "Some issues in quantitative health risk assessments for waterborne diseases.

Colin Aitken (School of Mathematics, University of Edinburgh) "Evaluation of trace evidence in the form of multivariate Data.

Michael Bulmer (Department of Mathematics, University of Queensland) "Virtual Worlds for Teaching Mathematics and Statistics."

Judi McWhirter

VICTORIA UNIVERSITY OF WELLINGTON

School of Mathematical and Computing Sciences

Bert Gerards from CWI in Amsterdam is visiting for three months. Jim Geelen from the University of Waterloo in Canada is here for three weeks. They are both here to do work in matroid theory with Geoff Whittle.

Rod Downey has the following visitors, supported by an NZIMA logic and computation program:

Carl Jockusch (University of Illinois at Urbana), Andre Nies (Auckland), Wolfgang Merkle (Heidelberg), Eric Allender (Rutgers), Janos Makowsky (Technion), Angsheng Li (Academica Sinica). Steffen lempp (Madison).

Moshe Vardi Rice visited in December and gave three talks on the unusual effectiveness of Logic in Computer Science.

Several of Rod's visitors spoke at either the VIC 2004 special session on complexity, and/or the Nelson Logic and Computation program, details of which can be found on http://www.mcs.vuw.ac.nz/~mathmeet/.

Rob Goldblatt has had Ian Hodkinson (Imperial College) visiting. Rob Goldblatt is now Coordinating Editor of The Journal of Symbolic Logic, the leading research journal in the field. He takes over that position from Rod Downey, who has become Managing Editor of the associated Bulletin of Symbolic Logic.

A very successful workshop was held during 11 –16 January at Tahuna Beach, Nelson, as part of the NZIMA programme in Logic and Computation directed by Rob Goldblatt. There were 36 participant, including 12 graduate students, who were treated to some outstanding lectures on a range of topics in computability and model theory. Lecture slides and other material related to the workshop is available at the webpage http://www.cllc.vuw.ac.nz/LandCworkshop.shtml. We will have Dr Huixiang Chen to visit for one year, starting in April. He is currently teaching at Yangzhu University, China. Dr Chen's research interest is in noncommutative algebra, representation theory.

Mark McGuinness spent a few months over Christmas visiting the Applied Mathematics Division of the Korean Advanced Institute of Science and Technology in Korea, accompanied by his family for part of the time. He came back to Auckland for the Mathematics-in-Industry Study Group in January, with a contingent of Korean students and academics. The Koreans were very impressed with the MISG process, and they all had a wonderful time in Auckland and sight-seeing in Rotorua afterwards. Mark also gave an invited lecture on modelling submarine lead-acid batteries, at the Applied Mathematics Forum held on 16 –17 February in Su An Bo, South Korea. Mark's next overseas trip is three weeks in Oxford, working on modelling the regulation of blood pressure in humans, in June and July.

Quite a lot has happened at VUW recently on the Stats/OR front. One of the biggest pieces of news is the departure of Yu Hayakawa, who left VUW early in February 2004, after 11 years here. Yu has accepted a position of Associate Professor in Statistics at Waseda University, Tokyo, back in her home country of Japan. Her many valuable contributions at VUW will be remembered for a long time, and the memory of her infectious enthusiasm and happy smile will stay with us for even longer, I suspect. We wish Yu all the best in her new position.

Before leaving VUW, Yu Hayakawa organised a Workshop on Point Processes in Reliability, jointly with Stefanka Chukova. The meeting was held in September 2003, and further details can be found on line at http://www.mcs.vuw.ac.nz/events/workshop03. Stefanka Chukova also participated at the International Conference in Reliability and Survival Analysis, May 21 –24, 2003, Columbia, South Carolina, USA.

Richard Arnold and Yu Hayakawa spent 2 weeks at Hong Kong University in December 2003, working with Paul Yip on Bayesian approaches to the analysis of capture-recapture datasets.

Helen Haywood turned 1 on 5 December 2003, which meant that her dad, John, had to hurry back from the second day of the Inaugural New Zealand Time Series Study Group Workshop held at University of Canterbury, where he was one of the invited speakers. John also (jointly) presented a paper at the 2003 NBER/NSF Time Series Conference, which was held at the University of Chicago in September 2003, in honour of George Tiao's retirement. In addition, John gave invited talks to the Statistics New Zealand Time Series in Official Statistics Day (in December 2003, in Christchurch) and to the Reserve Bank of New Zealand in August 2003.

Ivy Liu, Dong Wang and John Haywood all gave talks at the NZSA 2003 Conference held at Massey University (Palmerston North) in July. In August, Ivy also gave a talk at the 54th ISI meeting held in Berlin, Germany, in the same session as Sir David Cox. Perhaps not surprisingly, that session was well attended. Dong recently spent the summer months working in China and Australia, and arrived back at the end of February to start teaching 100-level statistics the next day.

Shirley Pledger has been enjoying sabbatical leave since September 2003, which continues until the end of June 2004. Shirley spoke at two conferences last year: EURING 2003 in Radolfzell, Germany (in October), and the International Wildlife Management Congress in Christchurch, in December. Shirley has hosted three visitors recently. Ken Burnham came from Colorado State University in December, while Hal Caswell and Christine Hunter, both from Woods Hole Oceanographic Institution, Massachusetts (but visiting Auckland University Statistics Department), were here in February 2004. Shirley recently honed her skills capturing and recapturing frogs on Maud Island in Pelorus Sound; however, she tells us she was there officially as a statistical consultant.

Estate Khmaladze was on sabbatical from mid-2003 to January 2004. In September he spoke at a conference at the Institute for Mathematical Research in Oberwolfach, and also was International Programme Committee Chair for the Kolmogorov-100 conference in Tbilisi, which had 49 selected participants from 32 countries. Estate spent November at the University of Karlsruhe, working on his Marsden-funded project on applications of differential geometry to statistics. In February 2004, back at VUW, Estate gave a paper at the VIC 2004 Conference: an international meeting in cooperation with the Israel Mathematical Union, the New Zealand Mathematical Society and the New Zealand Institute of Mathematics and its Applications. Estate's talk was in the session on Geometric Aspects of Functional Analysis.

Our PhD students have been busy too. Nuovella Williams returned home to Montserrat in early March 2004, where she will complete the write up of her thesis shortly. Caroline Roughneen has been visiting VUW from Trinity College, Dublin, since July 2003. Currently she is back in Ireland, but Caroline will be returning to Wellington within a couple of months. Steve Johnston is (jointly) responsible for the newest addition to the Stats/OR fold here at VUW: Timothy was born safe and sound (and pretty quickly too!) on 25 February 2004. The whole family are doing well, although Steve is looking a bit more tired than he used to.

Statistics student numbers are up 30\% putting some strain on our resources.

The Wellington Statistics Group (WSG) continues to meet regularly, with a typical gap between meetings of 5 –6 weeks, and a slightly longer break for summer. Over the last year, in reverse chronological order, there have been WSG talks given by:

- Brian Easton: "The Econometrics of Household Equivalence Scales.
- Stefanka Chukova and Yu Hayakawa, VUW: "Warranty analysis: An overview and some new probabilistic models.
- Nick Longford, De Montfort University, Leicester, UK: "Stability of household income in

European countries in the 1990s and a NZ connection.
- Caroline Roughneen, Trinity College, Dublin: "Study of Engineering as a Career Choice.
- Mark Weatherall, Wellington School of Medicine and Health "Sciences: Prevention of falls and fall related fractures in community dwelling older adults: A meta-analysis of estimates of effectiveness based on recent guidelines.
- Leigh Bull, DOC: "Sizing up shearwaters: morphological variation in the genus Puffinus.
- Chris Francis, NIWA: "Simultaneous testing for mean and variance differences with nasty data.
- Srinivas Chakravarthy, Kettering University, USA: "Impact of worker cross-training in service systems.

The next two WSG meetings will be addressed by Shirley Pledger on 25 March, and Jim Liu on 29 April. Shirley will be talking on "Using finite mixtures to model heterogeneity in capture-recapture models," while Jim will tell us about "Dynamics of interpersonal political environment and party identification: Longitudinal studies of voting in Japan and NZ." Anyone who does not presently receive WSG announcements and who wishes to be informed of future events is welcome to contact the WSG Convenor, John Haywood: John.Haywood@mcs.vuw.ac.nz.

Seminars

Bill Caelli (QUT), "Grand challenges in information security: Views from the CRA Conference November 2003.

Alex Potanin, "Snapshot query-based debugging.

Robin Tucker (Lancaster University), "The energy-momentum density of gravitational plane waves.

Dr Neal Glew (Intel), "LIL: An architecture-neutral language for virtual-machine stubs.

Professor Miklos Szilagyi (University of Arizona), "Computer simulation of multi-person prisoners' dilemmas.

Larry Constantine, "Abstract prototyping: user interface design using canonical abstract components.

Eric Grinberg (University of New Hampshire; UNH), "Integral geometry over finite fields. "

Dr Ray Hoare (HRS Ltd), "STATISTICA for research and teaching. "

Jerzy Filar (University of South Australia), "Sustainable production systems. "

Hal Caswell (Woods Hole Oceanographic Institution, USA and NZIMA), "Stochastic demography of a threatened floodplain plant".

Frank Maurer (University of Calgary), "What is the fuss about agile methods?

Andreas Bogk, Keith Bauer, Gabor Greif, Bruce Hoult, and Alex Potanin, "Rapid prototyping in Dylan and ICFP".

Graham Farr (Monash University), "Graph polynomials from the game of go."

Stewart Fotheringham (University of Newcastle upon Tyne, UK), "Geographically weighted regression. "

Kenneth P. Burnham (Colorado State University, USA), "Model selection: AIC, BIC and multimodel inference. "

Moshe Vardi (Rice University), "Constraints, graphs, algebra, logic, and complexity," "And logic begat computer science: when giants roamed the Earth (on the unusual effectiveness of logic in computer science)" and "Automated verification = graphs, automata, and logic."

Hugh Anderson (National University of Singapore), "Affine-based size-change termination. "

Mark McGuiness

Continued

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Number 90 April 2004

NEWSLETTER

OF THE

NEW ZEALAND MATHEMATICAL SOCIETY (INC.)

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NEW COLLEAGUES

Dr Claire Jordan
Institute of Information and Mathematical Sciences
Massey University

Dr Stephen Marsland
Institute of Information and Mathematical Sciences
Massey University

Dr Shixiao Wang
Department of Mathematics
The University of Auckland

Dr Claire Jordan

Claire Jordan comes from the University of Limerick, Ireland. She has several strings to her bow, with postgraduate study in Applied Mathematics and Computing (involving mathematical modelling of industrial fluid mechanics problems), a wide variety of teaching experience and a recently-awarded PhD in `Bayesian Classification using Product Partition Models'. Claire has the following to say about Limerick: "... I hail from Limerick City in the Republic of Ireland. Limerick is the spiritual home of Irish rugby and the scene of the All Black's famous defeat by Munster in 1978. It is Ireland's third-largest city and is located in the Southwest of the country on the banks of the River Shannon, Ireland's longest river,

and recently achieved fame as the setting for Frank McCourt's best-selling autobiography 'Angela's Ashes.'"

Dr Stephen Marsland

Stephen has just arrived to join the Computer Science group at Massey. However, his interests are sufficiently mathematical to justify us welcoming him to New Zealand. Indeed, we can even thank the CS group for saving us the trouble of hiring him! Stephen did his undergrad degree in mathematics at Somerville College, Oxford, and his PhD, (officially) in Computer Science at the University of Manchester. He then did two postdocs, half a year at the Sante Fe Institute and two years in imaging science at Manchester. Stephen's research interests include machine learning, image analysis, complexity science, statistical learning, information theory, medical imaging, bioinformatics, self-organisation, and agent-based models. A sample medical application is the following: suppose two brain scans are considered identical if their images are diffeomorphic. A metric on scans which factors out the diffeomorphism group will hopefully lead to a more reliable classification of the scans by medical conditions such as schizophrenia. Stephen is organizing a SIAM minisymposium on this theme in May. We look forward to his contributions to the NZ mathematical scene.

Dr Shixiao Wang

Dr Shixiao Wang joined the Department of Mathematics at The University of Auckland in November, as a Lecturer in Industrial Mathematics (at the Tamaki campus). He has a PhD in applied mathematics from the University Paris 6, with a thesis on nonlinear PDE. His research interests are in nonlinear PDE, fluid dynamics and industrial mathematics. He has applied nonlinear analysis and nonlinear PDE methods to the long-standing fluid mechanics problem of Vortex Breakdown, and he has found some basic physics behind this complicated phenomenon. He has also spent many years in the General Electric's Global Research Center at Schenectady, and engaged in research and development of highly-efficient turbine machinery and noise-control technologies.

Dr Arno Berger

Arno Berger recently took up a Lecturer position in the Department of Mathematics and Statistics at the University of Canterbury. His research is mostly on dynamical systems, with a special focus on the ergodic theory of spatially extended systems and applications thereof, e.g. the formation and propagation of fronts. Arno did his PhD at the Vienna University of Technology, Austria, where he then was an assistant professor in classical mechanics for several years. Before coming to New Zealand, Arno had also been a visiting assistant professor at the Georgia Institute of Technology, USA, supported by a Max Kade research grant, and a research fellow at the University of Warwick, UK, as a member of the European research network LOCNET.

Dr Satish Iyengar

Satish Iyengar joined the Department of Mathematics and Statistics at the University of Canterbury in January 2004. Satish did his AB in mathematics at Harvard in 1978 and his PhD in statistics at Stanford in 1982. He then joined the faculty at the University of Pittsburgh, where he was until he came to Canterbury. His research is in stochastic modelling in neuroscience and statistical methods in biological psychiatry.

Dr Alex James

Alex James joined the Department of Mathematics and Statistics at the University of Canterbury in February. She has a PhD in mathematics from the University of Leeds, and also did a six month Post-Doc at Leeds. She has been lecturing at Sheffield Hallam University for the last two years. Before studying at Leeds she was at the University of Newcastle where she gained a BSc in mathematics and then at University College London where she took a MSc in Nonlinear Dynamics. Her research interests are in mathematical modelling, using simple models and applying methods from dynamical systems and stochastic processes together with computer simulations to explore problems in areas including ecology and combustion.

Dr Carl Scarrott

Dr Carl Scarrott has recently become a Lecturer in Statistics at the University of Canterbury, Department of Mathematics and Statistics. He completed a BSc in Mathematics followed by a PhD in Statistics at the University of Lancaster, UK. His PhD was a collaborative project with BNFL looking at the prediction of nuclear reactor core temperatures and uncertainty estimation for risk assessment and control purposes. Following his PhD, Carl completed an 18 month post-doctoral fellowship at the Centre for Ecology and Hydrology, Wallingford investigating extreme rainfall and linkages with climate change. His research

interests include spatial statistics, spectral analysis and extreme value methods with applications to scientific, industrial and environmental problems.

FEATURES

NOTES FROM A FORDER LECTURER

When Henry George Forder first arrived from England in 1934 to take up his chair in what was then Auckland University College, it was as the sole professor, with just one lecturer, Keith Bullen, to assist him. By his retirement in 1955, the College had grown to six staff, Forder had built up an outstanding library, and had attracted the first few intrepid international mathematical visitors to New Zealand. All of which is a far cry from the modern Auckland, whose thriving mathematics department, with a staff of over 50, is very much on the international circuit.

Something of the changes which have taken place in New Zealand can be judged by the fact that during his whole 21 year tenure, Forder only twice travelled to meet colleagues from elsewhere in the country. Forder lecturers, on the other hand, have to organise themselves so as to give lectures at all seven New Zealand universities in the space of 3 –4 weeks. This somewhat daunting undertaking is, fortunately, amply aided by immense New Zealand hospitality. It is not often that one has the chance to visit so many institutions in such quick succession, each with, as here, its own unique character.

Times have changed from even a decade ago; email, telephones and aeroplanes have created a world in which nowhere is very far from anywhere else. Contacts with the outside world are many and strong and most mathematicians travel regularly to visit overseas colleagues. Even so, by the time you get to Dunedin (Gaelic for Edinburgh) you become aware that you have come pretty far, a quieter and more relaxed world than the sprawling modern metropolis which is Auckland.

Forder lecturers traditionally give some public lectures and I have to thank various of my hosts, particularly Graeme Wake in Christchurch, for organising very well attended evening events. In Wellington I was interviewed for local radio: the interviewer was so interested in the hot news of how the parallel postulate led to the discovery of non-Euclidean geometry that I had to repeat it on air. Sales of Indra's Pearls appear to be up in the southern hemisphere and a pleasing Kleinian fractal appeared on the cover of the December 2003 Canterbury Mathematics Association Newsletter.

Despite the many years in his adopted country, Forder's loyalty remained with the LMS, so much so that on his death in 1981, he made the very generous bequest which now funds the lectureship. This occasioned a certain amount of discussion during my travels: it is a tribute to the growth and development of the New Zealand mathematics scene that only 25 years later, it is almost impossible to imagine such a bequest not being made directly to the NZMS. There was much talk about the recently founded New Zealand Institute for Mathematics and its Applications, directed by Vaughan Jones and Marston Conder. Unlike most of the institutes now springing up around the world, NZIMA does not have any fixed location, but exists as a moving organism with maximum flexibility to promote mathematics in any form. Perhaps this is wise: a hot topic was which of New Zealand's many and spectacular tourist spots would be the venue for the next conference. Characteristically for New Zealand, they have taken as their logo an elegant mathematical version of the graceful and ubiquitous tree fern.

In fact I find it impossible to think about New Zealand without rhapsodising about its natural beauty. I regularly had the sensation of driving straight into a magnificent picture postcard. New Zealand is also a very educational experience. Having parted company from the rest of the world some 70 million years ago, it is an object lesson in how things might have been different: there didn't have to be mammals, (birds could have evolved to take their place); there didn't have to be deciduous trees (New Zealand trees aren't exactly evergreen either, but something in between). Sitting as it does on the fault line between the Pacific and Australian plates, the country is an open text book on geology: volcanoes, geysers, earthquakes, you name it, they have it. And just in case you feel homesick, New Zealand fascinatingly also sports a full range of English weeds and garden birds. (We may yet find ourselves reimporting song thrushes: you see more of them there in a week than here in a year.)

New Zealanders have justifiably much pride in this extraordinarily beautiful and unique country. Mathematics of all kinds is flourishing and I would encourage anyone who has the chance to go there to do so, perhaps taking advantage of the programmes of the NZIMA, about which you can find more at www.nzima.auckland.ac.nz.

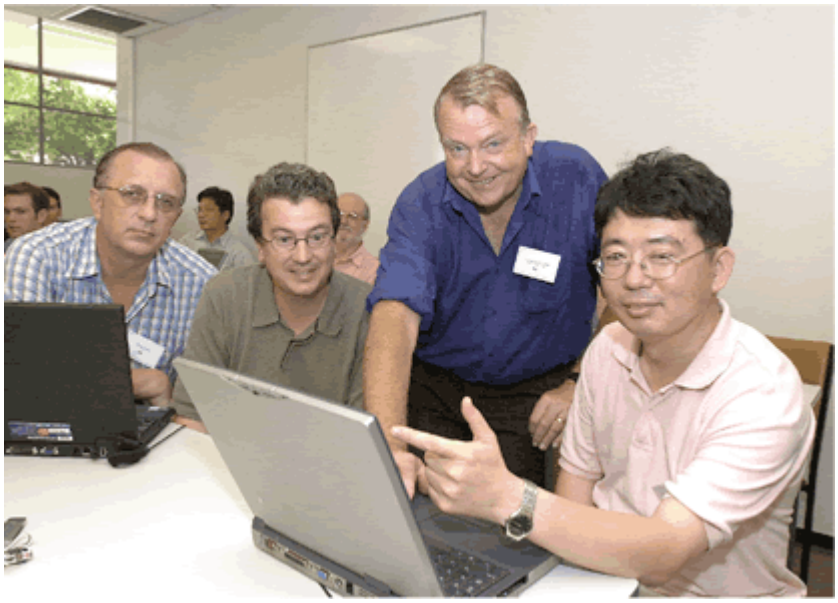
Caroline Series
Warwick, February 2004

MATHEMATICS-IN-INDUSTRY STUDY GROUP, AUCKLAND, JANUARY 2004: REPORT

After 20 years of being hosted very successfully in Australia, the **Mathematics-in-Industry Study Group** (MISG) moved across the Tasman to Auckland, NZ and was held there from 26 –30 January, the week before ANZIAM2004 in Hobart. It was organised by the newly formed **Centre for Mathematics in Industry** at Massey University in Albany, Auckland and was physically located at The University of Auckland's city campus. It brought together nearly 140 delegates from all parts of the world: international contributors included invitees Paul Dellar from OCIAM, Oxford, UK; John King from Nottingham, UK; together with five from the Korea Advanced Institute for Science and Technology (KAIST, including three students), and many other Asian countries were represented. In addition to the most important brain-storming sessions, a student workshop was held (speakers Alan Conaghan "Pavement Modelling", Graeme Wake "Industrial Mathematics" and John King "Mathematics in Medicine"); plenaries were given by Ray Hoare – on Software developments – and Paul Dellar – on Combustion waves/ UK Study Group problems; and a ferry/restaurant excursion was held one warm summer evening. More details can be found on the website: http://misg2004.massey.ac.nz including some of the key addresses given. Six industrial problems were considered:

- **Strip temperature in a metal coating line annealing furnace** (NZ Steel)
  to predict and control strip temperature during annealing-essential for ensuring product quality.
- **Modelling of a poultry shed** (NRM/Tegel)
  to provide underpinning decision support for the modelling of the energy exchange between the growing chickens and their shed environment.
- **Forecasting wind farm generation** (Transpower NZ Ltd)
  develop an algorithm to forecast wind farm electrical output from real-time to a day ahead, considering operational and meteorological characteristics.
- **Earthquake damage in underground roadways** (Solid Energy Ltd)
  provide a model that can relate risk/damage to underground roadways occurring from earthquake waves of varying depth, intensity and incidence.
- **Dispersion rates of wilding trees** (Environment Canterbury)
  provide a predictive model determining propagation rates of wilding trees as a function of environmental parameters so as to assist in planting and control strategies.
- **Optimal sorting of product into fixed weight packaging** (Compac Sorting Equipment Ltd)
  develop a robust routine for calculating categories of produce by weight and develop the software for implementation, using a "learning by experience" algorithm.

MISG2004 was a resounding success and gave Industrial Mathematics a significant boost in New Zealand simultaneously providing the annual ANZIAM MISG event in this area. *The picture below shows the Director Professor Graeme Wake with NZ Steel representatives Phillip Bagshaw (centre) and Nebojsa Joveljic along with Professor Chang-Ock Lee from KAIST. The moderators (not shown) for this problem were Mark McGuinness from Victoria University of Wellington and Steve Taylor from The University of Auckland.*



Although it is too early to say much about the final achievements, progress was made on each problem and some downstream collaborations are being nurtured. The latter were strongly encouraged, but not required, by the MISG organisers. The Proceedings of MISG2004 are to be published by our Centre by the end of 2004 and the Equation-free Summaries will be available mid-year, both from g.c.wake@massey.ac.nz. A summary of each of the six problems is included below.

Problem 1: Accurate control of strip temperature is essential for ensuring optimum product quality and throughput. New Zealand Steel has developed a simple mathematical model of their Metal Coating Line Annealing Furnace to enable prediction of strip temperature for various products and operating conditions. The model is applicable for approximately 50% of the operating time when the furnace is in equilibrium, thus is steady-state. Annealing is a process by which the steel is heated to a specific temperature in order to soften the steel by changing its structure. Considerable progress was made in developing and implementing a partial differential equation model, for the unsteady situation. The Industry representatives expressed satisfaction with the outcomes and arrangements are being made by the moderators (Mark McGuinness and Steve Taylor) for ongoing work. NZ Steel, now Bluescope Steel, also attended MISG2003 in Adelaide as problem sponsors.

Problem 2: This was specifically modelling the energy exchange between the chickens and their shed environment. The chicken shed modelled has chickens placed as day old chicks at a stocking density of 21.3 birds per square metre. They are floor reared on a concrete floor (approximately 15cm thickness), with dry wood shavings as "litter" spread on the concrete to 5 cm thick. This litter remains with flock for the duration of the batch "composting" down to a friable litter material consistent with "50% sawdust mixed with 50% dry garden soil". The sheds are "controlled environment" sheds, and the birds are grown to a specific temperature profile as they get older. The shed temperature control starts at 32 degrees C at day of placement graduating down approx 0.4 degrees per day to 20 degrees C by the time the birds reach processing age (average 37 days). The chickens have unlimited access to feed and water, and grow to a specific growth profile with target weight for age expectations. Specific air exchange requirements are necessary to maintain a shed environment acceptable for animal welfare and performance parameters. Water generated into vapour/humidity through evaporation, and carbon dioxide being the predominant waste products needing to be removed. The moisture content of the dry wood shavings prior to placing the chicks will be approx 5%. By the end of the growing cycle the litter moisture will ideally be no higher than 18% to 20%. Water accumulation in the litter is insignificant compared to total water through put during the run. By using specific quite simple heat and moisture balances the group led by moderators Robert McKibbin (Massey University) and Andy Wilkins (Canesis, Australia), were able to provide key decision support algorithms and approaches.

Problem 3: In the New Zealand Electricity Market (NZEM), generators offer power into the system for every half-hour trading period. These offers are made around 24 hours ahead for scheduling (forecasting) purposes, and are frozen two hours ahead of real time. In addition, the System Operator (Transpower) forecasts generation close to real time for dispatch and security analysis. The market works best, and dispatch is most secure, when forecasts of price and quantity respectively at each of these different time outlooks are accurate. While this is readily achievable for dispatch able generation such as hydro and thermal plant, it is more problematic for plant whose output is governed by environmental conditions, such as run of river hydro plant and especially wind turbines. There is currently one significant wind farm on the system, but expectations are that many more will be commissioned over the next few years. The

increasing proportion of wind power on the system risks significantly decreasing the accuracy of price and quantity forecasts, and thus market efficiency and potentially the level of security of supply. *The problem posed to the MISG was therefore to develop an algorithm to forecast wind farm electrical output from real-time to day ahead, considering operational and meteorological characteristics*. The team led by moderators Tasos Tsoularis (Massey University) and Bill Whiten (University of Quuensland) provided a range of algorithms by which Transpower can more reliably predict output, using forecasting techniques and neural networks.

Problem 4: New Zealand straddles the Pacific and Australian tectonic plates. To the north and south of the New Zealand landmass are subduction zones where one plate is being pushed under the other. The subduction zones dip in opposite directions, which results in a transitional zone through the middle of the South Island; the Alpine Fault. There is an apparent offset of approximately 500 km along the Alpine Fault. This significant displacement is testimony to the historical seismic activity of the region.

Research by Solid Energy NZ Ltd had found that historically, underground structures have undergone less damage than above ground structures during earthquakes. This is supported by wave theory. An earthquake initiates seismic waves of various frequencies when it ruptures, with the waves travelling up through the rock layers until they reach the earth's surface. The large reduction in stress and strain at the air-rock/soil interface results in an increase in amplification of the seismic waves when they reach the surface. Mathematically, in principle, the motion of an underground roadway during an earthquake should be one half that at the surface. Exceptions exist, however, and it is prediction of how a particular mine may be affected by an earthquake of magnitude x that forms part of this study. It is thought that the resonance of seismic wave frequencies with the natural frequencies of a structure, are a significant cause of the increase in damage (motion) experienced in some situations. Exceptions in the past have mainly been very shallow road and subway tunnels. Wave theory suggests that if a large proportion of high frequency, short wavelength seismic waves hit a mine and the wavelengths are small compared to the dimensions of the mine opening, they may treat the opening as a free surface, amplifying the motion felt underground. This introduces another uncertainty in that how close does an earthquake have to be to the mine for this to happen? There are a number of other factors that may affect the shaking felt underground: Angle of incidence of the waves (constructive and destructive); Degree of dampening of the waves (dependent on the media they are passing through); & Type of waves. When an earthquake occurs, a number of types of waves are generated that travel through the Earth's interior, these can be divided into two categories: body waves and surface waves. Body waves can be further subdivided into *p*-waves and *s*-waves. *P*-waves (also known as primary, compressional or longitudinal waves) involve successive compression and rarefaction of the materials they pass through. *S*-waves (also known as secondary, shear or transverse waves) cause shearing deformation as they pass through a material. From an engineering perspective the most important surface waves are Rayleigh and Love waves. These wave types are unlikely to have a significant damaging affect on an underground mine other than the potential to damage the portals (entrances).

What was required from this study was to: Determine the attenuation rate of high frequency, potentially damaging, earthquake induced waves for the Terrace and Spring Creek sites; Determine the critical frequency at which these waves may treat the mine openings as a free surface (potential for severest damage); Determine the effect on a single roadway and then investigate the effect on a network of intersecting roadways, of high frequency body waves; From this determine if there is mining direction that is less susceptible to damage from high frequency waves; From the above estimate the probability of a *ML*8.0 earthquake on the Alpine Fault or a *ML*7.0 earthquake on the secondary faults having a damaging affect on the Terrace and Spring Creek underground mines; From numerical modeling and analysis determine the consequence of a *ML*8.0 earthquake on the Alpine Fault or a *ML*7.0 earthquake on the secondary faults, on the two mines.

The team led by the moderators, Tim Marchant from the University of Wollongong and Graham Weir from Industrial Research, Wellington, provided a range of approaches which will need further evaluation before Solid Energy New Zealand Ltd will be in a position to achieve its aim to determine its level of corporate risk (probability ´ consequence) at these sites from a major earthquake. Certainly it appears that damage at depth is significantly less than at the surface. This rather uniquely NZ problem proved quite challenging (even to formulate) and is ripe for further study.

Problem 5: The uncontrolled spread of introduced conifers (wilding conifers) potentially threatens more than a million hectares of land in Canterbury, as well as other parts of the South Island, NZ. Wilding conifers threaten native vegetation, endangered species, and important wildlife habitat. Wilding conifers also threaten pastoral farmland, the distinctive expansive landscapes of the South Island, historic and cultural sites, and recreation opportunities. Wilding conifers are the most significant weed threat in many areas of the Canterbury high country, and do not discriminate between land tenures and property boundaries. Because funding is limited, control of wilding conifers must be targeted at the most important sites, coordinated between land management agencies and landowners, and be sustained for as long as there is a risk of re-infestation. Environment Canterbury has recently completed a survey of wilding

conifer spread in the Region's high country, covering a total area of about 2.3 million hectares. The Canterbury high country has characteristic features of topography, climate, vegetation and land use (mostly extensive grazing or conservation land) that make it particularly susceptible to wilding spread. At present approximately 62,000 ha within this part of the region contain wilding conifers. The most extensive areas of spread are in the inter-montane basins and ranges of the high country where grassland or shrubland ecosystems dominate. However, wilding conifer spread also affects alpine areas above the native timberline as well as regenerating forest and shrubland in coastal areas. Wilding conifer infestations range from dense stands near seed trees to distant spread where single seedlings are scattered at low densities over a wide area. Large infestations can sometimes result from one significant dispersal event, such as strong winds while trees are coning. Wilding conifer species are, by definition, invasive. The significant characteristics that set these invasive species apart from non-invasive introduced conifers are early maturing (coning), small seeds and frequent large seed crops. The invasiveness of wilding conifer species can, to some extent, be predicted by assessing criteria such as age of seeding, quantity of seed produced, viability of seed, seed dispersal, seedling establishment and growth rates. The spreading vigour of wilding conifer species can also be assessed, based on species' competitiveness, palatability, seed production and seed weight.

Factors influencing wilding spread include: Presence of seed sources; Siting and management of plantings (seed sources); Direction, severity and frequency of strong winds; Composition and stature of the plant communities on surrounding land; Presence of mycorrhizal symbionts (fungi) on surrounding land; Resistance of pests and diseases; Palatability of the wilding species; Site Conditions (including climate); and Management of surrounding land (including disturbance). Strong winds can transport seed for many kilometres. Wilding conifer spread has been recorded 40 kilometres from the seed source at Mid Dome (Southland) and wildings frequently establish at least 10 kilometres from parent trees. Seed is usually deposited at sheltered sites, such as lee slopes, where wind speed is reduced. The successful germination and establishment of wilding conifer seed may depend on the composition of plant communities at the site. Bare ground, or low stature plant communities such as grassland (including tussockland) and herbfield, are the most favourable communities for wilding establishment. Shrubland is relatively less favourable, and forest generally unfavourable. However Douglas fir, which is relatively shade-tolerant, may establish beneath a mature beech (Nothofagus sp.) forest canopy, and other wilding species may establish in openings within regenerating forest. The presence of wild or domestic animals and the palatability of introduced conifer species are likely to influence the successful establishment of wildings. Sheep can prevent the establishment of wilding conifers on intensively grazed land and reduce wilding spread on extensively grazed lands. Cattle can reduce wilding growth but rarely kill seedlings, and may enhance wilding establishment by reducing tussock and shrub cover. Fluctuating rabbit numbers and the retirement of land from grazing has contributed to wilding spread in the Mackenzie Basin, while possum or hare browse may prevent wilding establishment or hinder plant growth.

This was a popular problem and the group had to subdivide!! The problem group, led by moderators Heather North from Landcare Research NZ and Mick Roberts from Massey University, canvassed a range of deterministic and stochastic models which can be used by Environment Canterbury to predict invasive spread in a large number of scenarios. Several models are the subject of ongoing investigations.

Problem 6: Many of Compac's customers sort their fruit into cardboard boxes or plastic bags using their equipment. The normal requirement is for a fixed number of fruit to fill a box to a fixed weight, e.g., 100 apples into a box to weigh 18 kg in total. Typically the fruit being sorted is divided into about 16 sizes by weight of a piece of fruit, with the smallest size targeting 216 fruit into an 18 kg box, and the largest size targeting 36 fruit into an 18 kg box, with the individual fruit weighing from 80 grams through to 400 grams (fruit weighing accuracy is to within a standard deviation of 1.5 grams). The problem is to maximise the number of boxes produced by minimising the amount that a box weighs over the target weight, by continuously monitoring the distribution of fruit being sorted and adjusting the weight bands that different sizes fit into. The distribution of fruit is continuously changing throughout the day due to the fruit coming from different orchard blocks or areas of an orchard block. It is allowable to target a certain small percentage of boxes that will end up underweight as these can be manually adjusted, as typically every box is checked for its final weight after being filled, and the customer would want to be able to adjust how often this occurs. One complexity is that customers wish to take one particular size and put half the production into 18 kg boxes and half into 19 kg boxes. There are two types of box filling that it is required to optimise, which may require different solutions: (1) they know exactly which fruit went into which box; (2) they only know that a fruit went into one of the last few boxes filled.

The team led by moderators Phil Kilby from CSIRO, Sydney and Clive Marsh from Canesis Network NZ, achieved almost a complete solution of this popular OR problem. Implementation is underway.

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MISG 2004 was sponsored by ANZIAM, NZ Mathematics Society, Massey and Auckland Universities, Hoare Research Software Ltd, Canesis Network Ltd, Industrial Research Ltd, Pavement Management

Services and Transfield Services; and each participating company named above provided logistical and financial support all of which is gratefully acknowledged. The Director's prize for the best remark "Overheard in Passing" was given to Darren Jilks of Bluescope Steel (Australia) who was heard to say: "*They're both infinitely wide but one is twice as wide as the other*."

Buoyed by the success of MISG2004, we are, as agreed by ANZIAM, planning for MISG2005, which will be in Auckland 24 –28 January 2005. The ANZIAM Applied Mathematics Conference in Napier is the following week. Plan to be at both.

Graeme Wake, Director:
g.c.wake@massey.ac.nz

THE CRAWLER

Reporting internet links is hardly original research, so is it a crime to report a link to other people's links? Instead of having to think of something interesting to search for, I am effectively varying my filter on a higher-order search. In this instance I spent a happy hour browsing the journals of one Thane Plambeck at www.plambeck.org, a Silicon Valley consultant with an interest in (inter alia) mathematics. There I found a rejection letter (http://www.plambeck.org/oldhtml/bio/dartmouth.jpg), beautiful of its kind, but still not quite up to the affrontery of the Courant Institute who once thanked me for "helping to maintain the high standard of the applicant pool"; an electronic version of Oliver Byrne's startling 1847 version of Euclid (http://sunsite.ubc.ca/DigitalMathArchive/Euclid/byrne.html), all done with colour pictures—I knew about this from Edward Tufte's books, but had never seen it—a link to a photo essay about MSRI by their Journalist-in-Residence, Ed Alcock (http://www.msri.org/media/photography/ed_alcock_spring_2003/index_html, but the photos seem to be broken at the moment) and the following anecdote about the topologist R.H. Bing (http://www.utexas.edu/faculty/council/2000-2001/memorials/Bing/bing.html):

> It was a dark and stormy night when R.H. Bing volunteered to drive some stranded mathematicians from the fogged-in Madison airport to Chicago. Freezing rain pelted the windscreen and iced the roadway as Bing drove on—concentrating deeply on the mathematical theorem he was explaining. Soon the windshield was fogged from the energetic explanation. The passengers too had beaded brows, but their sweat arose from fear. As the mathematical description got brighter, the visibility got dimmer. Finally, the conferees felt a trace of hope for their survival when Bing reached forward—apparently to wipe off the moisture from the windshield. Their hope turned to horror when, instead, Bing drew a figure with his finger on the foggy pane and continued his proof—embellishing the illustration with arrows and helpful labels as needed for the demonstration.

Robert McLachlan
Massey University

RECENT RESEARCH GRADUATES

RESEARCH GRADUATES 1997 –2003

[The Newsletter here continues its irregular summaries of PhD and MSc graduates in mathematics and statistics from New Zealand universities. Previous summaries have appeared in issues 10S (to 1977), 18S (1977 –79), 32S (1979 –83), 61 (1984), 62 (all PhD graduates to 1993,) 63 (MSc graduates, 1983 –1994, incomplete), 64 (1994 –95), 67 (1994 –96), 70 (1996 –97), 73 (1997 –98), and 76 (1998 –99). The format is **Name**; University; Year; "Thesis title"; Advisor(s); present position if known

Thanks to all our local correspondents for this information – *Editor*.]

DOCTORATE

Ali, Farhad; University of Waikato; 2001; "Current sheet formation in uniformly twisted magnetic flux tubes"; A. Sneyd and I. Craig; lecturer at a university in Islamabad.

Allsop, Nicholas; Massey University; 2000; "The quotient between length and multiplicity"; Dr Kee Teo.

Alsop, Jon; University of Otago; 1998; "On the temporal stability of populations"; Professor Bryan Manly (jointly with Botany Department).

Bai, Changyun; Victoria University of Wellington; "Some extensions of the statistical analysis of space diversity wireless communications systems"; Peter Smith.

Basse, Britta; University of Canterbury; "Case studies in mathematical modelling for biological conservation"; Professor G.C. Wake [Dr J.A. McLennan ; Post-Doctoral Fellow, Germany.

Beale, Ian; Massey University; 2002; "Subset selection routing: Modelling and heuristics"; Dr John Giffin.

Ben-Tal, Alona; The University of Auckland, Department of Mathematics; 2001; "A study of symmetric forced oscillators"; Dr Vivien Kirk; Bioengineering Institute, The University of Auckland.

Boustead, Therese; University of Canterbury; "Undergraduate difficulties: algebraic skills and mathematical comprehension"; Dr J. Hannah; manager and research associate at the Curriculum, Evaluation and Management Centre, University of Canterbury.

Bracewell, Paul J.; Massey University (Albany); 2003; "Quantification of individual rugby player ability through multivariate analysis and data mining"; Denny Meyer; Lecturer in Statistics, Massey University (Albany).

Bradley, Chris; The University of Auckland; 1998; "A three-dimensional torso model for electrocardiology"; A. Pullan, P. Hunter; Post doctoral fellow at Oxford University.

Brown, Sheena; University of Otago; 2000; "Ultrastructural analysis of activity-dependent volume changes in the antennal lobe of the worker honey bee, Apis mellifera"; Dr Caryn Thompson (jointly with Zoology Dept).

Bruhn, Aaron; University of Otago; 1999; "Problem Solving Groups: A descriptive study from the classroom"; Professor Derek Holton.

Buckland, Paul; University of Otago; 2002; "Global optimisation in the New Zealand electricity market"; Dr John Shanks.

Buist, Martin; The University of Auckland; 2001; "Modelling cardiac activation from cell to body surface"; A. Pullan, P. Hunter; Research Scientist in the Bioengineering Institute, The University of Auckland.

Cai, Bo; The University of Auckland, Department of Statistics; 2003; "Adaptive sampling schemes and Bayesian semiparametric survival analysis"; Dr Renate Meyer.

Cheng, Leo; The University of Auckland; 2001; "Non-invasive electrical imaging of the heart"; A. Pullan; Research Scientist in the Bioengineering Institute, The University of Auckland.

Cherrie, Jon; University of Canterbury; "Fast evaluation of radial basis functions: theory and application"; Associate Professor R.K. Beatson.

Chung, Hyuck; The University of Auckland, Department of Mathematics; 2002; "Mathematical studies of wave propagation in sea-ice"; Dr Colin Fox; Postdoctoral Fellow at University of Illinois Urbana-Champaign.

Clark, Austina; University of Otago; 1998; "Spatial design for field experiments"; Dr David Fletcher.

Croucher, Adrian; The University of Auckland; 1998; "Modelling of contaminant transport in rivers and estuaries"; M. J. O'Sullivan; Post-Doctoral Fellow, Department of Engineering Science, The University of Auckland.

Dediu, Simona; University of Canterbury; "The constructive theory of operator algebras"; Professor D.S. Bridges; Post-Doctoral Fellow, University of Canterbury.

Dobscanyi, Peter; The University of Auckland, Department of Mathematics; 2000; "Adaptations, parallelisation and applications of the low-index subgroups algorithms"; Professor Marston Conder; Research Fellow at Queen Mary College, London.

Du Fresne, Sam; University of Otago; 2000; "Abundance estimating of Hector's dolphin"; Dr David Fletcher (jointly with Marine Science Department).

Elkin, David; University of Otago; 2001; "Forest partitions of regular graphs"; Dr Robert Aldred.

Enlow, John; University of Otago; 2002; "Mathematical modelling of surfactant liquid crystal x-ray diffraction"; Ray Enlow, Vernon Squire, Patricia Cragg, Roland Broadbent.

Emms, Grant William; The University of Auckland, Department of Mathematics; 2001; "Active sound absorbers: Their effect on sound transmission through openings"; Dr Colin Fox; Chief acoustics scientist

for Forest Research in Rotorua.

Gardner, Paul; Massey University; 2003; "Simulating the RNA world and computational ribonomics"; Professor Mike Hendy; Post-doctoral Fellow at the Technical Faculty at the University of Bielefeld followed by a post-doctoral position (funded by the Carlsberg Foundation) at Copenhagen University with the Evolutionary Biology group from early 2004.

Gong, Rose Ying; The University of Auckland, Department of Mathematics; 1999; "A mathematical model of spontaneous combustion in wet lignite"; Professor Graeme Wake and Dr John Burnell; Scientist with Victoria Link, a research company operated by VUW.

Gormley, Andrew; (with Distinction); University of Otago; 2002; "Use of mark recapture for estimating abundance in marine mammals"; Associate Professor Richard Barker (jointly with Zoology Department).

Hamilton, Richard; University of Otago; 1999; "Tidal movements and lunar aggregating behaviours of Carangidae in Roviana Lagoon, Western Province, Solomon Islands"; Dr David Fletcher (jointly with Marine Science).

Hann, Chris; University of Canterbury; "Recognising two planar objects under a projective transformation"; Dr M.S. Hickman; Post-Doctoral Fellow, University of Canterbury.

Harder, David; University of Waikato; 2003; "Bodies of finite extent in classical and general relativity"; E. Kalnins and I. Craig; overseas.

Harmer, Mark; The University of Auckland, Department of Mathematics; 2000; "The matrix Schrödinger operator and Schrödinger operators on graphs"; Professor Boris Pavlov; NZ Science & Technology Postdoctoral Fellow, Department of Mathematics, The University of Auckland.

Hawke, Alexandra; (with Distinction); University of Otago; 1998; "Modelling individual tree growth of improved genotypes of Pinus radiata in a progeny trial with adjustment for spatial covariance"; Dr Caryn Thompson, Mr Mark Kimberly/Dr Bruce Manley (NZFRI) and Professor Bryan Manly.

Heerikhuisen, Jacob; University of Waikato; 2001; "Coronal magnetic energy release by current sheet reconnection"; I. Craig and A. Sneyd; postdoc in the US.

Higgins, Joanna; Victoria University of Wellington; "Learning and Teaching Mathematics in the First Two Years at School"; Lise Bird and Megan Clark; Senior Lecturer, Wellington College of Education.

Holden, Jennifer Kay; The University of Auckland, Department of Statistics; "Analyzing generalized linear models, with application to epidemiology"; Associate Professor Chris Triggs, Associate Professor Alan Lee & Professor George Seber; Research Fellow in Public Health at University of Western Australia.

Holland, Barbara; Massey University; 2001; "Evolutionary analyses of large data sets: Trees and beyond"; Professor Mike Hendy; (FoRST funded) NZST Postdoctoral Fellow with the Allan Wilson Centre, IFS, Massey University.

Hong, Kian Sam; University of Otago; 2003; "Evaluation of a web-based tertiary statistics course using a problem-based learning approach"; Associate Professor Kwok Wing-Lai (School of Education) and Professor Derek Holton.

Hooks, Darren; The University of Auckland; 2002; "Activation of myocardial sheets"; I. LeGrice, B. Smaill, P. Hunter; Finishing off Medical School, The University of Auckland.

Huakau, John Tupou; The University of Auckland, Department of Statistics; 2001; "New methods for analysis of epidemiological data using capture-recapture models"; Associate Professor Alan Lee, Professor George Seber & Associate Professor Chris Triggs; Research Fellow in Public Health, Massey University.

Hunter, Christine; University of Otago; 2000; "Demography of procellariids: model complexity, chick quality, and harvesting"; Dr David Fletcher (jointly with Zoology).

Johnson, Grace; University of Canterbury; "A simulation study of individuals' price expectations and market processes"; Dr F.R. Lad; Tutor, University of Canterbury.

Johnson, Simon; University of Otago; 2000; "Prumnopitys ferruginea (miro) seedling recruitment patterns in the Catlins, New Zealand and dispersal by Hemiphaga novaseelandiae (New Zealand pigeon)"; Dr Caryn Thompson (jointly with Environmental Science).

Johnston, Mark; Massey University, 1999; "Dynamic routing with competition: foundations and competition"; Dr John Giffin.

Kathirgamanathan, Padmanathan; Massey University; 2003; "Source parameter estimation of atmospheric pollution from accidental releases of gas"; Professor Robert McKibbin.

Ko, Te-Han; Victoria University of Wellington; "Studies in the Structural Theory of Forcing"; Colin Bailey.

Korobeinikov, Andrei; The University of Auckland, Department of Mathematics; 2001; "Stability and bifurcation of deterministic infectious disease models", Dr Wayne Walker, NZ FRST Postdoctoral Fellow at Mathematical Institute, University of Oxford.

Kota, Saraswathi; The University of Auckland, Department of Mathematics; 2000; "The role of affective factors in problem solving"; Dr Mike Thomas & Professor Ivan Reilly; teaching in Australia.

Kuo, Frances Y.; University of Waikato; 2002; "Constructive approaches to quasi-Monte Carlo methods for multiple integration"; S. Joe and I. Hawthorn; postdoc at University of New South Wales.

Lau, Ngee Kiong Paul; University of Otago; 1998; "Problem solving as an approach to the teaching and learning of mathematics"; Professor Derek Holton.

Layanage, Sanka Bambrawana; The University of Auckland, Department of Mathematics; 2003; "A framework for informal arithmetical questions used by secondary school mathematics teachers"; Dr Mike Thomas & Dr Kay Irwin; Teacher at McLean's College.

MacKenzie, Darryl; University of Otago; 2002; "Assessing Mark-Recapture data with computer intensive statistics"; Richard Barker.

McCartin, Catherine; Victoria University of Wellington; "Contributions to parameterized Complexity"; Rod Downey; Lecturer at Massey in Palmerston North (Computer Science).

McGregor-Macdonald, Athene; University of Otago; 2000; "The $E(m,n)$ property"; Professor Derek Holton, Dr Robert Aldred.

McKenzie, Andy; University of Canterbury; "Stochastic speciation models for evolutionary trees"; Associate Professor M.A. Steel.

McKenzie, Joanne; University of Otago; 1999; "A simulation experiment investigating the power of Manly's (1995) analysis of species co-occurrences test"; Professor Bryan Manly.

McNaughton, Alistair; The University of Auckland; 1998; "Long term scheduling of harvesting with adjacency and trigger constraints"; D. M. Ryan and E. M. Rönnqvist; Senior Tutor, Department of Mathematics, The University of Auckland.

McQueen, Dougal; University of Otago, 2002, "Stochastic modelling of electricity demand for power quality analysis"; Dr John Clark (jointly with Physics Department).

Meaney, Tamsin; Department of Mathematics, The University of Auckland; 2000; "An ethnographic case-study of a community-negotiated mathematics curriculum development project"; Associate Professor Bill Barton & Dr Kay Irwin; Researcher at NEMP, University of Otago.

Moon, Margaret; University of Otago; 2000; "Chronic pain: a model based on general system theory;" Professor Vernon Squire (jointly with Microbiology and Anatomy and Structural Biology).

Mouat, Cameron; University of Canterbury; "Fast algorithms and preconditioning techniques for fitting radial basis functions"; Associate Professor R.K. Beatson.

Mphako, Eunice; Victoria University of Wellington; "Tutte polynomials, chromatic polynomials and matroids"; Geoff Whittle; Lecturer in Mathematics, University of Malawi.

Nash, Martyn; The University of Auckland; 1998; "Mechanics and material properties of the heart using an anatomically accurate mathematical model"; P. Hunter, B. Smaill; Lecturer, Department of Engineering Science, The University of Auckland.

Navarro-Alberto, Jorge; University of Otago; 2003; "Generalized linear models and Monte Carlo methods in the analysis of species co-occurences"; Dr David Fletcher.

Neyland, Jim; Victoria University of Wellington; "An ethical critique of technocratic mathematics education: towards an ethical philosophy of mathematics education"; H. Lauder, Megan Clark; Senior lecturer in education, Victoria University of Wellington.

O'Malley, James; University of Canterbury; "Some new considerations for the statistical analysis of an assay"; Professor J.J. Deely, Dr M.H. Smith.

Ostring, S; University of Canterbury; "Reactive traffic control mechanisms for communication networks with self-similar bandwidth demands"; Dr H. Sirisena, Dr I. Hudson.

Penados, Filiberto; University of Otago; 1999; "Reflection in Mathematics Teaching"; Professor Derek Holton, Dr Bruce McMillan (Education Department).

Pledger, Shirley; Victoria University of Wellington; "Finite mixtures in capture-recapture models"; Brian Dawkins; Senior lecturer in Statistics, Victoria University of Wellington.

Popa, Gabriela; University of Canterbury; "A theoretical constructivisation of mathematical economics"; Professor D.S. Bridges; Tutor, University of Canterbury.

Randal , John; Victoria University of Wellington; "Robust Volatility Estimation and Analysis of the Leverage Effect"; Peter Thomson, Martin Lally; Lecturer in Econometrics at Victoria University of Wellington.

Reddy, Muni V.; University of Waikato; 2000; "The structure and average discrepancies of lattice rules for numerical integration"; S. Joe and I. Hawthorn; lecturer at University of the South Pacific.

Richardson, Kerry; The University of Auckland, Department of Mathematics; 2000; "Topological Languages"; Professor David Gauld & Dr David McIntyre, University of Yokohama.

Rivers, Catherine; Massey University; 2002; "Coordination in vehicle routing"; Dr John Giffin.

Roberts, Leigh; Victoria University of Wellington; details unavailable; Senior lecturer in financial mathematics, Victoria University of Wellington.

Schofield, Paul; University of Otago; 2001; "Empirical and Modelled Interpretations of Sooty Shearwater Survival in Unharvested Populations;" Dr David Fletcher, Associate Professor Richard Barker (jointly with Zoology).

Sheu, Ru-Shuo; The University of Auckland, Department of Statistics; 2002; "Queuing and storage control models"; Dr Ilze Zeidins & Dr Geoff Pritchard; Lecturer in the Department of Computer Science at the Hsin-Wu Institute of Technology in Taipei.

Shin, Sung Nam; University of Waikato; 2000; "Kelvin-Helmholtz instability in aluminium reduction cells"; A. Sneyd and I. Craig; high school teacher.

Shorten, Paul; University of Canterbury; "Mathematical models of pituitary corticotrophs and perifusion experiments"; Associate Professor D.J. Wall.

Siripornpibul, Taweesak; University of Canterbury; "Survey designs and compensation methods for nonresponse problems"; Dr E. Chacko [Dr J.A. Brown].

Smith, Alistair; University of Canterbury; "Optimal marine farm structures"; Professor G.C. Wake [Dr A. Ross; Dr V. Nikora].

Smith, Nicolas; The University of Auckland; 1999; "Coronary flow mechanics —an anatomically accurate mathematical model of coronary blood flow coupled to cardiac contraction"; P. Hunter, A. Pullan; Lecturer, Department of Engineering Science, The University of Auckland.

Smith, Tammy; Massey University; 2001; "Mathematical modelling of underground flow processes in hydrothermal eruptions"; Professor Robert McKibbin; Lecturer in Mathematics, Massey University.

Soehle, Ilka; University of Otago; 2000; "Telemetry Studies of Sooty Shearwaters"; Dr David Fletcher (jointly with Zoology Dept).

Solomon, Nicola; University of Otago; 2000; "Development of an odour mixture model for cheese flavour"; Dr Caryn Thompson (jointly with Zoology Dept).

Stevens, Carey; The University of Auckland; "An anatomically-based computational study of cardiac mechanics and myocardial infarction"; 2002; P. Hunter; Runs a startup company called ZEST.

Tawhai, Merryn; The University of Auckland; 2001; "An anatomically based mathematical model of the human lungs, applied to gas mixing and water vapour and heat transport"; P. Hunter, A. Pullan; Research Scientist in the Bioengineering Institute, The University of Auckland.

Todoroki, Christine; The University of Auckland; 1997; "Primary and secondary log breakdown simulation"; M. Rönnqvist; Research Scientist, Forest Research.

Tomlinson, Karl; The University of Auckland; 2000; "Finite element solution of an eikonal equation for excitation wavefront propagation in ventricular myocardium"; A. Pullan, P. Hunter; Research Scientist in the Bioengineering Institute, The University of Auckland.

Trew, Mark; The University of Auckland; 1999; "Aspects of shallow water modelling"; M. J. O'Sullivan; Post-Doctoral Fellow, Bioengineering Institute, The University of Auckland.

Tu'akilaumea (Havea), Robin; University of Canterbury; "Constructive spectral and numerical range theory"; Professor D.S. Bridges.

Uhlmann, Sebastian; University of Otago; 2001; "Incidental takes of Sooty (Puffinus griseus) and short-tailed Shearwaters (Pitenuirostris) in fisheries"; Dr David Fletcher (jointly with Zoology Department).

Vasiljevic, Sanja Todorovic; The University of Auckland, Department of Mathematics; 2001; "Bounds on the number of automorphisms of a compact non-orientable surface of given genus"; Professor Marston Conder; Actuary with AMI, Christchurch.

Wallace, Christopher; The University of Auckland; 2001; "The construction of optimal tours of duty for long haul flight attendants"; D. M. Ryan; OR Group, Air New Zealand.

Walls, Fiona; Victoria University of Wellington; "Sociomathematical Worlds: The social world of children's mathematical learning in the middle primary years"; Megan Clark; Senior Lecturer, School of Education, Murdoch University.

Walshaw, Margaret; Massey University; 2000; "Paradox, partiality and promise: A politics for girls in school mathematics"; Dr Gillian Thornley; Senior Lecturer, Department of Technology, Science and Mathematics Education, Massey University.

Ware, Robert; University of Canterbury; "Three studies in numerical methods for statistical approximations"; Dr F.R. Lad [Dr I.L. Hudson].

Wharton (nee Taylor), Fiona; Massey University; 2000; "Search and rescue management: Modelling and development of heuristics strategies within a simulation environment"; Dr John Giffin.

Wright, Will; The University of Auckland, Department of Mathematics; 2002; "General linear methods with inherent Runge-Kutta stability"; Professor John Butcher; Postdoctoral Fellow at University of Bergen.

Wu, Guohua; Victoria University of Wellington; "Structural properties of DCE degrees and representations of CE reals"; Rod Downey; Post-doctoral fellow, Victoria University of Wellington.

Yamamoto, S.; University of Canterbury; "Linear and nonlinear integral equation population models"; Professor G. Wake, Associate Professor D. Wall.

MASTERATE

Afzal, Ramzan Ali; Victoria University of Wellington; "On the quantification of risk and the estimation of motor insurance premiums"; Leigh Roberts, Megan Clark; Ministry of Health, NZ.

Allsopp, Toby; The University of Auckland; 1998; "Stochastic weather routing for sailing vessels"; A. Philpott, A. Mason; Analyst, Peace Software.

Arnold, Richard A; Victoria University of Wellington; "Bayesian Spectral Analysis of White Dwarf Light Curves"; Tony Vignaux; Lecturer in Statistics, Victoria University of Wellington.

Au, Khanhav; Victoria University of Wellington; "Simulation and Estimation for hidden Markov models of Brownian motion"; David Vere-Jones; PhD, ANU Canberra.

Averill, Robin; Victoria University of Wellington; "Just by aiming for the middle: a study of year 9 mathematics schemes"; Megan Clark; Lecturer, Wellington College of Education.

Bell (nee Crocombe), Joanne; The University of Auckland; 1997; "Customising computational models"; A. Pullan; Research Scientist for AgResearch, Hamilton.

Bills, Robert A.; University of Waikato; 2000; "A model of follicular development and ovulation in mammals"; R. Murray and T. Soboleva; Fletcher Challenge Forests.

Binns, Stephen; Victoria University of Wellington; "The Effective Topos"; Rob Goldblatt; graduated PhD from Pennsylvania State University.

Boyes, Richard; The University of Auckland; 1998; "Towards modeling ventricular fluid dynamics"; P. Hunter, G. Mallinson; Working in an IT job in London.

Bracewell, Paul J.; MApplStats; Massey University (Albany); 2000; "Statistical methods for cricket team selection"; Denny Meyer; Lecturer in Statistics, Massey University (Albany).

Burnnand, Kerrin; The University of Auckland; 2002; "Generation and quality assessment of grids for tidal flow stimulation"; 2002; M. J. O'Sullivan; Engineer, Fisher and Paykel.

Byatt, David; University of Canterbury; "Convergent variants of the Nelder-Mead Algorithm"; Dr C.J. Price, Dr I.D. Coope; PhD student, University of Canterbury.

Chen, Hu-Ching; University of Canterbury; "Characterization of wavelets and construction of wavelet sets"; Dr H.Q. Bui.

Chou, Lin-Yu; The University of Auckland, Department of Mathematics; 2000; "On order 5 and order 6 symplectic explicit Runge-Kutta-Nyström methods"; Dr Phil Sharp; PhD student at University of Waikato.

Collie, Stephen; The University of Auckland; 2000; "Numerical modeling of the three-dimensional turbulent flow past upward yacht sails"; M. J. O'Sullivan; PhD student, Department of Engineering Science, The University of Auckland.

Daish, Katrina; University of Canterbury; "An evaluation of distance sampling for plants"; Dr J.A. Brown.

Darsono, Synthia Dewi (now Wang, Cynthia Dewi); Massey University (Albany); 2001; "The scattering of waves by an elastic floating body on water of variable depth"; Mike Meylan; Doctoral research student at Massey University (Albany).

Davey, Nicholas; The University of Auckland; 1998; "Resonances of AT-cut quartz strips"; P. Nielsen, P. Sharp.

Day (nee Scott), Amanda C; The University of Auckland; 1999; "Call repair for long-haul flight attendants"; D. M. Ryan; OR Group Leader, Air New Zealand.

Douillet, Cyrille; The University of Auckland; 2000; "Solving the incompressible Navier-Stokes problem on a two-dimensional mast and sail section"; M. Gerritsen.

Druce, Oliver; Victoria University of Wellington; Masters by papers and project "Records and rankings in a sequence of random variables"; Dong Wang.

Ee, Bernard Kuo Wei; Massey University (Albany); 2003; "An analysis of two-layered flows in pipelines"; Robert McKibbin; Doctoral research student at Monash University (Australia).

Enright, Jamas; Victoria University of Wellington; "Antimatroids and oracle complexity"; Geoff Whittle.

Flack, Bevan; Victoria University of Wellington; "Bayesian Cloud Classification of Multi-source Satellite Imagery with Spatio-temporal Dependence"; Yu Hayakawa and Tony Vignaux; Transpower NZ.

Filimon, Artemiza; The University of Auckland, Department of Mathematics; 2000; "Models of Interactive Rate Targetting Strategies With Announcement Dates"; Dr Wiremu Solomon; Dr Julian Wright & Dr Graeme Guthrie; (now Artemiza Woodgate) PhD student at University of Washington, Seattle.

Fouhy, John; Victoria University of Wellington; "Computational Experiments on Graph Width Metrics"; Rod Downey; PhD at Victoria University of Wellington.

Guild, Sarah-Jane; The University of Auckland; 1998; "Cardiac metabolism"; P. Hunter, D. Loiselle; PhD student, Medical School, The University of Auckland.

Hall, David; The University of Auckland; 2002; "Modelling the atrio-ventricular node"; P. Hunter.

Hall, Rhiannon; Victoria University of Wellington; "Excluded minors for the matroids of branch-width 3"; Geoff Whittle; DPhil student at Oxford.

Harrild, Kirsten; University of Canterbury; "An investigation into the use of acoustic pingers to prevent Hector's dolphin entanglement in gill nets"; Dr J.A. Brown.

Harrington, Justin; Victoria University of Wellington; "Topics in Foreign Exchange: The Spot Rate and the Forward Rate"; Peter Thomson; PhD student UBC, Canada.

Heaven, Matthew; The University of Auckland; 1997; "An algebraic algorithm for solving the assignment problem with complicating constraints; C. Dang.

Hedley, Warren; The University of Auckland; 1998; "Finite element modelling of the left ventricle using magnetic resonance image data"; P. Nielsen, A. Young; Working in San Diego for the NIH-funded 'Alliance for cellular signalling'.

Heung, Tony; The University of Auckland; 2000; "Automatic registration of 3D magnetic resonance images of the brain in multiple sclerosis"; P. Nielsen.

Hingano, Siofilisi; Victoria University of Wellington; "Uniform structures and uniformly continuous functions on topological groups and their factor spaces"; Vladimir Pestov; PhD, University of Ottawa.

Ho, Wai Ip; Massey University (Albany); 2001; "An analysis of the socio-economic indices in New Zealand"; Denny Meyer.

Hodgen, Edith; Victoria University of Wellington; "Cancer Forecasting in New Zealand"; Richard Arnold; Statistician and Data Manager, New Zealand Council for Education Research, Wellington.

Hristev, Ryurick; University of Canterbury; "Matrix techniques in artificial neural networks"; Associate Professor R.K. Beatson.

Hu, Peter; The University of Auckland; 2001; "Single-reservoir long-term hydro scheduling in an electricity pool market"; A. Philpott, G. Zakeri.

Jackson, Alan; University of Canterbury; "Global optimisation methods for oceanic acoustic modelling"; Dr C.J. Price.

Jackson, Bethanna Marie; The University of Auckland, Department of Mathematics; 2000; "Effective order of Runge-Kutta Methods with zero spectral radius"; Professor John Butcher; PhD student at Imperial College.

Johnston, Steven; Victoria University of Wellington; Masters by papers and dissertation "A Review of an application of the Accelerating Moment Release Model to Produce Earthquake Probability Forecasts"; David Vere-Jones; PhD student, Victoria University of Wellington.

Kao, Jake; Massey University (Albany); 2001; "Generalizations of free objects"; Yow-Tzong Yeh; Education consultant in China.

Kazakov, Dimitri; Victoria University of Wellington; "Counting Derangements", Colin Bailey.

Keating, Paul; The University of Auckland; 1998; "Vessel scheduling with time windows using probabilistic column generation"; A. Mason, M. Rönnqvist.

Kensington-Miller, Barbara Ann; The University of Auckland, Department of Mathematics; 2002; "Professional development of senior mathematics teachers in low-decile secondary schools in New Zealand"; Associate Professor Bill Barton; PhD student at The University of Auckland.

Lam, Heung Yeung; Massey University (Albany); 2001; "The development of the elliptic functions according to Ramanujan"; Shaun Cooper; Doctoral research student at Massey University (Albany).

Lim, Leng Leng; University of Canterbury; "Computer-aided teaching and testing"; Dr E. Chacko, Mr R.L. Broughton.

MacDonald, Ian T.; University of Waikato; 2003; "Edge-waves on beaches of arbitrary profile"; A. Sneyd; NIWA.

Malcolm, Duane; The University of Auckland; 2000; "Estimating the material properties of inhomogeneous elastic membranes"; P. Nielsen, P. Hunter; PhD student in the Bioengineering Institute, The University of Auckland.

Martindale, Charlotte E.; University of Waikato; 1999; "A dynamical systems model of the soil sulphur cycle"; G. Wake and A. Sneyd; working in Australia.

Mayhew, Dillon; Victoria University of Wellington; "Inequivalent representations of certain classes of matroids"; Geoff Whittle; DPhil student at Oxford.

McLennan, Tim; University of Canterbury; "Improving the performance of a fast multipole method for thin-plate splines"; Associate Professor R.K. Beatson.

McGowan, James; University of Canterbury; "Effects of particulate air pollution on cardiorespiratory admissions in Christchurch, NZ"; Dr E. Chacko.

McGregor-MacDonald, Simon; Victoria University of Wellington; "Path-following methods for linear programming: a comparison with the simplex method"; Tapas Sarkar; Data modeller, Market21 Pty Ltd, Sydney.

McInnes, Leland; University of Canterbury; "Algorithms in invariant theory and quasi-minimal bracket expressions"; Dr M.S. Hickman; PhD student, Univerity of Western Ontario.

McLean, Stephen; The University of Auckland; 2003; "Finding efficient treatment plans in radiation therapy; M. Ehrgott; Lending Officer with Southern Cross Mortgages.

Merrifield, Alistair; Victoria University of Wellington; "An examination of prospective foreshock probabilities in New Zealand"; David Vere-Jones, Martha Savage; PhD University of Sydney.

Nickerson, David; The University of Auckland; 1998; "Electro-mechanical modelling of cardiac cells"; P. Hunter; PhD student in the Bioengineering Institute, The University of Auckland.

Nissen, Kirsten; University of Canterbury; "Accelerated life testing of tires—computational posterior estimation"; Dr F.R. Lad.

O'Sullivan, Matthew; The University of Auckland; 2002; "Optimal fibre-optic cable layout using dynamic programming"; A. Philpott, M. O'Sullivan Jr.

Papps, Simon; The University of Auckland; 1998; "Harvest planning in forestry with uncertain future prices and demands"; A. Philpott.

Patel, Kamalnayan; The University of Auckland; 2002; "Electrochemical and thermal modelling of high power lithium-ion batteries"; M. J. O'Sullivan.

Paul, Sue; Victoria University of Wellington; "Estimation of Fish Density and Location Using Trawl Data"; A Vignaux, Y. Hayakawa.

Peter, Malte Andreas; Massey University (Albany); 2002; "The interaction of multiple bodies and water waves with application to the motion of ice floes"; Mike Meylan; Doctoral research student at University of Bremen (Germany).

Pohl, Colin; The University of Auckland; 1999; "A radial basis function approach to financial time series forecasting"; A. Philpott, V. Kecman.

Raghu, Rashmi; The University of Auckland; 2003; "Forward and inverse modeling of muscles of the human jaw"; A. Pullan, PhD student at Stanford University.

Randal, John; Victoria University of Wellington; "The Constant Elasticity of Variance in the Option Pricing Mode"; Peter Thomson; Lecturer in Econometrics Victoria University of Wellington.

Rangiwhetu, Todd; Victoria University of Wellington; "Concentration and group representations in

Banach spaces"; Vladimir Pestov; teaching in London, UK.

Reid, Stephanie; Victoria University of Wellington; "The Classes of Algorithmically Random Reals"; Rod Downey; PhD at Victoria University of Wellington.

Reilly, James M.; The University of Auckland, Department of Statistics; 2001; "The development and evolution of statistical matching applications"; Professor Alastair Scott; PhD student at The University of Auckland.

Rosser, Edward; The University of Auckland, Department of Mathematics; 2002; "Computational inference in electrical impedance tomography"; Dr Colin Fox & Dr Geoff Nicholls; Currently embarking on his big OE after a period as a cycle courier here in Auckland.

Ryland, Brett; Massey University; 2002; "Nonholonomic dynamical systems"; Professor Robert McLachlan.

Scheffer, Judith-Anne; Massey University (Albany); 2000; "An analysis of the missing data methodology for different types of data"; Barry McDonald; Part-time student and tutor, Massey University (Albany).

Schulte, Rolf; The University of Auckland; 2002; "Development of a human heart model"; A. Pullan, O. Dossel; PhD student in Switzerland.

Selvaratnam, Anton; Massey University; 2000; "Geometrical interpretations of B\"acklund transformations and certain types of partial differential equations"; Associate Professor Bruce van Brunt.

Senerath, Padma; Massey University; 2000; "Fundamentals of Riemannian geometry and its evolution"; Dr Gillian Thornley.

Snowdon, Jody; The University of Auckland; 1999; "Simultaneous train timetabling and crew scheduling"; D M Ryan.

Somervell, Michael; The University of Auckland; 1998; "Progressive hedging in parallel"; S. Henderson, A. Mason, G. Zakeri.

Srebotnjak, Tanja; The University of Auckland, Department of Statistics; 2000; "Bayesian Modelling of Survival Data Using Mixtures of Distributions"; Dr Renate Meyer & Professor W. Urfer.

Stewart, Robert; The University of Auckland; 1999; "A model of the moisture distribution during the production of medium density fibreboard"; I. Collins, K. Jayarama.

Tawamala Gamage, Janapriya; Victoria University of Wellington; title unavailable; Tapas Sarkar.

Teirney, David; The University of Auckland; 1999; "Yacht match-race simulation"; A. Philpott, S. Henderson; Analyst, Orion systems.

Timarac, Daniel; The University of Auckland, Department of Mathematics; 2001; "Simulation of M32, M110 and the disk of M31"; Dr Phil Sharp; Working for a software firm.

Timarac, Dejan; The University of Auckland, Department of Mathematics; 2002; "Using one-step methods to find the orbit of an asteroid"; Dr Joel Schiff & Dr Phil Sharp; Working (with his brother Daniel) for a software firm.

Timarac, Sanya; The University of Auckland, Department of Mathematics; 2002; "A survey of models and numerical techniques for option pricing"; Dr Rod Gover & Dr Wiremu Solomon; employed by MCA as an actuarial analyst.

Tsai, Angela Yi Jing; The University of Auckland, Department of Mathematics; 2000; "A study of extrapolation applied to hamiltonian problems"; Dr Robert Chan; PhD student at The University of Auckland.

Tse, Pui-Sze Priscilla; The University of Auckland, Department of Mathematics; 2003; "Lie group methods in geometrical integration"; Professor John Butcher; PhD student at La Trobe University.

Upton, Darren; Victoria University of Wellington; "A one-factor spot rate model for the New Zealand term structure of interest rates"; Peter Thomson; PhD, Cambridge.

Walker, Cameron; The University of Auckland; 2001; "A real-time optimisation model for the

resolution of disruptions to a train schedule"; D. M. Ryan; Lecturer, Department of Engineering Science, The University of Auckland.

Wang, Yueguang (Jane); Victoria University of Wellington; "Sochastic models of certain Pavlovian conditioning learning experiments"; Peter Smith.

Weeraprajak, Issarest; University of Canterbury; "A comparative study of time-series forecasting applied to stock market price"; Dr E. Chacko.

Williams, Clemency; University of Canterbury; "The analytic art: Fran\'Aois Vi\"Ete and the development of mathematical analysis"; Dr J. Hannah, Dr P. Catton; Completing PhD at Brown University.

Wright, Benjamin; The University of Auckland; 2002; "A computationally efficient approach for generating body surface potentials for ventricular activation wavefronts"; A. Pullan.

Yassi, Rita; The University of Auckland; 2003; "Electrical activity of the stomach and small intestine"; A. Pullan; PhD student in the Bioengineering Institute, The University of Auckland.

CENTREFOLD

Professor Charles Pearce

Charles E.M. Pearce FNZMS, F AustMathSoc

Charles was born in 1940 in Wellington and was educated there. He obtained his BSc (a double major in Applied and Pure Mathematics and a further double major in Physics and Mathematical Physics) and in 1962 he gained a MSc with first class honours in Mathematics, all from Victoria University of Wellington. The Bachelor's degree, it must be asserted, was from the University of New Zealand, as the constituent colleges of UNZ, of which Victoria University College was one of four, had proliferated into four autonomous Universities by the time Charles completed his Masters degree. It was at this time I first became aware of Charles who was a prominent figure in all ways then, and as now 41 years later, both physically and intellectually. I was then studying 3rd year Applied and Pure Mathematics at Victoria University of Wellington, and he was my senior by a couple of years. Certainly I was the inconspicuous one.

Charles has throughout his long ongoing career worn his NZ origins with strength and pride. Being descended from the Maori people he could claim his NZ ancestry was longer than almost all his peers from NZ. He remains essentially a true New Zealander although he has not lived here since 1962. As a very frequent visitor to our shores he and we have seen his contacts here grow enormously-heightened by his high stature in probabilistic and statistical modelling. He is well-known to the mathematical community here as he is indeed throughout the world.

His early schooling was in Wellington and he was dux of Hutt Valley High School in 1957. He is descended from Alexander Gray, one of just five Scots who settled in New Zealand as part of the original and largely unsuccessful NZ Company settlement of 1826. The marriage in 1830 of his full Maori ancestor Hinerangi to Alexander is the first entry in the marriage register in Paihia in the Bay of Islands. His long history of NZ connections (some 22 generations, no less) has led to his having a life-long passion for Maoritanga. He claims with great pride his connection back to three waka (canoes) in the heke (migration): Aotea, Kurahaupo and Takatimu. His principal tribal connection is with the Ngati

Ruanui, which is a tribe based in the southern Taranaki.

In 1963 Charles left New Zealand for doctoral study at the Australian National University (ANU) in Canberra, under the supervision of the late Professor P. Moran. Thereafter followed short stints (1 to 3 years) as Lecturer in ANU; Queensland (visiting Professor); Rennes, France; and Sheffield (1966 –68). He was appointed to the University of Adelaide in 1968 and has remained there for the ensuing 25 years having been appointed Reader in 1982. He is a leading figure in their Department of Applied Mathematics there. While at ANU, he met and married Frances (née O'Connor), and they have brought up their family in Adelaide. Charles has published prolifically in the area of probabilistic and statistical modelling and analysis, with strong contributions being made in both theory and practice. The former are amazingly detailed papers of high abstract quality. His forthcoming book (with Dragomir) addresses the fine points of the Hermite-Hadamard inequality and is being published by Kluwer Academic Press. His applied interests include queuing theory, road traffic, telecommunications, and urban planning. With former student Bill Henderson (now deceased), who followed him from Sheffield to Adelaide, he helped establish the successful Tele-traffic Centre in the University of Adelaide.

A recent calculation showed that he had attracted research funding totalling over $A1.1 million in competitive research grants and contract research awards since 1986, which is when we started counting. Publications are numerous and include a book (with S.S. Dragomir), 23 book chapters, and well over 200 research articles. He is a sought after and frequent visitor to research centres around the world. Last year he visited Brazil, Toulouse in France, Hungary and Korea. Often these visits are as an invited speaker. He has to his record 19 successful PhD students (plus 10 in progress), and many other smaller project activities.

But it does not stop there. With the formation of the Division of Applied Mathematics of the Australian Mathematical society, Charles soon emerged as a key figure. The most enduring significant role has to be his stewardship as Chief Editor of their Applied Mathematics Journal, now called *The ANZIAM Journal of Applied Mathematics*, which is arguably the best Applied Mathematics Journal in the southern hemisphere. The formation of ANZIAM in 1993 (hatched during a meeting in Adelaide) must have warmed Charles's heart, as it encapsulated the union he espoused of joint activity in Applied Mathematics involving both Australia and New Zealand. He has been a strong worker for ANZIAM and it was fitting that this, along with his outstanding research work, was recognised by the award of the ANZIAM medal in 2001. This is a premier award for scholarly contributions, awarded every two years. It is significant that three of the four awardees are from Adelaide.

Student feedback is warm and generous: students write of his outstanding experience and breadth of knowledge, and of being an excellent mentor. He shows his consulting arena very strongly and those of us who attend the Mathematics-in-Industry Study Groups can see firsthand his talents in this area.

The sheer volume of quality activities with which Charles is involved seem insurmountable: I used to wonder if he ever slept, but I did once observe this at a Council meeting—however, he then floored me with a most accurate and penetrating summing-up question, proving that he indeed listens actively whilst *appearing to sleep*!!

Those of us on this side of "the ditch" wonder why Charles was never lured back permanently to his country of origin. But we need to keep trying. Meantime, it has been fitting that very recently Charles was elected as a *Fellow of the New Zealand Mathematical Society*, which sets into concrete the strong affinity and connection he has with New Zealand. I'm certain he would support the All Blacks even when they are playing the Wallabies!! Meanwhile the NZ mathematical community can take pride in the ongoing contributions of one of its distinguished famous sons. Well-done: Charles Pearce FNZMS.

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Centrefolds Index

BOOK REVIEWS

Information has been received about the following publications. Anyone interested in reviewing any of these books should contact

David Alcorn
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SPRINGER-VERLAG

Adem A, Cohomology of finite groups. (2nd ed) (Grundlehren der Mathematische Wissenschaften, 309) 325pp.
Aigner M, Proofs from THE BOOK. (3rd ed) 239pp.
Arnold VI, Lectures on partial differential equations. (Universitext) 157pp.
Barth WP, Compact complex surfaces. (2nd ed) (Ergebnisse der Mathematik und ihrer Grenzgebiete. 3 Folge, 4) 436pp.
Benth FE, Option theory with stochastic analysis. An introduction to mathematical finance. (Universitext) 162pp.
Beuter A, Nonlinear dynamics in physiology and medicine. (Interdisciplinary Applied Mathematics, 25) 434pp.
Bingham K (ed), New analytic and geometric methods in inverse problems. 381pp.
Boscain U, Optimal synthese for control systems on 2-D manifolds. (Mathematiques et Applications, 43) 261pp.
Boubaki N, Elements of Mathematics. Integration I. Chapters 1-6. 472pp.
van Brunt B, The calculus of variations. (Universitext) 670pp.
Christensen C (ed), Algebra, arithmetic and geometry with applications. 784pp.
Cuntz J, Cyclic homology in non-commutative geometry. (Encyclopaedia of Mathematical Sciences, 121) 137pp.
Emmer M (ed), Mathematics and culture I. 352pp.
Eriksson K, Applied mathematics: body and soul. Derivatives and geometry in R^3. 426pp.
Eriksson K, Applied mathematics: body and soul. Integrals and geometry in R^n. 360pp.
Eriksson K, Applied mathematics: body and soul. Calculus in several dimensions. 428pp.
Fuchs DB, Topology II. Homotopy and Homology. Classical manifolds. (Encyclopaedia of Mathematical Sciences, 121) 257pp.
Godement R, Analysis I. Convergence, elementary functions. (Universitext) 430pp.
Kurzweil H, The theory of finite groups. An introduction. (Universitext) 387pp.
Lam TY, Exercises in classical ring theory. (2nd ed) (Problem Books in Mathematics) 328pp.
Lando SK, Graphs on surfaces and their applications. (Encyclopaedia of Mathematical Sciences, 141) 455pp.
Ma Y, An invitation to 3D-vision. (Interdisciplinary Applied Mathematics, 26) 526pp.
Margulis GA, On some aspects of the theory of Anosov systems. (Springer Monographs in Mathematics) 139pp.
McCrimmon K, A taste of Jordan algebras. (Universitext) 562pp.
Mikosch T, Non-life insurance mathematics (Universitext) 235pp.
Pedregal P, Introduction to optimization. (Texts in Applied Mathematics, 46) 245pp.
Protter PE, Stochastic integration and differential equations. (2nd ed) (Applications of Mathematics, 21) 415pp.
Russo L, The forgotten revolution. How science was born in 300BC and why it had to be reborn. 487pp.
Seydel RU, Tools for computational finance. (2nd ed) (Universitext) 240pp.
Shpilrain V, Combinatorial methods. Free groups, polynomials, free algebras. (CMS Books in Mathematics) 317pp.
Straughan B, Semigroups, boundary value problems and Markov processes. (Springer Monographs in Mathematics) 337pp.
Taira K, Dynamical systems in population biology. (CMS Books in Mathematics) 276pp.
Teuscher C (ed), Alan Turing: life and legacy of a great thinker. 542pp.
Walker P, Examples and theorems in analysis. 287pp.
Wiggins S, Introduction to applied nonlinear dynamical systems and chaos. (2nd ed) (Texts in Applied Mathematics, 2) 808pp.
Zorich VA, Mathematical analysis I & II. (Universitext) 574+641pp.

BIRKHÄUSER PUBLICATIONS

Albeverio, S, Nonlinear hyperbolic equations, spectral theory and wavelet transformations. (Operator Theory: Advances and Applications) 446pp.
Andreu-Vaillo, F, Parabolic quasilinear equations minimizing linear growth functionals. (Progress in Mathematics) 356pp.
Antreich, K, Modeling, simulation, and optimization of integrated circuits. (International Series of Numerical Mathematics) 376pp.
Colli P (ed), Free boundary problems. (International Series of Numerical Mathematics) 356pp.
Gray, A, Tubes. (2nd ed) (Progress in Mathematics) 296pp.
Gohberg, I, Basic classes of linear operators. 444pp.
Gohberg, I, Operator theoretical methods and applications to mathematical physics. (Operator Theory: Advances and Applications) 492pp.

Krausshar SR, Generalized analytic automorphic forms in hypercomplex spaces. (Frontiers in Mathematics) 184pp.
Picco, P, From classical to modern probability. (Progress in Probability) 236pp.
Thas K, Symmetry in finite generalized quadrangles. (Frontiers in Mathematics) 240pp.

ESSENTIAL MATHEMATICAL BIOLOGY

by Nicholas F. Britton, Springer Undergraduate Mathematics Series, Springer-Verlag, Berlin, 2003, 335 pp, EUR 29.95. ISBN 1-85233-536-X

Britton writes a book that provides for an introductory account of mathematical biology. The book is for readers that have knowledge of a standard calculus and standard differential equations course. The author provides the main results of the calculus and differential equations needed in an appendix. The major topics covered in the book include population dynamics, infectious diseases, population genetics and evolution, biological motion, molecular and cellular biology, pattern formation and tumour modelling. Many examples are given to illustrate these topics. The figures are clear and precise. All mathematical formulae, equations and models are complete, clear and readable. A `hints on how to' solve the exercises is included in an appendix. The author provides a website link which provides more detailed solutions to the exercises. The book consists of eight chapters and five appendices. The author includes a useful introduction and conclusions section for each of the eight chapters.

Chapter one introduces the population dynamics of a single species. A model for insect populations with competition is discussed. Differential equation models, harvesting and fisheries, Euler-Lotka equations (discrete and continuous time) are among some of the topics presented within this chapter. Chapter two examines the population dynamics of interacting species. Lotka-Volterra prey predator equations are described. Models of functional response are developed. The author concentrates on predation and competition. In chapter three the author asks and answers the following questions. Will there be an epidemic? If the answer is yes, then how many will be affected? Is the disease endemic? If the answer is yes, then what is the prevalence of the infection? The author continues by asking can the disease be controlled or even perhaps eradicated? What is the effect of the population age? A basic model for macroparasitic diseases is presented and evolutionary aspects are discussed. Chapter four discusses population genetics and selection. This includes selection for a dominant allele, for a recessive allele, selection against dominant and recessive alleles, an analytical approach for weak selection and the balance between selection and mutation. The author outline evolution of the genetic system and introduces game theory. Chapter five introduces the reader to the concept of the motion of cells or organisms. The macroscopic theory of motion is discussed. Organisms and cells can move towards or away from an external stimulus. This movement is called a taxi. Steady state equations are presented. An example given is a model for muskrat dispersal. Travelling wave solutions of general reaction-diffusion equations and of systems are described. Chapter six is concerned with molecular and cellular biology. Neural modelling, immunology and AIDs are discussed. Biochemical kinetics, metabolism, activation and inhibition are sections included within this chapter. Chapter seven concentrates on biological pattern formation. Ideas of linear stability theory and activator-inhibitor systems are explored. The author asks and answers the following question. Do activator-inhibitor systems explain biological pattern formation? Tail patterns of the cheetah, jaguar and leopard, angelfish patterns and patterns in bacteria are shown. Chapter eight explores modelling of tumours. Phenomenological models, nutrients, moving boundary problems, growth promoters, inhibitors, metastasis and the immune system response are topics covered within this chapter.

The appendices contain information and results on: a) difference equations, b) ordinary differential equations, c) partial differential equations, d) non-negative matrices and e) hints for the exercises.

The author gives ideas for further reading. The material in the book is clear and concise. The book provides the reader with a wealth of information and is well suited as a textbook for a course in mathematical biology. I highly recommend this book to everyone interested in mathematical biology. It makes a worthwhile addition.

Paul Johnson
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GALOIS THEORY OF LINEAR DIFFERENTIAL EQUATIONS

by Marius van der Put and Michael F.Singer, Springer-Verlag, Berlin, 2003
438 pp, EUR 89.95. ISBN 3-540-44228-6

This book is an introduction to the algebraic, algorithmic and analytic aspects of Galois theory of homogeneous linear differential equations. The Galois theory of these equations has its origins in the 19th century and was put on a firm footing by Kolchin in the 20th century. It has experienced a resurgence of activity in recent years. This book presents many of the recent results and approaches to this classical field. The Galois theory of linear differential equations is the analogue for linear differential equations of

the classical Galois theory for polynomial equations. The natural analogue of a field in this context is the notion of a differential field. This is a field k together with a derivation (derivative) d :k ® k that is an additive map which satisfies d (ab)=(d a)b + a(d b) for all a,b in k. With the exception of the last chapter all the fields considered have characteristic 0. A linear differential equation is taken is taken as an equation of the form dY = AY where A is an n ´ n matrix with entries in k which is equivalent to a single scalar differential equation of the form $L(y) = d^n y + a_{n-1} d^{n-1}\}y + ... + a_0 y = 0$. For an equation of this type there is the notion of a "splitting field", the so called Picard-Vessiot extension, which contains "all" solutions of $L(y) = 0$ and has the additional structure of being a differential field. The differential Galois group is the group of field automorphisms of the Picard-Vessiot field fixing the base field and commuting with d. This group, although defined abstractly, can be represented as a group of matrices and has the structure of a linear algabraic group, i.e., a group of invertible matrices defined by a set of polynomial relations on the entries of these matrices. There is then a Galois correspondence identifying differential subfields with linear algebraic subgroups of the Galois group. Corresponding to the notion of solvability by radicals for polynomial equations is the notion of solvability in terms of integrals, exponentials and algebraic expressions of the functions appearing in the differential equation. Solvability of this type can be characterised in terms of the Galois group. This book gives a thorough treatment of recent developments of the Galois theory of homogeneous linear differential equations. Included in the first chapters are the study of differential operators over a differential field k and the study of differential equations over the field of fractions of the ring of formal power series over the field of complex numbers provided with the usual differentiation $\partial = \frac{d}{dx}$.

The next topic covered is the explicit calculation of the differential Galois group of a differential equation. This can in some cases be done by means of an effective algorithm. The book then goes on to relate analytical properties of the solutions and their relation to the properties of the underlying Galois group. Incorporated in this treatment is a version of Hilbert's 21st problem. Included in the study of the analytic properties are the conditions that determine uniqueness of solutions and their singular directions and the related Stokes phenomenon. These play a crucial role in the succeeding chapters where an analytic description of the Galois group as well as a classification meromorphic differential equations is given. Indeed it is established that any linear algebraic group occurs as a differential Galois group of a differential equation and the minimal number and type of singularities such an equation should have to realise a given group are determined. Particular reference is made to when the group is semisimple. Finally there is some discussion of the extension of these ideas over a field of characteristic $p > 0$. This book is comprehensively written and contains exercises and examples throughout. Many of the mathematical tools required in the text but not directly part of the content are given in a number of appendices. What is not covered in this book are discussions of the arithmetic theory of linear differential equations as well as the Galois theory of nonlinear differential equations. This book is comprehensively written and thorough but requires (for the reviewer at least) some effort to get the best out of it.

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MATHEMATICAL BIOLOGY II: SPATIAL MODELS AND BIOMEDICAL APPLICATIONS
(3rd ed)
by J. D. Murray, Springer–Verlag, 2003, 811pp, ?84.95. ISBN 0-387-95228-4.

This is the second volume of the third edition of Murray's "Mathematical Biology". The book was split into two volumes after the second edition [1], and I have previously reviewed the first volume of the third edition (NZMS Newsletter, vol 87).

Murray's intention was that this second volume would concentrate more on spatially-extended systems, and would thus require more knowledge about PDEs and more mathematical maturity than the first volume. This is certainly the case—volume II covers a wide variety of problems in pattern formation, each discussed in its biological context.

There are several chapters dealing with waves of various types, including the spread of GM organisms and the patterns formed by a single inoculation of bacteria on an agar plate. While the model for the spread of GMOs is too simple to be realistic, it does give some indication of possible outcomes and provides a starting point for further work. The experimentally obtained bacteria patterns show surprising regularity and symmetries. Some models involving chemotaxis (the movement of organisms up a concentration gradient—effectively negative diffusion) are given and they successfully reproduce some of the patterns.

In another interesting chapter, Murray discusses the well-known Turing instability for pattern formation in reaction-diffusion systems, and extends these results to the case of a growing domain. Examples include the formation of stripes on alligators and also the patterning of their teeth! (The teeth form in a precise spatial pattern and order as the jaw grows.)

There are two chapters on wound healing, dermal and epidermal. Although wound healing is still far from well understood, Murray argues that studying mathematical models of the process can only help, in highlighting gaps in our knowledge and suggesting experiments to perform, the ultimate goal being scarless healing. Also, constructing a model forces one to choose between several possible mechanisms and to decide what is truly essential, both in terms of variables and processes —an important skill for any modeller.

Other chapters deal with the growth of brain tumours, pattern formation in neural systems, and wolf pack territoriality. I was disappointed that the chapter on neural pattern formation has not been updated for this edition, save for the addition of several pages on "shamanism and rock art" in which Murray discusses the apparent similarities between children's scribblings, images on rocks that have been painted by ancient people—perhaps under the influence of hallucinogenic drugs—and the patterns that occur in some neural models under the variation of a parameter. While this is interesting, it would have been better to summarise some of the results in this active field from the past 15 years.

This volume alone is a large book, with more than 800 pages and a similar number of references. There are 14 chapters, 8 of which are new. These new chapters largely describe the work done by Murray and his students over the past ten years. As a consequence, this volume sometimes seems a little like a "collected works". However, it is a valuable collection of results from different areas of mathematical biology.

In summary, much of this volume consists of applications of reaction-diffusion equations to biological systems, with plenty of explanation as to their biological context and subsequent analysis of the equations. There is much in both volumes to keep an applied mathematician busy. Combined, they would provide ample material for an advanced course on mathematical modelling, nonlinear dynamics, or mathematical biology.

References

[1] J. D. Murray. Mathematical Biology (2nd, corrected edition). Springer –Verlag, 1993.

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SET THEORY

The third millennium edition, revised and expanded, by Thomas Jech, Springer Monographs in Mathematics,
Springer-Verlag, Berlin, 2003, 769 pp, US$129.00. ISBN 3-540-44085-2

Jech's book, "Set theory" (Academic Press, New York, 1978) has been a standard reference for over 25 years. This "Third Millennium Edition", not only includes all the materials in the first two editions, but also covers recent developments of set theory during the last 25 years. We believe that this new version will become a standard reference on set theory for the next few years.

The book is divided into three parts. Part I, Basic Set Theory, includes the Zermelo-Fraenkel axioms of set theory, ordinals and cardinals, real numbers, the axiom of choice, fundamentals of combinatorial set theory, a brief introduction of large cardinals, Borel and analytic sets, and basics of models of set theory. Everything in this part is derived from scratch. However, the pace is so fast that a beginner should have read other introductions to set theory before reading this book.

Part II, Advanced Set Theory, contains the important techniques and ideas of modern set theory. This part can be used as a textbook on set theory for graduate students. Chapter 13 introduces Gödel's theory of constructible sets, which leads to the consistency proofs for the axiom of choice and the GCH (generalized continuum hypothesis). Chapter 14 deals with forcing, generic models, Boolean-valued models, and Cohen's independence results. In Chapters 15 and 16, the author applies forcing to Suislin's problem, and presents several applications of Martin's Axiom. Chapters 17, 18, 19, 20, 21 provide an extensive exposition of large cardinals. In Chapter 17, the author shows that while "smaller" large cardinals (Mahlo, weakly compact) can exist in L, the Gödel's constructible universe, the " bigger" large cardinals (measurable, Ramsey) cannot. Chapter 18 introduces the concept of $0^{\#}$ (zero-sharp), and gives an outline of the proof of Jensen's covering theorem. Chapter 19 is on the generic ultrapowers and inner models for sequences of measures. Chapter 20 is devoted to the study of the strongly compact cardinals, the supercompact cardinals and extenders, and also introduces the Woodin cardinals, all of which have played crucial roles in the theory of large cardinals. In Chapter 21, the author presents several forcing techniques, like Kunen-Paris forcing, Silver forcing, Prikry forcing, etc., which are used for changing cofinalities, and for violating Singular Cardinal Hypothesis that use large cardinals. Chapters 22 and 23 are devoted to the results on saturated ideals, precipitousness and saturation of the nonstationary ideals. In

Chapter 24, the author introduces Shelah's *pcf* theory, and gives a complete proof of Shelah's result that if $\aleph_\omega$ is a strong limit cardinal then $2^{\aleph_\omega} < \aleph_{\omega_4}$. Chapter 25 continues the investigation of descriptive set theory and Chapter 26 presents a brief discussion of cardinal invariants related to measure and category.

In Part III, the author provides several current research topics in set theory from areas as diverse as forcing theory, inner model theory, descriptive set theory, as well as the connection of these areas with large cardinals. A number of equiconsistency results are mentioned (e.g., consistency strength of AD in Chapter 33, of the failure of the singular cardinal hypothesis in Chapter 36). Proofs given in this part are sketchy, and several results are only stated without proofs (the corresponding references are mentioned in the context). Because of the breadth of areas covered, Part III will be a good reference manual for set theorists to look up for recent developments in set theory.

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THE LEBESGUE-STIELTJES INTEGRAL

by M. Carter and B. van Brunt , Undergraduate Texts in Mathematics, Springer-Verlag, Berlin, 2000, 228 pp, US$49.95. ISBN 0-387-95012-5

The aim of the authors of this book is to illuminate the basics of analysis and to bring students to some fertile area where interesting and prospective analytical problems may be formulated. Integration theory is a good topic which allows both to be done. The main difficulty to be overcome is the supposedly very low level of general mathematical knowledge of the students. There are two possible ways to accomplish the job:

1. Begin with an elementary course of analysis based on classical Weierstrass and Cantor theorems and the Borel lemma. This way would naturally bring the authors to the standard path which would immediately results in the serious development of the total material covered.
2. Find special elegant tricks which permit the introduction of basic ideas, like countable additivity or absolute continuity, through the back door at low cost (or even not to introduce them at all) but still arrive at a reasonably complete version of the integral (or at least the version which students may memorize as a complete version whose main aspects they will not need to reconsider in the near future when meeting integrals in other parts of analysis).

Neither of two versions is ideal, if one has in mind the shaky basement of the building of calculus taught to students in our time on levels 1 and 2. The authors choose the second option. What is lost in their approach?

First of all, the classical theorems of analysis. In particular, the second Weierstrass theorem which normally serves a base for the solution of most of linear and some non-linear equations, for instance by the finite element method. Presumably the authors assume that the necessary material may be included into other courses. Is it possible to do it without a rush? And, if it is done anyway, why should we restrict ourselves to the back-door if the front door is already opened by somebody else?

Next, countable additivity. It has disappeared together with all measure theory. This seems to be an even bigger loss, since the countable additivity (or "continuity") of the Lebesgue integral is a foundation for all theorems describing passing to the limit. In particular, the proof of the important Lebesgue dominant convergence theorem is lost. And even the formulation is deficient—the requirement of monotonity is excessive.

One further essential gap is the Fubini theorem. The essence of the theorem is the existence of the repeated integral for the absolutely integrable function $f(x,y)$ on each of variable for almost all values of the complementary variable. The standard formulation of the result includes the measurability of another function $\tilde{f}(x,y)$, such that the difference $f - \tilde{f}$ is zero almost everywhere. This substitution of f by $\tilde{f}$ is the most essential and difficult part of the proof. Students who believe that the statement of the Fubini theorem suggested by the authors is complete, may be disconcerted when meeting the material "in real life".

The last part of the book contains a sketchy review of applications of the Lebesgues integral, in particular to Fourier analysis and the Sturm-Liouville problem. The friendly style of these paragraphs, with trivial algebraic calculations, may also mislead young readers, suggesting to them the idea that everything is simple and that the book contains all they need to know.

I understand perfectly that the authors did a good job, selecting the proper material for this publication. I am sure that, when teaching this course, they have discussed in detail most of the gaps which remain in the published text—the traces of these discussions are present in numerous places of the book, for example at the end of (9.3). But it seems that generally the wish to cover as much interesting material as

possible, in a friendly manner, has resulted in a text which may be misleading in places.

For instance, the authors discuss in (9.4) the Sturm-Liouville problem. The main result from this important area is, probably, the completeness of the system of eigenfunctions (Th.9.42). Here the easy style of the authors brings the unwary reader to the edge of a dangerous swamp by failing to give sufficient emphasis to the necessity for the function *r* to be strictly positive on the interval.

The last, but not the least of my remarks is about the list of references, You may find numerous classical books in it (like Courant and Hilbert's "Methods of Mathematical Physics" or Titchmarsh's "Eigenfunction expansions") but few of recent vintage. Presumably the recent books by Bartle and Lieb in the AMS Graduate Studies in Mathematics series and a handful of publications by Kurzweil and others on the Kurzweil-Henstock integral are too recent to have been included.

All the previous remarks were about the choice of the material and the style. One can also find some shaky places in the proofs provided. Generally the statements (when proven) are proven accurately. But the approaches are not systemized, the choice of them is done at random. Sometimes the proofs are too discursive or too formal. For instance theorem 27.4 gives a condition for boundedness of variation in terms of absolute continuity. The proof is long and formal. In fact, by defining the absolute continuity as a uniform estimate $\sum_i |f(x_i) - f(x_{i-1})| \le \varepsilon$ for $\sum_i |x_i - x_{i-1}| \le \delta$, $\varepsilon(\delta) \to 0$ if $\delta \to 0$, the authors could use the triangle inequality to estimate the variation V_a of the function on the lattice $\{a_s\}$, $V_a = \sum_s |f(a_s) - f(a_{s-1})|$ by variation of the function on the product of lattices $\{y_t\} = \{a_s, x_i\}$ with the uniform lattice, $x_i - x_{i-1} = \frac{b-a}{N}$:

$$\sum_s |f(a_s) - f(a_{s-1})| \le \sum_s |f(y_i) - f(y_{i-1})| \le$$

$$\le \sum_i \sum_{y_s, y_{s-1} \in \Delta_i = [y_s, y_{s+1}]} |f(y_s) - f(y_{s-1})| \le \varepsilon(\frac{b-a}{N})N.$$

Still, I guess that creation of a friendly, honest and attractive textbook (or rather a book of problems with accompanying commentary) for modern students learning classical analysis at Stage 3, is POSSIBLE. The book in question is a step in this direction but it demonstrates that any attempt to bring students to the front-line of professional mathematics while avoiding the classical theorem of Analysis is a difficult task, which needs very accurate placed and exact comments from the tutor, and can't be left entirely to a written text like one referred to. So I would recommend this book for use by a qualified tutor who could combine the friendly approach with the production of attractive vistas and exact criticism but I would hesitate to recommend it to students for independent reading.

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THE PROBLEM OF INTEGRABLE DISCRETIZATION: HAMILTONIAN APPROACH
by Yuri B. Suris, Birkhäuser-Verlag, 2003, 1092 pp, EU 158.36. ISBN 3-7643-6995-7.

In one of the earliest and still one of the most striking and influential uses of computers in mathematics, Enrico Fermi and Stanislaw Ulam decided in the early 1950s to use the then brand-new {\sc maniac} computer at Los Alamos to study problems in physics. They sought a problem which was simple to state but could not be solved by the existing mechanical computers, and settled on the nonlinear discrete string (or "lattice") described by the ODEs

$$m\ddot{y}_i = k(y_{i+1} - 2y_i + y_{i-1}) + k\,a((y_{i+1} - y_i)^2 - (y_i - y_{i-1})^2)$$

with boundary conditions $y_0(t) = y_N(t) = 0$ and initial conditions $y_i(0) = \sin(i\pi/N)$. Taking up the story in Ulam's own words,

> "Our problem turned out to have been felicitously chosen. The results were entirely different qualitatively from what even Fermi, with his great knowledge of wave motions, had expected. The original objective had been to see at what rate the energy of the string, initially put into a single sine wave (the note was struck as one tone), would gradually develop higher tones with the harmonics, and how the shape would finally become "a mess" both in the form of the string and in the way the energy was distributed among higher and higher modes. Nothing of the sort happened. To our surprise the string started

> playing a game of musical chairs, only between several low notes, and perhaps even more amazingly, after what would have been several hundred ordinary up and down vibrations, it came back almost exactly to its original sinusoidal shape." (S. M. Ulam, *Adventures of a Mathematician*, University of California Press, 1983.)

Intense interest in the results of this so-called FPU experiment (John Pasta did the programming) led directly to Kruskal and Zabusky's 1965 simulations of the Korteweg-de Vries equation $u_t + u\,u_x + u_{xxx} = 0$, a continuum limit of the FPU lattice. They discovered that the same initial condition broke up into a chain of 8 isolated pulses, christened "solitons", which traveled at different speeds and, on meeting, passed through one another apparently unscathed. By 1968 this was explained in terms of the complete integrability of KdV: an infinite number of conservation laws were discovered and a solution, for some initial and boundary conditions, obtained using the inverse scattering transform. The decades since have seen an enormous expansion of this field, with at least 16,800 papers published on integrable PDEs, a flood which is barely abating even today. Although many of the PDEs studied are related to mathematical physics (nonlinear Schrödinger equation, Yang-Mills equation), the main reason for the field's success is its rich mathematical structure and a whole string of unexpected connections that look at first sight like coincidences or even miracles.

Although PDEs are still probably the mainstream of modern research on integrability, various restrictions are possible. Discretizing the spatial variables gives a lattice, and if the lattice is finite, we have a system of ODEs; and so the integrable structure of famous classically solved systems of ODEs such as the Kepler 2-body problem and the Euler rigid body has been explained. Discretizing also the time variable gives a map, with finite and infinite lattice maps as special cases. The book under review is concerned with these maps, or more precisely, with the discretization process and the relationship between the continuous and the resulting discrete-time systems. The extra structure of a small parameter, representing the time step, makes a unifying treatment possible.

By far the most famous integrable lattice was introduced by Morikazu Toda in 1967. Like the (non-integrable) FPU lattice, the Toda lattice is a discretization of the KdV equation. It was originally written as a Newtonian mechanical system

$$\ddot{x}_i = e^{x_{i+1}-x_i} - e^{x_i - x_{i-1}},$$

but the full structure of the system is only revealed by the change of variables $b_i = \dot{x}_i$, $a_i = e^{x_{i+1} - x_i}$ introduced by Hermann Flaschka in 1974. Then, letting L be the symmetric tridiagonal matrix with a_is on the diagonal and b_is off diagonal, the equations of motion take the ("Lax") form

$$\dot{L} = [B(L),L] = BL - LB$$

where $B(L)$ is a skew-symmetric, tridiagonal matrix with b_is above and $-b_i$s below the diagonal. This shows immediately that the eigenvalues of L are first integrals, and in fact they are in involution and hence for this system establish that the Toda lattice is completely integrable.

It seems impossible that this could be the whole story of lattice integrability. The integrals don't even depend on the function B which defines the dynamics! But that is indeed the point of view adopted in this book. The book's subtitle ("Hamiltonian approach") indicates how the integrability itself becomes trivial and all the interesting stuff is pushed into the Hamiltonian structure. You can see part of what is needed by observing that for this example, it is crucial that the space of tridiagonal, symmetric matrices is invariant under $\dot{L}=[B,L]$. If $L(0)$ is not tridiagonal, the motion is not in fact integrable. Secondly, the Hamiltonian structure of the system needs to be clarified. The obvious one here is the standard Lie-Poisson structure, in this case on the Lie algebra of all $n \times n$ matrices, but this is not the structure that generalizes. The bulk of the book concerns *r-matrix Poisson brackets*. The simplest example in a Lie algebra g is to split $g = g_+ \oplus g_-$ as a sum of subalgebras, with projections p_+, and let $R : g \to g$ be defined by $R = p_+ - p_-$. Then $[x,h]_R = \tfrac{1}{2}([R(x),h] + [x,R(h)])$ is a Lie bracket. The Lax equation $\dot{L} = [L,R(f(L))]$ then preserves the Lie-Poisson structure associated with $[,]_R$ for any Ad-covariant function $f : g \to g$. (In the matrix case, this means that $A\,f(L)\,A^{-1} = f(A\,L\,A^{-1})$ for all $L, A \in g$, for example, $f(L) = L^m$.) The Toda lattice takes this form with g split into a sum of skew-symmetric and upper-triangular matrices, and $f(L) = L$. Furthermore, for this Poisson structure, the tridiagonal matrices form a Poisson submanifold, so the dynamics can be properly restricted to them. Thus the goal of this book is to present a unified treatment of all known integrable lattice equations by constructing suitable Lie algebras, suitable r-matrix Poisson brackets, and suitable Poisson submanifolds for them.

Having achieved that, the discretization step is almost embarrassingly simple. Indeed it takes only one out of the book's 1070 pages to describe. For, associated to the Lie algebra splitting $g = g_+ \dot{A} g_-$ is a matrix factorization $M = P_+(M)\, P_-(M)$ where $P_\pm(M)$ belong to Lie groups with Lie algebras $g_\pm$. In the Toda lattice case discussed above, $P_+(M)$ is orthogonal and $P_-(M)$ is upper triangular, so this is the familiar *QR* factorization from linear algebra. Then, for *any* covariant function $F : g \to G$, the map

$$L \mapsto \bar{L}: \quad \bar{L} = \Pi_+(F(L))^{-1}\, L\, \Pi_+(F(L))$$

commutes with the flow of any Lax equation $\dot{L} = [L,R(f(L))]$. It is therefore integrable and shares all integrals of the Lax equation. It also preserves the *r*-matrix Poisson bracket, and hence preserves the same Poisson submanifolds (e.g. the tridiagonal matrices) as the Lax equation. In fact, the exact flow of the Lax equation is obtained by choosing $F(L) = \exp(tL)$. Simpler integrable maps are obtained by choosing simpler functions F, and often $F(L) = I + t\,L$ does the job.

There is one more interesting point to the author's examples, although it is not part of any general theory. Typically the maps obtained are implicit: when written as lattice maps $\tilde{x}_i = \phi_i(x_1, \ldots, x_n)$, the ϕ_i depend on all the x_i, not just the neighbouring sites $x_{i-k}, \ldots x_{i+k}$, say. The local nature of the original ODEs is lost. (For example, the factors Q and R in the factorization $QR = F$ depend on all the entries of F.) However, the author is able to recover a kind of locality by finding new variables in which the maps take the implicit form $\psi_i(y_{i-k}, \ldots, y_{i+k}, \tilde{y}_{i-k}, \ldots, \tilde{y}_{i+k}) = 0$. Sometimes the map is even explicit. The changes of variables themselves are local and explicit. Miraculously, the original ODE and some combination of its Poisson brackets often remain local under this change of variables.

The book itself is a bit daunting at 1070 pages. I was initially skeptical when I saw that even at that length it was not a survey of integrable maps—discretizations of PDEs, Painlevé equations, and many other discretization methods are not covered, only the *r*-matrix approach for autonomous ODEs. This unified approach has been most notably developed by the author himself, just in the last few years, so there is a danger of getting a skewed point of view. However, the unity itself is impressive and strongly promotes the author's position. Chapter 1 (50 pages) introduces Hamiltonian mechanics, and Chapter 2 (50 pages) the theory of *r*-matrix Poisson brackets sketched above. Each of the remaining 25 chapters (970 pages) covers a different class of examples and serves as a kind of handbook or encyclopedia for these systems. These have been introduced and explored over decades so the book collects a very wide literature. Among them I will just mention one of particular interest to me, the discrete rigid body discovered by Alexander Veselov and proved integrable by himself and Jürgen Moser. Let Q be an orthogonal matrix representing the orientation of a rigid body with inertia tensor J. Its Lagrangian is $\int \mathrm{tr}\,\dot{Q}J\dot{Q}^T\,dt$. Amazingly, the simplest conceivable discretization of this Lagrangian, namely $\sum_i \mathrm{tr}(Q_{i+1} - Q_i)J(Q_{i+1} - Q_i)^T$, not even respecting its Lie group structure, gives an integrable mapping with all the same integrals as the continuous system. This system too has an *r*-matrix formulation.

Robert McLachlan
Massey University

CONFERENCES

NZMRI SUMMER WORKSHOP 2004
Computational Algebra and Number Theory
January 3 –10, Nelson

They just keep getting better. It would be hard to fault this year's meeting in any way. The location (the Tahuna Beach Holiday Park in Nelson) did lack the small town atmosphere of some other meetings, but the superb beach helped to make up for that. Not only were all the speakers of the very highest quality as mathematicians, they were all excellent speakers as well. Also, the organizers apparently gave the speakers a stern talking to with the result that the level of the talks was down a notch from previous years, maybe even somewhere near the median comprehension of the audience! But, judging from the question times, there was still a lot there for the experts.

Although maybe not the largest ever summer workshop, 70 participants and 35 family members makes a pretty big group. This includes 30 students, an excellent turnout, of which five were Australian – hopefully Australian numbers will continue to increase. David Gauld led a group up Mount Arthur, and a larger group toured the vinyards. There was excellent wind for the kitesurfers (only Vaughan, as far as I know).

John Cannon unfortunately couldn't make it, but we had superb series from John Conway ("Some things

you can't hear the shape of"), Hendrik Lenstra ("Primality testing"), Peter Neumann ("Calculating probabilities in matrix groups over finite fields"), Karl Rubin ("Counting points on elliptic curves") and Charles Sims ("Algebraic Algorithms: A Personal Perspective"), and single lectures by Cheryl Praeger ("Finding the rank profile of a matrix"), Mike Newman ("Art and science in extracting information from finite group presentations"), Alice Silverberg ("Applications of number theory to cryptography") and Hendrik Lenstra, "Escher and the Droste effect". This last was a public lecture recounting a detailed study of the mathematics underlying Escher's "The Picture Gallery" (see http://escherdroste.math.leidenuniv.nl/. If I had had to give such a talk, I would have gotten stuck at the first hurdle, namely, how to explain the idea of a conformal map to a general audience. You know Lenstra is a master because that didn't slow him up one bit. (He ignored it.) He had the audience in his hand from the very beginning and he held them there, on one topic, for an hour. Amazing.

Some quotes from Conway's talks:

> "I'm not explaining it well, but I'm *doing* it well."
> "I'm just teetering on the edge of incomprehensibility, but take it from me, it is obvious."
> "You should have commented on that, and I'm glad you didn't.
> " (of a first term not folded into a sum) "You're suffering from zerophobia."
> "I'm not an anal-ist, but ..."
> X: "The lower you write on the board, the more efficiently you annoy the audience."
> Conway, after sleeping on it: "Thank you X, and I'd like to say that if anyone is to be consulted on how to annoy people efficiently, it is X."

Conway also gave the audience a present, namely the notation $\mathsf{M}_{i\in S} a_i := \left(\sum_{i\in S} a_i\right)/|S|$ for a mean value. He missed Gaven Martin's comment that this doesn't extend to integrals—the speaker rarely understands the question—but later, when $(q_3 + q_4)/2$ appeared in a formula, was happy to note Marston Conder's point that he'd missed a chance to use his own notation.

At one point Conway interrupted Lenstra several times, he seemed to be unhappy with the idea of a probable prime. Finally Lenstra replied, "OK, the number [reported prime] might not be prime, but then, sometimes people buy a vacuum cleaner and it doesn't work. If the number later turns out not to be prime, we'll replace it with another one for free."

I also heard an idea for a (minimally) interactive mathematics seminar: each member of the audience has a hidden button which they can press when they are no longer following the seminar. When everyone has pressed their button, the seminar is over.

And from Peter Neumann: "I hope I haven't told a lie\dots I may have told the truth in a perverted way, but after all, that's what mathematics is."

Robert McLachlan
Massey University

VICTORIA INTERNATIONAL CONFERENCE: VIC 2004

The idea for VIC 2004 grew out of the visit of Professor Vitali Milman to work with Vladimir Pestov in 2002. Vitali, then president of the Israel Mathematical Union agreed with Rod Downey as president of the NZ Mathematical Society that they would hold a joint meeting in the summer of 2004. The meeting was held at Victoria University of Wellington from 9-13 February 2004. The meeting was supported financially by the NZ Institute of Mathematics and its Applications and by the Royal Society's International Conference Fund. The Israeli Foreign Ministry also provided some support for participants attending from Israel. We warmly acknowledge this funding, which enabled us to cover costs for some of the plenary speakers, and to set zero registration fee for graduate students as well as providing travel and accommodation grants for them.

The meeting was attended by 100 mathematicians (including 25 from Israel), from 13 different countries. Fourteen participants were graduate students. The quality of the presentations was uniformly high and represented research in a number of areas of fundamental importance in contemporary mathematics. The organisers felt that the conference was highly successful in creating an opportunity for interaction and collaboration.

The two mathematical societies each proposed plenary speakers and a number of special sessions were established, generally co-organised by mathematicians from each country. Plenary speakers were:

- Rod Downey (Victoria) *Algorithmic Randomness and Complexity*
- Vaughan Jones (Berkeley) *Two Subfactors*
- David Kazhdan (Harvard and Hebrew) *The Langlands Program*

- Janos Makowsky (Technion) *Splitting Formulas for Graph and Knot Polynomials and their Algorithmic Use*
- Robert McLachlan (Massey) *Geometric Numerical Integration*
- AndrŽ Nies (Auckland) *Randomness Notions and Lowness Properties*
- Victor Palamodov (Tel Aviv) *Reconstruction from Boundary Measurements*
- Ran Raz (Weizmann Institute) *Multilinear Formulas for Permanent and Determinant are of Super-Polynomial Size*
- Hugh Woodin (Berkeley) *A Structural Equivalence for the Determinacy of Real Games*

Fifty-six talks were given in special sessions, which ran on the following topics:

- Computational Complexity, organized by Rod Downey
- Surface Approximation, organized by Shayne Waldron
- Geometric Aspects of Functional Analysis, organized by Vitali Milman and Vladimir Pestov
- Operator Algebras and Representation Theory, organized by David Kazhdan and Chris Atkin
- Nonlinear Analysis and Optimization, organized by Bruce Calvert
- Game Theory, organized by John Hillas, Arkadii Slinko and Jacek Krawczyk
- Functional-Differential Equations and Applications, organized by Bruce van Brunt and Gregory Derfel

A further 3 contributed talks were also included in the programme.

Talks from two of the sessions will be published: Computational Complexity is to appear in the Annals of Pure and Applied Logic, and Nonlinear Analysis and Optimization in the Journal of Nonlinear and Convex Analysis, later this year. Slides of some of the plenary talks will be made available via the website www.mcs.vuw.ac.nz/~mathmeet/vic2004/index.shtml as an additional resource.

The presence of a significant number of speakers in computational complexity and logic was partly a result of the ongoing 6-month programme in Logic and Computation funded by NZIMA.

Further funding for the GAFA and OART streams was provided through Vladimir Pestov's Marsden Fund project "Geometry of high-dimensional structures: dynamical aspects". The first stream of the GAFA session was dedicated to geometry in high dimensions, GAFA-II was largely devoted to links between dynamics and geometric aspects of functional analysis and the unifying topic for the GAFA-III session was applications. The OART-I session dealt with groups and their representations and OART-II was largely centred on C*-algebras.

Professor Pestov reported that there was a great number of informal mathematical discussions, facilitated by the (mostly) beautiful weather. Overall, the conference, in particular the GAFA and OART sessions, was a definite success and participants expressed the view that it should be repeated in the not too distant future.

These views are endorsed by the conference organisers, who were Vitali Milman and Allan Pinkus (IMU), Rod Downey and myself (VUW), John Fouhy and Joe Miller (website and proceedings), Ginny Nikorima and Rowan McCaffery (administration, budget, accommodation, activities).

Peter Donelan
Victoria University of Wellington

Conferences in 2004

21 –23 April 2004 (Auckland) **Workshop on Computational Partial and Ordinary Differential Equations**
website: http://www.math.auckland.ac.nz/~butcher/pde-ode/

30 August –3 September 2004 (Raglan) **International Workshop on Dynamical Systems and Numerical Analysis**
website: http://www.math.waikato.ac.nz/~rua/dsna.html\#events

30 August –3 September 2004 (Palmerston North) **7th Australasian Conference on Mathematics and Computers in Sport**
website: http://7mcs.massey.ac.nz/

30 August –3 September **NZIMA Workshop on Dynamical Systems and Numerical Analysis**
website: http://www.math.waikato.ac.nz/~rua/dsna.html

12 –17 December 2004 (Massey University, Albany) **Eighth International Conference on Developments in Language Theory**; International Workshop on Automata, Structures and Logic; and

the International Workshop "Tilings and Cellular Automata"
website: https://www.cs.auckland.ac.nz/dlt04/

13 –18 December 2004 (Taupo) **Conference in Combinatorics and its Applications, in association with the 29th Australasian Conference in Combinatorial Mathematics and Combinatorial Computing (29th ACCMCC)**
website: http://www.nzima.auckland.ac.nz/combinatorics/conference.html

8 –15 January 2005 (Napier) **11th NZMRI Summer Meeting on Geometry: Interactions with Algebra and Analysis**
website: http://www.math.auckland.ac.nz/Conferences/2005/geometry-program/nzmri.html

30 January –3 February 2005 (Napier) **Annual meeting of ANZIAM (Australian and New Zealand Industrial and Applied Mathematics)**
website: http://www.anziam.org.au/nzbranch.html

14 –18 February 2005 (Auckland) **International Meeting on Geometry: Interactions with Algebra and Analysis**
website: http://www.math.auckland.ac.nz/Conferences/2005/geometry-program/auckland.html

MATHEMATICS-IN-INDUSTRY STUDY GROUP 2005
MISG2005

This is being organised by the Centre for Mathematics in Industry, Massey University, Auckland, New Zealand. It immediately precedes the annual Applied Mathematics conference ANZIAM 2005, in Napier, NZ.

Dates: Monday 24th to Friday 28th January 2005
Venue: Auckland
Director: Professor Graeme Wake; g.c.wake@massey.ac.nz
Administrator: Nikki Luke; n.luke@massey.ac.nz

FIRST NOTICE OF THE NZMS 2004 MATHEMATICS COLLOQUIUM

The 2004 Mathematics Colloquium will take place at the University of Otago from Monday December 6 to Wednesday December 8 (inclusive). Accommodation for delegates will be provided on campus in a brand new wing of University College at reasonable cost (approximately $45 per night for bed and breakfast). There are also many motels available within a short distance of the University, as well as a large number of restaurants and cafes, catering to all budgets and ethnicities. So far, Peter Cameron, Rod Gover, James Sneyd, and Carsten Thomassen have accepted invitations to give invited addresses and it is anticipated there will be another two guest speakers.

The second SIAM (Southern Industrial Applied Mathematics) day will be held in conjunction with the Colloquium on Tuesday December 7. The Colloquium will conclude at lunchtime on Wednesday December 8, but the entire Wednesday will be devoted to a Tertiary Education day (with an invited speaker yet to be announced).

It is expected that a Colloquium dinner will be held on the Tuesday evening, in conjunction with a twilight trip to one of the popular wildlife colonies on the Otago Peninsula.

The conference fee will be announced later (and there will be separate fees available for those attending the SIAM or Education days only). As usual, there will be an award for the best graduate presentation and students are reminded there may be financial help available from the NZMS (contact the secretary). Please visit the Colloquium website: www.maths.otago.ac.nz, which will be updated as further information comes to hand, or contact the Colloquium secretary: igoodwin@maths.otago.ac.nz.

NOTICES

ALEXANDER VON HUMBOLDT FELLOWSHIP

Dr Britta Basse has won (for 2004) a prestigious Alexander von Humboldt Fellowship to continue her research in Mathematics in Medicine (Cancer modelling) in Leipzig, Germany. The *Humboldt Research Fellowships* are for highly qualified scholars not resident in Germany, aged up to 40 and holding a doctorate, enabling them to undertake periods of research in Germany (500 fellowships per annum). Britta completed her Masters in Mathematics in The University of Auckland in 1992 and her PhD in Applied Mathematics from the University of Canterbury in 2000. From 1992 –5 she was a tutor in mathematics in The University of Auckland and from 2000 –3 she was a postdoctoral fellow in the University of Canterbury. Key papers on her work have just appeared in the *Journal of Mathematical Biology* and *Mathematical Medicine and Biology: A Journal of the IMA*

THE 2004 J.H. MITCHELL MEDAL

The 2004 J.H. Mitchell Medal, awarded by ANZIAM to a researcher who has completed their PhD within the past 10 years and who has been a member of ANZIAM for at least three years, has been awarded to **Mark Ian Nelson**.

Mark Nelson received his PhD from the University of Leeds in 1994. He arrived in New Zealand in 1997 as the Royal Society of London Postdoctoral Fellow working with Graeme Wake at The University of Auckland and the University of Canterbury for more than a year. For the next three years he generated papers at the Australian Defence Force Academy with Harvey Sidhu, Rod Weber and Geoff Mercer, except for a nine-month period back at Leeds. For the last year he has been at the University of Wollongong.

Mark has written 31 refereed papers (5 individually, 18 as senior joint author) in the area of non-linear chemical dynamics. These involve the application of bifurcation theory, continuation methods, dynamical systems methodology and singularity theory to problems in combustion, chemical reactor engineering and bioreactor engineering. Sixteen of these papers are based on research accomplished since arriving in Australasia six years ago.

NEW ZEALAND MATHEMATICAL SOCIETY
AMENDMENT TO CONSTITUTION

Last year the Council decided that it ought to be a requirement for new Fellows of the NZMS to have shown a strong interest in the New Zealand Mathematical Community in addition to excellence in their professional activities. The wording of the Constitution as it stands does not clearly stipulate this. The Council has therefore proposed an amendment to the constitution to better reflect this view. The current wording is given below, followed by the proposed wordiing.

Current wording of Article IV, Item 3

"A Fellow shall be a person who currently has or previously has had the qualifications of an Accredited Member and who, in addition, is deemed by the Accreditation Committee (see paragraph below) to have demonstrated a high level of attainment or responsibility in mathematics and to have made a substantial contribution to mathematics or to the profession of mathematician or to the teaching or application of mathematics."

Proposed amendment to wording of Article IV, Item 3

"A Fellow shall be a person who currently has or previously has had the qualifications of an Accredited Member and who, in addition, is deemed by the Accreditation Committee (see paragraph below) to have demonstrated a high level of attainment or responsibility in mathematics, to have made a substantial contribution to mathematics or to the profession of mathematician or to the teaching or application of mathematics and to have shown a strong interest in the objects of the Society."

Notes: The full constitution is available at www.math.waikato.ac.nz/NZMS/nzmsconst.html. The objects of the Society are defined in Article II of the constitution as:

"The purposes for which the Society shall be established are

1. To promote research in the mathematical sciences and to promote the development, application and dissemination of mathematical knowledge within New Zealand.
2. To assist mathematicians in New Zealand to maintain effective cooperation with one another and with mathematicians and mathematical societies in other countries, and to facilitate collaborative

research in the mathematical sciences as a consequence of such cooperation.

The Society shall be administered with these ends in view and not for the purpose of financial gain for its members."

Would you:

i. Please indicate on the enclosed ballot paper whether or not you approve the motion as indicated;
ii. Seal your marked ballot in an envelope;
iii. Sign the declaration;
iv. Place the envelope containing the ballot and the signed declaration in another envelope, which should be sent to the address below **no later than 30 May 2004**

Dr Shaun Hendy
NZMS Secretary
Industrial Research Ltd
PO Box 31 –310
Lower Hutt

Motion to amend Article IV, Item 3 in the Constitution so that this item reads:

"A Fellow shall be a person who currently has or previously has had the qualifications of an Accredited Member and who, in addition, is deemed by the Accreditation Committee (see paragraph below) to have demonstrated a high level of attainment or responsibility in mathematics, to have made a substantial contribution to mathematics or to the profession of mathematician or to the teaching or application of mathematics and to have shown a strong interest in the objects of the Society."

(Please mark one box only)

Approve motion ☐
Disapprove motion ☐

Cut-here

Declaration

Full name:

Address:

I declare as follows:

(a) I am the person whose name and address is stated above and

(b) I am entitled to vote, being a member of the New Zealand Maths Society

Dated this: day of 2004

Signature:

NZMS ACCREDITATION

Applications are invited for NZMS Accreditation. The deadline for applications is **Saturday May 1st, 2004**. If you would like to be considered or would like to nominate someone could you send for application forms to

The Accreditation Secretary
C/- Department of Mathematics and Statistics
University of Otago
P O Box 56
DUNEDIN

or & email lgrant@maths.otago.ac.nz.

To help you understand better what each of the categories of membership are, I have added a copy of

Article IV of the Constitution.

ARTICLE IV: OPTIONAL ACCREDITATION

An Ordinary Member (or Reciprocity Member) may apply to the Council to become a Graduate Member, Accredited Member, or Fellow. The Council shall make and issue, and may revise from time to time, Rules which shall give effect to the following requirements.

1. A Graduate Member shall have completed a degree or diploma at a recognised university or other tertiary institution, the studies for which shall include mathematics as a major component, and shall be currently employed or occupied in the development, application or teaching of mathematics.
2. An Accredited Member shall have completed a postgraduate degree in mathematics at a recognised university or other tertiary institution, or shall have equivalent qualifications, and shall have been employed for the preceding three years in a position requiring the development, application or teaching of mathematics.
3. A Fellow shall be a person who currently has or previously has had the qualifications of an Accredited Member and who, in addition, is deemed by the Accreditation Committee (see paragraph below) to have demonstrated a high level of attainment or responsibility in mathematics and to have made a substantial contribution to mathematics or to the profession of mathematician or to the teaching or application of mathematics.

An Honorary Member shall have the right to become a Fellow immediately upon application to the Council and without payment of a fee.

The Council shall establish an Accreditation Committee to consider applications for designation as a Graduate Member, Accredited Member or Fellow, and to administer the Rules described in the first paragraph of this Article. In its determinations, the Accreditation Committee shall discount interruptions to employment such as temporary unemployment and parental leave.

A Graduate Member may use the abbreviation GNZMS, an Accredited Member may use the abbreviation MNZMS, and a Fellow may use the abbreviation FNZMS. These designations and the corresponding abbreviations are the rights of that class of Member only while the member remains a financial member of the Society and while the occupational requirements outlined in the first paragraph of this Article continue to be satisfied. The occupational requirements shall be deemed to be satisfied by Honorary Members and in the case of interruptions to employment such as temporary unemployment and parental leave, and they shall not be applied in the case of retirement or promotion to an administrative or other position.

A fee shall accompany each application to the Accreditation Committee. The fee shall be additional to the annual subscription charged by the Society and shall be the only charge for accreditation.

****

If you have any queries could you please direct them to me at the above address or by email (dholton@maths.otago.ac.nz).

Derek Holton
Chair, Accreditation Committee

The New Zealand Institute of Mathematics and its Applications
[http://www.nzima.auckland.ac.nz]
is sponsoring a thematic program on

"GEOMETRY: INTERACTIONS WITH ALGEBRA AND ANALYSIS"

based at The University of Auckland from January–June, 2005

Program themes:
The program will focus on geometric themes including:

1. Discrete groups;
2. Algebraic groups;
3. Geometric group theory;
4. Low-dimensional topology and hyperbolic geometry;
5. Geometric function theory; and
6. Analysis and PDEs.

The two central events of the program are:

1. **Summer Workshop, Napier, January 8–15, 2005**
   The provisional list of principal speakers include:
   Ben Andrews (Canberra), Craig Evans (Berkeley), Martin Liebeck (Imperial College), Alex Lubotzky (Jerusalem), and Peter Sarnak (Princeton).
   Each will deliver a series of lectures intended for a general mathematical audience, including senior undergraduate and graduate students.
   The workshop will also include a day of lectures by leading international researchers to celebrate Fred Gehring's 80th year. As usual, we will cover accommodation and some other costs for NZ-based participants in the workshop.
2. **International conference, Auckland, February 14–18, 2005**
   The provisional list of principal speakers include:
   Marston Conder (Auckland), Rob Howlett (Sydney), William Kantor (Oregon), Laci Kovacs (Canberra), Gus Lehrer (Sydney), Martin Liebeck (Imperial College), Gunter Malle (Kassel), Colin Maclachlan (Aberdeen), Chuck Miller (Melbourne), Cheryl Praeger (University of Western Australia), Peter Schmid (Tuebingen), Akos Seress (Ohio State University), and Aner Shalev (Jerusalem).
   There will be opportunities for contributed talks, and financial support for students to participate.

Graduate Student Scholarships:

As part of the program, Masters and PhD scholarships are available for suitably qualified candidates. Please contact either of us initially. We particularly welcome your suggestions of suitable candidates.

Additional information: The WEB site for the program is

http://www.math.auckland.ac.nz/Conferences/2005/geometry-program

It contains more information on the program, its activities, and on funding opportunities for NZ-based participants and students.

We welcome enquiries from those interested in taking part in the program.

Best wishes.

Gaven Martin and Eamonn O'Brien
Programme directors, Department of Mathematics, The University of Auckland

GRANTEE REPORTS

The MISG2004 (reported elsewhere) issued 18 student grants to support attendance. Two of these grants were provided by the NZMS, which greatly assisted the financing of MISG2004 which is gratefully acknowledged. Here is one of these reports:

When I first heard about MISG, it sounded interesting and I thought it would be a good opportunity to glimpse at real world mathematics as it happens. So I decided to head up to Auckland for the week (generously supported by NZMS, thanks!)

With so far only having completed an undergraduate degree, being exposed to mainly coursework in a fairly isolated environment, to then go to MISG where you see a bunch of excited mathematicians, working away together on unsolved problems. It was also reassuring to see that it wasn't an ego-fest (like you find in many other academic areas) and that everyone could speak freely and contribute to the various problems.

I worked on the problem brought to MISG by NZ Steel/Bluescope Steel. I am pleased to say that I understood what was going on, which was more than expected and even managed to speak on a few occasions. It was good to see how the problem was tackled and how each contributing factor was dealt with. Even by the end of the week, there were the "oh yeah, we haven't even looked at that yet" comments, and I was surprised how many things had to be considered and how complex it became (I suppose that is how mathematicians keep their jobs). I had wanted to look at some of the other problems but found myself addicted to this one problem (like some people with soap operas) and wanted to see what was going to happen next ...

I also enjoyed the social side of MISG, it was good to meet people from around New Zealand and around the world, on a different level than you do, in the usual conference environment. It was fun talking/eating

/drinking with others and I met some really good people and interesting characters. It was useful to hear what people are involved with and get advice on opportunities available, it gave me ideas and motivation on what to do next.

I found it to be a worthwhile trip and a great experience and I am looking forward to MISG2005!

Alysha Nickerson
Victoria University of Wellington

Note from Director of MISG: Alysha also kindly agreed to operate the video camera on the final day of problem reports which is gratefully acknowledged. These videos are available to interested persons from the MISG Administrator, Nikki Luke: n.luke@massey.ac.nz *Total cost $20 (including tapes).*

MATHEMATICAL MINIATURE 23

The Commuting Mathematician goes to a Wedding

For a short time I was a celebrity. Not only was I employed as a mathematician on Auckland buses, adding value to the ordinary traveller's commuting experience through my stimulating and arcane conversation, but I was also commissioned to expand this valued service through the recruitment of colleagues to assist me. And then the final accolade of a celebrity – my television appearance. What a dream!

Many years ago, after a visit to a North American University, I was sent to the airport in a chauffeured vehicle. The driver was trying to better himself by studying the type of introductory mathematics popular at that time, full of Venn diagrams and truth tables. He tried to explain what he was doing by working through notebooks with me as the car sped along icy highways. I had some concerns, but we got to the airport safely and I flew away. Perhaps it was this commuting tutorial that came back as the source of my dream last night.

Today I join in the celebration of the marriage of Nicolette Moir. Nicolette is one of the stars of my mathematical career; I have known her since her undergraduate days and have helped to guide her through her MSc and through her almost completed PhD. Her research is on numerical solutions of ordinary differential equations using what we call ARK ("Almost Runge-Kutta") methods. I would like to offer this brief introduction to her work on this happy day.

Numerical methods for solving differential equations are generally based on two types of operations: evaluating derivatives and forming linear combinations of already computed quantities. Suppose the differential equation is $y'(x) = f(x, y(x))$, and an approximation has already been found after n - 1 steps: $y_{n-1} \approx y(x_{n-1})$. The aim is now to advance the solution one step further by computing $y_n \approx y(x_n)$, where $x_n = x_{n-1} + h$. In one particular family of Runge-Kutta methods, discovered by Kutta in 1901, a sequence of four derivative approximations, F_1, F_2, F_3, F_4 is computed corresponding to approximation solutions at $x_{n-1}, x_{n-1} + th, x_{n-1} + \frac{1}{2}h$ and $x_{n-1} + h$. These are given by

$$\begin{aligned}
Y_1 &= y_{n-1}, & F_1 &= f(x_{n-1}, Y_1) &&\approx y'(x_{n-1}),\\
Y_2 &= y_{n-1} + thF_1, & F_2 &= f(x_{n-1} + th, Y_2) &&\approx y'(x_{n-1} + th),\\
Y_3 &= y_{n-1} + \tfrac{4t-1}{8t}hF_1 + \tfrac{1}{8t}hF_2, & F_3 &= f(x_{n-1} + \tfrac{1}{2}h, Y_3) &&\approx y'(x_{n-1} + \tfrac{1}{2}h),\\
Y_4 &= y_{n-1} + \tfrac{1-2t}{2t}hF_1 - \tfrac{1}{2t}hF_2 + 2hF_3, & F_4 &= f(x_{n-1} + h, Y_4) &&\approx y'(x_{n-1} + h).
\end{aligned}$$

These computed results are sufficiently accurate to enable y_n to be computed using Simpson's rule, without detracting significantly from the quality of that famous integration rule. That is,

$$y_n = y_{n-1} + \tfrac{1}{6}hF_1 + \tfrac{2}{3}hF_3 + \tfrac{1}{6}hF_4.$$

If $t = -1$ or $t = -\frac{1}{2}$, it is possible to lower the cost of the algorithm, but with some impact on the computational properties, by replacing F_2 by either F_1 or F_3 as computed in the *previous* step. In ARK methods we take this idea a little further by using information from the previous step combined in a package which approximates not just $hy'(x_{n-1})$, available here as hF_1, which could equally well have been computed as part of the previous step, but also $h^2 y''(x_{n-1})$. Things can be contrived so that the modified methods have the same stability properties as for a standard Runge-Kutta method and, furthermore, the derivative approximations on which the method is built are more accurate than for a Runge-Kutta method. This last feature has several advantages including the ability to obtain realistic error estimates and the ability to obtain reasonably accurate and, at the same time inexpensive, interpolations.

One of Nicolette's special contributions has been the extension of ARK methods to the solution of so-called stiff problems. The crucial difference between stiff and non-stiff problems is that stiff problems need to be solved using implicit methods. Implicit methods cost a great deal more per step but there is a hope that there will be many fewer steps required to obtain comparable accuracy, because of better stability. A second significant contribution has been in the design of a new fourth order ARK method which can be implemented in such a way that it acts as though it were fifth order, even when h changes from step to step.

This new explicit method passes approximations to y, hy' and $h^2 y''$ from step to step. Denote these approximations, as computed in step number n, by y_n, hy_n' and $h^2 y_n''$. The formula for these quantities, and for the stage values which lead to them are

$$
\begin{aligned}
Y_1 &= y_{n-1} + \tfrac{1}{4}hy'_{n-1} + \tfrac{1}{32}h^2y''_{n-1}, & F_1 &= f(x_{n-1} + \tfrac{1}{4}h, Y_1),\\
Y_2 &= y_{n-1} + \tfrac{1}{10}hy'_{n-1} + \tfrac{1}{40}h^2y''_{n-1} + \tfrac{2}{5}hF_1, & F_2 &= f(x_{n-1} + \tfrac{1}{2}h, Y_2),\\
Y_3 &= y_{n-1} - \tfrac{3}{640}hy'_{n-1} - \tfrac{69}{1280}h^2y''_{n-1} + \tfrac{27}{160}hF_1 + \tfrac{75}{128}hF_2, & F_3 &= f(x_{n-1} + \tfrac{3}{4}h, Y_3),\\
Y_4 &= y_{n-1} - \tfrac{41}{140}hy'_{n-1} + \tfrac{17}{280}h^2y''_{n-1} + \tfrac{69}{35}hF_1 - \tfrac{51}{28}hF_2 + \tfrac{8}{7}hF_3, & F_4 &= f(x_{n-1} + h, Y_4),\\
Y_5 &= y_{n-1} + \tfrac{7}{90}hy'_{n-1} + \tfrac{16}{45}hF_1 + \tfrac{2}{15}hF_2 + \tfrac{16}{45}hF_3 + \tfrac{7}{90}hF_4, & F_5 &= f(x_{n-1} + h, Y_5),\\
y_n &= Y_5,\\
hy'_n &= hF_5,\\
h^2y''_n &= \tfrac{242}{75}hy'_{n-1} - \tfrac{1352}{225}hF_1 + \tfrac{34}{15}hF2 - \tfrac{256}{75}hF_3 - \tfrac{196}{225}hF_4 + \tfrac{24}{5}hF_5.
\end{aligned}
$$

Try it, using starting values $hy_0' = hf(x_0,y_0)$ and $h^2y_0'' = hf(x_0+ h, y_0 + hy_0') - hy_0'$, and see how it compares with a classical Runge-Kutta method.

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