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NEWSLETTER

OF THE

NEW ZEALAND MATHEMATICAL SOCIETY (INC.)

Contents

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PUBLISHER'S NOTICE

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The homepage of the New Zealand Mathematical Society with URL address:
http://www.math.waikato.ac.nz/NZMS/NZMS.html (Webmaster: 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

It's been a good year for mathematics in the New Zealand media. Just to include programmes that I've caught a part of, Radio New Zealand has featured Keith Devlin on the Poincar'e conjecture, Marcus du Sautoy on the Riemann hypothesis (illustrating the importance of prime numbers with the worthy example shown by the 17 year cicadas) and Australian Clio Cresswell on the mathematics of sex (she of the infamous '12 bonk rule'). Our incredible summer season of conferences, at least 13 by my count, generated a fair amount of local publicity. Graeme Wake reports that media coverage of the MISG, while still ongoing, was an improvement from last year, when the Australian dailies covered the scientific content in depth but in New Zealand MISG ran in the 'odd spot'. This year Radio New Zealand ran features on both the rural and financial programmes, as well as a widely heard interview with Oxford's Sam Howison—although the papers again concentrated on the flap over Michael Cullen's fencing wire comments and not on the actual content of the study groups. Then on 11 April Documentary New Zealand screened 'The Other Olympiad', following the NZ maths olympiad team as they trained and

competed in Athens in 2004. The team members came over extremely well, looking keen, relaxed, and well-rounded, as well as winning the medals that Arkadii Slinko had them marked out for. Slinko, in a superb yet understated performance, even managed to provide some mathematical content that didn't end up on the cutting room floor! This was surely the best possible publicity for mathematics and for the olympiad.

(TVNZ suggested the Association of Maths Teachers web site, www.nzamt.org.nz, for follow up. To you I'd recommend the 'Where are they now?' page on Australian olympians, www.amt.canberra.edu.au/olympian.html. Fascinating and at times disturbing.)

Now, who will be our Paul Callaghan?

Although your *Newsletter* represents fantastic value for money, the whole NZMS is a bit of a shoestring operation and the Newsletter is one of its larger projects. Therefore I'd like to particularly thank the American Mathematical Society (AMS), the Society for Industrial and Applied Mathematics (SIAM), and Birkäuser for advertising with us. Together with recent sponsorship from Hoare Research Software they cover a good fraction of our printing costs. I'd also like to thank Springer and Birkäuser for providing books for review and encourage all our readers to try their hand at a review. Reviews of maths books seem to have evolved in a different direction than in other areas: sometimes, as in the epic reviews in the *Bulletin of the AMS*, they don't even mention the book under review. In fact, those are the best ones. Sometimes a gentle and, why not, boosterish introduction to a field is wanted.

By the end of this year I'll have completed six years as Editor and I've decided to step down, having reached but not surpassed the tenure of Mike Hendy. By then the newsletter will have been based in Palmerston North for 12 years so it could be time for a change. (No jokes, please.) Please forward any suggestions for future editors, or on how the Newsletter should evolve, to the secretary Winston Sweatman. The editor's job seems to consist mostly of correcting dashes and serial commas and asking for favours. However, you will need the support of your department to provide secretarial support—here, the Newsletter has been ably set into TeX by Fiona Richmond—and of your printery to print at cost.

Robert McLachlan
Massey University

PRESIDENT'S COLUMN

In the last newsletter we published the names of those who have served on the NZMS council over the past 30 years. David Vere-Jones was the first president and the earlier years feature other names that would be regarded as 'statistical' rather than 'mathematical', including Murray Jorgensen, the current president of the NZSA. Otago and Canterbury Universities both have a Department of Mathematics and Statistics. At some universities the statisticians are in separate departments to the mathematicians, although they may sit within the same school with varying degrees of interaction. Massey University has it both ways: mathematics and statistics are in separate institutes at Palmerston North and together at Albany. In my previous existence at AgResearch I got into repeated trouble for advocating that the mathematicians and statisticians should be grouped together, now that I've left they have merged into the Bioinformatics, Mathematics, and Statistics Section.

I have met representatives of industry who believe that spreadsheets do statistics and nothing else is required—certainly no mathematics. Many research scientists believe that a package gives them all they need: type in your data, run your favourite test and look for a 'p value', the smaller the better. However, if you don't achieve the magic $p < 0.05$ your result might still be biologically or economically significant, even if it is not statistically significant. (Yes, I was told that more than once. It is, of course, nonsense.) While at AgResearch I was frequently asked what a Durbin-Watson statistic is, because Minitab calculates it when you do a regression. It is a curious attitude: if the computer calculates something it must be useful. At the other extreme, it has also been put to me that statistics is just an applied branch of measure theory, and should be taught in the abstract. I sometimes hear my own work referred to as 'statistical modeling', which is preferable to 'computer modeling' but reflects the misunderstanding of the individual rather than reality. The reality is that the most ardent deterministic modelers in mathematical biology are having to confront probabilistic effects, and that the push of mathematical methods into finance and risk analysis is raising problems couched in terms of stochastic processes. This is not helped by the rule of thumb that if it contains a probability it belongs in a statistics course. There is a growing need for statisticians versed in mathematical methods, and for mathematicians versed in probability theory. To meet this need university mathematics and statistics groups should be growing together and promoting a double major.

My colleague Jeff Hunter is Professor of Statistics and a Fellow of the NZMS. He is to be congratulated

on being awarded a DSc by Massey University for his contribution to statistics (but it looks pretty mathematical to me!). Jeff was the chair of the International Workshop on Matrices in Statistics, 2005, held at Albany. At that meeting I chaired the keynote address on 'Coefficients of ergodicity in a matrix setting' presented by the NZMS lecturer, Professor Eugene Seneta of the School of Mathematics and Statistics at the University of Sydney. It only takes a glance at the abstract to appreciate the demanding mathematical nature of the talk's content. The NZMS council recognized the contribution of IWMS 2005 to the mathematical life of New Zealand, and agreed to support a speaker.

Another meeting supported by the NZMS was the 2005 Mathematics in Industry Study Group, organized by Graeme Wake at Albany. The society contributed towards the participation of students at the meeting. Out of the seven problems presented by industry this year, two had a significant statistical content. Statisticians do not usually attend the MISG in great numbers, but this year David Scott from Auckland and Ken Russell from Wollongong were present and made a valuable contribution. Both Graeme and Ken have written accounts of the meeting for the NZSA newsletter, see http://nzsa.rsnz.org/Newsletter61/MISG.htm, making a plea for more statisticians to become involved in MISG. Perhaps we are on the verge of a great coming-together.

At the Dunedin colloquium the NZMS speaker was the 2003 winner of the NZMS Research Award, Rod Gover, with a presentation on 'Overdetermined PDEs, the Einstein equations and conformal geometry'. There is a notice about nominations for the 2005 award elsewhere in this issue. At the AGM there was a discussion of the nature of the award—should it become a medal, are the rules appropriate, should there be a more tangible prize? The council will be taking up these questions, so if you have any views or ideas please email them to me. The Aitken Prize for the best student talk at the colloquium was awarded to Joanne Mann of Massey University, Albany, for her presentation 'To vaccinate or not to vaccinate?' A paper by Jo appears elsewhere in this issue. At the colloquium dinner I was pleased to award honorary memberships of the society to four of our colleagues: Marston Conder, Rob Goldblatt, Gillian Thornley and Graeme Wake. In addition to their names featuring frequently in the list of council members published in the last newsletter, they have each contributed much to the NZMS behind the scenes over the years. This is the society's way of expressing it's gratitude.}

Mick Roberts
Massey University, Albany

Mick Roberts
Massey University, Auckland

LOCAL NEWS

AGRESEARCH

With the recent restructuring of AgResearch, three of the mathematical groups have been merged into a new "Bioinformatics, Mathematics, and Statistics" Section consisting of 16 biometricians, five bioinformaticians and five mathematical biologists.

On the conference scene, five of the biometricians went to the Biometrics/Genstat conference at Thredbo in February. David Baird ran a pre-conference workshop on "Design and analysis of microarray studies using GenStat" and gave an invited paper on "The analysis of nuclear magnetic resonance data." Peter Johnstone spoke on "Density estimation from distance sampling using splines" and Lilian Morrison presented on "Immunity to gut nematodes in sheep." Neil Cox and Vanessa Cave were the other two attendees. Being up in the "mountains" it wasn't too hot for the kiwi contingent, but the Queenslanders complained about the cold. Most folk got to climb to the top of the mountain or took the chairlift up and walked down. The wine-tasting competition gave some trouble, and it was decided that tasty was the wrong word for describing cheap (under A$10) wines.

Harold Henderson's work over the last decade with Data Desk graphics has culminated in the publication in JABES (Dec 2004) of a 30-page editor's invited article entitled "Interactive and dynamic graphics in statistical consulting." After a similarly long gestation period, a paper by Graham Wood and Dave Saville on the *n*-dimensional geometry of the linear model *p*-value has been published in JRSS-A in Jan 2005 under the obscure title "The ubiquitous angle"; this work could be of interest to teachers of linear algebra who are on the lookout for interesting applications.

Four of the mathematical biologists attended the 41st Applied Mathematics Conference (ANZIAM 2005) in Napier from 30 January to 3 February. Kumar Vetharaniam spoke on "Sampling strategy for DNA backtracing of mixed meat products," Paul Shorten on "A mathematical model of human liver fatty acid metabolism and lipoprotein asssembly" and Ken Louie on "A distributed-delay differential equation

model for the growth of ryegrass-clover pastures." Tanya Soboleva was the other attendee. The usual Hawkes Bay sunshine was noticeably absent the entire week, replaced by humid drizzle, although that did not deter a large group from enjoying an adventurous ride out to visit the gannet colony at Cape Kidnappers on the free afternoon.

Rajiv Chaturvedi has joined as a Scientist with the Bioinformatics, Mathematics and Statistics group at AgResearch this January. His research area is development of computational and mathematical methodologies and implementing them in software for computational systems biology problems.

His research at the University of Notre Dame, IN, USA has dealt with modeling morphogenesis [1]. Formation of the structure of an organism or its part encompasses differentiation and growth of tissues and organs during development, starting from undifferentiated mesenchymal cells, under the influence of multiple morphogens, in a complex, dynamically changing spatial domain. The dynamic, three-dimensional, composite model framework to treat vertebrate development combines submodels that address, in a unified framework, length-scales from subcellular to tissues and organs. Interacting submodels he has used include a discrete model derived from non-equilibrium statistical mechanics (Cellular Potts Model) and continuous reaction-diffusion models. A state diagram with associated rules and a set of ordinary differential equations model genetic regulation to define and control cell differentiation. Simulations of spatiotemporal bone patterning in the proximo-distal (from body towards digits) direction of developing avian limb have been carried out as a sample application. The framework has been developed so that future enhancements to refine and add ever more phenomena of interest are allowed (for example, musculature, vasculature, and cytoskeleton modeling).

At AgResearch he is working with Tanya Soboleva on metabolomics of systems of biological interest.

[1] R. Chaturvedi, C. Huang, B. Kazmierczak, T. Schneider, J. A. Izaguirre, T. Glimm, H. G. E. Hentschel, J. A. Glazier, S. A. Newman, M. Alber, "On Multiscale Approaches to Three-Dimensional Modeling of Morphogenesis," Journal of the Royal Society Interface, in press.

Our new Bioinformatics, Mathematics, and Statistics Section had its inaugural annual get-together at Ruakura, Hamilton, from 21 to 23 March, with the middle day spent at the C R Rao workshop.

Ken Louie

THE UNIVERSITY OF AUCKLAND

Department of Computer Science

Dr Alexei Drummond has accepted an offer of a position as a Lecturer in Bioinformatics. This position is joint between the Bioinformatics Institute and the Department of Computer Science, funded largely by the former.

Dr Nevil Brownlee commenced work as Associate-Professor in February 2004.

Dr Ian Warren commenced work as a Lecturer in April 2004.

Dr Sathiamoorthy Manoharan has been promoted over the bar in the Senior Lecturer Scale, Dr John Hamer has been promoted to Senior Lecturer, Andrew Luxton-Reilly has been promoted over the bar in the Senior Tutor scale, and Dr Burkhard Wuensche has received a special increment in the Lecturer scale.

Dr Richard Lobb took early retirement from his position as Senior Lecturer at the end of February 2004. As a founding member of this Department, Richard made a major contribution to the department and its development over its entire history. Richard took a lead role in the development of the department's curriculum and its computing infrastructure, and he has established the Graphics and Visualisation Research Group as a significant research force in the department. Richard is a Distinguished Teaching Award recipient, and he is well recognized as one of the best teachers and mentors in the department.

Associate-Professor Peter Gibbons took early retirement from his position in August 2004. Peter has also made a major contribution to the department and its development over almost its entire history. Peter served as both Deputy Head of Department and Head of Department for a substantial period of the department's development, and he guided the department through two academic reviews (declining the opportunity to guide the department through a third review this year!). Peter was warmly respected in his leadership roles within the department and faculty, and he is internationally recognized for his work in computational complexity.

Associate-Professor Peter Fenwick has chosen to take early retirement from his position, effective from the beginning of February 2005. Peter was initially appointed as an academic member of the Computer

Centre, transferring to the Department of Computer Science in the late 1980s. He has had a major role in developing curricula in Data Communications, and he has a strong international reputation for his work in compression algorithms, including having one of his algorithms implemented in the standard Unix text compression utility. Peter has had many leadership roles in both the department and the Faculty, serving an extended period as Deputy Dean and a year as Acting Head of Department. He has most recently led the department's enrolment team.

Dr Jennifer Lennon retires from her position as Senior Lecturer, effective from the end of February 2005. Jennifer has led the Hypermedia Unit for many years, and she has an international reputation in the area of hypermedia applications for flexible learning. She started in the department as a Senior Tutor, then studied for a PhD under the supervision of Prof. Maurer, becoming the first woman PhD graduate from the department. Jennifer has had an active role in developing the highly-popular graduate Hypermedia course.

The Department would like to take this opportunity to recognise the contributions of Richard, Peter Gibbons, Peter Fenwick and Jennifer to this Department, to the University of Auckland and to Computer Science, and we wish them well in their retirement.

Dr Lew Hitchner completed his one year position as Senior Lecturer in June 2004.

Dr Myra Cohen resigned her position as Senior Tutor in August 2004.

Dr Hans Guesgen has been awarded a U21 Fellowship for 2005. That will allow Hans to visit several Australian and European U21 partner Universities, for benchmarking to assist in development of the department's strategic plan.

IWCIA 2004, the Tenth International Workshop on Combinatorial Image Analysis, was held at the University of Auckland. on December 1st to 3rd. Besides three invited talks, there were 55 accepted papers at IWCIA 2004 (out of 88 submissions for this conference).

Seminars

Professor Rod Downey (VUW), "Generalized Collatz functions and computability".
Mark Moir, "Using elimination to implement scalable FIFO queues."
Jeremy Gibbons, "Enumerating the rationals."

Garry J. Tee

Department of Engineering Science

It is twelve months since your tardy correspondent communicated. During that period Ian Collins has been elected to a Fellowship of the Royal Society of New Zealand and Matthias Ehrgott has been promoted to Associate Professor.

In order to make room for the expansion of the Engineering Library, the Department of Engineering Science has moved from the main Engineering building at 20 Symonds Street to 70 Symonds Street (Uniservices House), so it is now reunited with the Bioengineering Institute. We occupy floors 2,3 and 4, with the bioengineers just above us. We are comfortable in refurbished offices with air-conditioning. We have two new computer laboratories and two seminar rooms suitable for Year 4 teaching.

The Department is basking in the glory of being ranked 3rd equal among departments in NZ universities in the Performance Based Research Fund exercise recently held. On the criterion of percentage of staff given an A classification (35%) we rank first. (Six people were ranked as A grade researchers. Their names are confidential, so it could conceivably be a coincidence that following the promotion mentioned above we now have precisely six Professors and Associate Professors.)

Andrew Mason and David Ryan are two of the four founding directors of Optimal Decisions Technologies (ODT), a company that has produced "Siren", a computer program that simulates and co-ordinates the movements of ambulances and trucks.

The Department is getting ready to host the NZIMA Workshop on Mathematical Models for Optimizing Transportation Services (April 18–22).

Don Nield

Department of Mathematics

A Symposium in honour of David Gauld was held on 2004 December 10, with the following lectures:

John Butcher, "Riemann surface snakes and ladders."
Cris Calude (Computer Science), "Topology, randomness and uncertainty."
Don Nield (Engineering Science), "Integrating Bessel functions analytically: why and how?"
Sina Greenwood, "Brunnian rings."
Marston Conder, "Highly transitive imprimitivities."
Boris Pavlov, "A solvable model of the Helmholtz resonator."
Abdul Mohammed (Sultan Qaboos University, Oman), "A survey of metrization theory of manifolds."
Arkadii Slinko, "Optimal lobbying is W[2]-complete."
David Ryan (Engineering Science), "Exploiting balanced matrix structure in scheduling."
Ivan Reilly, "Some topics in topology."
James Sneyd, "Nonlinear calcium dynamics."
Gaven Martin (Massey University—Albany), "Equations of nonlinear elasticity and the Hilbert-Smith conjecture."
David Gauld, "Some reflections."

David Gauld completed his final term of office as Head of Department on 2005 January 31st, after a total of 5079 days, and he was succeeded as HOD by Bill Barton.

Rod Gover has been promoted to Associate Professor; Vivien Kirk, Mike Meylan and Warren Moors have been promoted to Senior Lecturer; and Judy Paterson and Wendy Stratton have been promoted above a bar in the Senior Tutor scale.

Marston Conder has been awarded one of the two inaugural outgoing Hood Fellowships, and at the 2004 New Zealand Mathematics Colloquium (University of Otago) he was elected an Honorary Life Member of the New Zealand Mathematical Society.

Geoff Nicholls has accepted an appointment in the Department of Statistics at Oxford University.

Professor John H. Conway F.R.S., the Distinguished John von Neumann Professor at Princeton Institute of Advanced Studies, visited the Department for January 2005. He was here as one of the participants in the program on "Geometry: Interactions with Algebra and Analysis," which is funded by the NZIMA during the first six months of 2005. He gave lectures on "Geometrical groups in 2 and 3 dimensions,""Hunting the Monster with few weapons," and on "The Free Will Theorem."

Recent visitors include Professor Len Bos (University of Calgary), Professor Sydney Bulman-Fleming (Wilfrid Laurier University, Waterloo), Professor Michael Eastwood (University of Adelaide), Professor Peter Gill (ANU), Professor Derek Holt (University of Warwick), Professor Patrick DF Ion (Mathematical Reviews), Professor Bill Kantor (University of Oregon), Professor Wolfgang Knapp (Universitaet Tuebingen), Professor Martin Liebeck (Imperial College), Professor Colin Maclachlan (University of Aberdeen), Dr Aisling McCluskey (National University of Ireland, Galway), Professor David Witte Morris & Professor Joy Morris (University of Lethbridge, Alberta), Dr Paul-Andi Nagy (Humboldt University, Berlin), Dr Richard Porter (Bristol University), Professor Cheryl Praeger (UWA), Professor Akos Seress (Ohio State University), Professor Dimitri Shakhmatov (Ehime University, Japan), Professor Andrew Waldron (University of California—Davis), Dr Shanshuang Yang (Emory University) and Dr Tsukasa Yashiro (Osaka University).

The 2004 NZ Mathematics Colloquium was held at the University of Otago on December 6–8. Plenary Addresses were given by Rod Gover on "Overdetermined PDEs, the Einstein equations and conformal geometry," and by James Sneyd on "Neither an ant nor a spider be: historical vignettes in mathematical physiology." Members of this Department gave the following contributed papers:

Bill Barton, Bob Chan & Chris King, "Undergraduate mathematics
learning in English by speakers of other languages."
Marston Conder, "Group actions on hyperbolic manifolds."
David Gauld, "Analytic=Continuous.'
Jeffrey Gong & Gaven Martin, "Extension of quasiconformal homogeneity."
Sina Greenwood, "Brunnian rings."
Michael Meylan, "The vibration of rivetted elastic plates."
Alastair McNaughton, "Optimization of forest harvesting."
Boris Pavlov, "Fitting a solvable model of a Helmholtz resonator."
Steve Taylor, "The temperature in an annealing furnace: an MISG project."
Garry Tee, "Surface area of ellipsoids in *n* dimensions."

A workshop on geometry was held at The University of Auckland on January 29th, as part of the NZIMA Geometry Program. The speakers were Vaughan Jones, Shanshuang Yang (Emory) on "Uniform Sobolev extension and LLC domains," Michael Eastwood (Adelaide) on "Moduli of isolated hypersurface singularities," Tsukasa Yashiro (Osaka) "On deformations of surface diagrams," and John Conway

(Princeton) on "Geometrical groups in 2 & 3 dimensions."

An NZIMA Conference on "Geometry: Interactions with Algebra and Analysis" was held at The University of Auckland, on February 14th–18th. Marston Conder gave a Plenary Address on "Compact hyperbolic 4-manifolds of small volume." Members of this Department contributed the following lectures:

Rod Gover, "Operators on differential forms and global invariants."
Shih-Chang Huang, "Dade's conjecture for the Chevalley groups $G_2(q)$ in defining characteristic."
Primoz Potocnik, "Imprimitive permutation groups with blocks of size two."
Garry Tee, "Surface area and capacity of *n*-dimensional ellipsoids."

Rick Beatson and Qui Bui (both from Canterbury) and Shayne Waldron ran a conference here in February, on Approximation Theory and Harmonic Analysis. The following lectures were presented:

John J Benedetto (University of Maryland), "Sigma-Delta quantization and finite frames."
Qui Bui (University of Canterbury),"Some remarks on Heisenberg frames."
Len Bos (University of Calgary), "Spanning sets in Lebesgue and Hardy spaces."
,**Peter G Casazza** (University of Missouri), "Signal reconstruction without noisy phase."
,**Xuan Thinh Duong** (Macquarie University), "New characterizations of BMO and Morrey-Campanato spaces."
Kil Hyun Kwon (Division of Applied Mathematics, KAIST), "Asymmetric multi-channel sampling and its aliasing error."
,**Seng Luan Lee** (National University of Singapore), "Approximation of Gaussian and its properties."
Q.T. Le Gia (UNSW), "Polynomial operators and local approximation of solutions of pseudo-differential equations on the unit sphere."
,**Paul Leopardi** (UNSW), "The Riesz energy of counting measures on the sphere."
,**David Levin** (Tel Aviv University), "Moving least-squares for surfaces."
Alvise Sommariva (UNSW), "Quadrature over the sphere."
Vilmos Totik (University of Szeged & University of South Florida), "Equilibrium measures and polynomials."
,**Janet C Tremain** (University of Missouri), "The Kadison-Singer problem and the Feichtinger conjecture."
,**Daniel S Zwick** (Wilcox Associates), "Some innovations in computing best-fit features in metrology."

The 8th Devonport Topology Festival on February 25th at Devonport was organized by Sina Greenwood, with the following lectures:

Kevin Broughan (The University of Waikato), "Colloquium Postscript,"
Richard Evans, "McMullen's bounded injectivity radius conjecture,"
David Gauld, "A report on the Oman games,"
Aisling McClusky (National University of Ireland), "Rocky Mountain mathematics,"
David McIntyre, "Topology dictionary and topology oracle,"
Gaven Martin (Masey University—Albany), "Extremal mappings of finite distortion,"
Dmitri Shakhmatov (Ehime University, Matsuyama), "Constructing Hausdorff group topologies on Abelian groups: a selection of recent results."

Paul Bonnington was invited to give a seminar at Keio University in Japan on February 25th, as part of the Japanese "21st Century COE Program: Integrative Mathematical Sciences." He was at Keio University and Yokohama National University from February 23rd to March 1st.

David Gauld was absent from Auckland from January 21st to February 21st, visiting and working with Dr Abdul Mohamad who is now an Assistant Professor at Sultan Qaboos University in Oman. Abdul previously completed his PhD at Auckland supervised by David Gauld & David McIntyre. David Gauld spoke to a general university audience on "The Changing Research Context in New Zealand," and he spoke on "A survey of manifolds" to an audience from the Department of Mathematics and Statistics. Abdul and David also climbed the highest mountain in the Arabian Peninsula, Jabal Shams, at 3009 metres above sea level.

Greg Oates presented his paper "Measuring the degree of technology use in tertiary mathematics courses" at the 9th Asian Technology Conference in Mathematics, National Institute of Education, Singapore, and he received the Best Paper Award.

Philip Sharp has won a travel grant from the ISAT Linkages Fund, administered by the RSNZ.

Jozef Siran worked with Dr Martin Knor (Slovak University of Technology) and Dr Roman Nedela (Mathematics Institute of the Slovak Academy of Sciences), financed from the Slovak Research Grant Agency. He has won a travel grant from the ISAT Linkages Fund, administered by the RSNZ.

In 2005 we have four secondary teachers on Study Awards (Margaret Bryant, Lisa Darragh, Suzanne Kerr, Rasela Lafaele); and two secondary teachers on RSNZ Fellowships (Anna Dumnov, Sue Wood). An agreement has been signed with Majlis Amanah Rakyat (MARA) in Malaysia, for a Uniservices contract to provide a 20-week course for 25 mathematics and science teachers.

We have four NZIMA-funded post-doctoral fellows currently with the Department: Primoz Potocnik (ex-Ljubljana), Jana Siagiova (ex-Bratislava), Bart Oldeman, and Richard Evans.

Shirley Huang has successfully defended her thesis for PhD in the oral examination.

Shih-chang Huang has completed the PhD oral examination on his thesis entitled "Dade's conjecture for the Chevalley groups $G_2(q)$ in defining characteristic," supervised by Jianbe An and Eamonn O'Brien. The recommendation from his examiners is that, subject to minor corrections to his thesis, he be awarded the degree of PhD.

The Department had 22 summer students, nine paid by the Department and 13 by the Faculty. A further five students were offered scholarships, but turned them down so they could work elsewhere. Two students who applied for scholarships were instead employed to work on teaching material within the Department. Dr Arkadii Slinko and honours student Robin Christian had a particularly successful summer scholarship project, producing two papers that will be presented at conferences in France and USA.

Simon Marshall has been chosen to represent this university at the Universitas-21 undergraduate research conference in Virginia.

Rachel Joanne Weir graduated here and went in 1995 to the University of Michigan (PhD 2001). She then had an appointment at the University of Virginia. In 2004 Rachel and her husband (Dr Carswell) were both appointed to the Department of Mathematics at Allegheny College, at Meadville in Pennsylvania, where she is an Assistant Professor of Mathematics.

Seminars

Dr Warren Moors, "Separate continuity, joint continuity and the Lindelof property."

Dr Peter MW Gill (ANU), "Introduction to quantum chemistry."
Robin Christian,"On computational complexity of lobbying in multiple referenda."
Professor Dmitri Shakhmatov (Ehime University, Japan),"Constructing Hausdorff topologies on Abelian groups" (2 lectures).
Professor Derek Holt (University of Warwick),"Groups with regular sets of geodesics," and"Formal language theory and the word problem in groups."
Dr Paul-Andi Nagy (Humboldt University of Berlin), "Nearly-Kaehler manifolds."
Professor John Butcher, "General linear methods."
Renu Choudhary, "Some topics from the theory of monotone operators and nonlinear semigroups," and"Generic convergence of a convex Lyapounov function along trajectories of nonexpansive semigroups in Hilbert space."
Professor Richard Porter (University of Bristol),"Wave scattering by an ice sheet of varying thickness."
Professor Wolfgang Knapp (Universitaet Tuebingen),"Primality testing with the group *SL(2,Z/nZ)*".
Professor Bill Kantor (University of Oregon),"Algorithms for Sylow subgroups" (4 lectures).
Dr Garth Gaudry & Jan Thomas (Australian Mathematical Sciences Institute),"The AMSI and the International Centre of Excellence for Education in Mathematics."

Garry J. Tee}
Department of Statistics

Our biggest news has been the richly deserved promotions of Alan Lee and Chris Triggs as professors in the department. We are still, of course, reluctant to let their predecessor Alastair Scott retire completely. In a last-ditch effort to keep him, the university bureaucracy stepped in and lost his retirement notice, with the happy consequence that he remains with us for another month!

Our PhD students have been exceptionally busy recently. Monique Mackenzie (now at St Andrews University) and Andreas Berg successfully defended their theses, and Yuichi Hirose submitted his, all within the space of a week. Sarah Song was awarded an NZ International Postgraduate Research Scholarship for her PhD with Mik Black and Yong Wang. As if all this wasn't enough, James Reilly and Mat Pawley are both the proud new fathers of baby girls, and Andreas Berg is a proud expectant father.

Mik Black attended the ANU BioInfoSummer meeting and the Otago Genomics Facility Microarray Meeting, as well as the International Conference on Bioinformatics here in Auckland in September. Ilze Ziedins was an invited participant to a month-long programme on Queueing Theory at The Royal Swedish Academy of Sciences, Stockholm, in November.

Before the summer break, staff and grad students wound down by challenging each other to a Paintball match. After two hours of fierce warfare it was looking like stalemate, until Brian McArdle launched an heroic sting raid and captured the enemy flag, with the invaluable assistance of the Marti Anderson Getaway Outfit. Better luck to the students for next time, but the staff are quietly confident (read "gloating furiously") for another victory next year!

A workshop on Bayesian inference and MCMC, organized by Renate Meyer, was held here on February 24th. The speakers were:

Quentin Atkinson, "Bayesian inference for language phylogenies."
Mik Black, "Estimating disease prevalence in the absence of a gold standard."
Bill Bolstad, "A Monte-Carlo analysis of a mixture-based shrinkage estimator."
Colin Fox, "Solving Inverse Problems using MCMC with an approximation."
Ville Kolehmainen, "Parallelized Bayesian Inversion for three-dimensional dental X-ray imaging."
Renate Meyer, "Bayesian semiparametric modelling of stratified survival data using mixtures."
Russell Millar, "A simple case-deletion diagnostic for Bayesian models."
Geoff Nicholls, "Deposition model-comparison from radiocarbon data."
Allen Rodrigo, Angelika van der Linde,"Coefficients of determination and predictive model choice."
Tim Watson, "A hierarchical Bayesian model and simulation software for the maintenance of water pipe networks."

The 14th International Workshop on Matrices and Statistics IWMS-2005 was held at Massey University —Albany from March 29th to March 1st. George Seber gave a Keynote Lecture on "Things my mother never told me about Matrices," Alan Lee & Alastair Scott gave an Invited Lecture on "Semi-parametric efficiency, projection and the Scott-Wild estimator," and Garry Tee gave an Invited Lecture on "Eigenvectors of block circulant matrices."

And finally, our departmental manager Sharon Walker found herself fielding more than the usual workload in March. As she walked out of the building, a giant 2kg bunya nut fell from an Araucaria tree and missed her by millimetres. She paused to inspect that UFO, whereupon she was narrowly missed by a second one! The department is looking into alternative ways of expressing our appreciation for Sharon.

Seminars

Dr Peter MW Gill (ANU), "Efficient calculation of *p* values in permutation significance tests."
Professor CR Rao F.R.S. (Pennsylvania State University, NZSA Visiting Lecturer 2005),"Statistics: reflections on the past and visions for the future."
Dr Angelika van der Linde (University of Bremen),"General measures of variability and dependence for multivariate continuous distributions."

Garry J. Tee

UNIVERSITY OF CANTERBURY

Department of Mathematics and Statistics

Norhayati Hamzah has completed all the requirements for her PhD following her oral examination in mid-December. Her PhD thesis was entitled "A bifurcation analysis of a multi-compartment plankton-zooplankton-nutrient interaction" and was supervised by (now Adjunct-) Professor Graeme Wake and Dr Alex Ross (ex-NIWA). Yati is now back in her home University in Brunei Darussalam as a Lecturer in Mathematics.

Douglas Bridges gave a lecture in March at the Special Session on Proof Theory and Constructivity, at the Annual Meeting of the Association of Symbolic Logic, in Stanford. He and Simona Vita then visited several universities in Texas and New Mexico, lecturing on their joint work on apartness spaces. Mike Steel is heading off in April to the Mathematical Sciences Research Institute (MSRI) at Berkeley where he will present some results from his just-completed MacLaurin Fellowship. The workshop is titled "Models of Real World Random Networks". Ben Martin gave a talk at the Oberwolfach meeting "Groups and Geometries" in March. Thirteen people from the department, including three students, went to the NZMS Mathematics Colloquium in Dunedin in December, giving eleven talks between them.

Recent visitors include: Professor Claude Bélisle (Laval University), Professor Jotun Hein (Oxford), Dr Anne-Mette Hein (Imperial College), Professor Greg Reid (University of Western Ontario), Professor Hajime Ishihara (Japan Advanced Institute of Science and Technology), Professor Vincent Moulton (University of East Anglia), Dr Katharina Huber (University of East Anglia), Dr Burkhard Polster (Monash University)

Seminars

Norhayati Hamzah, "A bifurcation analysis of a multi-compartment plankton-zooplankton-nutrient interaction."
Professor Martin Liebeck (Imperial College), "Random walks on finite groups."
Professor Benny Chor (Tel Aviv University), "Maximum likelihood of evolutionary trees is hard."
Professor Jasbir Chahal (Brigham Young University), "Congruent numbers and elliptic curves."
Professor Marcel Herzog (Tel Aviv University), "Characterization of non-nilpotent groups with two irreducible character degrees."
Dr Günter Steinke, "Old and new on Laguerre geometries."
Professor Jotun Hein (University of Oxford), "Finding the minimal number of recombinations for a set of sequences from a population."
Professor Angelika van der Linde (University of Bremen), "Model complexity."
Professor Claude Belisle (Laval University), "Aspects of directional sampling on $\mathbf{R}^d$."

Ben Martin

MASSEY UNIVERSITY

Institute of Fundamental Sciences (Palmerston North)

Mathematics

We welcome Aroon Parshotam who has been appointed as a lecturer for one year. This appointment arose as Robert McLachlan has taken up his MacLaurin Fellowship from the New Zealand Institute of Mathematics and its Applications this year.

We said farewell to Tom Lofaro who went back home to Missouri and welcomed back Bob Richardson from North Carolina.

Our congratulations to Gillian Thornley who has been awarded an honorary membership of the New

Zealand Mathematical Society.

Also our congratulations to Kee Teo who won the Vice-Chancellor's Award for Excellence in Teaching First Year Students. Well deserved!

John Hudson attended the Summer Workshop on "Geometry: Interactions with algebra and analysis" held in Napier, January 8–15, 2005.

Bruce van-Brunt, Igor Boglaev, Aroon Parshotam, Dean Halford, Robert McLachlan and Marijcke Vlieg went to Napier to attend the 41st Australia New Zealand Industrial and Applied Mathematics (ANZIAM2005) Conference held from 31 January to 3 February noon. The conference was very well attended by both countries (140) and there were about 120 talks and these were of high standard. Robert McLachlan was an invited speaker and talked about 'Geometric Numerical Integration.' Igor, Aroon and Bruce presented a paper.

Seminars

Professor Tianming Wang (Department of Mathematics, Dalian University of Technology, People's Republic of China), "Algorithmic proofs of combinatorial identities."
Professor Ian Enting (The University of Melbourne), "Forty years of CO_2 inversions: What have we learned."
Professor Gaven Martin, "The equations of nonlinear elasticity, conformal geometry and the Hilbert-Smith conjecture."

Marijcke Vlieg-Hulstman

Institute of Information and Mathematical Sciences (Albany)

The year had a busy start with the MISG at Albany and the meetings at Napier.

The ANZIAM Mathematics-in-Industry Study Group for 2005 was hosted by the Centre for Mathematics in Industry at Massey University (Albany) on 24th–28th January, just before ANZIAM2005 in Napier. 120 delegates from 13 countries participated and 7 industries presented problems for analysis, and hopefully, practical solutions. Six of these problems were from New Zealand industries (Lincoln Ventures, NZ Steel, Transpower, Environment Canterbury, Compac Sorting Equipment, and Fisher and Paykel), and one was from Australia (Backyard Technology). On the first day an opening address was given by invitation by the Deputy Prime Minister of New Zealand, Dr Michael Cullen, which was very widely reported. Dr Suki Siriwardene, Manager of Technology New Zealand, then broke the good news to the workshop that her organisation was supporting this venture under their "SmartStart" program. A student workshop was held within MISG2005. Dr Sam Howison, Director of OCIAM, University of Oxford, who was a special invited facilitator, spoke at this and also gave a separate plenary lecture. DVDs of all the main Monday (Problems) and Friday (Solutions) sessions are available for purchase. (See notice elsewhere in this Newsletter). The Director of MISG2005 (Professor Graeme Wake) and Massey's Centre have agreed to host the MISG2006, in a similar pattern. (See elsewhere.) An informal dinner was enjoyed by delegates at the adjacent North Harbour Stadium complex, but we could not arrange for a Trans-Tasman rugby test to be played that night, regrettably!! The Proceedings of MISG2004 are in press and are eagerly awaited, judging from the number of inquiries.

The Mathematicians were highly involved in both meetings at Napier at the start of the year.

Gaven Martin organised (with E. O'Brien) the 11th annual NZMRI summer meeting in Napier on the topic "Interaction between Analysis and Geometry". Shaun Cooper and Uros Abas were other participants from IIMS.

Robert, Graeme, Mick, Carlo, Winston, Jo and Amanda all attended ANZIAM in Napier at the start of February. We enjoyed a great week despite the rain. Robert continues as President of ANZIAM and Carlo took on his new role as chairperson of the New Zealand Branch of ANZIAM. Looking back to the end of last year, December saw many of the Albany Mathematicians at the NZMS Colloquium at University of Otago: Robert, Graeme, Mick, Carlo, Winston, Mini, Jo and Frederick. We congratulate Jo Mann on winning the Aitken Prize for the best student presentation "To vaccinate or not to vaccinate" and also Heung Yeung (Frederick) Lam, who receive one of two honourable mentions for his talk "Sums of two squares and a conjecture for sums of 8t squares". Graeme Wake was awarded an Honorary Membership of the NZMS. At the meeting Gaven became incoming Vice President of the NZMS, Winston became Secretary, Mick continues as President.

The week before the colloquium, Winston and Carlo participated in the NZIMA workshop on scientific computation, bifurcation theory and geometric mechanics in Leigh.

In November, Leng Leng Lim travelled to the International Association of Volcanology and Chemistry of the Earths Interior 2004 (IAVCEI) General Assembly meeting at Puc\={U}n, Chile. She presented some of her research done with Robert McKibbin and Winston Sweatman in a talk "Modelling volcanic ashfall". She also visited Villarrica, one of the most active volcanoes in Chile. One other unforgettable moment for her was having her birthday song sung in Spanish at the conference dinner by over nine hundred people from all around the world. She says that she was very touched although she could not understand a single word of it.

Dr Alona Ben-Tal has taken up her Lectureship in Mathematics. Alona has just completed a three year period as a NZ S&T Postdoc Fellow with the Bioengineering Institute at the University of Auckland, where she studied the cardio-respiratory system.

Sharleen Harper and Amanda Elvin have started their PhD projects. Sharleen is studying Aerosol Transport with Graeme Wake and Robert McKibbin. Amanda is studying Computational Neuroscience with supervisors Carlo Laing and Mick Roberts.

Congratulations to Cynthia Wang who has successfully defended her PhD thesis. Cynthia is currently a postdoctoral fellow at the University of Queensland, Brisbane, working with Dr Lutz Gross (previously of IIMS). Visitors}

Geoff Mercer from the University of New South Wales (ADFA in Canberra).
Colin Maclachlan from the University of Aberdeen.
Henning Rasmussen from the University of Western Ontario, Canada.
Sam Howison from the University of Oxford, England.
Patrick Ion from Mathematical Reviews.
Heng Huat Chan from the National University of Singapore.

Seminars

Jon Chapman (University of Oxford, England),"Exponential asymptotics and nonlinear eigenvalue problems."
Martin Reimann (University of Bern, Switzerland),"Wavelets for hearing and an uncertainty relation for the affine group."
Carlo Laing, "Equation-free modelling: some neural examples."
Heng Huat Chan (National University of Singapore), "When is a prime a sum of two squares?"
Henning Rasmussen (University of Western Ontario, Canada),"Swing Options in Financial Mathematics."
Shaun Cooper,"Introduction to the Macdonald identities."
Sam Howison (University of Oxford, England),"Mathematics of splashing and water entry."

Winston Sweatman

Institute of Information Sciences and Technology (Palmerston North)

Steve Haslett has again been traveling to strange and unfamiliar territories, most recently Vietnam and Azerbaijan on a World Bank project involving small national surveys of water and sanitation providers. The project plan is to use these studies to set up a toolkit which will be a template for future surveys in other countries. He reports that the local cuisine was excellent in both cases. He has now returned to yet another strange and unfamiliar territory: first year teaching.

Steve and Geoff Jones are also completing a project for the World Bank and the National Statistical Coordination Board of the Philippines, producing small-area estimates of poverty incidence for the Philippines for use in aid targeting. They spent part of last year in Manila working with NSCB staff. The food was quite good here too, but the national habit of snacking every two hours was difficult to keep up with.

Doug Stirling recently won a Massey Teaching Excellence Award for his web-based teaching software CAST. He is currently working on a Rockefeller Foundation-funded project to develop a version of CAST for Africa and will be on sabbatical at the University of Reading from June until January adding chapters about multiple regression and multivariate analysis. He has been invited to run a Workshop at the Applied Statistics 2005 conference in September in Slovenia.

In February Ganesh and Geoff Jones attended and presented papers at the Regional Biometrics Society Conference in Thredbo, Australia. They made up half of the "Palmy Pirates" team who astonished everyone by coming from nowhere to take third place in the Thredbo Challenge (see attached photograph).

This is perhaps the first Local News in which it is not reported that Mark Bebbington has been overseas. He has however been promoted to Associate Professor, for which we congratulate him.

Ganesalingam has now almost recovered from the physical effects of the tsunami in which he and his family were caught while holidaying in Sri Lanka just prior to the International Sri Lankan Statistical Conference in December. He would like to thank the many well-wishers who contacted him.

David Alexander, having just achieved his doctorate, has now achieved parenthood as well, being the proud father of Daniel (7lb 8 0z). He is currently on parental leave. The switch from first year teaching to changing nappies has no doubt been traumatic.

Although still working at Landcare, Greg Arnold is reducing still further, to 20%, his involvement in the university, confirming the old adage that"old statisticians never retire, they just tend to zero (almost surely)".

Geoff Jones

UNIVERSITY OF OTAGO

Department of Mathematics and Statistics

We are pleased to welcome several new staff members and a continuing appointment.

Prof Mark Meerschaert of the University of Reno, Nevada, has taken up his position as Chair of Applied Mathematics in February. He is featured in the "New Colleagues" section.

Dr Amal Amleh has continued her Fixed Term position as Lecturer in Computational Modelling from February 2005 for a further year.

Dr Richard Martin, of Wirksworth, U.K, has been appointed to the position of Fixed Term Statistics Lectureship while Assoc Prof Richard Barker is on study leave this year.

Mr Chris Palmer has been appointed as Computer Programmer/Support Person from mid-December 2004.

Dr Robert Aldred attended the 2004 NZIMA Conference on Combinatorics and Its Applications combined with 29th Austrasian Conference on Combinatorics and presented a paper and Poster in Taupo 13–18 December last year. The meeting was well attended with twenty invited speakers representing some of the biggest names in Graph Theory worldwide. Apart from the talks which were of a very high standard, Robert was able to discuss several current projects with international collaborators

John Clark attended the International Workshop on Algebra (VIC 2005) in February at Victoria University of Wellington and gave an invited talk entitled "Locally semi-T-nilpotent families of modules."

Mr John Harraway has just returned from six weeks in Brazil. He presented an invited paper at the 9th Brazilian Regression Conference in Sao Pedro. He also gave seminars in the Department of Exact Sciences at the University in Piracicaba and the Institute of Mathematics and Statistics at the University of Sao Paulo. He visited Dalton Andrade at the Federal University of Santa Catarina in Florianopolis for collaborative work on item response theory and the Federal University of Bahia in Salvador, the city where ICOTS7 (International Conference on Teaching Statistics 7) will be held in July 2006. John is Scientific Secretary for ICOTS7 and while in Brazil he had meetings with the Local Organising Committee in Sao Paulo and meetings in Salvador at the venue for ICOTS7 as well as with others involved with the conference next year. John was recently elected a Vice President of the International Association for Statistical Education.

Visitors

Russell Higgs, from University College Dublin, has been visiting the Department for three months with his PhD student Donal Healy. Russell won this period of leave as part of a President's Teaching Award and chose to come to Otago to savour the Dunedin weather (well it is as least as good as Dublin's!) and to work with John Curran and Dennis McCaughan. Russell's interest is in projective representations which has some connections with central automorphisms.

In March Yonas Gebeyehu Tesfaye visited the University of Otago to work with his PhD thesis advisor Mark Meerschaert, Chair of Applied Mathematics. Yonas is a graduate student in Hydrological Sciences at the University of Nevada, Professor Meerschaert's previous post. Yonas's research concerns statistical models of river flows that take into account the seasonal variability in covariance structure, and the heavy

tailed nature of river flows. Mathematically, "heavy tails" means that the probability of exceeding a threshold R falls off like a power of R, and practically this means that observations several times larger than the mean are common. Yonas expects to defend his PhD thesis at the University of Nevada in May 2005. He enjoyed leaving the Nevada snow and desert to spend a few weeks in the beautiful green surroundings of Dunedin. He also reports that the coffee here is much better, and being Ethiopian, he is an expert in that area.

Seminars

Professor Richard Porter (University of Bristol), "Wave scattering by ice sheets of varying thickness."
Professor Jasbir Chahal (Brigham Young University), "Congruent numbers and elliptic curves."
Rick Beatson (University of Canterbury), "Interpolations and approximation with radial basis functions and applications."

New Zealand Statistical Association Visiting Lecturer for 2005

C R Rao (Eberly Professor Emeritus of Statistics, Pennsylvania State University, USA), "Cross Examination of Data."
Dr Russell Higgs (University College Dublin), "An Introduction to Projective Representations of Finite Groups."
Peter Fenton, "Life of Pi."
Angelika van der Linde (University of Bremen, Germany), "Model complexity."

Lenette Grant

THE UNIVERSITY OF WAIKATO}

Department of Mathematics}

In the latest promotion round, Rua Murray was promoted to Senior Lecturer and Stephen Joe was promoted to Associate Professor. Congratulations to them both.

The majority of the department is recovering from running the ANZIAM2005 conference held in Napier. Alfred Sneyd, Tim Stokes, Rua, Sean Oughton, and Stephen were on the organizing committee. Other people to attend from the department were Ian Craig, two postdocs, and four postgraduate students.

Participants at other conferences were Kevin Broughan and Rua who attended the "Geometry: Interactions with Algebra and Analysis" meeting held in Napier at the start of the year.

After the ANZIAM2005 conference, we had a number of short term visitors. These included the former post-docs Jacob Heerikhuisen, Jonathan Kress, and Paul Watson. Also visiting was James Lyness from Argonne National Laboratory.

Ernie Kalnins is now back from study leave in the United States. In turn, Stephen is currently on study leave visiting the University of New South Wales until mid-June. The other person on study leave in the first half of the year is Sean. He will start the overseas leg of his leave in early April. He will spend about a month in the United States, followed by about six weeks in Wales, after which he will attend a conference in Canada.

Stephen Joe

Department of Statistics}

Greetings from the Waikato. It has been a while since I have contributed to the Mathematical Society newsletter and there has been much happening, so forgive me in advance for any errors and omissions.

In April of 2004, the department hosted a successful workshop by Professor Peter Green of the University of Bristol, entitled"Structure and uncertainty: statistical modelling, stochastic systems and Bayesian computation." In March 2005, we presented another one day workshop, entitled "Data Scrutiny and Data Mining". The presenter was the NZSA Visiting Lecturer, Professor C R Rao from Penn State University, USA. Professor Rao, is one of the most eminent statisticians in the world, with a biography that lists two pages of medals, high level appointments, awards, publications and qualifications, spanning six decades. Anyone who has studied statistics will have come across his name. Technical terms such as Cramer-Rao inequality, Rao's Score Test, the Fisher-Rao Theorem and Rao distance appear in all standard books on statistics.

Last year saw the successful defense and graduation of our two PhD students Carole Wright and

Khangelani Zuma. Carole's thesis was entitled "Variety Trials in 2-dimensional layouts" and Khange's thesis was "Sexual Network Random Effects Model of Migration and Spread of HIV and other STIs in South Africa". Congratulations also go to Bill Bolstad for the successful launch of his book"Introduction to Bayesian Statistics" which was released in April, 2004.

On the visitor front, we again enjoyed a visit from Ken Russell and also Dave Johnson from Loughborough. Dave was with us for all of the second semester. He was involved with some teaching in our department, but he was here primarily to work with Nye John and David Whitaker on the revisions for the second edition of their book "Statistical Thinking for Managers" which is currently with the publishers.

Now, for a little on the "comings and goings" of members of our department. Lyn Hunt was on leave for the second half of 2004. During this time, she visited Melbourne and also Brisbane, where she was working with Kay Basford. Murray Jorgensen went to the United States in October, where he presented papers in Chicago and also at Colorado State University, in Fort Collins. Nye John and Dave Whitaker attended IBC in Cairns in July and Dave was also a participant at the NZORS conference held in Auckland in November. In May, James Curran went to Vienna where he attended the R conference. He also attended the Bruce Weir Symposium in Raleigh North Carolina and was an invited speaker at the NCSU Summer School Statistics Genetics also in Raleigh. In June James went to the JBRC Workshop on Identification in Edinburgh and was on leave for the rest of the year to work in Birmingham for the Forensic Science Service. In December, Bill Bolstad went to the 3rd Winter Workshop on Statistics and Computer Science - Scientific Application of Bayesian Analysis in Ein Gedi, Israel. Bill also attended the NZSA conference in Wellington in July 2004, along with Judi McWhirter and Murray Jorgensen. At the AGM, held during the conference, Murray was elected President of the Society and Judi was elected Secretary.

Finally, Dave Whitaker is currently on Sabbatical Leave and in his absence, Nye is acting Chairperson of the department.

Seminars

Jan Bulla (Goettingen University, Germany), "Introduction to Hidden Markov Models."
Angelika van der Linde (University of Bremen, Germany), "General measures of variability and dependence for multivariate continuous distributions."
Rosemary Bailey (Queen Mary University of London), "Hasse diagrams to describe the structure of designed experiments."
Jacques Poot (Population Studies Centre, University of Waikato), "On the use of meta-analysis in economics."
Nye John, "Inverse of the Information Matrix."
David Johnson (Business School, Loughborough University), "Teaching Statistics with Microsoft Excel."
Peter Davis (Department of Sociology, The University of Auckland), "Social facts and social stats: applications in quantitative sociology."
James Curran, "Some issues surrounding the interpretation of Low Copy Number (LCN) DNA evidence."
Murray Jorgensen, "Estimating a density of microbial densities."
Harold Henderson (Statistics, AgResearch Ruakura),"Henderson-Dynamic Graphics in Statistical Consulting."
David Ryan (Department of Engineering Science, The University of Auckland), "Robustness Issues in Aircrew Tours of Duty Optimisation."
Ray Hoare (Hoare Research Software Ltd, Hamilton), "Why do we need ANOTHER statistics program?"

Judi McWhirter

VICTORIA UNIVERSITY OF WELLINGTON}

School of Mathematics, Statistics and Computing Sciences *Te Kura Tatau*

There is to be a review of our mathematics, statistics and operations research academic programmes in August this year, so we are busy preparing self-reviews as part of this process.

Peter Donelan was an invited speaker at the Applications of Singularities workshop at CIRM (Centre International de Rencontres Mathematiques) in February, speaking on Singularities in Robotics.

Guohua Wu will be leaving us in April for a (tenure-track) lectureship at Nangyang Technological University, Singapore.

Mark McGuinness has once again spent several months as a Visiting Foreign Professor at the Applied Mathematics Division of the Korea Advanced Institute of Science and Technology in Taejon over Christmas, coming back for the Mathematics in Industry Study Group held at Massey University in Albany at the end of January. Mark is also visiting Andrew Fowler in Oxford for three weeks in April this year, working on models of cardiac control.

On the 28th and 29th of January 2005, MSCS hosted a two-day workshop on general relativity (Einstein's theory of gravity). New Zealand contains two active research groups in general relativity, once centered on Dr Matt Visser at Victoria University, and the other centered on Dr David Wiltshire at Canterbury University. For these two days both groups got together in Wellington for a series of thirteen informal seminars describing ongoing research.

Topics covered included cosmology, black holes, relativistic stellar structure and horizons. If you would like to find out more about the Victoria University General Relativity Research Group, or about one of the seminars given, please visit the Gravity Group homepage or contact the MSCS School office.

Seminars Given at the Gravity Workshop:}

Matt Visser, "Effective refractive index tensor for weak-field gravity."
Joey Medved, "Bekenstein-Hawking entropy confronts the generalized uncertainty principle."
Silke Weinfurtner, "Analogue quantum gravity phenomenology from a 2 phase BEC."
Celine Cattoen "Necessary and sufficient conditions for bangs, bounces, crunches, rips, sudden singularities, and more."
Petarpa Boonserm, "Generalizing and classifying perfect fluid spheres."
Piyush Jain, "Application of the classical field method to acoustic black holes in Bose-Einstein condensates."
David Wiltshire, "Accelerating cosmologies from compactification with a twist."
Roy Kerr, "Killing's equations for lazy students."
Benedict Carter, "Thermodynamic geometry for black holes."
Ben Leith, "Supercomputers, uniqueness and multi-scalar black holes."
Ishwaree Neupane, "Cosmology as Geodesic Motion: Multiple Scalars."
Alex Nielsen, "Random stuff about black hole horizons."
Marni Sheppeard, "From M-theory to tricategories—some current developments."

The Master of Science Degree in Stochastic Processes in Finance and Insurance is being offered by MSCS, for the first time, in 2005. Overseas specialists will be invited to lead courses, and representatives from the finance industry will be called in to help guide students through their projects. There is also a twinning arrangement with Tilburg University, so that students may be able to undertake some of their studies in the Netherlands.

Readers interested in finding out further information are encouraged to check out the programme website, or contact the director of the programme, Professor Estate Khmaladze.

Professor John Hine took up the position of Head of School on Wednesday 1 December. John has been Deputy Head for the last three years and some time prior to that was Chairperson of the former Department of Computer Science.

John joined Victoria University in 1977 after completing a Master of Science degree and a Doctor of Philosophy from the University of Wisconsin in the United States. He led the team that introduced the Internet to New Zealand at the start of 1986. The model of providing Internet access as a service made Victoria's then Computer Science Department the first Internet Service Provider (ISP) in New Zealand and eventually led to the establishment of NetLink, a University-owned ISP, in 1997.

John's research interests involve many facets of distributed systems, and his research has led to a role in the development of an Advanced Network for Research and Education for New Zealand. He has served on several Ministry of Research, Science & Technology working groups related to the development of this network and is now leading the capability development in anticipation of its implementation in 2005. He has also been spearheading the development of grid computing facilities at Victoria, including establishing an Access Grid node ({\tt http://www.accessgrid.org}) and a distributed grid of desktop computers for large-scale computing.

John replaces Dr Peter Donelan who has completed his term as Head of School. Peter summarised his term as Head of School as follows:

Three years as Head of School seem to have gone by in a flash. There have been plenty of good moments

and achievements, some good ideas that haven't yet come to fruition and maybe some missed opportunities.

Some of the achievements include: a very pleasing PBRF ranking for all the school's disciplines; ongoing success in Marsden; getting the BIT bedded in; some outstanding theses from Masters and PhD students, and lots more in progress; a superb office staff providing splendid service to the School; a computer network that demonstrates best practice that works!; numerous excellent workshops and conferences; expanding links with industry; an attractive website with well-designed functionality; and the growth and success of applied statistics.

Although as individuals we sometimes have different views about aspects of what we do and why, I have always felt genuine support from colleagues and a collective desire to achieve the best in the circumstances we are in. The School Executive Committee has provided advice and contributed to decisions on a wide range of matters affecting us. In particular, John Hine has provided a sounding board for ideas and applied clear-sighted advice and judgment without which I would not have been able to carry out the role. I wish him all the best for the next three years and I am confident the School will continue to flourish.

Congratulations to Yinhuo Zhang and Matt Visser who have been recently promoted.

Current news from the Stats/OR group}

(Thanks to John Haywood for this report): Megan Clark has been on Research and Study (R&S) leave since September 2004. Now back in Wellington, but still on leave until the end of April 2005, Megan visited Memorial University of Newfoundland and McMaster University in Hamilton (both Canada), London South Bank University (UK) and Freie Universitat Berlin (Germany). Thus Megan replaced most of Wellington's summer by winter elsewhere, although before Christmas that wasn't too bad a swap!

John Haywood had quite a short period of R&S leave from October 2004 to January 2005, but spent the time in Wellington and, among other things, that meant he got to enjoy Helen Haywood's 2nd birthday party early in December. John presented a paper at the NZ Econometrics Study Group 2005 summer meeting in Christchurch, 11–12 March.

Stefanka Chukova has R&S leave from December 2004 to June 2005. Stefanka is visiting colleagues in the US at University of North Carolina, University of Michigan (Ann Arbor), General Motors R&D Center (Michigan) and Kettering University, before attending a conference in Bulgaria. An important event that occurred early in Stefanka's leave was the birth of her first grandson Kian, who was born with no problems on 14 December 2004. We all hope Kian's first few months have gone smoothly, and are looking forward to a lengthy update on his progress when Stefanka returns. Before her R&S leave Stefanka went to a conference in Hiroshima, Japan in late August 2004. When Stefanka does return to NZ, she'll have quite a heavy landing, since she'll be taking over immediately as Program Director for Stats and OR from Shirley Pledger, who has been in that role since Megan started her leave.

Surprisingly(?), Shirley is showing no signs of a love of the power that comes with the job, and in fact seems even more keen than the rest of us for Stefanka to return! Shirley recently presented a paper at the February 2005 Thredbo Conference of the Australasian Region of the International Biometric Society. While there (which is quite "close" to Canberra), Shirley went up Mt Kosciuszko, a high point (literally and metaphorically) in Kosciuszko National Park. Those familiar with Mt Kosciuszko will note that I wrote "went up", rather than "climbed".

Also in February 2005, Richard Arnold attended COBAL2—the Second Meeting of the Bayesian Society of Latin America—held in the Baja California in Mexico. Richard presented a poster on determining tectonic stress using earthquake data. Dong Wang was away from December 2004 to early February 2005, working at RMIT (Australia) and also attending conferences in Sri Lanka and Australia.

Ivy Liu has R&S leave from November 2004 to June 2005. Ivy was initially based in the US at Purdue University, West Lafayette, Indiana. However Ivy was planning to move around a bit during 2005, before returning to VUW for the last month or so of her leave.

Estate Khmaladze was away for January 2005 and a couple of (separate) weeks in February. Estate presented papers at the International Conference on the Future of Statistical Theory, Practice and Education (Hyderabad, India), the Annual all-Indian Conference in Probability Theory, the Second Bachelier Colloquium on Stochastic Calculus and Finance, in honour of Albert Shiryaev's 70th birthday (Metabief, France), and the NZIMA international conference on Geometry: Interactions with Algebra and Analysis (Auckland). Estate was especially disappointed that this last conference coincided with our enrollment in person week, so he didn't get the chance to sign lots of students into our first year papers. At least, I think he said he was disappointed, but it's possible I misheard.

We were pleased to host Professor Guennady Martynov from the Russian Academy of Sciences, Moscow, who visited Estate Khmaladze from early February to late March. Professor Martynov is a well known specialist in the area of goodness-of-fit theory, and in the theory of Cramer-von Mises tests in particular. While at VUW, Prof Martynov worked on the development of a web page dedicated to goodness-of-fit theory and the online implementation of modern testing methods. He also gave a seminar while at VUW, on new results for Cramer-von Mises goodness-of-fit tests.

The group is excitedly looking forward to the arrival of two new staff around the middle of the year; an Operations Research lecturer and a Consulting Statistician. There'll be more details on these appointments later. Finally, while Stefanka is on leave we are very grateful that Prof Moshe Haviv is visiting us from the Department of Statistics, Hebrew University of Jerusalem, for the first half of 2005. Moshe is taking half of two of our Operations Research courses between March and June in Stefanka's place, and we're very pleased to have him on board.

Wellington Statistics Group

The Wellington Statistics Group (WSG), a local group of the New Zealand Statistics Association, continues to meet regularly. Attendance at the early evening meetings remains pretty good (typically 20 to 30 people, sometimes more) and the evenings often continue with up to a dozen or so people dining together. Since the WSG-organised NZSA Conference on 1 July 2004 in Wellington, in reverse chronological order there have been WSG talks given by:

Tim Ball, Statistical Consulting for Continuous Improvement, February 2005: "Golden Opportunities—A Case Study."
Estate Khmaladze, VUW, December 2004: "Probability and Statistics in Tbilisi, Georgia in retrospect: 1963-1983."
Robin Willink, (Applied Mathematics) Industrial Research Ltd, November 2004: "Statistical methods in metrology (measurement science)."
Robert Davies, Statistics Research Associates Ltd, September 2004: "Crash Risk and Road Surface Characteristics."

The eminent statistician Professor CR Rao also spoke in Wellington, to a large audience, on 17 March 2005 during his NZ tour.

Details of the NZSA 2004 Conference programme (plus abstracts, etc) can be found at: http://www.mcs.vuw.ac.nz/events/NZSA2004/.

Preceding the NZSA conference, WSG heard talks by:

Jeff Robinson, General Motors R&D Center, Michigan USA, May 2004:"Estimating Mean Functions from Warranty Data with Dual Useage Measures."
James Liu, VUW, April 2004: "Dynamics of interpersonal political environment and party identification: longitudinal studies of voting in Japan and NZ."
Shirley Pledger, VUW, March 2004: "Using finite mixtures to model heterogeneity in capture-recapture models."

The next WSG meeting will be on 13 April 2005, addressed by Mark Weatherall from Wellington School of Medicine and Health Sciences, on "Graphical sensitivity analysis with different methods of imputation for a trial with probable non-ignorable missing data."

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

Martin Bridson (Imperial college, London; Forder Lecturer), "Isomorphism, Conjugacy, and the Grammar of Combings."
Martin Bridson (Imperial College London; Forder Lecturer), "The language of symmetry and the grammar of space."
Martin Bridson (Imperial college, London; Forder Lecturer), "Curvature and decidability in geometry and group theory."
Nevil Brownlee (Computer Science, The University of Auckland and CAIDA, UC San Diego), "Internet Flows and Streams: Observations with NeTraMet."
Neal Glew (Intel), "Typed STIR: Experiences with Type Checking the IR of an Optimising Java JIT."
S. Ejaz Ahmed (Head of Department of Mathematics and Statistics, University of Windsor, Canada), "Simultaneous Quantiles Estimation under Right Censoring and Left Truncation."
C.R.~Rao, "Cross Examination of Data."

Mark Moir (Sun Microsystems), "Using Elimination to Implement Scalable FIFO Queues."
Angelika van der Linde (University of Bremen), "Model complexity."
Sam Howison (Oxford University), "Models for splashing and water entry."
Guennadi Martynov (Russian Academy of Sciences, Moscow), "New results for Cramér-von Mises goodness of fit tests."
Jasbir Chahal (Brigham Young University), "Congruent numbers and elliptic curves."
Mary Poppendieck, "Lean Software Development."
Marcos Nunes-Ueno (Microsoft Game Studios), "Usability and Games."
Dean Pemberton, "Internet Background Radiation."
Frank Stephan, "Which structures are automatic?"
Angela Martin, "The Role of Customers on Extreme Programming Projects."
Peter Komisarczuk, "Wireless Virtual Organizations."
Angelika van der Linde (University of Bremen), "Model complexity."

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Number 93 April 2005

NEWSLETTER

OF THE

NEW ZEALAND MATHEMATICAL SOCIETY (INC.)

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CENTREFOLD

BOB LONG

Robert Stephen Long is a very good candidate for a long-service medal for his contributions to mathematics in this country, and his career illustrates with great clarity the development of the subject in the past half-century.

Bob turned up at Canterbury University College in 1942, with a University Entrance Scholarship, from St Andrews College. At this time, the mathematics staff of C.U.C. numbered four, and was headed by Professor Sadler, a Scottish geometer, who had been appointed in 1930. Bob did well as an undergraduate—in 1944, at the end of his BSc course, he was awarded a Sir George Grey Scholarship, and the Haydon Prize in physics—and he went on to study for an MSc in mathematics. In the third term of the 1945 year, he went down with pneumonia, from which he had barely recovered by the time of his examinations, and he was awarded second class honours, rather than the first that he and his teachers no doubt had expected.

He treated this set-back with the stubborn determination that anyone who has ever played tennis or badminton against him would recognize; he returned to his old school, St Andrews, as a mathematics master, to earn and save enough money to take him to Cambridge on his own account. (During this time he first encountered the young Roy Kerr, whom he remembers as being very brisk in dealing with set work in class.) By the middle of 1946, he had saved enough, and sailed off to England and Cambridge. As was the practice at Cambridge in those days, he was obliged to study for a BA; and he completed this in two years, and was awarded first class honours. His course was largely in applied mathematics, which in these days would seem rather to be classical continuum mechanics/theoretical physics, and he was tutored by the astronomer R A Lyttelton, of the famous Hoyle–Bondi–Lyttelton trio, whom he recalls as being capable of giving an elegant solution to almost any problem in the field he studied.

He stayed at Cambridge for another year, taking advanced courses; but the money inevitably ran out (despite some assistance from Canterbury U C) and he returned to New Zealand in 1952, and took a position as lecturer in the Mathematics Department at CUC. Sadler was still the head; but now there were five other members of staff. Research was no longer actively discouraged (see, if you can't believe that this once was the case, Karl Popper's autobiographical "Unended Quest") but as the Hughes Parry report of 1959 indicated—CUC was invidiously cited in this for its amazingly economical use of staff in mathematics teaching—the time which could be devoted to it was constrained by a very high teaching load. In these earlier years of his university teaching career, Bob was called on to give honours courses in five subjects; Electricity & Magnetism, Hydrodynamics, Quantum Mechanics, Optimal Control, and Analysis.

With the retirement of Sadler, and the arrival of Derek Lawden as HoD, the atmosphere if not the resources for research improved a great deal, and through the 1960s Bob wrote and published a series of papers, largely on one of the topics that Lawden had pioneered, that of orbital transfer. He was promoted to a readership in 1968.

Throughout his time in the department, Bob took more than his share of administrative work, and of the teaching of first-year and engineering mathematics courses, and is rightly remembered for his patience and

thoroughness.

On his retirement at the end of the 1980s, Bob became involved in (perhaps "was inveigled into" suits the case better) the NZ International Mathematical Olympiad movement, and set up the weekly coaching sessions which are open to candidate olympians in Christchurch. He is still in charge, and the number of this country's best young mathematicians who have passed through his hands, and who owe a real debt to him for patient instruction, encouragement and inspiration, grows by the year.

Bob's activities beyond the department and mathematics were, and are, for he still pursues them, very much those of the model twentieth century New Zealand man. He plays tennis, and played badminton, with zeal and tenacity. He delights in tramping in the back-country, and has done many of the classic hard tramps of the South Island. He was until very recently an enthusiastic skier. He is a meticulous gardener. And a pivotal point in his life occurred in the early fifties, when at a tennis club afternoon he was allocated a mixed doubles partner, no doubt by some random process: This of course a classic mid-twentieth way of meeting one's future wife, and indeed he and Betty, the young woman concerned, celebrate fifty years of marriage this month. A number of his Christchurch friends will share this celebration; and I am sure that many more of his colleagues and friends in the NZMS will wish them well, and will also celebrate BobÕs career, so far, of patient and well-judged service to mathematics and the world at large, and wish it to long continue.

Brian Woods

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NEW COLLEAGUES

Professor Mark Meerschaert

"I joined the Department of Mathematics and Statistics at the University of Otago in February 2005 as the new Chair of Applied Mathematics. The previous chair, Vernon Squire, is now serving as Pro-Vice-Chancellor of the Division of Sciences. Prior to that, I spent 12 years in the Departments of Mathematics & Statistics and Physics at the University of Nevada, and before that, 8 years at Albion College, a small liberal arts college in Michigan USA. I also worked in industry for several years as a Systems Analyst in Operations Research. I was born and raised in Michigan and received my BS, MS, and PhD degrees from the Mathematics Department at the University of Michigan, where I specialized in limit theorems in Probability and Mathematical Statistics.

I decided to study mathematics because I could not manage to limit my interests to just one area of science or engineering. My current research interests reflect that. Partial differential equation models that use fractional derivatives are useful to model flow and transport of contaminants in ground water and surface water. Heavy tailed stochastic processes describe the microscopic behavior of these phenomena. Numerical methods for fractional partial differential equations require a new approach, since the fractional derivative operator is non-local. These numerical methods are important for applications in which physical parameters, like groundwater velocity, vary over space and time, so that analytical solutions are not available. Heavy tailed time series analysis is useful for modeling river flows when the flow volume is highly variable. Statistical models for heavy tailed phenomena require novel parameter estimation methods, since the outliers we usually discard are now the main items of interest. Applications include floods, droughts, and large price jumps (up or down) in financial markets."

FEATURES

AITKEN PRIZE 2004

The Aitken Prize for best student talk at the New Zealand Mathematics Colloquium was awarded in 2004 to Joanne Mann of Massey University, Albany, for her talk presented below.

TO VACCINATE OR NOT TO VACCINATE?
Joanne Mann

Vaccination and immunisation are two of the most cost effective ways to combat an infectious disease. You may be choose to vaccinated to prevent being infected and passing the infection to others around you, and it may be the "cheaper" option. However, you may choose not be vaccinated due to concerns about any adverse side effects from the vaccine or concerns about the vaccine efficiency; and some people believe that natural immunity is better than imposed immunity.

Assume that there is a constant cost associated with being vaccinated, C_V, which includes the actual cost of the vaccine, the possible side effects caused by the vaccine and the time taken to be vaccinated. This cost could be quite low if you think of the sore arm you get after an influenza vaccination, or quite high when you consider that smallpox vaccination causes 1 - 2 deaths per million. We also assume a constant cost associated with being infected, C_I, that includes the effects of the infection, the cost of the treatment for the infection, the time required off work for recovery and any lasting side effects caused by the infection—for example the scars left from chicken pox or the loss of limbs from meningitis. The idea of these two costs was presented in Bauch et. al. (2003).

Individuals have two options: remain susceptible and risk infection, or be vaccinated. The expected cost of remaining susceptible depends on the proportion of the population who are vaccinated, as this affects the probability of infection. The individual will choose whichever option they perceive to present the lowest cost to them, and we assume that everyone in the population has access to the same information and understands it in the same manner. The expected cost to the community depends on the proportion of individuals choosing to be vaccinated, and the costs associated with the two strategies.

We determine what proportion of the population needs to be vaccinated to minimize the cost to the community as a whole and compare this with the optimal solution for the individual. We consider two vaccination scenarios: an epidemic infection, such as influenza where vaccination is required yearly; and an endemic infection, such as tuberculosis.

Epidemic Infections

To measure the spread of an infection in a population we use the basic reproduction ratio, R_0, defined as "the number of secondary cases that occur from a primary case in a fully susceptible population" (Anderson & May, 1992). If $R_0 > 1$ then there will be an epidemic, and if $R_0 < 1$ the infection will not persist in the population. If a proportion v of the population is vaccinated, then there will be an epidemic if:

$$v < 1 - \frac{1}{R_0}$$

We calculate the basic reproduction ratio from:

$$R_0 = N \int_0^\infty p(t)C(t)dt$$

where N is the total number in the population, p(t) is the probability of infection given contact with an infective and C(t) is the contact/mixing rate between susceptibles and infectives.

The number of new cases of infection, or incidence of infection i(t), as shown in Diekmann & Heesterbeek (2000) is:

$$i(t) = i(0)\delta(t) + S(t) \int_0^t p(\tau)C(\tau)i(t-\tau)d\tau$$

where S(t) is the size of susceptible population, and the $i(0)\delta(t)$ accounts for the initial case of infection in the population. The incidence of infection is the same as the negative rate of change of S(t); hence we gain the final size equation:

$$\log\left(\frac{s(\infty)}{s(0)}\right) = \left(\frac{s(\infty)}{s(0)} - 1\right) s(0)R_0$$

where $s(\infty)$ is the proportion of the population who remain susceptible after an epidemic, and S(0) is the initial proportion of the population who are susceptible. When the proportion of the population vaccinated reaches $1 - \frac{1}{R_0}$ there will no longer be an epidemic, so we can let $s(\infty)$ decrease linearly with v, and we do

not solve the non-linear equation. The maximum value of s(v) is $\frac{1}{R_0}$ and is reached at the critical point v = $1-\frac{1}{R_0}$.

Individuals either have the cost associated with vaccination, or the expected cost associated with remaining susceptible:

$$\begin{aligned} E_v^Y &= C_V \\ E_s^Y &= \frac{1-v-s(\infty)}{1-v}C_I \end{aligned}$$

The expected cost to the community is proportional to a linear combination of the expected costs of the two individual strategies

$$C^Y(v) = \begin{cases} vC_V + (1-v-s(\infty))C_I & \text{if } 0 < v < 1-\frac{1}{R_0} \\ vC_V & \text{if } 1-\frac{1}{R_0} < v < 1 \end{cases}$$

The two individual strategies have a break even point when:

$$v = 1 - \frac{s(\infty)}{1-\frac{C_V}{C_I}}.$$

The community's best strategy is found by minimising the cost function for the community. Assuming that the cost associated with vaccination is less than the cost associated with being infected, the minimum occurs when v = $1-\frac{1}{R_0}$.

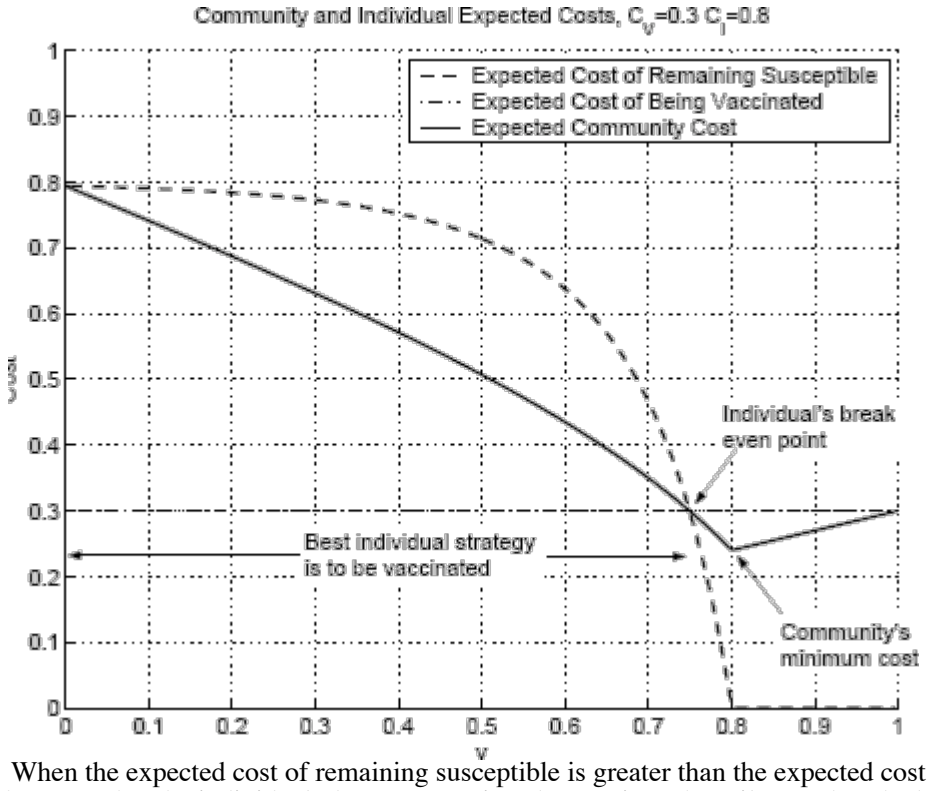

Figure 1 When the expected cost of remaining susceptible is greater than the expected cost of being vaccinated, we see that the individual's best strategy is to be vaccinated, until v reaches the break even point where all three lines intersect; after this point the best strategy is to remain susceptible. The best strategy for the community is to vaccinate the proportion of the population equal to $1-\frac{1}{R_0}$, which is greater than the individual's break even point. Hence the optimum vaccination coverage for the community results in some individuals being vaccinated when their best strategy would be not to. R_0 = 5 for this example.

Endemic Infections

We now consider an infection that is endemic in the population, for example tuberculosis. We assume that if a person chooses to be vaccinated it is at birth or near to birth, and they are not included in the susceptible population prior to vaccination. We use a susceptible, infected, and removed model (SIR). The demography of the population now has to be considered, so we include a constant birth/death term in the model.

The expected cost to an individual depends on the probability of being infected at some point during their lifetime, which we can calculate using the endemic steady state of the SIR model (note that R_0 has a different mathematical expression, but the same biological meaning as in the epidemic situation):

$$Prob(\texttt{infection during lifetime}) = 1 - \frac{1}{R_0(1-v)}$$

The expected costs to an individual are:

$$\begin{aligned} E_v^L &= C_V \\ E_s^L &= \left(1 - \frac{1}{R_0(1-v)}\right) C_I \end{aligned}$$

The individuals break even point now occurs when

$$v = 1 - \frac{1}{R_0\left(1 - \frac{C_V}{C_I}\right)}.$$

The community's expected cost is a combination of the two individual expected costs:

$$C^L(v) = \begin{cases} vC_V + \left(\left(1 - \frac{1}{R_0}\right) - v\right) C_I & \text{if } 0 < v < 1 - \frac{1}{R_0} \\ vC_V & \text{if } 1 - \frac{1}{R_0} < v < 1 \end{cases}$$

Minimising the above function, we find the expected cost for the community is at its lowest when v = $1 - \frac{1}{R_0}$, assuming that the cost associated with vaccination is less than the cost associated with being infected.

Conclusion

For both scenarios, the minimum expected cost to the community is reached when v = $1 - \frac{1}{R_0}$. This is greater than the proportion of the population that is vaccinated at the individual's break even point. If the choice of vaccination is left to the individual, and they behave rationally, the community will incur a higher cost as too few will choose vaccination and there will be an epidemic. If the expected cost to the community is minimised individuals will incur a higher cost, but there will not be an epidemic. As an individual, the best strategy is to be not vaccinated, and to make sure that every one around you is!

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T. M. CHERRY PRIZE 2005

The T. M. Cherry Prize for best student talk at ANZIAM was awarded in 2005 to Jason Looker of the University of Melbourne, for his talk presented below.

HOMOGENIZATION OF THE IONIC TRANSPORT EQUATIONS IN PERIODIC POROUS MEDIA[1]

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Introduction

The transport of electrolyte through porous media is a classical multiscale phenomenon with numerous applications in geophysics and bio-porous materials modeling. Phenomenological equations relating the transport of ions and solvent to electrical potential, pressure and concentration gradients have achieved widespread acceptance in the literature (Adler, 2001; Coelho et al., 1996; de Groot and Mazur, 1969;

Edwards, 1995; Gross and Osterle, 1968; Marino et al., 2000, 2001; Revil and Leroy, 2004). These equations are assumed to be valid on the scale of the porous body (the macroscopic or Darcy-scale) and represent an average, in some sense, of the pore-scale (or microscopic) equations. Attempts at deriving macroscopic transport equations from microscopic equations have been successful under various somewhat restrictive assumptions (Edwards, 1995; Gross and Osterle, 1968; Moyne and Murad, 2002, 2003; Revil and Leroy, 2004). Furthermore, the precise form of these equations varies between authors. In this paper, Darcy-scale transport equations are derived with minimal assumptions using homogenization theory. Without any additional assumptions, we rigorously prove that the transport coefficient tensors obey certain fundamental thermodynamic requirements, namely, Onsager's reciprocal relations and the positive definiteness of the diagonal coefficient tensors (de Groot and Mazur, 1969).

We consider an N-component electrolyte in a dilute Newtonian solvent flowing through a rigid porous body with a periodic microstructure, where the geometry of the porous medium ensures that the Reynolds number of the flow is much less than unity. The electrolyte flows in response to a static (d.c.) electric field and a constant surface charge density on the pore walls. The magnitude of the applied field is assumed to be sufficiently small to permit the linearization of the ionic transport (electrokinetic) equations. In addition, we utilize the standard approximation $\varepsilon^s/\varepsilon \ll 1$, where ε^s is the dielectric constant of the solid part of the porous medium, and ε is the dielectric constant of the fluid. This approximation enables the electric potentials in the fluid and solid parts of the porous body to be decoupled.

Gross and Osterle (1968) derived Darcy-scale transport equations for the case of a capillary model for charged wide-pore membranes. This simple geometry allowed for a complete analytical solution of the electrokinetic equations, without linearizing the Poisson-Boltzmann equation, including the establishment of the Onsager relations. By assuming a very thin double layer on the pore walls, Edwards (1995) employed a volume averaging approach to derive macroscopic transport equations for a periodic porous body. However, Edwards did not succeed in establishing Onsager's reciprocal relations. The paper by Marino et al. (2001) studies a periodic porous medium subjected to an external electric field, a pressure gradient and a concentration gradient. The well-known phenomenological equations are assumed to hold and, starting from the electrokinetic equations on the pore-scale, the transport coefficient tensors are calculated numerically for a number of different microstuctural geometries. Moyne and Murad (2002, 2003) also considered a periodic porous medium but in addition, they permitted the porous body to swell. No linearization of the pore-scale Nernst-Planck equation was carried out. However, by assuming the Peclet number to have the same order of magnitude as the microscopic length scale, they effectively neglected pore-scale ionic convection. Under the assumption that the ionic concentrations in the pore water obey the Donnan distribution, Revil and Leroy (2004) used volume averaging to derive macroscopic transport equations from linearized microscopic equations. The Onsager relations were established under these conditions. In all of the aforementioned articles, only a 1-1 electrolyte was considered.

In this paper, no assumptions are made about the double layer thickness or Peclet number and the equilibrium concentrations obey the Boltzmann distribution. Consequently, our analysis includes the effects of pore-scale ionic convection. No assumptions are made regarding the microstructure. Although we assume periodicity of the porous domain, there exists an equivalence between periodic and statistically homogeneous random porous media (Beliaev and Kozlov, 1996; Espedal et al., 2000).

This work is stimulated by the author's interest in developing a theory for the electroacoustic characterization of suspensions of porous particles (O'Brien, 1988). To determine the electrophoretic motion of a porous particle, we need to specify the governing equations outside the particle, inside the particle and the boundary conditions coupling the two domains. The governing equations exterior to the particle are the well-known electrokinetic equations (Hunter, 1987Ð1989; Lyklema, 1991). It is therefore natural to upscale the electrokinetic equations to obtain a Darcy-scale model inside the particle. The authors have used scaling arguments in conjunction with recent results in homogenization theory to develop a model for the hydrodynamics of an oscillating porous particle (Looker and Carnie, 2004), since electroacoustic experiments generate oscillatory flows. To be consistent with this work, we choose to employ homogenization theory to upscale the electrokinetic equations.

Homogenization

Homogenization theory exploits the fact that transport phenomena in porous media occur on two disparate length scales: a macroscopic} scale (the scale of the reservoir, L) and a microscopic} scale (the pore scale, ℓ). Transport phenomena can then be characterized via the small dimensionless parameter $\epsilon = \ell/L$. In practice we only observe macroscopic transport phenomena and it is sufficient for information regarding the microstructure to be retained purely in the form of averaged quantities, such as porosity and permeability. The homogenization process transforms equations on the microscopic scale to effective equations on the macroscopic scale by determining the limiting behavior of the microscopic equations as $\epsilon \to 0$. For an extensive coverage of homogenization and porous media, see Hornung (1997).

We briefly describe the construction of a periodic porous domain with period ϵ. A complete description of periodic porous media can be found in Espedal et al. (2000). A standard cell consists of a three

dimensional cube C containing a standard obstacle S where the fluid part of the cell is $\mathcal{Y} = \mathcal{C} \setminus \mathcal{S}$, with boundary $\partial\mathcal{C} \cup \partial\mathcal{S}$. This cell is extended periodically, with period ϵ, to all of three dimensional space. A domain Ω is then intersected with the periodically extended standard cells to give the periodic porous domain. The fluid part of the periodic porous domain is given the symbol Ω^ϵ, with boundary $\partial\Omega^\epsilon \setminus \partial\Omega$. The limit $\epsilon \to 0$ corresponds to the size of the cells becoming progressively smaller and greater in number until the fluid part is annihilated (or, the pore size goes to zero).

Under the assumptions stated in the introduction, the scaled linearized microscopic equations are for $j = 1, \ldots, N$ (O'Brien and White, 1978):

$$
\begin{aligned}
&\overline{n}_j^{\,\epsilon} = n_j^\infty \exp\left(-z_j \overline{\psi}^{\,\epsilon}\right) && \text{in } \Omega^\epsilon, \\
&\epsilon^2 \nabla^2 \overline{\psi}^{\,\epsilon} = -4\pi \sum_{j=1}^{N} z_j \overline{n}_j^{\,\epsilon} && \text{in } \Omega^\epsilon, \\
&\epsilon \hat{\mathbf{n}} \cdot \nabla \overline{\psi}^{\,\epsilon} = -\sigma && \text{on } \partial\Omega^\epsilon \setminus \partial\Omega, \\
&\nabla^2 \Phi_j^\epsilon = z_j \nabla \overline{\psi}^{\,\epsilon} \cdot \left(\nabla \Phi_j^\epsilon + \overline{\mathbf{E}} + \frac{\lambda_j}{z_j} \mathbf{u}^\epsilon\right) && \text{in } \Omega^\epsilon, \\
&\hat{\mathbf{n}} \cdot \nabla \Phi_j^\epsilon = -\overline{\mathbf{E}} \cdot \hat{\mathbf{n}} && \text{on } \partial\Omega^\epsilon \setminus \partial\Omega, \\
&\epsilon^2 \nabla^2 \mathbf{u}^\epsilon = \nabla P^\epsilon + \sum_{j=1}^{N} z_j \nabla \overline{n}_j^{\,\epsilon} \left(\Phi_j^\epsilon + \overline{\mathbf{E}} \cdot \mathbf{x}\right) && \text{in } \Omega^\epsilon, \\
&\nabla \cdot \mathbf{u}^\epsilon = 0 && \text{in } \Omega^\epsilon, \\
&\mathbf{u}^\epsilon = \mathbf{0} && \text{on } \partial\Omega^\epsilon \setminus \partial\Omega.
\end{aligned}
\qquad \text{(11) to (18)}
$$

The ionic parameters z_j, λ_j and n_j^∞ represent the valency, drag and the (scaled) bulk ionic number density of the jth ionic species, respectively. The physical constant σ is the (scaled) surface charge density and $\overline{\mathbf{E}}$ is the applied electric field. The functions $\overline{\psi}^{\,\epsilon}$, $\overline{n}_j^{\,\epsilon}$, Φ_j^ϵ, $\mathbf{u}^\epsilon$ and P^ϵ are the equilibrium electric potential, equilibrium number density of the jth ionic species, ionic potential of the jth ionic species, velocity of the solvent, and the partial pressure of the solvent. The vector $\hat{\mathbf{n}}$ denotes the outward unit normal to $\partial\Omega^\epsilon \setminus \partial\Omega$. The dependence of these functions on the characteristic microscopic length scale is signified by the superscript ϵ. Observe that the boundary conditions are applied on the boundary of the pore walls, not} on the boundary of the macroscopic domain C. For convenience, all functions and variables in the above equations refer to dimensionless quantities. We shall adopt this convention for the remainder of the paper.

To study the limit as $\epsilon \to 0$ of equations 11 to 18 above, we postulate that $\overline{\psi}^{\,\epsilon}$, $\mathbf{u}^\epsilon$, P^ϵ and Φ_j^ϵ have formal two-scale asymptotic expansions of the form, $f^\epsilon(\mathbf{x}) = f_0(\mathbf{x}, \mathbf{y}) + \epsilon f_1(\mathbf{x}, \mathbf{y}) + \mathcal{O}(\epsilon^2)$, where the f_i are $\mathcal{Y}$-periodic with respect to the microscopic (or fast) variable $\mathbf{y} = \mathbf{x}/\epsilon$. A $\mathcal{Y}$-periodic function has the same value on each opposite face of $\partial\mathcal{C}$. The two different length scales imply that the derivatives must be transformed according to,

$$
\nabla = \nabla_x + \frac{1}{\epsilon} \nabla_y, \qquad \nabla^2 = \nabla_x^2 + \frac{2}{\epsilon} \nabla_x \cdot \nabla_y + \frac{1}{\epsilon^2} \nabla_y^2.
$$

The asymptotic expansions for $\overline{\psi}^{\,\epsilon}$, $\mathbf{u}^\epsilon$, P^ϵ and Φ_j^ϵ are substituted into equations 11 yo 18 and terms of the same order of magnitude are compared, generating a cascade of equations. Solutions are sought in terms of products of macroscopic forcing terms and cell functions. Cell functions are defined only in $\mathcal{Y}$ and are required to be $\mathcal{Y}$-periodic

Non-Equilibrium Thermodynamics

After homogenization of the microscopic equations and integration over a cell, it is shown in Looker and Carnie (2005) that the macroscopic fluid velocity and ionic flux of the jth species can be expressed as:

$$
\begin{aligned}
&\mathbf{u}_{\text{eff}}(\mathbf{x}) = -\sum_{j=1}^{N} \bar{\mathbf{J}}_j \cdot \nabla \bar{\mu}_j^{\text{eff}}(\mathbf{x}) - \mathbf{K} \cdot \nabla p_{\text{eff}}(\mathbf{x}) && \text{in } \Omega, \\
&\mathbf{j}_j^{\text{eff}}(\mathbf{x}) = -\mathbf{D}_j^a \cdot \nabla \bar{\mu}_j^{\text{eff}}(\mathbf{x}) - \sum_{l=1}^{N} \mathbf{D}_{jl}^c \cdot \nabla \bar{\mu}_l^{\text{eff}}(\mathbf{x}) - \bar{\mathbf{L}}_j \cdot \nabla p_{\text{eff}}(\mathbf{x}) && \text{in } \Omega,
\end{aligned}
\qquad \text{(19) (20)}
$$

where $\bar{\mu}_j^{\text{eff}}$ and p_{eff} are the effective electrochemical potential and pressure, respectively. The electrochemical potential is a thermodynamic measure of how much work is required to return a system to equilibrium (Lyklema, 1991); it is related to the ionic potential via,

$$\nabla \bar{\mu}_j^e = -z_j \left(\nabla \Phi_j^e + \overline{\mathbf{E}} \right).$$

The tensors $\bar{\mathbf{J}}_j$ and $\bar{\mathbf{L}}_j$ are coupling tensors, $\mathbf{K}$ is the permeability tensor, $\mathbf{D}_j^s$ is a self electrodiffusion tensor and $\mathbf{D}_{jk}^e$ accounts for cross electrodiffusion effects. Note that $\mathbf{D}_{jj}^e \equiv \mathbf{0}$. Our aim is to establish the validity of these macroscopic equations. This shall be accomplished by rigorously proving, without any additional assumptions, that our macroscopic system obeys one of the fundamental laws of non-equilibrium thermodynamics: Onsager's reciprocal relations. The primary reference for this section is de Groot and Mazur (1969).

Onsager's reciprocal relations are essentially a statement of time reversal invariance. That is, if a small perturbation to a system in some reference state is sent back in time, then the system will return to that reference state. If the system is expressed in the following format,

$$\mathcal{J} = \mathcal{M} \cdot \mathcal{F}, \quad (21)$$

where $\mathcal{J}$ is a vector representing the fluxes and $\mathcal{F}$ a vector of the independent thermodynamic forces, Onsager proved that the tensor $\mathcal{M}$ must obey $\mathcal{M} = \mathcal{M}^T$, that is, $\mathcal{M}$ must be symmetric. Recasting Eqns 19 and 20 into the form of Eqn 21 gives,

$$\begin{pmatrix} \mathbf{u}_{\text{eff}} \\ \mathbf{j}_1^{\text{eff}} \\ \vdots \\ \vdots \\ \mathbf{j}_N^{\text{eff}} \end{pmatrix} = - \begin{pmatrix} \mathbf{K} & \bar{\mathbf{J}}_1 & \cdots & \cdots & \bar{\mathbf{J}}_N \\ \bar{\mathbf{L}}_1 & \mathbf{D}_1^s & \mathbf{D}_{12}^e & \cdots & \mathbf{D}_{1N}^e \\ \vdots & \mathbf{D}_{21}^e & \ddots & & \vdots \\ \vdots & \vdots & & \ddots & \vdots \\ \bar{\mathbf{L}}_N & \mathbf{D}_{N1}^e & \cdots & \cdots & \mathbf{D}_N^s \end{pmatrix} \cdot \begin{pmatrix} \nabla p_{\text{eff}} \\ \nabla \bar{\mu}_1^{\text{eff}} \\ \vdots \\ \vdots \\ \nabla \bar{\mu}_N^{\text{eff}} \end{pmatrix}.$$

Symmetry of the coefficient tensor requires that:

$$\mathbf{K} = \mathbf{K}^T, \quad \bar{\mathbf{J}}_j = \left(\bar{\mathbf{L}}_j \right)^T, \quad \mathbf{D}_j^s = \left(\mathbf{D}_j^s \right)^T, \quad \mathbf{D}_{jk}^e = \left(\mathbf{D}_{kj}^e \right)^T, \quad (22)$$

must be true for each $j = 1, \ldots, N$ if the Onsager relations are to hold.

A necessary condition ensuring the entropy production of the system remains positive, is the positive definiteness of the diagonal tensors in $\mathcal{M}$. Therefore the permeability tensor $\mathbf{K}$ and the self electrodiffusion tensor $\mathbf{D}_j^s$ are required to be positive definite.

It is rigorously proven in Looker and Carnie (2005) that Eqns 22 hold and the permeability and self electrodiffusion tensors are positive definite, for the transport coefficient tensors defined in this paper. The proof follows directly from the ionic and fluid cell problems.

Discussion

Note that Eqns 19 and 20 are formally the same as the Darcy-scale equations modelling ionic transport in porous shales derived by Revil and Leroy (2004), and are identical to the phenomenological transport equations presented in de Groot and Mazur (1969). Explicit expressions for the transport coefficient tensors in terms of solutions to cell problems are presented in Looker and Carnie (2005), where it is shown that all of the transport coefficient tensors have been influenced by the inclusion of pore-scale ionic convection in the present model.

This paper constitutes a theoretical framework for a greater understanding of the assumptions underlying the phenomenological equations and similar models describing transport phenomena in porous media; however more work is required. For instance, computing the transport coefficient tensors numerically by solving the ionic and fluid cell problems will elucidate the relative importance of the terms in Eqns 19 and 20. Furthermore, making the formal mathematical calculations presented in this paper rigorous by establishing the two-scale convergence (Hornung, 1997) of the microscopic functions to their homogenized counterparts will further clarify the assumptions upon which Eqns 19 and 20 are based, and may be of independent mathematical interest.

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[1] A longer paper of the same name has been submitted to Transport in Porous Media.

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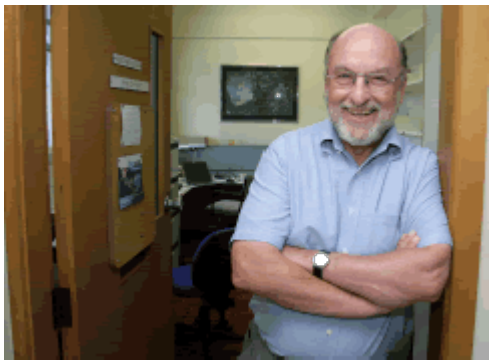
NZMS LECTURER

The NZMS lecturer Professor Eugene Seneta with Jeff Hunter and Mick Roberts at the 14th International Workshop on Matrices and Statistics, Massey University, Albany.

LEADING MATHEMATICIAN RETIRES



Professor Alastair John Scott is one of New Zealand's leading mathematical scientists and one who has contributed greatly to the health and international profile of mathematical sciences in New Zealand.

After graduating in Mathematics from The University of Auckland in 1961, Alastair started his career in the Applied Mathematics Division of the DSIR, before undertaking graduate study in statistics at the University of Chicago.

After his time in Chicago he joined the Department of Statistics at the London School of Economics before returning to the Mathematics Department at the University in 1972. Alastair was head of the Department of Mathematics and Statistics on two occasions before the (amicable) divorce of the two departments in 1994, and became the founding head of the Department of Statistics.

Alastair has made many fundamental contributions to the analysis of survey data, often in collaboration with J.N.K. Rao and T.M.F. Smith. His 1981 paper with Jon Rao in the Journal of the American Statistical Association was selected as one of the 19 landmark papers in the history of survey sampling for the 2001 IASS (International Association of Survey Statisticians) centenary volume. He has guided the official statistics agencies in Australia and Canada as well as Statistics New Zealand. He has also made fundamental contributions to many other areas of statistics, including the design and analysis of retrospective studies extending classical results for case control studies with applications in medicine and many other fields.

Amongst the honours bestowed upon him are fellowships of the Royal Society of New Zealand, the American Statistical Association, and the Institute of Mathematical Statistics. He is an elected member of the International Statistical Institute, and a past president and one of only four honorary life members of the New Zealand Statistical Association.

He has also served on the board of directors of the American Statistical Association and as a member of the council and as scientific secretary of the International Association of Survey Statisticians. In April 2005 this association is sponsoring a satellite conference of the 55th Session of the International Statistical Institute to celebrate Alastair's distinguished career.

As well as all this achievement, Alastair has become a much loved figure in the University; he has always been happy to advise research students and colleagues across the University. Many have benefited from his collaboration; his list of publications includes joint papers with members of five different faculties of the University.

He has served on many University committees, chaired several departmental reviews and for a time was a board member of the Environmental Risk Management Authority (ERMA).

His retirement will allow him spend more time with his grandchildren in the holiday house at the head of Leigh Harbour, which he owns jointly with other members of the department that he founded.

Professor Chris Wild (Statistics) andAssociate-Professor Chris Triggs (Statistics—Tamaki

SPEECH TO MATHEMATICS IN INDUSTRY STUDY GROUP
Hon Dr Michael Cullen, Deputy Prime Minister
Delivered 24 January 2005, Massey University, Albany Campus, Auckland

I am very pleased to open this year's Mathematics in Industry Study Group. The Study Group is exactly the kind of cross-fertilisation between academia and industry that we need to sustain growth in our economy and to build a vigorous tertiary education system.

I would like to commend the leadership of Professor Graeme Wake and the work of his colleagues at Massey University in bringing this event together

It is a little known fact that I am the only New Zealand finance minister in history (and, I believe, the only New Zealand member of parliament) to have had a degree in mathematics. I would like to say that this training has been instrumental in achieving a series of strong fiscal surpluses in the last five years. However, the truth is that managing government expenditure and revenue is primarily an exercise in understanding and accounting for human behaviour, in which the hard sciences play something of a handmaidÕs role.

However, it is certainly my ambition, when I retire, to attempt to develop a set of algorithms which explain mathematically the behaviour of ministers of the Crown and MPs in a parliamentary democracy. This work will have to compete with my ambition to undertake a detailed analysis of my golf swing, and I expect both of these endeavours will need to draw considerably on the mathematics of chaos theory if they are to come to any conclusion.

While my own academic career in mathematics took a turn towards social statistics and merged with the study of history, I see an important common principle in the approach of the Mathematics in Industry Study Group. That is the conviction that even the purest and most abstract forms of mathematical theory can shed light on real life problems, even if takes some time for that to occur.

After all what attracts most of us into the study of mathematics is the realisation that numbers explain things, be they natural phenomena such as the growth of plants, the swarming of insects or the changes in weather patterns, or aspects of the human environment such as the design of hard structures, the manipulation of chemistry or biology, the transmission of energy or the management of information.

Linking the advanced study of mathematics to the challenges of industry (the challenges of managing risk, streamlining production and creating new value) not only benefits industry and hence the community, but also provides fresh intellectual challenges to mathematicians and thereby extends the boundaries of the discipline.

I think this gives the lie to the kind of reductionist utilitarian view of academic endeavour, the view that says that research that has no immediate commercial application should not receive public funding. This is certainly not the approach that drives the governmentÕs tertiary education and research policies.

We are certainly looking to foster a tertiary sector that is engaged with its community. We want to see tertiary institutions that provide education and training that is relevant to the needs and aspirations of students, and that is delivered in ways that aid their learning and fire their enthusiasm.

We expect tertiary institutions to show leadership in forming partnerships with industry, both in terms of fine tuning the kind of education programmes they provide so as to meet the long term skill needs of the

economy, and in terms of building a portfolio of research that extends New ZealandÕs reputation as a nation of innovators.

These are more than vague ambitions. For the past five years we have worked with the research community and the business community to develop a Growth and Innovation Framework which focuses resources on the ways in which new knowledge generates growth in the New Zealand economy, and on the key points in the value-chain where we need to build our capacity or to clear away roadblocks.

Alongside of this we have increased government expenditure on research, with a significant proportion of the new expenditure targeted to research partnerships involving key growth industries.

However, none of this alters our commitment to maintaining a strong tradition of liberal education within our tertiary system. We see academic freedom as an essential value, and want to sustain a system in which researchers are able to pursue knowledge for its own sake.

This commitment can be seen in the way we have increased public expenditure on scientific research year or year, and have created funding mechanisms that use public resources to attract more private resources into research partnerships. Looking ahead, we are increasing government's investment in research by $212 million over the next four years. Again, a large portion of this increase has been targeted at research ventures involving CRIs and industries where public and private investment work hand in hand.

It is also reflected in the Performance-Based Research Fund, which rewards institutions which undertake research that is recognised as world-class, and scholars who are active and valued contributors to international networks of researchers.

What we don't want is for the process to stop there. If we are to create a vibrant `knowledge economy' then we need a more disciplined approach to the transmission and dissemination of knowledge. And as a small country, we one of those disciplines is to make strategic choices about where to focus our efforts so as to build on our competitive advantages and create strong and sustainable niche industries.

Inevitably this means change. One thing that has to go is the cherished myth of the amateur; the individual who retreats to the garden shed, constructs an unlikely piece of sophisticated equipment, and produces something world-beating. It is time we put this little romance to bed.

As management theorists like Peter Drucker and Peter Senge have argued, innovation is not an art; it is a set of disciplines that can be learned, practiced and taught.

With hindsight we can trace the history of the computer through three centuries, from the development of binary theory in the seventeenth century, Charles Babbage's calculating machines in the 1820s and 1830s, the invention of the punchcard by Herman Hollerith in 1890, through Bertrand Russell and Alfred North Whitehead's work on symbolic logic, the invention of the audion tube, the transistor, the microchip and so on. The question for us is: how can we speed up this process whereby advances in mathematics and technology are combined to create innovations that serve humanity and create wealth?

There is no law that requires new discoveries in mathematics to take three centuries to find practical applications.

A true knowledge economy needs more than just smart people. It depends upon the quality of relationships between those people, and a culture that supports the sharing of information and collaboration across disciplines.

These things do not arise spontaneously; they have to be consciously designed and created, and they need energetic people to drive them. The interests of all have to be understood and respected. Issues such as intellectual property need to be worked through, and common understandings are required around best practice collaboration. We need this kind of interchange to be a regular, ongoing activity, and not just a periodic one.

The Mathematics in Industry Study Group is an excellent example of collaboration between academics and industry. Over the next few days you will take part in an extended process of intellectual `fermentation'.

This not only provides an opportunity to dig deep into the underlying causes of the problems you will consider. It also builds the kind of relationships that assist better transmission of new research into industry and guide future research. And it enables you to explore questions that may at first seem tangential, but which may lead to new discoveries, or at least to new questions and problems that deserve attention in the future.

Reading the feedback from previous study groups, the over-riding theme is one of surprise at how valuable the process can be. I trust that this year's experience will be the same.

This is the kind of endeavour that signals where New Zealand businesses should be heading in terms of harnessing technology to increase value, and of what New Zealand universities should be doing to engage with business.

My chief regret in opening this event is that my schedule does not allow me to stay and witness the proceedings.

Thank you.

BOOK REVIEWS

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

Bruce van Brunt
Institute of Fundamental Sciences
Massey University
(email: B.vanBrunt@massey.ac.nz)

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ALGEBRAIC TRANSFORMATION GROUPS AND ALGEBRAIC VARIETIES
Proceedings of the Conference on Interesting Algebraic Varieties Arising in Algebraic Transformation Group Theory held in Vienna, October 22–26, 2001.
Edited by Vladimir L. Popov.
Encyclopaedia of Mathematical Sciences, 132. Invariant Theory and Algebraic Transformation Groups, III. Springer-Verlag, Berlin, 2004. xii+238 pp. ISBN 3-540-20838-0

This collection of articles deals with relationships between algebraic transformation groups and algebraic varieties. Here the varieties in question are mostly projective algebraic varieties over an algebraically closed field k of characteristic zero and the groups are linear algebraic groups over k — subgroups of a general linear group $GL_n(k)$ defined by polynomial equations in the matrix entries. Linear algebraic groups are varieties of a very special kind; nonetheless all sorts of surprising interactions have been discovered between the theory of algebraic groups and algebraic geometry as a whole.

One link comes from geometric invariant theory, which asks the following question. Suppose a linear algebraic group G acts on a variety V. Under what circumstances can one form a reasonable quotient variety V/G? Hilbert's 14th Problem was to show that if V is affine then the subring of invariants $k[V]^G$ of the co-ordinate ring k[V] is finitely generated as a k-algebra. Nagata in 1958 gave a celebrated counter-example; Hilbert himself proved that if G is reductive then $k[V]^G$ is finitely generated, so one can define V/G to be the affine variety with $k[V]^G$ as its co-ordinate ring. The article of Snow investigates the question of when a coset space G/H (where H is a closed subgroup of G) is affine. The article of Mukai gives further counterexamples to Hilbert's problem by a geometric construction involving the cohomology groups of certain projective varieties.

A rich source of interesting varieties comes from the representation theory of semisimple algebraic groups. Let G be such a group, let v be an irreducible representation of G and let $0 \neq v \in V$. Let [V] denote the image of V in the projectivisation P(V). The orbits G·v in v and G·[v] in P(V), and their closures, have been much-studied. De Concini in his article looks at the normalisation of orbit closures; Popov and Tevelev in theirs consider self-dual projective varieties arising from nilpotent orbit closures in the projectivised adjoint representation of G.

If G/V are as above then there is a unique closed orbit G·v in P(V). This orbit is of the form G/P, where P is a parabolic subgroup of G; here G acts transitively on G/P by left translation. Projective varieties of the form G/P are called homogeneous varieties. Several of the articles in this collection involve the geometry of homogeneous varieties: that of Hwang and Mok proves a rigidity result when G is of type F_4, that of Tevelev is motivated by a question involving vector bundles on G/P, while that of Landsberg and Manivel looks at the local structure of homogeneous varieties.

An important theme in projective algebraic geometry is classification: to describe or list all projective varieties of a certain type. Suitable invariants such as dimension and degree are helpful here. Zak in his article generalises the notion of determinant of a matrix to arbitrary projective varieties, giving new invariants.

The collection is rounded off by three articles (the two of Ciliberto and Di Gennaro and the one of Krashen and Saltman), which have little or no input from algebraic groups, on the geometry of varieties.

This book gives a good flavour of some current research in algebraic transformation groups and their applications. It is not well-suited to beginners: many of the articles are very technical. Several of the authors, however, have written clear introductions and/or included expository sections. I found the article of Landsberg and Manivel particularly readable; it brings together ideas from projective geometry, representation theory, Jordan algebras and knot theory.

The contents are as follows: Ciro Ciliberto and Vincenzo Di Gennaro, Factoriality of certain hypersurfaces of P^4 with ordinary double points; Ciro Ciliberto and Vincenzo Di Gennaro, Boundedness for low codimensional subvarieties; Corrado De Concini, Normality and non normality of certain semigroups and orbit closures; Jun-Muk Hwang and Ngaiming Mok, Deformation rigidity of the 20-dimensional F_4-homogeneous space associated to a short root; Daniel Krashen and David J. Saltman, Severi-Brauer varieties and symmetric powers; Joseph M. Landsberg and Laurent Manivel, Representation theory and

projective geometry; Shigeru Mukai, Geometric realization of t-shaped root systems and counterexamples to Hilbert's fourteenth problem; Vladimir L. Popov and Evgueni A. Tevelev, Self-dual projective algebraic varieties associated with symmetric spaces; Dennis Snow, The role of exotic affine spaces in the classification of homogeneous affine varieties; Evgueni A. Tevelev, Hermitian characteristics of nilpotent elements; Fyodor L. Zak, Determinants of projective varieties and their degrees.

Ben Martin
University of Canterbury

INTRODUCTORY OPERATIONS RESEARCH
by Harvir S. Kasana and Krishna D. Kumar,
Springer-Verlag, 581pp, US $79.95. ISBN 3-540-40138-5

Kasana and Kumar provide an introductory text for the theory and applications of operations research. The book will be of interest to engineers, managers and students of statistics looking for a self-contained text. The book consists of eighteen chapters and an appendix. There is much material and many examples provide for interesting reading. The book may be used as a one-year course. Each chapter contains exercises and answers to the exercises are given at the end of the book. The authors suggest the book be used as an undergraduate or graduate level textbook. I agree and also feel the book provides an excellent source of reference material.

Chapter 1 introduces linear programming and optimization in general. One example: how should a patient select food items to minimize cost subject to fulfilling minimum daily requirements. Chapter 2 provides a geometric interpretation of the linear programming problem (LPP). If a linear programming problem has n_2 constraints then the LPP has a 2-dimensional representation. The authors discuss extreme points, basic feasible solutions (BFSs) and the objective function. In chapter 3 the authors develop the theory of the simplex method to solve linear programming problems. First start at some BFS and then move to another so that the value of the objective function is improved. After a few steps the desired BFS is reached where the optimal solution exists. Two other methods discussed are slight variants of the simplex method known as the big-M method and the two-phase method. Plenty of examples are given. Chapter 4 considers the dual linear problem, where for each linear program there corresponds another with the same set of data. The dual of a minimization problem is a maximization problem. An important result is that if either the original or dual LPP has a finite optimal solution then both achieve the same optimal objective value. Chapter 5 continues with more advanced techniques. The revised simplex algorithm is described, where instead of finding the next iteration by row operation, the next iteration is computed by using the product form to invert the basis matrix. Other techniques include the bounded variable technique, the decomposition algorithm and the Karmarkar interior point algorithm. In chapter 6 the linear programming problem produces a solution that may need refinement at a later time to find a new optimal solution. Small changes that will have an effect on the objective function value and solution require the use of sensitivity analysis. Chapter 7 discusses a special type of LPP, the transportation problem. Material is transported from different sources to different destinations. Five methods are described: 1) the North-west rule; 2) the least cost method; 3) the Vogel approximation method; 4) the Russell approximation method; and 5) the u - v method. The process of transshipment and the assignment problem are included. The Hungarian method to solve the assignment problem is outlined. Chapter 8 is concerned with networks. The minimal spanning tree algorithm calculates the minimum distance between nodes connected directly or indirectly. The authors analyze the minimum distance between two specified nodes connected through various feasible paths. The authors next consider the maximal flow problem and give an example of two wells which supply crude oil to refineries. Chapter 9 examines the critical path method for managing the successful completion of a project. Chapter 10 evaluates the sequence that should be taken to minimize the time needed for a finite number of jobs processed on a finite number of machines. This is the sequencing problem. Chapter 11 examines the integer linear programming problem, where decision variables are positive integer values. The traveling salesman and the cargo-loading problem are described. Chapter 12 introduces dynamic programming. Recursive relations, the continuous and the discrete case are considered. Dynamic programming is compared to linear programming. Chapter 13 presents nonlinear programming when the objective function includes several variables and any type of constraints. Two methods are described. These are the Lagrange multiplier method for nonlinear problems with equality constraints and the Kuhn–Tucker theory for nonlinear problems with inequality constraints. Chapter 14 considers the unconstrained optimization of nonlinear problems. The authors use the Fibonacci search method, the Golden section method, the steepest descent method, and the conjugate gradient method. Chapter 15 examines different types of geometric programming problems. Chapter 16 introduces goal programming when more than one objective function is to be optimized. Chapter 17 introduces games theory and compares it to linear programming. Chapter 18 concludes with the description of various special topics. The topics include the extremum difference method, generalized transportation and assignment problems and the multi-objective transportation problem. The appendix lists objective type questions.

I liked the book. The book makes a worthwhile addition for those interested in operations research. The book contains much reference material and is well written. The book contains an extensive subject index.

The examples, summaries, discussions and conclusions are well presented. The authors in my opinion should have added additional material, perhaps even a chapter, discussing various computer packages and/or software for use in solving such problems. I liked the useful exercises at the end of each chapter. I recommend this book. It makes a worthwhile addition to a mathematics/statistics library.

Paul Johnson
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MATHEMATICS HANDBOOK FOR SCIENCE AND ENGINEERING (Fifth edition)
by Lennart Räde and Bertil Westergren, 562pp, £ 38.50, SFr88.50, US $59.95. ISBN 3-540-21141-1.

My dictionary defines a handbook as a "concise manual or reference book providing specific information or instruction about a subject or place." Most of my previous experience with mathematical handbooks has involved trying to find obscure integrals in the likes of Gradshteyn and Ryzhik, so I was interested to see how useful the book under review (which is much more widely ranging than that weighty tome) would be. It contains much information—and a little instruction—which adds greatly to its usefulness. Not surprisingly, it is not a book to read for instruction alone, but rather one in which to look up those things you know that you know but can't remember off the top of your head and don't want to derive from scratch. But rather than just being lists of expressions and equations, we have these interspersed with short explanations, notes and examples. These serve to jog the memory, explain notation, or provide examples of the concepts being discussed (with answers given for comparison).

The book is organised into 19 chapters, starting from discrete mathematics (logic, algebraic structures, graph theory, etc.) and ending with statistics (point estimation, factorial experiments, a glossary, etc.). Along the way, algebra, geometry, calculus, transforms, complex analysis, optimisation and more are covered, and it includes 30 pages of definite and indefinite integrals. Each chapter is divided into about eight sections in a logical fashion.

This book is in its fifth edition, so one would have expected that obvious typos would have been edited out by now. However, I found a few: "condradiction" (p. 10, which was also there in the third edition), "intervall" (p. 135) and "respektively" (p. 236). On p. 71 we have k defined as the curvature of a circle and r its radius, but then find the formula k = 1/r, and on p. 432 the expected value E[X] should be E[Y]. These are minor, but on p. 113 several lines of text from p. 112 appear again, which could lead to confusion.

There were several other things that I originally thought were typos, but turned out to be more involved than that. The authors consistently use ${}^{a}\log$ instead of $\log_a$ to denote "log to the base a". I have never seen this notation elsewhere, and it makes their definition of entropy, for example, which contains a term of the form ${}^{2}\log f(x)$ instead of $\log_2 f(x)$, look unusual. The authors also use "artanh", "arcosh" and "arsinh" to denote the inverses of the hyperbolic functions tanh, cosh and sinh, respectively, seemingly replacing "arc" with "ar". Apparently, this is the usual spelling in some European countries (the authors are from Sweden). These terms can be derived from the Latin "area tangentis hyperbolicae", "area cosini hyperbolici" and "area sini hyperbolici," respectively. This was a revelation to me, as I had always assumed that "arc" was just a way of indicating an inverse.

Having said that, the text is well laid-out and many useful diagrams are included. The index is sufficiently detailed to be useful (it is 16 pages long) and there is some cross-referencing within the text, so finding what one is looking for in a reasonable time is not too difficult. I don't recommend that you rush out to buy this book, but it is certainly a handy one to have within reach.

Carlo Laing
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RUSSIAN MATHEMATICIANS IN THE 20TH CENTURY
Yakov Sinai (editor)
World Scientific, Singapore, 2003 ISBN 981-02-4390-1

This large book (700 pages) has chapters about 33 Russian mathematicians, each of whom was one of the important mathematicians of the 20th century—but there is no perceptible ordering in that list, neither chronological nor alphabetical. The mathematicians considered are (in alphabetic order): A. D. Aleksandrov, P. S. Aleksandrov, S. N. Bernstein, N. N. Bogoliubov, N. G. Chebotaryov, B. N. Delone, D. F. Egorov, D. K. Faddeev, I. M. Gelfand, A. O. Gelfond, L. V. Kantorovich, M. V. Keldysh, A. Ya. Khinchin, A. N. Kolmogorov, M. G. Krein, M. A. Lavrentev, Yu. V. Linnik, L. A. Liusternik, N. I. Luzin, A. M. Lyapunov, A. I. Malcev, A. A. Markov, D. E. Menshov, P. S. Novikov, I. G. Petrovsky, L. S. Pontryagin, V. A. Rokhlin, V. I. Smirnov, S. L. Sobolev, V. A. Steklov, A. N. Tikhonov, P. S. Urysohn, I. M. Vinogradov. Israil Moiseevich Gelfand is the only one still living. Remarkably, no women are included—I would certainly have expected a chapter about O. A. Ladyzhenskaya; and each of V. N.

Faddeeva, P. Ya. Kochina, L. V. Keldysh and O. A. Oleinik had a strong claim to be included. \par Each chapter starts with a brief biography by the Editor, with photograph and dates of birth and death. None of those biographical articles cites any source, except for D. K. Faddeev. (But there is no photograph of D. K. Faddeev, and no date is given for his death.) The texts of the biographies mostly occupy 1 to 2 pages: but the entire biographical text for L. A. Liusternik (p. 469) consists of the sentence "Lazar Liusternik was a corresponding Member of the Division of Physical-Mathematical Sciences since 4 Dec 1946".

The Editor's biography is followed by a biographical article (in Russian) for V. A. Steklov, and by 3 biographical articles (1 in Russian, 2 in English) for D. F. Egorov. Each of the other 31 chapters reprints one or more articles by that mathematician (in Russian or French or German or English, or in English translation from Russian or from French), and in some chapters another biographical article is reprinted (in English translation from Russian, or in English).

This anthology of mathematical writings contains many very significant works, including I. M. Vinogradov's renowned papers on primes [1,2], A. O. Gelfond on Hilbert's 7th problem [4], A. Ya. Khinchin's classic little book **Three Pearls of Number Theory** [5], A. N. Kolmogorov on turbulent fluids [6,7,8,9], S. L. Sobolev on functional analysis [11], I. G. Petrovsky on partial differential equations [12], L. V. Kantorovich's pioneering papers (written in English) on linear programming [13,14], and A. A. Markov (\textsl{junior}) on algorithms [15].

Many of the reprints of articles lack bibliographic details, and so the reader needs to consult the list of Contents (pp.vii-xi)—but some bibliographic information is missing there. The articles by A. M. Lyapunov [17,18] are printed in English translation (typewritten), but the Contents ascribes those translations only to **Collected Papers** [19], with no further information. The article [20] about V. A. Steklov is a speech (in Russian) given by N. M. Gyunter at a memorial meeting of the Leningrad Physical-Mathematical Society on 9 October 1926, and the Contents identify the source only as Uspekhi, Vol.1, new series, No.4. In fact, Gyunter's speech was first published as pp.49–77 in the book **In Memory of V. A. Steklov** (in Russian), a collection of papers published by the Academy of Sciences of the USSR at Leningrad in 1928. It was reprinted in Uspekhi Matem. Nauk (new series) **1**, No. 3–4 (1946), 23–43, and that reprint is reproduced in this book. I. M. Vinogradov's renowned papers [1,2] on primes are published in English translations, which are not identified as coming from his **Selected Works** [3].

The 3 chapters of A. Ya. Khinchin's classic little book **Three Pearls of Number Theory** are reproduced from the English translation ([5], pp.11–64) published by Graylock Press—but the publication date (1952) is not stated. And Khinchin's very significant preface A Letter to the Front: March 24, 1945 is not reproduced from pages 9–10. He addressed that to a former student (for one year) who had been wounded after 3 years of fighting against the Nazi invaders, and had written from a hospital to his former professor asking him to send "some little mathematical pearls". After several days of deliberation, Khinchin selected "the three theorems of arithmetic which I am sending you, to be genuine pearls of our science". He explained that "They have all been solved quite recently, and there are two remarkable common features in their history. First, all three problems have been solved by the most elementary arithmetical methods (do not, however, confuse elementary with simple: as you will see, the solutions of all three problems are not very simple, and it will require not a little effort on your part to understand them well and assimilate them). Secondly, all three problems have been solved by very young, beginning mathematicians, youths of hardly your age, after a series of unsuccessful attacks on the part of `venerable' scholars. Isn't this a spur full of promise for future scholars like you? What an encouraging call to scientific daring!

The work of expounding these theorems compelled me to penetrate more deeply into the structure of their magnificent proofs, and gave me great pleasure."

A. N. Kolmogorov's 4 papers on turbulence in fluids [6,7,8,9] are published in English translations, which are not identified as coming from Volume 1 of his **Selected Works** [10]. L. S. Pontryagin's papers [21,22,23,24] are published in English translations, which are not identified as coming from Volume 1 of his Selected Works [25].

The paper [26] by M. Krein and D. Milman (in English with Ukrainian summary, pp.457-462) was published in the Polish journal Studia Mathematica t.**9**, but the highly significant date of publication (1940) is not indicated. L. A. Liusternik's survey article [27] is attributed to Uspekhi, new series, Vol.1, No.1 with no date given: actually it was published in Vol.1 No.11 (1946), 30-56. The very brief biographical article (p.599) about Andrei Andreyevich Markov (1856-1922) tells that "Markov had a son (of the same name) who was born on September 9, 1903 and followed his father in also becoming a renowned mathematician". But the following articles [15,16] were both written by the younger Andrei Andreyevich Markov! M. A. Lavrentev's paper [28] is attributed to J. d'analyse Mathematique **19**; which should be J. d'Analyse Mathématique **19** (1967), 217-225. A. N. Tikhonov's paper [29] is attributed to Math. Ann. **102**, but the date of publication (1930) is not indicated; and P. S. Aleksandrov's paper The principal topological discoveries of A. N. Tikhonov [30] is misnamed in the Contents (p.xi) as The principal mathematical discoveries of A. N. Tikhonov.

There are several further misprints, including (on p.viii) "Scienes" for "Sciences", "P. S. Alexdrov" for "P. S. Aleksandrov" and "Petreovski" for "Petrovsky".

This book is a valuable anthology of mathematical writings—but it should have been edited with greater care.

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CONFERENCES

REPORT ON NZIMA MEETING IN LEIGH
30 November–3 December, 2004

Last year's NZIMA thematic programme on Dynamics Systems and Numerical Analysis came to a triumphant close in December with a meeting at the Goat Island Marine Reserve in Leigh. Around 30 of us gathered at the reserve for 2½ days of talks. The definite highlight was almost 3 hours of presentation by Jerry Marsden from Caltech, who showed us what we can only aspire to in our most vainglorious dreams, with reports of a huge variety of work in discrete mechanics, variational integrators, and optimal control.

In addition to Jerry, two invited speakers, Jeroen Lamb from Imperial College & our own Robert McLachlan gave extended presentations. Jeroen, a veteran of the NZIMA programme since he also talked at the Raglan meeting, talked about bifurcations in the presence of symmetry. He also brought a number of his PhD students from the UK. Robert kicked off the scientific programme with a general introduction to geometric numerical integration.

The rest of the scientific presentations came from talks from the audience, and covered a wide variety of themes, from bifucation analysis to image registration, via inverse problems and the rotating shallow water equations. There was a good mix of talks by students and academics. The full program, and links to the slides for some of the talks are available at http://www.math.waikato.ac.nz/ rua/dsna/leigh/speakers.html

However, I couldn't possibly write this review without mentioning the facilities provided for us by the Marine Reserve. They fed us admirably, and provided a wonderful location. While it was still rather cold for snorkelling—my first December in New Zealand wasn't the sun-drenched wonder I'd imagined from the Northern Hemisphere winter the previous year—a number of us did brave the water to see a wide variety of fish, and a great many could also be seen from the safety of the rocks. Furthermore, the Wednesday afternoon free time enabled the organisation of a trip on the `Glass-Bottomed Boat', a Leigh innovation for those wishing to see underwater without freezing. Pretty much the whole group, and assorted hangers-on and families joined the trip around Goat Island, with the skipper providing a commentary of marine life we were seeing below the boat, while his assistant spent her time vigorously polishing the glass to stop it from misting up.

In conclusion, I'd like to thank the organisers, Vivien Kirk, Rua Murray, and Robert McLachlan for an extremely interesting, stimulating, and enjoyable workshop—I'm looking forward to some future follow-up meeting already.

REPORT ON THE 2004 NEW ZEALAND MATHEMATICS COLLOQUIUM
6–8 December 2004

The 2004 New Zealand Mathematics Colloquium was held at the University of Otago from 6–8 December 2004. It incorporated the Annual General Meetings of the New Zealand Mathematical Society and ANZIAM (NZ branch).

There was a welcoming reception at Unicol on Sunday evening 5 December, and the programme included a SIAM (South Island Applied Mathematics) Day on the Tuesday and an Education Day on the Wednesday. The invited speakers were:

Rod Gover (University of Auckland), "Overdetermined PDEs, the Einstein equations and conformal geometry."
Peter Cameron (Queen Mary College), "The Rado graph and the Urysohn space."
James Sneyd (The University of Auckland), "Neither an ant nor a spider be: historical vignettes in mathematical physiology."
Bill Currie (Fisher & Paykel), "Simulation and appliance design: using applied maths to get better outcomes faster."
Carsten Thomassen (Technical University of Denmark), "Rendezvous numbers and von Neumann's mini-max theorem."

There were 103 registrants and 53 contributed talks. The Aitken prize for the best student talk was awarded to Joanne Mann of Massey University at Albany for her talk To vaccinate or not to vaccinate.

Following afternoon tea on Tuesday afternoon there was an excursion to Natures Wonders—a bus trip down the Otago peninsular in a bracing wind and showery weather, not inhospitable to the albatross. This was followed by the Colloquium dinner at Glenfalloch. In recognition of its thirty year anniversary the NZMS presented Life memberships to the four longest serving office bearers: Marston Conder, Rob Goldblatt, Gillian Thornley and Graeme Wake. The NZMS Research Award to Eamonn O'Brian was formally presented (in Eamonn's absence) though it had been announced earlier in the year at a Royal

Society function.

The Colloquium Business Meeting agreed to depart once again from the "Peterson cycle" on account of possible forthcoming combined meetings with the American Mathematical Society at Victoria and with the Australian Mathematical Society at Canterbury over the next four years. The 2005 Colloquium will therefore be hosted by Massey University at Palmerston North.

We are grateful to our sponsors, the NZMS and ANZIAM (NZ branch) for their financial support. We thank the Otago organising committee for a well run Colloquium and the typical southern hospitality.

Gillian Thornley
Massey University, Palmerston North

DLT'04: Short Presentation
12–17 December 2004

In December 2004 the Eighth International Conference "Developments in Language Theory" (DLT'04) was held at Massey University at Albany; it was jointly organized with the Centre for Discrete Mathematics and Theoretical Computer Science of the University of Auckland, under the auspices of the European Association for Theoretical Computer Science (EATCS), with the support of the New Zealand Royal Society. Together with the satellite workshops, the International "Workshop on Automata, Structures and Logic", and the International Workshop "Tilings and Cellular Automata", DLT'04 had about 100 participants from 17 different countries from all continents.

The main subjects of the DLT conference series—the main international conference in formal language theory—are formal languages, automata, conventional and unconventional computation theory, and applications of automata and language theory.

A panel of distinguished theoretical computer scientists have selected selected 30 papers (out of 50) to be presented at DLT'04 (which includes a record number of papers written by graduate students: 5); they were complemented by five invited lectures given by the well-known experts Bruno Courcelle (Bordeaux, France), Rodney Downey (Wellington, NZ), Nata\v sa Jonoska (Tampa, USA), Anca Muscholl (Paris, France) and Grzegorz Rozenberg (Leiden, Holland). The proceedings of the conference have been published as the volume 3340 of the Lecture Notes in Computer Science series of Springer, Heidelberg (2004, 442 pp).

A detailed presentation of DLT'04 will appear in the Bull. Eur. Assoc. Theor. Comput. Sci. EATCS 85, S(2005).

Elena Calude

REPORT ON 2004 NZIMA CONFERENCE IN COMBINATORICS AND APPLICATIONS
13–18 December 2004

The conference was held in conjunction with The 29th Australasian Conference on Combinatorial Mathematics & Combinatorial Computing and was held at Copthornes-Manuels Hotel in Taupo from 13 to 18 December 2004. About 150 participants from 22 countries attended the conference. Massey's participants were Charles Little, Serguei Norine, Bhalchandra Thatte, and Kee Teo. I have never met so many world-reknowned researchers at a combinatorics conference before. I was particularly pleased to meet Alan Sokal and Carsten Thomassen, whom I have communicated with in the past. The talks given by the invited speakers and most speakers were outstanding. The invited speakers were Dan Archdeacon, Rosemary Bailey, Richard Brualdi, Darryn Bryant, Peter Cameron, Maria Chudnovsky, Bruno Courcelle, Jim Geelen, Bert Gerards, Catherine Greenhill, Bojan Mohar, Bruce Richter, Neil Robertson, Paul Seymour, Alan Sokal, Robin Thomas, Carsten Thomassen, Tom Tucker, Mark Watkins and Dominic Welsh.

The conference excursion included the Huka Falls and the Taupo Prawn Farm and ended at Orakei Korako Thermal Park. I could hear a lot of oohs and aahs about this truly unique geothermal wonderland.

Paul Bonnington and his committee must be congratulated for organising such a great and successful conference.

Kee Teo
Massey University, Palmerston North

NZ MATHEMATICS RESEARCH INSTITUTE SUMMER WORKSHOP 2005
9–15 January 2005

The workshop this year was held in sunny Napier from 9th–15th January at the Napier War Memorial Conference Centre. It was sponsored by the New Zealand Institute for Mathematics and its Applications as one of the key events in the Geometry Program which runs from January to June 2005. The theme of the meeting was *Geometry: Interaction with Algebra and Analysis* and was interpreted broadly, indeed few parts of mathematics were left untouched by the star-studded line-up of invited speakers.

The meeting attracted over 80 participants, including students and post-docs, and over 40 accompanying persons. The weather behaved, the vineyards sparkled, the climb of Mt Kaweka succeeded and the gannets put on a grand show. One blemish—the breeze was too light for wind-surfing.

Speakers in the main session (each gave three lectures) were Ben Andrews (Camberra) who discussed the recently announced proof of the Poincaré conjecture, Craig Evans (Berkeley) who presented weak KAM theory and non-linear PDEs (here is the formula but what does it mean!), Martin Liebeck (Imperial) who presented probabilistic group theory with a kiwi connection, Alex Lubotzky (Jerusalem) who showed how counting groups, manifolds and primes can be related and Peter Sarnak (Princeton) who discussed eigenvalues and eigenfunctions in the context of analysis and arithmetic on locally symmetric spaces.

The Thursday was devoted to celebrating Fred Gehring's 80^{th} year with a set of additional speakers having a close relationship to Fred. They were Kari Astala (Helsinki) who discussed *Quasiconformal methods in impedance tomography*, Tadeusz Iwaniec (Syracuse) - *Extremal mappings of finite distortion*, Peter Jones (Yale) - *Some random homeomorphisms in analysis* and Stephan Rohde (Seattle) - *The stochastic Schramm-Loewner evolution equation*.

The day concluded with a fine banquet held at Clearview Estate Vineyard with Gaven Martin giving an outrageously funny after-dinner speech.

In addition, three after-dinner lectures, suitable in the main for a public audience, were given. John Conway (Princeton) - *How to beat children at their own game*, Michael Eastwood (Adelaide) - *Complex analysis out of thin air* and Peter Jones - *Geometry meets the traveling salesman*.

The contribution made to the success of the meeting by the organizers Gaven Martin and Eamonn O'Brien and the support of the NZIMA are gratefully acknowledged.

(Some photographs, including the gannets, Napier, the venue, and Ben Andrews completing the proof of the Poincare conjecture are at http://math.waikato.ac.nz/~kab and follow the link under NZMRI Napier 2005 Workshop.)

Kevin Broughan
The University of Waikato

REPORT ON VIC2005, INTERNATIONAL WORKSHOP ON ALGEBRA
9–10 February 2005

The VIC2005 Workshop took place at Victoria University of Wellington on February 9–10, 2005. The themes of the meeting included noncommutative geometry, quantum groups and representation theory. 15 participants from Europe, China, Israel and New Zealand attended the two day meeting; and nine interesting one hour talks were given by Professor Fred Van Oystaeyen (University of Antwerp), Dr Huixiang Chen (VUW), Dr Jianbei An (The University of Auckland), Professor Piotr Hajac (Mathematical Institute, Polish Academy of Science), Professor Mia Cohen (Ben Gurion University), Dr John Clark (University of Otago), Dr Ben Martin (University of Canterbury), Professor Stefaan Caenepeel (Free University of Brussels) and Professor Quanshui Wu (Fudan Univ). The programme can be viewed at www.mcs.vuw.ac.nz/events/VIC2005. Thanks to our School Manager Ginny Nikorima, who did most of the local organization (and drove the bus on the wine trail to Martinborough), the workshop ran very smoothly and successfully.

Yinhuo Zhang
Victoria University of Wellington

APPROXIMATION AND HARMONIC ANALYSIS
held at The University of Auckland, 8–11 February 2005

This was the third conference in a series the others having been held at the University of Canterbury in February 1999, and at Westport in February 2002.

The fields of Approximation and Harmonic Analysis were virtually identical in the time of Zygmund but have unfortunately grown apart in recent times. This conference aimed at fostering and highlighting cross connections between these fields. We believe that it succeeded in this, in that almost all the talks were very interesting to audience members of the "other" specialty. A highlight of the conference was the excursion to Tiritiri Matangi, an idyllic wildlife reserve off the coast of Auckland. This provided a beautiful setting for the all important informal interactions between delegates.

The following invited talks were given

John Benedetto, "Sigma Delta quantization and finite frames."
Len Bos, "Some remarks on Heisenberg Frames."
Pete Casazza, "Signal Reconstruction without Noisy Phase."
Xuan Duong, "New characterisations of BMO and Morrey-Campato spaces."
David Levin, "Moving Least Squares for Surfaces."
SL Lee, "Approximation of the Gaussian and its Properties."
Vilmos Totik, "Equilibrium Measures and polynomials."

There were participants from Australia, Canada, Hungary, Israel, Korea, Singapore, United States of America, and New Zealand.

The organisers Shayne Waldron (Auckland), Qui Bui and Rick Beatson (Canterbury) are grateful to The University of Auckland, the University of Canterbury and the New Zealand Institute for Mathematics and its Applications for their support of this successful conference.

Rick Beatson

NEW ZEALAND PHYLOGENETICS MEETING
February 13–17, Whitianga'05

This year it was Auckland University's turn to host the NZ Phylogenetics meeting—the rules are that hosts can't hold the meeting in their own city—so we headed off to Whitianga. As in previous years the talks were on a spectrum from the more mathematical to more biological (with a healthy dash of statistics and computer science thrown in). One session that stood out was devoted to talks on applying phylogenetic techniques to studying the "evolutionary relationships" of languages and manuscripts. Quentin Atkinson gave a talk on how techniques that are usually used to put dates on evolutionary trees of species can be used to put dates on the "evolutionary tree" of Indo-European languages. Their findings support the Anatolian farming hypothesis that Indo-European languages started to diversify about 10,000 years ago along with the spread of agriculture. Of the talks with a math/computer science flavour, the one that stood out was Benny Chor on `Maximum Likelihood of Evolutionary Trees is Hard'. The hardness proof for this method has been an open problem in phylogenetics for years (the intuitively easier method Maximum Parsimony was already known to be NP-Hard in 1986), so it was great to get the gist of how this has now been proven. Whitianga turned on beautiful sunshine for the week (making up for Whitianga'02 when the meeting got hit by a cyclone) and people took full advantage. Tuesday evening saw most of the attendees wallowing in the mud at Hot Water Beach, and the following day the walk around to Cathedral Cove was the most popular excursion. A tally of the list of attendees shows that 24 of the 47 came from overseas with

the biggest component from Australia or the UK. It's great that these meetings are consistently able to encourage so many people to travel from overseas. Next year is Canterbury University's turn to host so we will be heading back to Kaikoura. Already looking forward to it.

Barbara Holland
Massey University, Palmerston North

GEOMETRY: INTERACTIONS WITH ALGEBRA AND ANALYSIS
14–18 February 2005

This conference, part of the NZIMA Thematic Program with the same title, attracted visitors from many countries, including Japan, Israel, Italy, Australia, Britain, the Netherlands and the United States. It was held at The University of Auckland. Most of the participants stayed in hotels or Halls of Residence an easy walk from the university, avoiding the need to struggle against the Auckland traffic.

The subject of the conference was very broad. Geometry is an elusive creature and almost every speaker seemed to have his or her own idea of what it means: differential geometry, geometric group theory, algebraic geometry, geometric invariant theory, the geometry of projective planes, ... I found the wide spread of topics attractive; it's a shame more New Zealanders (and students in particular) were not able to attend the meeting and learn from the visiting experts.

The conference was well run by the organisers, Eamonn O'Brien and Gaven Martin (no relation to this writer!). They arranged excursions to Rangitoto Island and Muriwai Beach on the free afternoon. Getting to the conference dinner became a struggle when the taxis, carefully booked in advance, mysteriously failed to appear, but it was worth it: everyone I spoke to thought the meal was magnificent.

I thoroughly enjoyed the meeting. It's great to have the chance to talk to collaborators from outside New Zealand without having to travel half way around the world! Many of the overseas visitors stayed on to explore the country further and visit other universities.

Ben Martin
University of Canterbury

Conferences in 2005

19–22 April 2005, at The University of Auckland: **Mathematical Models for Optimizing Transportation Services**.
https://secure.orsnz.org.nz/transportation/

p29 June–1 July 2005, in Wanaka: **Hidden Markov Models and Complex Systems Workshop**
http://nzsa.rsnz.org/HMM1/index.htm

p2–7 July 2005, in Auckland: **SRTL4 2005–the Fourth International Research Forum on Statistical Reasoning, Thinking and Literacy**
http://www.stat.auckland.ac.nz/srtl4/

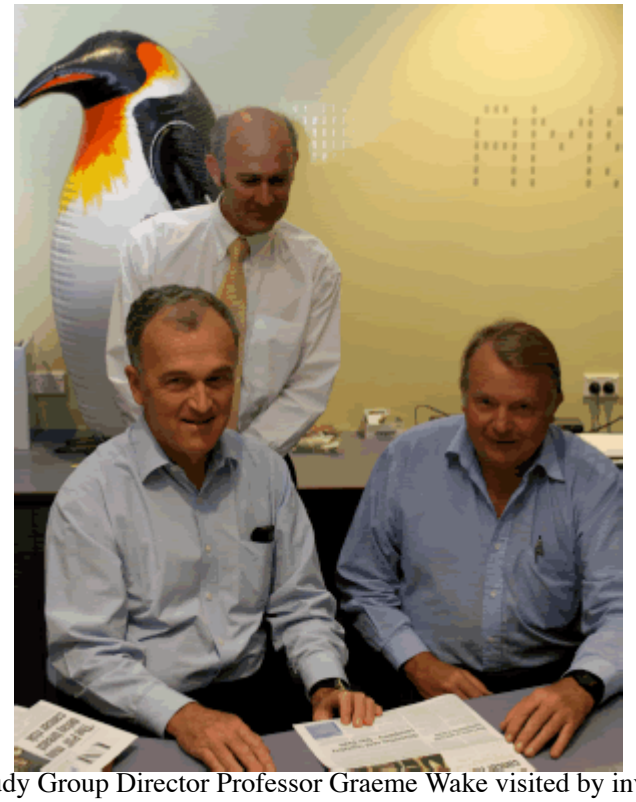
p4–6 July 2005, in Dunedin: **Annual Conference of the NZ Statistical Association**
http://www.maths.otago.ac.nz/nzsa2005/home.php

p5 July 2005, in Auckland: One-day meeting on **Dynamical Systems and Numerical Analysis**, on Tuesday July 5th, 2005 at The University of Auckland.
{\tt v.kirk@auckland.ac.nz}

27–30 September 2005, in Christchurch: **9th Biennial New Zealand Association of Mathematics Teachers conference**
http://www.nzamt9.org.nz/

5–7 December 2005, in Palmerston North: **New Zealand Mathematics Colloquium**.

5–9 December 2005, at the University of Queensland, Brisbane: **Thirtieth Australasian Conference in Combinatorial Mathematics and Combinatorial Computing (30 ACCMCC)**.
website: http://www.maths.uq.edu.au/cdmc/30accmcc.html



Maths-in-Industry Study Group Director Professor Graeme Wake visited by invitation the Australian Mathematical Sciences Institute (AMSI) on Monday 4th April in Melbourne. Discussions were held about activities by AMSI in Industrial Mathematics and its relationship to the 20 year ANZIAM MISG, presently being run in Massey, Auckland. He is pictured seated on the right with AMSI Director Professor Garth Gaudry on the left. Behind them standing is Dr Tom Montague, the Industry Liaison person for AMSI. The penguin is the star of the reception foyer!

NOTICES

ERRATUM

One of the founding vice-presidents of the society was Professor William Davidson of the University of Otago. We apologize for incorrectly naming him in the list of council members in Newsletter Number 92.

CALL FOR NOMINATIONS FOR 2005 NZMS RESEARCH AWARD

This annual award was instituted in 1990 to foster mathematical research in New Zealand and to recognise excellence in research carried out by New Zealand mathematicians. Recipients to date have been John Butcher and Rob Goldblatt (1991), Rod Downey and Vernon Squire (1992), Marston Conder (1993), Gaven Martin (1994), Vladimir Pestov and Neil Watson (1995), Mavina Vamanamurthy and Geoff Whittle (1996), Peter Lorimer (1997), Jianbei An (1998), Mike Steel (1999), Graham Weir (2000), Warren Moors (2001), Bakhadyr Khoussainov (2002), Rod Gover (2003) and Eamonn O'Brien (2004).

Call for nominations 2005

Applications and nominations are invited for the NZMS Research Award for 2005. This award will be based on mathematical research published in books or recognised journals within the last five calendar years: 2000–2004. Candidates must have been residents of New Zealand for the last three years. Nominations and applications should include the following:

1. Name and affiliation of candidate.
2. Statement of general area of research.
3. Names of two persons willing to act as referees.
4. A list of books and/or research articles published within the last five calendar years: 2000–2004.
5. Two copies of each of the five most significant publications selected from the list above.
6. A clear statement of how much of any joint work is due to the candidate.

A judging panel of three persons shall be appointed by the NZMS Council. The judges may call for reports from the nominated referees and/or obtain whatever additional referee reports they feel necessary. The judges may recommend one or more persons for the award, or that no award be made. No person shall

receive the award more than once. The award consists of a certificate including an appropriate citation of the awardee's work, and will be presented (if at all possible) at the RSNZ Awards Dinner in 2005.

All nominations (which no longer need to include the written consent of the candidate) and applications should be sent by 30 June 2005 to the NZMS President, Associate Professor Mick Roberts, Institute of Information and Mathematical Sciences, Massey University, Albany Campus, Private Bag 102 904, North Shore Mail Centre, Auckland, New Zealand.

Please consider nominating any of your colleagues whose recent research contributions you feel deserve recognition!

NZMS ACCREDITATION

Applications are invited for NZMS Accreditation. The deadline for applications is **Saturday 30 April 2005**. 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 University 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.

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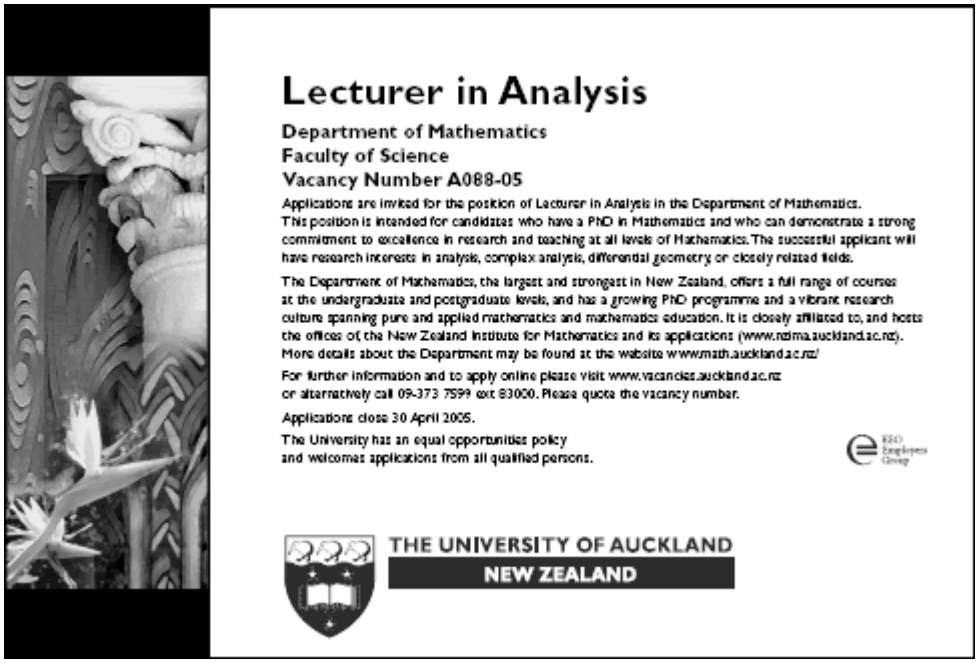
If you have any queries could you please direct them to me at the above address or by email dholton@maths.otago.ac.nz.

Derek Holton
Chair, Accreditation Committee



Lecturer in Analysis

Department of Mathematics
Faculty of Science
Vacancy Number A088-05

Applications are invited for the position of Lecturer in Analysis in the Department of Mathematics. This position is intended for candidates who have a PhD in Mathematics and who can demonstrate a strong commitment to excellence in research and teaching at all levels of Mathematics. The successful applicant will have research interests in analysis, complex analysis, differential geometry or closely related fields.

The Department of Mathematics, the largest and strongest in New Zealand, offers a full range of courses at the undergraduate and postgraduate levels, and has a growing PhD programme and a vibrant research culture spanning pure and applied mathematics and mathematics education. It is closely affiliated to, and hosts the offices of, the New Zealand Institute for Mathematics and its applications (www.nzima.auckland.ac.nz). More details about the Department may be found at the website www.math.auckland.ac.nz/

For further information and to apply online please visit www.vacancies.auckland.ac.nz or alternatively call 09-373 7599 ext 83000. Please quote the vacancy number.

Applications close 30 April 2005.

The University has an equal opportunities policy and welcomes applications from all qualified persons.

THE UNIVERSITY OF AUCKLAND
NEW ZEALAND

LECTURER/SENIOR LECTURER IN MATHEMATICS
Institute of Fundamental Sciences
Massey University, Palmerston North

We wish to appoint a mathematician with a PhD in mathematics, proven research capabilities and excellent teaching skills. A significant component of the teaching responsibility for the Mathematics Discipline is in extramural (distance) teaching. The appointee would be expected to contribute to both internal and extramural teaching. The group also teaches graduate and research degrees, including PhD level. You would also be expected to make a significant contribution to the research activities of the Institute. You should also be an effective communicator who has demonstrated an ability to work as part of a team. Applications are particularly encouraged from those with research experience in one of the fields of Applied, Computational or Discrete Mathematics.

Enquiries of an academic nature should be addressed to Dr Kee Teo, Discipline Leader of Mathematics (telephone 356 9099 extension 3572, email K.L.Teo@massey.ac.nz). Further information regarding the Institute of Fundamental Sciences can be found at the following website: http://ifs.massey.ac.nz. Estimated closing date 30 May 2005.

OPPORTUNITY FOR POSTGRADUATE RESEARCH 2005–2007

A three-year PhD scholarship is available on "Efficient Operation of Bioreactors Using Nonlinear Dynamical Systems Theory." The scholarship is A$23,866 tax free p.a for 3 years. Australian residents or NZ Citizens who are prospective or previous honours graduates in Applied Mathematics, Physics, or Engineering (particularly
Chemical Engineering) are invited to submit a preliminary application by sending a curriculum vitae to: Dr Harvinder Sidhu, School of Physical, Environmental and Mathematical Sciences, University of New South Wales at the Australian Defence Force Academy, Canberra, ACT 2600. Tel: (02) 6268 8820, Fax: (02) 6268 8786, E-mail: h.sidhu@adfa.edu.au or Dr Mark Nelson, Department of Mathematics and Applied Statistics, University of Wollongong, Wollongong, NSW 2522, Tel:(02) 4221 4400, Fax:(02) 4221 4845, E-mail: mnelson@uow.edu.au

RECORDINGS FROM THE ANZIAM MATHEMATICS-IN-INDUSTRY STUDY GROUP 2005

The Centre for Mathematics in Industry at Massey University, Auckland, NZ has available a set of DVDs of the formal presentations of the Monday and Friday sessions of MISG2005. We can place bulk orders for these at just $NZ 24 + GST (= $NZ 27) for each set. They include the power point and video presentations of "Problems" and "Solutions" of the seven problems packaged together, and the opening ceremony. These were produced professionally. Four discs with two Problems & Solutions on each disc. They are excellent for promotional purposes. Orders to Professor Graeme Wake, Centre for Mathematics in Industry, Massey University at Albany, Private Bag 102904, North Shore MC, Auckland, New Zealand. Please include

cheque (made out to Massey University) or Visa/MasterCard details with each order. E-mail g.c.wake@massey.ac.nz

MINUTES OF THE 30TH ANNUAL GENERAL MEETING
5-50 pm Monday 7 December 2004
Burns 7 LT, University of Otago

Present. Mick Roberts (Chair), Shaun Hendy, Tammy Smith, Rua Murray, Graeme Wake, Garry Tee, Peter Donelan, David Gauld, Mick Roberts, Robert McKibbin, Graeme Wake, Ivan Reilly, Bill Barton, Amal Amleh, Allison Heard, Igor Boglaev, Dennis McCaughan, John Curran, Peter Fenton, Peter Cameron (observer), Marston Conder, Kevin Broughan, Derek Holton, Gillian Thornley, ? Chacko, Gloria Olive, Dean Halford, Winston Sweatman, Carlo Laing, Michael Albert, Celine Cattoen, Stephen Joe, Stephen Goulter (observer).

1. **Minutes of 29th Annual General Meeting.**

   It was moved (Smith, Joe) that the minutes of the 29th Annual General Meeting of the NZMS be accepted. The motion was carried.

2. **Matters arising from the minutes**

   There were no matters arising.

3. **Presidents report.**

   (a) The report was delivered to the meeting and will appear in the NZMS newsletter.

   (b) It was moved (Albert, Smith) the report be accepted. The motion was carried.

4. **Treasurer's report.**

   (a) The Treasurer's report was delivered to the meeting and the financial statements were distributed to the members.

   (b) Tammy Smith summarised the report, noting that money received in subs was slightly down this year due to a drop in membership and late payment. Peter Donelan asked about how Council set its budget for student travel and research awards. Tammy Said that it was set in advance at $2500. In addition $1000 was budgeted for student assistance to attend MISG in 2005. Mick Roberts informed the meeting that the Council had decided to increase the amount of travel assistance that it awarded to individual students. Previously students were considered eligible for only one award of up to $500 during their time as student members. The Council would now award a total of up to $1000 over the duration of a students membership. For travel within New Zealand the maximum value of any one award would be $500 (for example this would allow the student to recieve two $500 grants for travel with NZ during their studies). For overseas travel the value of any one award would be for up to $1000.

   (c) It was moved (Roberts,Murray) that the statements be accepted. The motion was carried.

5. **Membership Secretary's report and annual subscriptions.**

   A report from the Membership Secretary, John Shanks, was tabled by Shaun Hendy. Mick Roberts noted that membership was slightly down and asked that members encourage students and new staff to join the Society. It was moved (Roberts, Hendy) that the report be accepted. The motion was carried.

   Mick Roberts informed the meeting that the Council had recommended that subs be fixed at current levels ($36 ordinary member, $18 reciprocal, $18 overseas student and $7.60 student). It was moved that subs be fixed at current levels (Roberts, Wake).

6. **Nominations for four Council positions.**

   (a) The terms of office of Shaun Hendy, Geoff Whittle and Rod Downey (outgoing VP) have ended. A new incoming VP and two other councillors were needed.

   (b) Nominations for Council received at closing date: Shaun Hendy (IRL), Winston Sweatman (Albany) and Gaven Martin (for incoming Vice-President, Albany).

   (c) Shaun Hendy and Winston Sweatman were unopposed and duly elected to the Council. Gaven

Martin was also unopposed for the position of Vice-President and was duly elected.

7. **Appointment of auditors.**

   It was moved (Smith, Roberts) that the current auditors, McKenzie McPhail (4th floor, Farmers Mutual House, 68 The Square, Palmerston North), be reappointed for another year. The motion was carried.

8. **New Zealand Journal of Mathematics.**

   The report was circulated to the members. It was noted that Gaven Martin is the current editor. After some discussion, the meeting recommended that the NZJM committee give consideration into policies that encourage the submission of articles from New Zealand based mathematicians.

   It was moved (Roberts, Hendy) that the report be accepted. The motion was carried.

9. **Forder Lecturer 2005.**

   (a) Prof. Martin Bridson is the Forder Lecturer for 2003. Gaven Martin is coordinating his visit in April 2005.

   (b) Mick Roberts agreed to approach the British Council for support once a firm itinerary is in place for Prof Bridson's visit.

   (c) It was noted that each local department will be expected to provide some support for local expenses during Prof. Bridson's visit to their centre.

10. **NZMS - American MS Joint Meeting 2007.**

    Peter Donelan informed the meeting that he was organising a NZMS - American MS Joint Meeting to be held at Victoria in mid-December in 2007. Peter proposed that this meeting ought to incorporate the 2007 Maths Colloquium. It was moved (Donelan, Roberts) that the meeting endorse this proposal and recommend it to the Colloquium Business Meeting. The motion passed.

11. **General Business.**

    (a) Graeme Wake raised the possibility of replacing the NZMS Research Award with a medal. The meeting was largely in favour of this and recommended that the Council investigate this (and other options) and bring a proposal back to the AGM in 2005. Mick Roberts informed the meeting that nominations for the 2005 Research Award were now being called for.

    (b) It was moved (Roberts,Gauld) to formally thank Rod Downey, Geoff Whittle and Shaun Hendy for their contributions during their time on Council. The motion was carried.

    The meeting closed at 6-40pm.

MATHEMATICAL MINIATURE 26

Mathematicians and light bulbs

At the ANZIAM 2005 conference in Napier, a competition was held on the subject "How many mathematicians does it take to change a light bulb?". This Miniature contains the text of the winning entry with names changed to protect the identity of the mathematicians involved.

I feel I need to justify my lack of seriousness in writing about a subject to which Mathematics is not traditionally applied. More than 30 years ago, Martin Gardner announced a number of plausible but untrue results in his regular column in Scientific American, as what was later realised to be an April Fools joke. This will probably be the last Miniature I write for an April issue so, ever the rebel, this will be my last chance to say that if was good enough for Martin Gardner it is good enough for me. So I return to the light bulb question and I announce the answer and the steps which led to this conclusion.

The answer is |1| under certain conditions, otherwise it is 7.}

Before our group of mathematicians could tackle this question, we felt we needed some theory. Gav Mehrtens wanted some axioms and a definition of light bulb. Mast Candour thought that it wasn't an interesting question: better to ask whether the number being sought was actually integer, and if not whether it was rational, and if not whether it was algebraic.

Jam Snyder, showed his contempt for this line of discussion by asking, sarcastically, whether the number was even finite.

Axian Ford, thought we shouldn't hold back from using knowledge from Physics and that finiteness didn't matter too much because we could always extract the part of the result that was observable by applying renormalization, or some other such trick.

Jon Harpoon thought we were on quite the wrong track and that we needed a model. A considerable time was spent trying to agree on a model that everyone was happy with.

When we realised we weren't going to get any agreement on the model, we decided to follow a lead from Grim Hwayk and considered first the question:

"Could a single mathematicians change a light bulb?"

We all thought not, but how about a second attempt, in which the first mathematician is now joined by a second? If the answer had been yes, we still wouldn't have enough for a publishable paper so we decided to assume, for the moment, that the answer was "No", or possibly "Maybe".

Because we couldn't be really sure about this step, we decided to assign a probability to it. In the absence of any reliable evidence we set the probability that this second attempt would be successful as ½. There were now two cases known to the more general question:

"What is the probability that success will be achieved by n or fewer mathematicians?" Both known cases fitted into the formula

$$P_n = \frac{n-1}{n}$$

so this was assumed to be the answer for the general case.

We really wanted the value of p_n, the probability that exactly n mathematicians would be needed.

Davier Johannes offered to help with the calculations, which now involved probability and conditional probability. He came up with the formula

$$p_n = \begin{cases} 0, & n = 1, \\ \frac{1}{n(n-1)}, & n > 1. \end{cases}$$

The next step was to find the expected value of n and he was also able to give this result

$$E(n) = \sum_{k=2}^{\infty} k \cdot \frac{1}{k(k-1)} = 1 + \frac{1}{2} + \frac{1}{3} + \cdots.$$

Jam Snyder now felt vindicated by his earlier scepticism, because this sum was infinite. Axian Ford also could now make a specific proposal, coming out of his experiemce as a Mathematical Physicist, and this was to subtract from $\sum_{k=1}^{n} k^{-1}$ an adjustment of ln n, so that the limit was the Euler constant, given by

$$\gamma = \lim_{n\to\infty} \left(\sum_{k=1}^{n} \frac{1}{k} - \ln(n) \right).$$

Mast Candour tried to determine whether this was rational or not but soon gave up. Gav Mehrtens, ever the logical conservative, now questioned the very first step. What if a single mathematician had been able to accomplish the task alone? We decided to offer an alternative answer to cover this case. However, there was a short debate as to why 1 can be assumed to be real and positive. To cover our backs we decided to write |1.

It was generally agreed that offering two answers, when we weren't really sure which was correct, was a mark of intellectual integrity. Furthermore, it offered us the opportunity of a second paper later, with a guaranteed citation of the first paper, and altogether a firm case for continued funding.

John Butcher, butcher@math.auckland.ac.nz

[ ]