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NEWSLETTER

OF THE

NEW ZEALAND MATHEMATICAL SOCIETY (INC.)

Contents

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The New Zealand Mathematical Society,
c/- The Royal Society of New Zealand,
P.O. Box 598, Wellington, New Zealand.

However, correspondence should normally be sent to the Secretary:

Dr Shaun Hendy
Industrial Research Limited
Gracefield Research Centre
P O Box 31310, Lower Hutt
s.hendy@irl.cri.nz

NZMS Council and Officers

Web Sites

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

EDITORIAL

MORE, PLEASE

This issue began with the idea of honouring our achievers young and old. Cynthia Wang and Sivajah Somasundaram publish versions of their Aitken prizewinning talks, while to honour the lifetime achievements of Garry Tee, who has been awarded an honorary doctorate by the Auckland University of Technology, we publish a partial bibliography (selected by Garry himself) and his note on his recent talk on "The liberal art of geometry." If there is a value in prizes and awards, then surely it is maximized thus by rewarding people at the beginning and (towards) the end of their careers. There is also the publicity value to the discipline, so it was good to see the NZMS represented at the recent Science Honours Dinner; with the success of this event I'm sure even more science organizations will be clamouring to take part next year.

However, towards the end of the year honours seemed to rain down on our members, so that in this issue you can read about the achievements of not just Wang, Somasundaram, and Tee, but also Rod Downey

(FNZMS), Jeff Hunter (NZS&T Bronze Medal), myself (NZAS Research Medal), Charles Pearce (FNZMS), David Ryan (FRSNZ), Charles Semple (Hamilton Prize), Mike Steel (FRSNZ), and Guohua Wu (Hatherton Award). Pretty close to a clean sweep for maths!

Robert McLachlan
Massey University

PRESIDENT'S COLUMN

I was having a leisurely coffee one Saturday morning while Kim and Max impressed radio listeners with their knowledge of etymology. I took notice when Kim referred to (I paraphrase) a silent genius who can do differential equations, but is unable to maintain normal social interactions. I pay the mortgage by 'doing differential equations', and I wondered (not for the first time) why it is OK for arts graduates to be ignorant of mathematics and science. I tried asking a B.A. if she knew the significance of 3.14159, and was told that she didn't need to. My suggestion that that was the equivalent of me not recognizing a line from Hamlet was met with scorn. I was able to make use of the radio jibe after Massey put out a press release about my work, and I was phoned by Newstalk Radio for more details. I told them that I was "solving sets of differential equations, and nonlinear ones at that", and enjoyed the respectful silence on the other end. My contribution to that station was eclipsed, however, by some intemperate remarks from Paul Holmes; another B.A. who I suspect has no need of p.

A.C. Aitken is reputed to have been able to recite the first 1000 digits of p! The Forder lecturer is required to fulfill a feat that seems just as grueling, and Professor Caroline Series of the University of Warwick has just given 16 seminars in four weeks as the Forder lecturer. I'm sure that the novelty must wear off as you get towards the end of an undertaking like this, but all accounts of Caroline's visit are highly complimentary. We are fortunate to have access to some of the UK's elite mathematicians as a result of the Forder bequest.

I would like to congratulate two new Fellows of the Society. They are Professor Rod Downey of Victoria University, my predecessor in this position, and Associate Professor Charles Pearce of The University of Adelaide. Charles may be less well known in New Zealand circles, but he is a 22nd generation kiwi who just happens to work in the West Island. Another Fellow who was recently recognized is Professor Jeff Hunter of Massey University, who received a Royal Society of New Zealand Bronze Medal "for his significant contribution over an extended period to the public understanding of the role and importance that the mathematical and information sciences play in all spheres of the community including business and industry". One of the pleasures of being President is participating in the celebration of our high achievers. By the time that you read this the Inaugural Royal Society of New Zealand Science Honours Dinner will have taken place in Auckland and I will have handed Cynthia Wang and Rod Gover their certificates for the Aitken Prize and NZMS Research Award respectively (see President's Column last issue).

On October 17 Garry Tee, life member of the Society, was awarded an Honorary Doctorate by the Auckland University of Technology. I was present at an earlier function at the Auckland University mathematics department and conveyed congratulations to Garry from the NZMS. If anybody is unaware of Garry's contribution to New Zealand mathematics and the Society, I suggest they read the article by Graeme Wake and Les Woods in this issue. Garry was there at the founding of the NZMS in 1974, and was one of the first members. So, next year is the Society's 30th anniversary. Are we the sort of people that celebrate, or are we silent geniuses who can do differential equations but are unable to maintain normal social interactions? Any suggestions for fitting ways for the Society to mark its 30th birthday would be very welcome.

Mick Roberts
Massey University, Auckland

LOCAL NEWS

AGRESEARCH

Stathie Triadis has joined AgSystems, working with the mathematical modelling team at Ruakura under Tony Pleasants and Tanya Soboleva. His initial goal is to do a literature review on all mathematical models describing the relationship between nutrition and the post-partum anoestrous interval in high-yielding dairy cows in relation to bolic/reproductive hormones and energy partitioning, with a view to improving any existing models.

Stathie has recently graduated from the University of Waikato with an MSc in mathematics. He was born in Greece but has lived 22 of his 23 years in New Plymouth, where his family now lives. This is his first research-based job. He comes from a job teaching calculus to foreign students with the Foundation

Studies department at Waikato, and also tutoring first year university mathematics.

Paul Shorten presented a talk entitled "A mathematical model of fatty acid synthesis and triglyceride assembly in mammary cells" at the Modelling Cellular Function Meeting in Auckland in July, 2003, a seminar entitled "A mathematical model of fatty acid synthesis and triglyceride assembly: the role of Stearoyl CoA Desaturase (SCD)" to Vialactia in October, 2003, a seminar entitled "Biological control of Botrytis—a modelling analysis" at AgResearch in November, 2003.

Paul Shorten and Ken Louie gave presentations of some of their work as part of the ANZ sponsored "Maths in Action Week" to High School students and their teachers from Tauranga in August, 2003.

Dave Saville is apparently branching out into the murky waters of psychology—see Saville, D.J. (2003). Basic statistics and the inconsistency of multiple comparison procedures, *Canadian Journal of Experimental Psychology* **57(3)**, 167–175.

Ken Louie

THE UNIVERSITY OF AUCKLAND

Department of Computer Science

Dr Jing Sun has recently joined the Department of Computer Science as a Lecturer. He had recently completed his PhD at the National University of Singapore, in the area of integrated formal methods to support the development of complex software systems. His interests include software engineering, formal methods and specification languages, real-time modelling and requirements analysis and specification.

Professor Jim Goodman has delivered his Inaugural Lecture: "What does Moore's Law tell us about the future?".

Gill Dobbie has received a Marsden Grant for "A mathematical foundation for semistructured data", and Bakh Khoussainov & Andre Nies have received a Marsden Grant for "Computability, complexity, and randomness".

On September 23 the Computer Science and Software Engineering Facility, in the new Science Centre, was officially opened by the Chancellor and the Dean of the Faculty of Science. A new display of computing history has been installed there. The display consists of two main parts: a timeline of computing history which runs along the walkway connecting the Ground Floor of Building 303 to the extension, and a display of The University of Auckland's first computer, an IBM 1620, in the Floor 1 foyer.

The Bachelor of Engineering (Software Engineering) programme at The University of Auckland is co-taught by the Departments of Computer Science (Science Faculty) and of Electrical and Electronic Engineering (Engineering Faculty). The first students of this 4-year professional Engineering programme will complete their course at the end of 2003. The BE(SE) programme focuses on equipping graduates with software process, software design and testing, software development technology and a range of communication and research skills. A new Masters of Engineering(Software Engineering) has been approved to start in 2004.

Seminars

Gisela Klette, "Simple points in 3D binary images", and "Accurately measuring the size of the pupil of the eye".
Professor Cristian Calude, "Passages of proof".
Dr Alan Ling (University of Vermont), "Resolvable maximum packings with quadruples".
Ming Li, "A distributed framework for graph algorithms".
Jing Sun, "Tools and verification techniques for integrated formal methods".
Dr Jan Reimann (Universität Heidelberg), "Normal numbers and selection rules".
Colin Png, "Smart client technology".
Professor Rod Downey (VUW), "Parameterized complexity for the skeptic".
Professor Tadao Takaoka, "Heaps and shortest paths".
Dr André Nies, "Randomness and lowness".
Omer Rana, "Grid computing: the next grand challenge for computer science".
Dr Michael Dinneen, "An introduction to bounded-degree broadcast networks".
Chi-Kou Shu, "Computing exact approximations of a Chaitin Omega Number".
Dr Kevin Novins, "SIGGRAPH2003: a few of my favourite things".
Dr David Stanhill, "Multi-layer stereo using dynamic programming".
Johnson Chen, "Authoring and visualizing stereo panoramic images with Independent objects".
Mark Chan, "A strategy for 3D face analysis and synthesis".

Qi Zang, "Accuracy improvement in camera calibration".
Chia-Yen Chen, "3D reconstruction using shape from photometric stereo and contours".
Professor Moshe Y. Vardi (Rice University), "On the unusual effectiveness of logic in computer science", and "Logic begat computer science: when giants roamed the Earth".
Dr Frank Stephan, "Learning a subclass of regular patterns in polynomial time".
Dr Hartwig Hetzheim (DLR), "Fusion of properties of different kinds for decision making in image processing".

Garry J. Tee

Department of Engineering Science

David Ryan has been elected as a Fellow of the Royal Society of New Zealand in recognition of his work on Operations Research, notably in connection with aircrew rostering at Air New Zealand. Kevin Wood from the Naval Postgraduate School in Monterey, California, is a Visiting Professor for one year. He will be working with David Ryan. Ian Collins and Andrew Mason are on leave, and Andrew Pullan is enjoying his James Cook Fellowship free of teaching. It appears that after Christmas the Department of Engineering Science will be moved up the road, from 20 Symonds Street to 70 Symonds Street, despite some of our misgivings about being detached from other departments of the School of Engineering. One advantage is that we will be reunited with the Bioengineering section of our department

Don Nield

Department of Mathematics

Dr Mike Meylan has arrived, as Lecturer in Applied Mathematics; and Dr Shixiao Wang has arrived, as Lecturer in Industrial Mathematics at the Tamaki Campus.

Marston Conder has been elected to the Council of the Academy of the Royal Society of New Zealand.

Dr Richard Evans, born and bred in Auckland, received a BSc(Hons) in Pure & Applied Mathematics in 1994 and an MSc in mathematics under Gaven Martin in 1995, both at the University of Auckland. He moved to the USA and gained a PhD at the University of Michigan (Ann Arbor) in April 2000, for his thesis "Deformation spaces of hyperbolic 3-manifolds: strong convergence and tameness", supervised by Professor Richard Canary. He then moved to Rice University for a 3-year post-doctoral position, and there he married a Russian mathematics graduate student, Tatiana Marinenko. Richard is currently completing a NZ Science and Technology post-doctoral fellowship at the University of Auckland. Richard's wife Dr Tatiana Evans was born and grew up in St Petersburg, where she graduated from Herzen Pedagogical State University (with honours) and then went to the USA to obtain her PhD. She got her PhD at Rice University in May 2003 for her thesis "High-distance Heegaard splittings of 3-manifolds", under the supervision of Professor John Hempel. She works in low-dimensional topology, and her current research interests include Heegaard splittings of 3-manifolds and the curve complex. At present she has a 1-year lecturing position in our Department. Dr Helmut Podhaisky, from University of Halle, is here for a year (with his family), as a Postdoctoral Fellow in the NZIMA Programme. He is working with John Butcher on general linear methods for ordinary differential equations. Andy Begg is now an Honorary Research Fellow in the Department.

Bill Barton succeeds Maxine Pfannkuch as Head of the Mathematics Education Unit, for a 2-year term.

Rod Gover has been awarded a Maclaurin Fellowship, which is the premier award of the NZIMA. This award will enable Rod to concentrate full-time on research next year. No doubt some of that time he will want to travel overseas to enhance his research connections. However he is able to use some of the associated expense allowance to bring in visitors such as his current visitor, and that will be of benefit to the whole Department. This is another example of ways in which this Department is benefiting from the presence of the NZIMA. And Rod has received the NZ Mathematics Society Research Award for 2003 "for his highly original contributions in conformal differential geometry, that have led to the solution of some outstanding and difficult problems".

Marsden Fund Research Grants have been awarded to:

John Butcher (PI) & Allison Heard (AI), "Efficient general linear algorithms for ordinary different equations";
Howard Ross (PI), Dr Dianne Brunton (School of Biological Sciences, PI), Professor Allen Rodrigo (School of Biological Sciences, PI), Geoff Nicholls (AI) & A-Professor Russell Gray (Psychology, AI)}, "Singing in the Trees: Genealogical models of culturally-inherited traits and the population memetics of bird song";
Jozef Siran (PI), Paul Bonnington (PI) & Marston Conder (PI) }, "Algebraic and structural graph

theory"; and to
Mike Meylan (PI)}.

Bill Barton & Hannah Bartholomew have won a Ministry of Education Teaching and Learning Research grant ($180,000 over two years) for researching professional development of senior secondary mathematics teachers. This was one of 14 awards made nationally, from 180 applications. Auckland University's Research Committee has awarded research grants to David Gauld (External Collaboration Seed Fund), to Norm Levenberg (Staff Research Fund), to Vivien Kirk (Staff Research Fund) and to Arkadii Slinko (International Strategic Opportunities & Research Cooperation Fund). John Butcher's book on "Numerical Methods for Ordinary Differential Equations" (Volume 2) has now been published by J. Wiley & Sons. He was an Invited Speaker at the conference on "Advances and Challenges in Time-Integration of PDEs" (Brown University, August 18–20), at the "10th NUMDIFF Conference" (Halle, September 8–11); and at the "International Conference on Computational Methods in Science and Engineering 2003" (Kastoria, Greece, September 12–16). At that Kastoria conference John was a member of the Scientific Committee, and also he was presented with the ICCMSE Prize in Computational Mathematics.

Geoff Nicholls attended the "18th International Radiocarbon Conference" (Wellington, September 3–5), and the conference on "Point Processes in Reliability Models" (Wellington, September 6). He was an Invited Speaker at the conference on "Mathematics and Statistics of Complex systems: Monte Carlo" (Melbourne, November 10–14).

Arkadii Slinko has been appointed as an Independent Expert of the VI Framework Programme of the European Community for Research and Technological Development. He is a Member of the Scientific Committee of the V International Conference on Non-Associative Algebras and Their Applications (July 2003, Mexico), which he was not able to attend because of his teaching commitments—but he submitted a paper on "Non-associative bracket arrangements and multiset orderings" to the Proceedings. During his sabbatical leave he spoke on "Exploratory Data Analysis of Common Social Choice Functions" at the International Symposium on Control Sciences (Moscow, 16–20 June, 2003). He gave an Invited Lecture on "Mathematical Economics" (Central Institute for Mathematics and Economics of Russian Academy of Sciences, March 2003), a Colloquium lecture (University of Caen, April 2003), a Colloquium Lecture (Centre de Recherche en Economie Mathematique et Econometrie, Paris, April 2003), a seminar on "Discrete Mathematics and Social Sciences" (University of Paris 1, May 2003), and a seminar on "Decision Theory" (Institute of Control Sciences of Russian Academy of Sciences, Moscow, June 2003).

The conference "Delta:03, Southern Hemisphere Symposium on Undergraduate Mathematics Teaching" was held at Queenstown on November 22–27. Mike Thomas gave an invited plenary panel address on "The Use of CAS Technology in the Learning of First-Year Mathematics", and Barbara Miller-Reilly was a member of a plenary panel. The Proceedings of Delta:03 have been edited by Mike Thomas & Greg Oates.

The inaugural Auckland-Waikato Applied Mathematics Day was held at Massey University—Albany on October 31. From our Department there were John Butcher, Allison Heard, Robert Chan, Vivien Kirk, Steve Taylor, Mike Meylan, Nicolette Moir, Nicoleen Cloete, Helmut Podhaisky, and David Simpson and Jane Lee (masters students). Talks were given by Nicoleen, Nicolette and John. Angela Tsai, Shirley Huang and Allison Heard also went to and gave talks at the Wellington-Manawatu Applied Mathematics day in September.

A conference on Nearrings and Nearfields was held at Hamburg, July 27 to August 3, organized by Universität der Bundeswehr Hamburg and Universität Hamburg. Stuart Scott was one of the five Invited Speakers. Recent visitors include Professor Len Bos (University of Calgary), Dr Javier Cirre (UNED, Madrid), Professor George Havas (University of Queensland), Professor Finnur Larusson (University of Western Ontario), Professor Richard Lesh (Purdue University), Dr Kevin McLeod (University of Wisconsin—Milwaukee), Dr Abdul Mohamad (Sultan Qaboos University, Oman) and Dr Jan Saxl (University of Cambridge).

Seminars

Dr Arkadii Slinko, "Parametrized complexity of optimal lobbying".
Dr Carlo Laing (Massey University at Albany), "Pattern formation in neural systems".
Caroline Yoon (Purdue University), "A models and modelling perspective on mathematical creativity".
Dr Hannah Bartholomew, ",'A fiercely held modesty': the experiences of women studying mathematics".
Dr Paul Gartside (The University of Pittsburgh), "Get rich quick the Banach-Tarski way".
Professor Richard Lesh (Purdue University), "What mathematics preparation is needed by heavy users of mathematics?".
Professor Finnur Larusson (University of Western Ontario), "Complex geometry and abstract

homotopy theory".
Dr David McIntyre, "Finite intervals in partial orders of topologies".
Dr Peter Grootenboer (Waikato University), "The affective development of preservice primary teachers in mathematics".
Dr Peter Wills (Department of Physics), "Self-organised criticality in genetic systems".
Dr Abdul Mohamad, (Sultan Qaboos University, Oman), "Spaces with diagonal properties".
Dr Javier Cirre (UNED, Madrid), "Symmetry types of cyclic covers of the sphere branched over three points".
Professor Caroline Series (University of Warwick), "Indra's Pearls" (Forder Lecture 2003), and "Why dynamics requires hyperbolic geometry".
Dr Jiling Cao, "Topological properties defined by stars".
Willy Alangui, "Modelling water flow in a rice paddy".
Dr Richard Evans, "Thurston's ending lamination conjecture for hyperbolic 3-manifolds".
A-Professor Bill Barton, "Loose Talk: Some thoughts and questions about how we talk mathematics".
Professor George Havas (University of Queensland), "On proofs in finitely-presented groups".
Dr Tatiana Evans, "High-distance Heegaard splittings of 3-manifolds".
Dr Jamie Sneddon, "Obstructions to clustered planarity".
Professor Richard S. Laugesen (University of Illinois Urbana-Champaign), "Wavelet type spanning sets for L^p and Sobolev space".
Professor Tony Brown (Waikato University), "The language of mathematics teaching".
Professor David Gauld, "Some manifold problems I would like to be able to answer".
Dr Joel Schiff, "The world of cellular automata".
Dr Kevin McLeod (University of Wisconsin-Milwaukee), "An overview of the geometrisation conjecture for 3-manifolds".
Dr Paul Hafner, "The universe in the Higman-Sims graph".
Cathy P. Vistro-Yu, (Ateneo de Manila University), "Mathematical literacy of Filipino students".
Dr Sina Greenwood, "Brunnian braids".
Dr Ye Yoon Hong, "Integrating CAS calculators into mathematics learning: Identifying partnership issues".
Dr Wiremu Solomon, "Teaching Maths 101 via multi-videoconferencing to Kura Kaupapa mathematics teachers".
Dr Jan Saxl (University of Cambridge), "On distance-transitive graphs and multiplicity-free representations".
Dr Vadim Kuznetsov (University of Leeds), "Jack polynomials: integral equation, representation and factorisation".
Dr Melissa Rodd (University of Leeds), "Ways ahead: successful mathematics students at two universities".

Garry J. Tee

Department of Statistics

Congratulations to George Seber and Alastair Scott, who have been elected as Life Members of the NZAS. David Vere-Jones and Geoff Jowett are the only other Life Members now living.

Renate Meyer and Nelson Christensen (formerly in our Department of Physics) have developed techniques for analysing very large amounts of data. Their techniques have been applied to analyse the cosmic afterglow—the resulting information is orders of magnitude more than all previous information about cosmology. And the results are sensational—ordinary matter accounts for only four percent of the gravity in the observable universe!

Chris Wild has become the President of the International Association for Statistics Education, for two years.

Rachel Fewster has gained a Fast Start Marsden Award 2003, for her project on "Stochastic modelling of rat invasions among islands in the New Zealand archipelago".

At the Annual Conference of the New Zealand Ecological Society, at Auckland on 2003 November 18, Marti Anderson delivered a Keynote Address on "Multivariate models for monitoring and environmental impact assessment".

Arden Miller has returned from leave at Simon Fraser University, and Paul Murrell has returned from leave at the University of Toronto.

Brian McArdle spent two months in Pago Pago on a contract for the Coral Reef Advisory Group, to analyse the accumulated reef-monitoring data on fish and coral.

Bo Cai has completed his PhD, on "Adaptive Sampling Schemes and Bayesian Semiparametric Survival Analysis".

Seminars

Dr Tony Blakely (University of Otago), "Death and Statistics—Using data matching techniques to correct biases in New Zealand mortality data".
Dr Moshe Haviv (Hebrew University of Jerusalem), "Queues with relative priorities".
Professor John S. Gray (University of Oslo), "The estimation of species richness: a new method and its application to marine data from Norway and Hong Kong".

Applied Probability Seminars

Dr Arden Miller , "A geometric interpretation of the analysis of unreplicated factorial".
(University of Waikato), "Modelling the distribution of recovered glass".
Dr Nicholas T. Longford , (De Montfort University, Leicester), "Examples of multiple imputation".
Heidi Larsson (University of Aarhus, Denmark), "Perinatal factors, parental psychiatric history, socioeconomic status and autism in Denmark—a register-based case-control study".
Dr Greg Ewing (School of Biological Sciences), "Migration rates from DNA sequence data via reversible-jump MCMC".

Garry J. Tee

UNIVERSITY OF CANTERBURY

Department of Mathematics and Statistics

Alister Smith finished his PhD in May with a thesis on "Optimal Marine Farm Structures" which was supported under a FRST Top Achiever Scholarship. His work used the Lattice Boltzmann Methods for computation of solutions on the partial differential equations involved in the flow past mussel beds, incorporating nutrient update. This was supervised by Graeme Wake in conjunction with NIWA colleagues. After a brief period overseas, Alister has taken up a Postdoctoral fellowship at NIWA, working on further applications of these Lattice Boltzmann techniques. Alister graduates PhD in December.

Dr Chris Hann has been awarded a FRST Postdoctoral Fellowship to work in the Biomedical Engineering group within the Department of Mechanical Engineering. The work will involve blood flows and heart dynamics. Dr Geoff Chase is the leader of this project. Congratulations Chris.

Dr Britta Basse completed her UC Postdoctoral Fellowship after presenting papers on tumour cell dynamics at ICIAM 2003 (July) and the EU conference "Linking Biological and Mathematical Models of Cancer" in Magdeburg, Germany (September). Britta and family are remaining in Germany while husband Mike finishes his PhD.

Postdoc Stefan Grunewald (funded by the NZIMA) arrived from Uppsala to begin a 6-month contract working with Charles Semple and Mike Steel. A further postdoc (Magnus Bordewich) will arrive in March from Oxford University to begin a postdoc, working primarily with Charles Semple.

Charles Semple has been awarded this year's Hamilton Memorial Prize (Royal Society of New Zealand) and Mike Steel has been elected a Fellow of the Royal Society of New Zealand.

We had a very pleasant visit by Associate Professor Peter Fenton (University of Otago), who gave a very interesting talk about A.C. Aitken and renewed contacts with several members of the Department.

We are also enjoying an extended visit by Professor Richard Laugesen (University of Illinois at Urbana-Champaign), who is here courtesy of a Maclaurin Fellowship from the NZIMA. Rick is working on separate research projects with Qui Bui and Neil Watson. He is a native Kiwi, and a Canterbury graduate from the late 80's.

Peter Jarvis, a theoretical physicist from Tasmania spent two weeks working with Mike Steel, and talked about his recent work that applies techniques from quantum theory to phylogenetics.

A Southern Industrial Applied Mathematics (SIAM) day is scheduled at the Canesis Network premises at Lincoln, to facilitate industrial contact with applied mathematicians, in early December. These regional meetings are precursors to possible projects to be presented at a future MISG. This meeting is convened by Graeme Wake in conjunction with Canesis colleagues, and is supported by other South Island Universities.

Seminars

Dr Sung Woo Choi (Korea Institute for Advanced Study), "Medial axis transform and Minkowski sum".
Dr Arno Berger (Vienna University of Technology), "Dynamics and digits—The surprising ubiquity of Benford's law".
Dr Alex James (Sheffield Hallam University), "Modelling growth and foraging in fisheries recruitment".
Professor Gaven Martin (University of Auckland), "The PDE's of nonlinear elasticity, conformal geometry and the Hilbert-Smith Conjecture".
Dr Burkard Polster (Monash University), "What is the best way to lace your shoes?"
Professor Caroline Series (Warwick University), "The Geometry of Markov Numbers" and "Indra's Pearls".
Professor Peter Jarvis (University of Tasmania), "Structure and informatics of the genetic code".
Associate Professor Peter Fenton (University of Otago), "A. C. Aitken".
Dr Wim Hordijk , "Detecting autocatalytic, self-sustaining sets in chemical reaction systems".
Associate Professor Emeritus David A. Smith (Duke University), "Reusable Tools for Creating Interactive Online Learning Environments".

Charles Semple

INDUSTRIAL RESEARCH LIMITED

Applied Mathematics Team

Now that FRST bid writing is behind us for 2003, our day-to-day lives have returned to normal, with most of us trying to catch up with work on existing FRST contracts. The final outcomes of this bidding round won't be known until early April next year, although there will be a short-listing of proposals in December.

We hosted the Manawatu-Wellington Applied Maths Meeting this year. There was a good turn out again and an impressive variety of talks on offer. After the meeting, many of participants enjoyed a pleasant evening at the Sungai-Wan, a Malaysian Restaurant in Lower Hutt.

In October Shaun Hendy attended the Electrochemical Society meeting in Florida and gave a talk in the surface oxide films minisymposium entitled "Atomistic modeling of the passive film on iron".

Graham Weir attended the AIChE meeting in San Francisco in November and gave a talk on the "Coefficient of Restitution". Graham also have his Inaugural Lecture as a Fellow of the Royal Society of New Zealand in Auckland earlier in November.

Steve White and Warwick Kissling both attended the New Zealand Geothermal Workshop in Auckland in November. Steve talked about CO_2 sequestration and Warwick talked about the "Transport of hypersaline brines".

Shaun Hendy

LINCOLN UNIVERSITY

Applied Computing, Mathematics and Statistics Group

A research monograph **"Stochastic Dynamics"** on stochastic differential equations and their application in modelling fluid transport in a porous medium, was published earlier this year by Lincoln University authors Don Kulasiri and Wynand Verwoerd as Volume 44 in the North-Holland Series in Applied Mathematics and Mechanics.

Don Kulasiri has a background in theoretical engineering. He is currently professor of computational modelling and simulation, and teaches undergraduate courses in calculus and discrete event simulation, and postgraduate courses on advanced simulation and modelling of environmental systems. His research interests are in modelling and simulation of environmental and biological processes and systems, and engineering systems containing cellular materials.

Wynand Verwoerd is a senior lecturer in computing and quantitative methods, having broadened his interests from an earlier academic career in theoretical physics, to encompass applied mathematics and computation in biological and other sciences. He teaches undergraduate courses in linear algebra, differential equations and Monte Carlo risk analysis, and postgraduate courses in optimisation and mathematical modelling. His current research projects include stochastic transport in porous media, hydrodynamic potential modelling of flow in a non-homogenous porous medium, and population dynamics models of pest control.

Both authors are also founder members of C-fACS, the **Centre for Advanced Computational Solutions** at Lincoln University, that among others currently undertakes contract research on network fault diagnosis for Transpower, dairy farm modelling for Dexcel, and modelling of river flood events.

Wynand Verwoerd

MASSEY UNIVERSITY

Institute of Fundamental Sciences (Palmerston North) Mathematics

Michael Carter retires in December 2003. Mike is one of the 'Old Brigade' at Massey University, having come to here in 1971 from the University of Witwatersrand to take up a Lectureship in the Department of Mathematics. During his 33 years of service Mike has made an indelible impression on the mathematical scene. His enthusiasm, deep knowledge of his subject and expository skills has placed Mike in the highest rank of teachers of mathematics. His research, particularly in the history of mathematics and mathematics education, is noted for its quality of scholarship. Massey University and the wider community owe much to Mike for his initiatives and guiding hand in distance education generally and mathematics in particular. His administrative skills, logical approach and attention to detail are widely appreciated, particularly so by the Institute of Fundamental Sciences, Mathematics group which he has led for the last two years. Mike's superb knowledge of programmes and curricula, his first rate attention to student and staff needs and his fairness in dealing with issues has gained him the highest respect. His leadership was also recognised in his being elected the tenth President of the New Zealand Mathematical Society, 1984–85, a role that he exercised with diplomacy and insight. We will miss Mike's calm and efficiency in keeping us in order! We wish him and Norma all the best in retirement.

Robert McLachlan gave his inaugural professorial lecture, "The stars in their courses: 300 years of geometric integration" on 26 September. Copies of the lecture are available from the Institute. Ari Iserles sent his apologies from Cambridge, saying he would have liked to be there if only to see Robert in a suit. Sadly he would have been disappointed. (Doesn't John Butcher have a story about a mathematician who doesn't even own a shirt?)

Our congratulations to Robert who on 15 October won the New Zealand Association of Scientists Research Medal. Since one of the criteria is being under 40, this was almost (but not quite, he insists) his last opportunity. Previous mathematicians to have won this medal include Bruce Calvert in 1979, Rob Goldblatt in 1985, and Rod Downey in 1994. The medal was awarded at the Science Honours Dinner in Auckland on 13 November (see photo later in the Newsletter).

Also congratulations to Bruce van-Brunt who has been promoted to Associate Professor.

Finally our congratulations to Padmanathan Kathirgamathan who successfully defended his PhD thesis: "Source parameter estimation of atmospheric pollution from accidental releases of gas".

Bruce van-Brunt, Marijcke Vlieg-Hulstman, Patrick Rynhart, Igor Boglaev, Robert McLachlan, James Matheson and Tammy Smith braved a cold day with howling antarctic winds and persistent horizontal rain to attend the 6th Wellington-Manawatu Applied Mathematics Conference held at the Alan MacDiarmid Conference Centre, Industrial Research Limited, Gracefield, Lower Hutt.

Patrick spoke about "Mathematical modelling of wet granulation", Igor about: "On a block monotone domain decomposition algorithm for a nonlinear reaction-diffusion problem", Robert about: "Multisymplectic box schemes and the Korteweg-de Vries equation" and James about: "Modelling RNA replication". It was a pleasant day with interesting talks and it was great the to catch up on gossip with the other participants.

As those good events have so far taken place about 500 km south of the Bombay Hill, Waikato and Auckland decided to follow into Wellington-Manawatu's footsteps and held their first Auckland/Waikato Applied Maths day at the Albany campus of Massey University. Igor dared to head north of the Bombay Hill to inspect this Applied Maths day and spoke about "Monotone domain decomposition algorithms for a nonlinear convection-diffusion problem".

Barbara Holland writes: "Last month I managed to escape Massey for five weeks and visit Europe. I'm in the very fortunate position that my NZST postdoc comes with money that's intended to be spent on travel to conferences—if I don't spend it I just have to give it back. Vincent Moulton and I had submitted a paper to WABI 2003 (Workshop on Algorithms in Bioinformatics) which was accepted, so we decided I should present it and then travel up to work with him and Kathi Huber in Uppsala for a few weeks. "Uppsala is an old university town, the oldest in Scandinavia (they heard that the Danes were planning to build a University and decided that they'd better get one first). I managed to inveigle my way onto a tour of the university buildings. The most interesting place we visited was the old anatomy theatre. Under Swedish law the only people that could be used as medical cadavers were suicides and executed criminals. Suicides were no good as they could not be predicted and so it was impossible to sell tickets in advance. Apparently Olaf Rudbeck, the professor in charge, used to petition the local judges to stay executions until after the spring thaw so that he could sell more tickets to the dissections. "The same building contained a museum with all sorts of interesting things including a thermometer by Celsius. When he first built a thermometer he had 0 degrees as being boiling and 100 degrees as ice, according to the guide it is one of sciences minor mysteries as to when and why this got swapped around (anyone have any ideas on this?). "The museum also contained lots of information on Linnaeus who sounded like a dangerous sort of supervisor. He had a habit of identifying promising students and sending these students over the world on collecting trips. Only five out of 14 made it back to Sweden! Murder, madness, suicide and disease claimed the rest. One student (Daniel Solander) travelled with Captain Cook and Joseph Banks on their journey to New Zealand. "Another highlight in Uppsala was the discovery that an old "host sister" of mine, Karin was doing her PhD at the Angstrom Institute in Uppsala just across the road from where I was working—small world eh? Karin used to be a Swedish exchange student to Te Kuiti High School who stayed with my family for a year. "From Uppsala I travelled down to Tübingen in Southern Germany. It's a ridiculously picturesque little town. The Altstadt is pretty much intact, with lots of winding cobbled streets and building towering up at odd angles. I helped teach a two day block course on phylogenetic methods along with Daniel Huson, Vince Moulton and Kay Nieselt-Struwe (all of whom have had postdocs in NZ at one time or another). I was pleased to see that Daniel's PhD student Tobias (who visited the AWC last year) was almost recovered from his climbing accident—in fact he could get up the stairs on crutches faster than I could without them. "Finally I headed up to Bielefeld where I caught up with Paul and Erna Gardner. Paul has settled in well with Robert Giegirich's group still working on problems to do with RNA structure. They will be staying in Germany until February and then heading up to Copenhagen for another post-doctoral position (funded by the Carlsberg Foundation) at Copenhagen University with the Evolutionary Biology group."

Seminars

Professor Robert McLachlan , "The entropy of classical mechanics".
Dr Graham Weir (Industrial Research Limited), "Newton's coefficient of restitution".
Dr Aroon Parshotam (Landcare Research (NZ) Ltd), "Systems thinking and reductionism".
Dr Tammy Smith , "Massey mathematics on WebCT".
Dr Anthony Cole (Landcare Research (NZ) Ltd), "Modelling complex ecological-economic systems—a mathematical perspective".
Dr Anthony Blaom (The University of Auckland), "Reconstruction phases in Hamiltonian systems with symmetry".
Professor Caroline Series (The University of Warwick), Forder Lecturer, "Why is there hyperbolic geometry in dynamics?", "The geometry of Markov numbers" and "Indra's pearls".
Dr Carlo Laing (Institute of Information and Mathematical Sciences, Massey University, Albany), "Pattern formation in neural systems".
Dr Winston Sweatman (Institute of Information and Mathematical Sciences, Massey University, Albany), "Million-body and fewer-body problems".

Graduate Seminar Series

Amsha Nahid (Institute of Technology and Engineering), "Prediction of heat transfer in bulk milk-fat products".
James Matheson , "Modelling RNA replication".
Padma Senerath , "Finsler geometry".
Brett Ryland , "Random bead-packs in cylinders".
Bård Skaflestad , "Splitting methods for initial value problems".

Marijcke Vlieg-Hulstman

Institute of Information and Mathematical Sciences (Albany)

Jeff Hunter has been awarded a 2003 New Zealand Science and Technology Bronze Medal "For exemplary contributions over an extended period to the public understanding of the role and importance that the Mathematical and Information Sciences play in all spheres of the community including business and industry".

Carlo Laing has been awarded a Fast Start grant from the Marsden Fund to work on the project "Pattern formation in higher order differential equations". The award is for $100,000 over the period 2004–2005. Carlo will use the funds to continue his research on partial integro-differential equations that arise in the modelling of pattern formation in the cortex.

Jeff's travels took him to Europe in late July where he experienced their heat wave in contrast to the cool winter weather here. Coupled with a visit to University College London, he presented a paper on "Perturbations of Markov Chains" at the 12th Workshop on Matrices and Statistics at the University of Dortmund, Germany over the period 4 to 8 August. Jeff's bid to hold the 14th Workshop in this series has been accepted, with IIMS hosting the conference 30 March to 1 April, 2005. It is intended that the Workshop will be promoted as a satellite conference to the International Statistical Institute Conference in Sydney, which is to be held the week after.Jeff will chair a Local Organizing Committee while continuing to liaise with the International Committee.

Jeff also visited the School of Electrical and Electronic Engineering at Singapore Polytechnic in August and in September he attended the Workshop on Point Processes in Reliability Models, Victoria University of Wellington, and presented a paper on "Mixing Times with applications to Perturbed Markov chains".

In August, Howard Edwards also found the late northern summer when he attended the Joint Statistical Meetings (ASA/IMS/Biometrics) in San Francisco and an International Workshop on Bayesian Data Analysis in Santa Cruz. At the latter meeting he presented a paper on a hierarchical Bayesian approach to modelling the relationship between unemployment and crime in New Zealand.

On 2 September, an evening was held on campus in Albany for local school teachers. In an interesting session for all presentations were given by Carlo Laing, Paul Bracewell, Mick Roberts and Paul Cowpertwait on their varied Mathematics and Statistics research topics.

Graeme Wake and Robert McKibbin attended the 6th Annual Wellington-Manawatu Applied Mathematics Conference held at Industrial Research Limited, Gracefield, Lower Hutt, on 5 September. Graeme gave a talk on "Solution of the Cauchy problem for the convection-diffusion equation". Graeme has meanwhile been busy planning with the MISG 2004 "Mathematics-in-Industry Study Group" meetings to be held at the University of Auckland, 26 to 30 January of next year. Details of the MISG 2004, including registration, are available at http://misg2004.massey. ac.nz,.

On September 25, Paul Bracewell attended the SAS Users Conference and presented a paper on "Rugby brains that don't forget". His paper appears in the SUNZ Conference Proceedings, pp. 13–14, SAS Institute, Wellington. On 24th October, Paul appeared on TV One Breakfast to explain how to use statistics to evaluate the performance of All Black rugby players.

On 2nd October, Mick Roberts attended MicroNZ 2003, the combined annual meeting of the Australian and New Zealand Societies for Microbiology at the Aotea Centre, Auckland, and presented an invited paper on "A measles epidemic controlled by a mathematical model".

Also in October, Denny Meyer attended the 12th meeting of the NZ Econometrics Group in Wellington. The Vice-Chancellor has approved the establishment of a Centre for Data Mining within IIMS directed by Denny.

The postgraduate students have been busy this session. Well done to Jo Mann, who has obtained an NZIMA Postgraduate Scholarship in Industrial Mathematics. Congratulations to Paul Bracewell on the completion of his PhD "Quantification of Individual Rugby Player Ability through Multivariate Analysis and Data Mining", and to Bernard Ee who has completed his MSc "An analysis of two-layered flows in pipelines".

The annual "Beyond Graduation" session was held on 11 September when approximately 20 IIMS postgraduate students presented posters on their research. The postgraduate students had put an enormous amount of effort into preparation of their posters, and they looked fantastic. Frederick Lam and Joanne Mann were presented with excellence awards for their posters. The posters were followed on 21 and 23 October by a series of seminars given by the postgraduates.

The First Auckland/Waikato Region Applied Maths Day was held at the Albany campus of Massey University on 31 October and was coordinated by Carlo Laing. About 30 staff and students from Massey University (both Albany and Palmerston North), Auckland University, Waikato University, and IRL attended. There was a programme of 12 short talks (in order of presentation):

Nicoleen Cloete (Department of Mathematics, The University of Auckland), "MCMC for a distribution over ancestral selection graphs".
Robert McKibbin (IIMS, Massey University, Albany), "Particulate transport through a layered atmosphere".
Shaun Cooper (IIMS, Massey University, Albany), "Classical and cubic theta functions".
John Butcher (Department of Mathematics, The University of Auckland), "High order *A*-stable numerical methods for stiff problems".

Graeme Wake (IIMS, Massey University, Albany), "Activities for the Mathematics-in-Industry Study Group 2004".
Cynthia Wang (IIMS, Massey University, Albany), "Modelling a plate of arbitrary shape in an infinitely deep water using a higher order method".
Nicolette Moir (Department of Mathematics, The University of Auckland), "A new class of methods for solving ordinary differential equations".
Igor Boglaev (Institute of Fundamental Sciences, Massey University, Palmerston North), "Monotone domain decomposition algorithms for a nonlinear convection-diffusion problem".
Don Nield (Department of Engineering Science, The University of Auckland), "Advances in convection in porous media".
Mick Roberts (IIMS, Massey University, Albany), "SARS—what could have happened?"
Zhenquan Li (Department of Mechanical Engineering, The University of Auckland), "Numerical solutions for mathematical models in fluid engineering".
Winston Sweatman (IIMS, Massey University, Albany), "Symmetrical collinear four-body problems".

The Applied Maths Day concluded with a barbecue at Shaun Cooper's house. The quality of talks was high and the day was very successful. We hope that this was the first in a series of annual meetings to be held in the northern region.

Congratulations are due to Vanessa and Merrill Bowers on the birth of son and grandson Sebastian and to Graeme Wake on the birth of grandson Clayton.

We said farewell to Mike Meylan who has gone to The University of Auckland, and to Kathy Ruggiero who has gone to CSIRO in Canberra. Applications to fill their positions have been received, and are being processed.

Also, a subcontract from AgResearch enabled a vacancy for a post-doctoral fellow to work with Mick Roberts to be advertised. We should be able to announce some new appointments in the next NZMS newsletter.

At the time of writing (early November) several of the mathematicians are looking the worse for wear. Well done to Mick Roberts and Shaun Cooper who completed the Auckland Marathon and Winston Sweatman who completed the Half Marathon.

Visitors

The 2003 Forder Lecturer, Caroline Series, from the University of Warwick, visited Albany on 24 and 25 September. She gave two talks, "Indra's Pearls" and "The Geometry of Markov Numbers". Jeff Hunter recalled attending Professor Forder's lectures 40 years ago!

Moshe Haviv, from the Hebrew University, Jerusalem, visited Jeff Hunter on Thursday 25 September.

Seminars

Scott Whineray , "Two energy options: the solar house and the fuel cell car".
Denny Meyer , "Cointegration for count data".
Mick Roberts , "Modelling strategies for minimising the impact of an imported infection—SARS and smallpox".
Graeme Wake , "Modelling cell population growth with applications to cancer therapy".
Alona Ben-Tal (Bioengineering, The University of Auckland), "Modelling interactions between the heart and the lung".
Jeff Hunter , "Modelling correlated arrival processes and their impact on standard queueing models".
Nick Longford (De Montfort University, Leicester, UK), "Stability of household income in European countries in the 1990's".
Howard Edwards , "Bayesian statistics".
Nihal Kuluratna (Department of Electrical and Electronic Engineering, The University of Auckland), "Moore's law, system on a chip (SOC) concepts and the importance of power supply interface and protection".
Paul Bracewell , "Rugby match prediction using Data Mining Techniques".
Jamie Sneddon (Mathematics Department, The University of Auckland), "Obstructions to clustered planarity".
Richard S Laugesen (Department of Mathematics, University of Illinois, USA), "Characterizing wavelets".
Peter Hughes (Auckland College of Education), "The New Zealand Numeracy Project".

Winston Sweatman

UNIVERSITY OF OTAGO

Department of Mathematics and Statistics

Vernon Squire, our current Head of Department, has been awarded his third Marsden Grant, on which he is co-principal investigator with Michael Meylan who is now at The University of Auckland. Vernon has been heavily involved with the PBRF MIST panel, which he chairs, over the last few months. This has involved a considerable amount of work for many people but the preliminary results are now in at the time of writing, and the final scores will be decided in the near future. Vernon is actually departing the fold; he has been appointed to replace Dr Ron Heath as the new Assistant Vice-Chancellor of the Division of Sciences from February 2004. Unable to give a good reason why, he believes it is something to do with a mid-life crisis.

We are celebrating the award of a Fast-Start Marsden grant to Boris Baeumer to work on "Contaminant transport in fractal media". That should keep him busy for a while ... Richard Barker attended the EURING 2003 conference: Development, understanding and integration of new methodologies in the analysis of ringing data conference in Germany from 1–11 October and presented a plenary paper. EURING is the premier conference on mark-recapture methods in ecology and will be held in Dunedin in early 2007. He also visited the CEFE-CNRS in France from 22 September to 4 October on study leave to collaborate with Dr Jean-Dominique Lebreton, a leading ecological statistician who attended the SEEM4 conference in Dunedin as an invited speaker.

Dr Phil Battley has been appointed as a Postdoctoral Fellow for three years to work with Richard on a FoRST grant project entitled Linking hemispheres: comparative demographics and movements of migratory shorebirds. Phil's project involves looking at the energetic costs for bar-tailed godwits and red knots as they migrate from their Arctic breeding grounds to New Zealand. Some birds are believed to fly from 5000–8000 km in single flights during this migration.

John Clark was an invited speaker at the 4th China-Japan-Korea International Symposium on Ring Theory which was to be held in Nanjing, China from 24–28 June. Unfortunately this was cancelled due to SARS but has been rescheduled for 2004. John did attend the International Conference on Algebras, Modules and Rings held in Lisbon, Portugal from 14–18 July and preceded that with a week working with a fellow ring theorist at the University of Porto in Northern Portugal.

During 2003, Coralie Daniel's "maths-and-research-inspired art" led to her being invited to organise a section on "Stimulating Creative Thinking by Non-standard Methods" for the Third International Conference on Creativity in Mathematics Education and the Education of Gifted Students, held in Rousse, Bulgaria, in August, to be a keynote speaker at the Learning through the Arts Conference held in Wellington in July, and to exhibit her work at the Forrester Gallery, Oamaru, for two months in August/September.

John Enlow resigned his fixed term position as a Lecturer in Mathematics and Computational Modelling in October to take up a position outside of academia with ADInstruments. John has been around the Department for quite a long time, firstly as an Honours student, then as a teaching Assistant and finally as a Lecturer. We wish him well in his career as a scientific programmer.

David Fletcher attended the EURING 2003 Conference on mark-recapture methods in Radolfzell, Germany from 6–11 October. From there he travelled to CEFE-CNRS in Montpellier, France, to visit Jean-Dominique Lebreton. He spent two weeks study leave there, and also enjoyed the well-known gastronomic delights of that part of the world. David also attended the New Zealand Ecological Society meeting in Auckland in late November, where he gave an invited talk on the use of population modelling in conservation.

John Harraway was invited to speak in the Topic "Statistical Training for Consultants and Collaborators" at the 54th Session of the International Statistical Institute in Berlin in August. He also attended the IASE Satellite Conference on Statistics Education and the Internet and spent a week in Hamburg on study leave visiting Dr Stefan Brager who he has collaborated with on dolphin habitat selection problems.

Seminars

Associate Professor Peter Fenton , "Archimedes's Method".
April Patrick (Otago Boys' High School), "Statistics: From Otago University to the class room".
Richard R Laugesen (Department of Mathematics, University of Illinois at Urbana-Champaign), "Convex curves and surfaces with minimal moment of inertia".
Chris Woodward (Rutgers University), "Eigenvalues of sums of Hermitian matrices and puzzles".
Professor Caroline Series (Warwick University, 2003 Forder Lecturer), "Indra's Pearls" and "Kleinian

groups and their parameter spaces".
Ken Houston (University of Ulster), "Embedding 'key skills' in undergraduate mathematical sciences programmes".

Lenette Grant

THE UNIVERSITY OF WAIKATO

Department of Mathematics

We welcome our new post-doc, Gabriel Fruit, to the department. He has recently completed his PhD in (analytic) magnetospheric work at CESR Toulouse. He will be working with Ian Craig, Alfred Sneyd, and Sean Oughton on their Marsden Fund project which is investigating turbulence and magnetic reconnection in the solar atmosphere.

We congratulate Kevin Broughan on being awarded a Claude McCarthy Fellowship. This will enable him to go to the USA next year to continue his work on analytic number theory and software development.

In late November a retirement function was held for Graham French. Devoted readers of this column will recall the same sentence in the December 1997 issue of this Newsletter. So this event marked Graham's second retirement. He has served the Department and the University for about 35 years. We wish Graham well in his second retirement.

Jacob Heerikhuisen and Sivajah Somasundaram have recently left. Jacob has been a contract lecturer this year while Sivajah has recently submitted her PhD thesis. They have gone to sunny California, where Jacob is taking up a post-doc position at the University of California, Riverside.

The 2003 Forder Lecturer, Professor Caroline Series, visited us at the end of September. Both her public lecture and colloquium seminar were well-attended and well-received. We were delighted with the fractal pictures she showed during her talks.

Tim Stokes had Marcel Jackson from La Trobe University as a visitor for two weeks in November. They continued their research work on semi-groups.

Rua Murray is involved with the NZIMA thematic programme on Dynamical Systems and Numerical Analysis. This programme will take place in the second half of 2004.

One traveller in the department was Ernie Kalnins who spent most of August and part of September in Armenia. While there, he presented a talk at the X International Conference on Symmetry Methods in Physics held in Yerevan, the capital of Armenia. He also attended the XI European School of High-Energy Physics. This was held in Tsakhkadzor which is about 40 km north of Yerevan.

Another traveller was Sean who spent a week at the International Space Science Institute (ISSI) in Bern, Switzerland, where he was an invited attendee at a workgroup on "Plasma turbulence and the propagation of charged particles in the heliosphere". Although most attendees at ISSI are physicists, the institute nonetheless seems to take seriously Paul Erdos's dictum that a mathematician is a machine for turning coffee into theorems, with top quality coffee available on-tap throughout the week.

Seminars

M. Jackson (La Trobe University), "The Kuratowski closure-complement problem".
D. Leonova , "Game theory: Repeated games of complete information".
K. Spragg , "The shallow water equations: The method of characteristics and two numerical approximation schemes".
A.R. Barnett , "High-precision values of the real Gamma function".
C. Series (University of Warwick, Forder Lecturer 2003), "Why is there hyperbolic geometry in dynamics?".
C. Series (University of Warwick, Forder Lecturer 2003), "Indra's pearls".
S. Somasundaram , "Recent results on weak Asplund spaces".
I. Hawthorn , "The Banach-Tarski paradox".
S. Parkins (The University of Auckland), "Quantum chaos with ultra-cold atoms".
M. Meylan (The University of Auckland), "Application of spectral theory to linear water waves".
M. Black (Auckland University of Technology), "The Applied Mathematics Department at AUT".
S. Joe , "Construction of good quasi-Monte Carlo rules for functions in weighted spaces".

Stephen Joe

VICTORIA UNIVERSITY OF\\ WELLINGTON

School of Mathematical and Computing Sciences

We are all delighted that Guohua Wu is being awarded the Royal Society of New Zealand's 2003 Hatherton Award, for the best scientific paper by a student registered for the degree of PhD in NZ. The nominated paper Isolation and Lattice Embeddings is published in the world's top logic journal, the prestigious Journal of Symbolic Logic. This paper introduces a new notion called an isolation pair. This is used to give completely novel insight into lattice embeddings which are basic operations in the arena. The novel aspect is to separate the "cupping" and "capping" aspects of such an embedding. It allows for a new proof of Downey's Diamond Theorem. The technique also has been used recently by Downey, Li, and Wu to prove the remarkable result that a computably enumerable degree is capable if and only if it is complemented in the d.c.e degrees. This last paper is accepted for publication in the Annals of Pure and Applied Logic. Wu's technique seems to have a number of very important applications and hence has weight well beyond the (very fine) result itself.

We very much enjoyed the visit of Forder lecturer Caroline Series, who gave a public lecture on Indra's Pearls, as well as two more technical math seminars.

James Noble has accepted a Chair in computer science at VUW. He has been on the staff of SMCS since 1999, having completed a PhD here in 1996 and having positions at the University of Technology in Sydney and the Microsoft Research Institute at Macquarie in the 90s. James's research is in software engineering and specifically in aliasing in OO systems, design patterns and software design visualisation. He has had a very successful and ongoing collaboration with Robert Biddle with whom he has an active research group including more than 20 graduate students. He has also collaborated with other staff and students in SMCS and in SIM, SLALS, and Music. James is currently completing a Marsden Fast Start grant on aliasing and ownership and has a new 3-year grant starting in 2004. He is also involved in a PGSF project on Domain Specific Software Tools with colleagues in Auckland and a TBG grant with Robert and Information Power Ltd.

Lindsay Groves has accepted a position as Associate Professor in computer science. Lindsay has been at Victoria since 1985 and has an extensive publication record in formal methods of computer science, with emphasis on refinement calculus and its practical application to improving software, and more recently in concurrency. As well as being involved in a large FRST funded project in collaboration with colleagues at Waikato and a Marsden Fund project to start in 2004 with Gill Dobbie (Auckland), Lindsay (together with Ray Nickson) has received major funding from Sun Microsystems for a project on proof methodologies in concurrent algorithms.

Stuart Marshall has been appointed to a permanent position as Lecturer in computer science. Stuart has made a significant contribution already to teaching in software engineering, having taught in both COMP 301 and 389 during the last two years. He has already established an excellent reputation as a teacher, and he has had six papers published in conference proceedings and has a further four accepted for publication in 2004.

Promotions this year: congratulations to Richard Arnold, Colin Bailey, Ivy Liu and Ray Nickson all promoted to Senior Lecturer; Marcus Frean and Dong Wang promoted over bars in the Senior Lecturer scale; and Robert Biddle, Mark McGuinness and Megan Clark promoted within the Associate Professor/Reader scale. Shirley Pledger received an accelerated promotion on the SL scale which took her over a bar. The Promotions Committee particularly acknowledged the international recognition given to Shirley's work on heterogeneous capture-recapture models.

Yu Hayakawa has stepped down as programme director for the STOR group after nearly a year in the role.

Megan Clarke has agreed to take back on the role after a short escape from it, starting this week. Megan will hold the position till June 2004 soon after which she will be on research and study leave. Also, congratulations to Megan on her recent election to membership of the International Statistics Institute.

Congratulations to Marcus Frean for being voted a Victoria (Post-Grad Students Assoc. award) for Most Challenging and Stimulating Course in Science: COMP 421 Machine Learning.

Successful Marsden applications for 2004 were:

James Noble and Robert Biddle: Ownership types for Object-oriented and Aspect-oriented programming,
Yinhuo Zhang and Rob Goldblatt: Non-commutative geometry, Brauer group theory and geometric logic,
Lindsay Groves: A mathematical foundation for semistructured data (with Gill Dobbie at Auckland),

Marcus Frean (AI): Spatial scale and the paradox of the resource concentration hypothesis (PI Stephen Hartley, SBS).

Seminars

Yasuko Chikuse, "Statistical analysis on special manifolds".
Robin Crockett (University College Northampton, UK), "Patterns in numbers".
Stefanka Chukova and Yu Hayakawa , "Warranty analysis: An overview and some new probabilistic models".
Phillip Morrow (U. Ulster), "An image processing approach to determining fluid velocity fields for complex 2D media".
Saul Gass (University of Maryland), "The analytic hierarchy process".
Saul Gass (University of Maryland), "The first linear programming shoppe".
Tim Wright , "A task and multiple-language analysis of programming environments".
Stuart Marshall , "Understanding reusable components".
Lindsay Groves "Verifying non-blocking concurrent algorithms".
Pranay Chaudhuri] (U. West Indies), "A self-stabilizing graph algorithm: bridge-connected components detection".
Klaus-Dieter Schewe (Massey), "Functional dependencies in higher-order datamodels and XML".
Tom Downs (School of ITEE, University of Queensland), "Improving the performance of support vector methods".
Nicholas Longford (De Montfort University, Leicester), "Examples of multiple imputation in large-scale surveys".
Nicolai Shilov (Russian Academy of Science), "Axiomatizing propositional linear temporal logic at home of A. Prior".
Rod Lea "Dissecting the genetics of complex disease".
Richard Laugesen (University of Illinois at Urbana-Champaign), "Wavelet-type sampling formulas: how to discretize a mollification".
Tony McGregor (Waikato), "Computer network measurement research at Waikato".
Caroline Series (Forder Lecturer, University of Warwick, UK), "Indra's Pearls", "Geometry of Markov numbers" and "Kleinian groups and their parameter spaces".
Alan Blackwell (Cambridge), "Symbolic representations for home and school: Professor Rigour vs Doctor Accessibility".

Mark McGuinness

Continued

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NEWSLETTER

OF THE

NEW ZEALAND MATHEMATICAL SOCIETY (INC.)

Contents

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NEW COLLEAGUES

MIKE MEYLAN

Mike Meylan has recently joined The University of Auckland, Department of Mathematics from Massey—Albany, where he had escaped inclusion in this New Colleagues section. Mike did his PhD with Vernon Squire at the University of Otago, then he was a Post-doctoral Fellow at Otago and Auckland before taking up a Lecturer position at Massey University—Albany in 1999. Mike's research is in linear water-wave theory, especially the effect of floating elastic structures on waves. This research is applied to wave propagation in the Marginal Ice Zone and to very large floating structures, such as the floating runway built recently in Japan.

Garry J. Tee

FEATURES

AITKEN PRIZE 2002

SOME RECENT RESULTS CONCERNING WEAK ASPLUND SPACES

Sivajah Somasundaram

(based upon joint research with Warren B. Moors)
Department of Mathematics
The School of Computing and Mathematical Sciences
The University of Waikato
Hamilton
e-mail: ss15@math.waikato.ac.nz

This article summarizes the talk given at the New Zealand Mathematics Colloquium held at the University of Auckland from the 2nd of December till the 5th of December 2002.

$$\varphi(\lambda x+(1-\lambda)y)\leq\lambda\varphi(x)+(1-\lambda)\varphi(y)\quad\text{for all }\ x,y\in A\text{ and }0\leq\lambda\leq1.$$

We say that φ is *Gâteaux differentiable* at a point $x\in A$ if there exists a continuous linear functional $x^*\in X^*$ such that

$$x^*(y):=\lim_{\lambda\to0}\frac{\varphi(x+\lambda y)-\varphi(x)}{\lambda}\quad\text{exists for all }\ y\in X.$$

In this case, the linear functional x^* is called the *Gâteaux derivative* of φ at X. If the limit above is approached uniformly with respect to all $y\in B_X$ -the closed unit ball of X, then φ is said to be *Fréchet differentiable* at the point $x\in A$ and x^* is called the *Fréchet derivative* of φ at X.

The differentiability properties of convex functions on Banach spaces have been studied for many years and numerous results exist in the literature on the existence of points of Gâteaux and Fréchet differentiability of continuous convex functions defined on nice spaces (see for example:1; 2; 4; 5; 8; 9; 11; 14; 15 and 16 to name but a few).

One approach to this problem, which has forever changed the way people study this subject, is due to Asplund. His idea was to classify the class of Banach spaces according to the differentiability properties of the continuous convex functions defined on them, [7]. He called the Banach spaces on which every continuous convex function defined on them is Gâteaux differentiable everywhere except at the points of a first category set, *weak differentiability spaces*. These spaces have subsequently become known as *weak Asplund spaces*, [8].

This approach differs from the more traditional approach where the differentiability properties were considered on a function by function basis. The significance of Asplund's approach is that it connects the differentiability of continuous convex functions to the geometrical and topological structure of Banach spaces. Thus the "main problem" then becomes to provide an intrinsic characterization (either geometrical, topological or even analytical) of weak Asplund spaces. In one such attempt (to characterize the class of weak Asplund spaces) Larman and Phelps considered the following class of Banach spaces,[8]. A Banach space X is called a *Gâteaux differentiability space* (or GDS for short) if every continuous convex function defined on it is Gâteaux differentiable at the points of a dense, but not necessarily a G_d subset of X. While it easily follows from the definition that every weak Asplund space is a Gâteaux differentiability space, the status of the reverse implication is not so clear, and is in fact, the main point of this paper.

The significance of the reverse implication stems from the fact that Gâteaux differentiability spaces admit an intrinsic characterization in terms of a geometric property of their dual spaces. The proof of which was done in two parts. The first, in 1979 by Larman and Phelps, [8] and the second by M. Fabian in 1988 (unpublished).

Theorem 1 [Theorem 6.2][15] *A Banach space X is a Gâteaux differentiability space if, and only if, every non-empty weak* compact convex subset of x* is the weak* closed convex hull of its weak* exposed points.*

Recall that a point x^* in a weak* compact convex subset C of x^* is *weak* exposed* if there exists an element $x \in X$ such that $x^*(x) > y^*(x)$ for all $y^* \in C\backslash\{x^*\}$. That is, the weak* continuous linear functional $\hat{x} : X^* \to \mathbb{R}$ defined by, $\hat{x}(y^*) := y^*(x)$ attains its maximum value on C at the single point x^*.

Hence, if it could be shown that the class of Gâteaux differentiability spaces coincides with the class of weak Asplund spaces, then there would be an answer to the "main problem". Unfortunately, in this paper we provide a counter example to show that these two classes of spaces are in fact distinct.

Distinguishing the Gâteaux differentiability spaces from the weak Asplund space

In this section of the paper we show that there exists a Gâteaux differentiability space that is not weak Asplund.

In the hope of distinguishing the weak Asplund spaces from the Gâteaux differentiability spaces, a new class of topological spaces, which are defined in terms of minimal uscos was introduced in [6] and studied in [10], [11] and[12]. A set-valued mapping $\varphi : X \to 2^Y$ acting between topological spaces X and Y is called an *usco* mapping if for each $x \in X$, $\varphi(x)$ is a non-empty compact subset of Y and for each open set W in Y, $\{x \in X : \varphi(x) \subseteq W\}$ is open in X. An usco mapping $\varphi : X \to 2^Y$ is called a *minimal usco* if its graph does not contain, as a proper subset, the graph of any other usco defined on X.Recall that by the graph of φ we mean, $\mathrm{Gr}(\varphi) := \{(x, y) \in X \times Y : y \in \varphi(x)\}$. A topological space X is said to belong to *weakly Stegal* spaces if for every complete metric space M and minimal usco $\varphi : M \to 2^X$, φ is single-valued at some point of M. Correspondingly, we say that a Banach space X belongs to *class* $(w\tilde{S})$ if (X^*, weak^*) belongs to weakly Stegall spaces.

The relationship between weakly Stegall spaces and Gâteaux differentiability spaces is established through the subdifferential mapping. Let $\varphi : A \to \mathbb{R}$ be a continuous convex function defined on a non-empty open convex subset A of a Banach space X. Then the subdifferential mapping of φ is the mapping $\partial\varphi : A \to 2^{X^*}$ defined by,

$$\partial\varphi(x) := \{x^* \in X^* : x^*(y - x) \leq \varphi(y) - \varphi(x) \ \text{ for all } \ y \in A\}.$$

It is well-known that the subdifferential mapping is a norm-to-weak* usco, [p.19][15]. To establish the relationship between weakly Stegall spaces and Gâteaux differentiability spaces we need one more fact.

Lemma 1 [Proposition 7.3] *Let* $\varphi : X \to 2^Y$ *be an usco mapping acting between topological spaces X and Y. Then there exists a minimal usco mapping* $\psi : X \to 2^Y$ *such that* $\psi(x) \subseteq \varphi(x)$ *for all* $x \in X$ *(i.e., every usco mapping contains a minimal usco mapping).*

The relationship between Gâteaux differentiability spaces and class $(w\tilde{S})$ is revealed in the next theorem.

Theorem 2 [Theorem 13][11] *Every member of class* $(w\tilde{S})$ *is a Gâteaux differentiability space.*

Proof Suppose $X \in \text{class}(w\tilde{S})$. Let $\varphi : A \to \mathbb{R}$ be a continuous convex function defined on a non-empty open convex subset A of X and let $\psi : A \to 2^{X^*}$ be a minimal usco on A such that $\psi(x) \subseteq \partial\varphi(x)$ for all $x \in A$. As A is a non-empty open (and hence G_d) subset of a complete metric space, A itself is completely metrizable and since (X^*, weak^*) belongs to weakly Stegall spaces there must exist an everywhere second category subset R of A on which φ is single-valued. Next we let $\sigma : A \to (X^*, \text{weak}^*)$ be any selection of φ and let $x \in R$. We claim that φ is Gâteaux differentiable at X. For any $y \in X$ and l > 0 we have, by the definition of $\partial\varphi$, that

$$\sigma(x)(y) \leq \frac{\varphi(x + \lambda y) - \varphi(x)}{\lambda} \leq \sigma(x + \lambda y)(y).$$

Since s is norm-to-weak* continuous at X we have that,

$$\sigma(x)(y) = \lim_{\lambda \to 0^+} \frac{\varphi(x + \lambda y) - \varphi(x)}{\lambda}.$$

This means that φ is Gâteaux differentiable at *X* with derivative *s(x)*; which completes the proof.

Note: It is not necessarily true that if *X* belongs to class $(w\tilde{S})$ then *X* is weak Asplund. Hence one might hope that there exists a member of class $(w\tilde{S})$ that is not weak Asplund. Indeed, we obtain our counter example by constructing a non-weak Asplund space *X* such that $x \in$ class$(w\tilde{S})$. The key to achieving this goal is the consideration of the following family of compact spaces.

Kalenda compacta

Let *A* be an arbitrary subset of (0,1) and let

$$K_A := [(0,1] \times \{0\}] \cup [(\{0\} \cup A) \times \{1\}].$$

If we equip this set with the order topology generated by the lexicographical (dictionary) ordering (i.e., $(s_1, s_2) \leq (t_1, t_2)$ if, and only if, either $s_1 < t_1$ or $s_1 = t_1$ and $s_2 \leq t_2$) then with this topology K_A is a compact Hausdorff space [Proposition 2][7]. In the special case of *A* = (0,1), K_A reduces to the well-known "double arrow" space./p>

The following results supply us with some necessary conditions for spaces of the form $C(K_A)$ to be weak Asplund.

Theorem 3[3] *Let K be a compact Hausdorff space. If C(K) is weak Asplund then every closed subset of K contains a dense completely metrizable subspace.*

Proposition 1 [Proposition 5][7] *For any subset A of (0,1), the following conditions are equivalent:*

i. *Every closed subset of* K_A *contains a dense completely metrizable subspace.*
ii. *A is perfectly meager.*

Hence we see that if *A* is not perfectly meager then $C(K_A)$ is not weak Asplund. Recall that a subset $A \subseteq \mathbb{R}$ is called *perfectly meager*, if for every perfect set $P \subseteq \mathbb{R},\ P \cap A$ is meager (i.e., first category) in *P*.

Suppose **A** is a proper s-ideal of subsets on $\{0,1\}^{\mathbb{N}}$. We will say that a subset **A** of (0,1) satisfies property(*) with respect to **A** if $h^{-1}(A) \in \mathbf{A}$ for every homeomorphic embedding of $(\{0,1\}^{\mathbb{N}}, \tau_p)$ into [0,1].

We are now ready to present our main theorem.

Theorem 4 [Theorem 4][13] *Let* **A** *be a proper s-ideal of subsets on* $(\{0,1\}^{\mathbb{N}}, \tau_p)$ *and let A be any subset of (0,1) which satisfies property(*) with respect to* **A**. *Then* $C(K_A) \in class(w\tilde{S})$. *In particular,* $(C(K_A), \|\cdot\|_\infty)$ *is a Gâteaux differentiability space.*

Lemma 2 [Lemma 3][13] *There exist a proper s-ideal* **A** *of subsets on* $(\{0,1\}^{\mathbb{N}}, \tau_p)$ *and an everywhere second category subset A of (0,1) that satisfies property(*) with respect to* **A**.

Corollary 1 [Corollary 2][13] *There exists a Gâteaux differentiability space that is not weak Asplund.*

Proof Let *A* be the set constructed in Lemma 2 and let **A** be the corresponding s-ideal on $(\{0,1\}^{\mathbb{N}}, \tau_p)$. Then *A* satisfies property (*) with respect to **A**. Hence it follows from Theorem 4 that $(C(K_A), \|\cdot\|_\infty)$ is a Gâteaux differentiability space. On the other hand, if $(C(K_A), \|\cdot\|_\infty)$ is weak Asplund then by Theorem3, every closed subset of K_A contains a dense completely metrizable subspace. However by Proposition 1 this implies *A* is meager (in fact perfectly meager); which it is not. Therefore, $(C(K_A), \|\cdot\|_\infty)$ is not weak Asplund.

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AITKEN PRIZE 2003

ON WINNING THE AITKEN PRIZE

C. D. Wang

Winning the Aitken Prize was a great honour as well as a surprise that I did not anticipate at all when I gave my talk in Sydney on July 10th. I simply presented the work that I had done with my supervisor Dr. Michael Meylan in the last year. It was about modelling a floating thin plate of arbitrary shape on the surface of water that is either of finite depth or infinitely deep. This model was built to solve the linear wave scattering problem. We are interested to do this because there were many places where such problem exists. Some examples of these are the Marginal Ice Zone (the outer area of the polar region that is the closest to the open sea and consists of broken pieces of ice sheets) and the floating runway (a gigantic road that floats on the sea for a plane to land on).

Mike came up with a model that used the Finite Element Method (FEM) to solve motion of the plate, the Boundary Element Method to solve the motion of the water, and the constant panel method (in which the value of the function is assumed constant across the panel of the FEM) to compute the integrals. His method, however, is of lower order because of the use of the constant panel method. Another model that is of a higher order was developed by a Japanese ship-engineer Masashi Kashiwagi using the pressure distribution method and the Galerkin method to transform the integral equations into a set of linear equations. Yet it is very difficult to extend this model beyond a rectangular plate. Inspired by the need for a plate-water model that not only works for an arbitrary-shaped plate but also is of higher order we have developed our model by solving the boundary integral equation for the water using the basis functions of the FEM.

I will briefly explain the mathematical theory, and then the numerical scheme for solving for the plate and the water. Starting with the water, it is described by the usual Laplace's equation for its velocity potential Φ. On the bottom of the fluid domain we expect the normal derivative to be zero. On the free surface we have the kinematic boundary condition

$$\frac{\partial \Phi}{\partial z} = \frac{\partial W}{\partial t},$$

where $W(\mathbf{x}, t)$ is the surface displacement.

For the plate we use the pressure on both the dry and the wet surface of the plate. The pressure on the dry surface of the plate is described by the Bernoulli-Euler equation

$$D\nabla^4 W + \rho t h \frac{\partial^2 W}{\partial t^2} = p(t)\,.$$

On the wet surface of the plate (the contact surface between the plate and the water) we have the dynamical boundary condition that is represented by the linearised Bernoulli equation

$$-\rho\left(\frac{\partial \Phi}{\partial t} + gW\right) = p(t)\,.$$

To simplify the problem we assume that there is no submerged part of the plate in the water (this is called the shallow-draft model). We then non-dimensionalise the variables with respect to the area of the plate and we assume that the problem is single frequency. Therefore all variables are now dimensionless and time-independent. This gives us the first coupling equation:

$$\beta\nabla^4 w(\mathbf{x}) + (1-\alpha\gamma)\, w(\mathbf{x}) = i\sqrt{\alpha}\,\phi(\mathbf{x}),$$

where $w(\mathbf{x})$ and $\phi(\mathbf{x})$ are, respectively, the time-independent displacement and the potential, a is the wavenumber, b is the stiffness constant, and g is the mass constant.

In this work the numerical model was the most crucial part. It was a complex process that required extensive numerical coding and a huge amount of critical thinking as well as many cups of coffee and blocks of chocolate. It is very easy for me to slip into writing too much detail about this. However I shall restrain myself from getting too excited about it.

There are three steps involved in developing the solution for the plate-water motion. The first step is to discretise the plate, which we call D, into square pieces that we call panels D_d. A plate has *p* panels and *q* nodes. Then the basis functions of the FEM for non-conforming square panels are used to expand the dimensionless and the time-independent displacement *w* and potential Φ .

$$w(\mathbf{x}) = \mathbf{N}(\mathbf{x})\,\hat{\mathbf{w}},$$
$$\phi(\mathbf{x}) = \mathbf{N}(\mathbf{x})\,\hat{\phi}.$$

The Boundary Element Method is then employed to solve for the motion of the water. This is done by transforming Laplace's equation together with the kinematic and the bottom boundary conditions into an equivalent boundary integral equation involving the free-surface Green's function for infinitely deep water. The boundary integral equation, that is,

$$\phi(\mathbf{x}) = \phi^{In} + \int_{\Delta} G(\mathbf{x};\xi)\left\{\alpha\phi(\xi) + i\sqrt{\alpha}\,w(\xi)\right\}\, dS_{\xi},$$

is the second equation that couples the water and the plate. Such Green's functions can be found in numerous publications (e.g. The Handbook of Physics Volume 9 by Wehaussen and Latoines) and thus I will omit it. However, note that the Green's function is singular at $\mathbf{x} = \xi$. This is important because it affects the choice of the numerical integration scheme that will follow shortly.

The two coupling equations are simultaneously solved using the basis functions of the FEM to get *w* and Φ for the panels. This yields two linear equations:

$$\{\beta\mathbb{K} + (1-\alpha\gamma)\,\mathbb{M}\}\,\hat{\mathbf{w}} = i\sqrt{\alpha}\hat{\phi},$$
$$\mathbb{M}\hat{\phi} = \mathbb{M}\hat{\phi^{In}} + \mathbb{G}\left\{\alpha\hat{\phi} + i\sqrt{\alpha}\hat{\mathbf{w}}\right\},$$

where the matrices are: $\mathbb{K}$ the stiffness and $\mathbb{M}$ the mass for the plate; and $\mathbb{G}$ the Green's matrix that represents the water. $\mathbb{G}$ is similar to the stiffness and the mass matrices of the plate. The three matrices are obtained from assembling individual square panels back into the plate. Hence they are composed by sub-matrices from panel Δ_d: $[k]_d$, $[m]_d$, and $[g]_{de}$ the Green's matrix that relates D_d to another panel D_e. A "gluing" matrix is used to assemble these sub-matrices into the plate's matrices.

Due to limitation of space I will omit exhibiting the matrices. Assuming that readers are familiar with the FEM, the stiffness and the mass sub-matrices are known to be constant and independent of the location of a panel. However, the Green's matrix, which involves two area integrals, must be calculated individually for each panel.

The area integration for the Green's matrix is done numerically using the Gaussian quadrature with Legendre polynomials for the integration points and their corresponding weights. An identical set of Gauss-Legendre integration points and weights is used for all distinct panels, i.e. $D_d \neq D_e$. However the use of the same set on the same panels, i.e. $D_d = D_e$, causes singularity in the Green's function as mention above. The trick to avoid this is to employ a different set of integration points and their weights if the panels are one and the same.

Having done the numerical model I tested the validity of the results by comparing them to the ones produced using Mike's codes. To my delight, they are the same and my method requires fewer panels to obtain the same results as Mike's (for visual proof, read our paper in Journal of Fluid and Structures). Visual results for a square, a rhombus, a trapezoid, and a triangle plate on infinitely deep water were presented in the talk.

I now conclude this brief discussion on the modelling of a floating thin plate. My talk was simply an outline of the full model, which also included the case of water of finite depth. Though my plate-water model was a hybrid of complex mathematical theory and laborious numerical work, I intended to present it in the most entertaining way possible because I wanted people to attention to the model instead of yawning. As I have proven, this was not such a vain intention after all.

For all that I have achieved I owe it to my supervisor Mike, who is one of the best supervisor that a research student could have and that is the truth. To Mike, this prize is yours too.

DR GARRY TEE, CMATH, FIMA, AWARDED HONORARY DOCTORATE BY THE AUCKLAND UNIVERSITY OF TECHNOLOGY, NEW ZEALAND, AUGUST 2003

Garry Tee's many friends will be very pleased that his singular talents have been recognized by the Auckland University of Technology with the award of an Honorary Doctorate. Besides his research work in numerical analysis, he has made many important contributions to the history of science, particularly in mathematics and computing—readers of Mathematics Today were last treated to another sample of his scholarship in the April issue with his letter on the transit of Venus in 2004.

One of Garry's engaging historical pieces is a well-researched account of the distinguished mathematician A.C. Aitken, who hailed from New Zealand, but spent much of his career in Edinburgh. Aitken had an amazing memory—one of his feats was knowing the first 1000 decimal places of p and, given only three consecutive digits, being able to continue the sequence! Of course, such is Garry's own attention to detail, were there any inaccuracy in this story, Garry would be the first to supply a correction—as one of us (LCW) can confirm first hand on having the temerity to publish an autobiography: Garry's review of 'Against the Tide' left no stone unturned in the quest for accuracy.

Garry has, almost single-handedly, pioneered the study of scientists in and from New Zealand. A characteristic contribution is his article in 'Auckland Minds' on the mathematician H.G. Forder whose generous bequest supports the London Mathematical Society's Forder Lecturer on tour in New Zealand. Other eminent subjects on whom Garry has written with considerable erudition are Ernest Rutherford, Leslie John Comrie, and Vaughan F.R. Jones. Indeed, it is typical that, in the case of Comrie, for instance, he went much further, designing the bronze plaque that adorns the Auckland University Comrie Computing Laboratory, on having ensured the adoption of this imaginative name for the University's undergraduate computing facilities.

Garry John Tee was born in 1932 at Wanganui. At the age of 11, he entered Seddon Memorial Technical College (SMTC) in Auckland, taking an industrial science course. SMTC was a trade school that slowly evolved into a Technical Institute, then into the Auckland Institute of Technology, emerging finally, in 2001, as the Auckland University of Technology. So, appropriately enough for someone with interests in such histories, Garry Tee is amongst the first to be honoured by this new University, the successor to the institution where he started his studies sixty years ago. (The original Seddon Memorial College was sometime ago re-sited from its central city location to one of the western suburbs. Now it is re-named as "Western Springs College" and it caters for secondary school students, not tertiary students.) After graduating from Auckland University College (it became a full University in the 1960's), Garry's first employment was in computing with an oil exploration team in North West Australia. In 1958, sensing that electronic digital computers were poised to assume increasing importance, Garry moved to work for the English Electric Company in the UK. Six years experience there proved good grounding to becoming a foundation member of the Department of Mathematics at the University of Lancaster. After a decade in the UK, he returned to Auckland in 1968, joining the University's Department of Mathematics, where he attained emeritus status in 1998, having also been a founder member of the Department of Computer Science. The New Zealand Mathematical Society conferred honorary life membership on him in 1998 in recognition of his outstanding services to mathematics in New Zealand and to the Society itself in particular, service that happily continues—Garry remains in demand as an invited speaker, and his scholarly contributions are unabated. He was quick to become a Fellow of the Institute of Mathematics and its Applications in keeping with his sense of a professional community, of which truly he is himself a servant and ornament.

Dr Garry Tee—never Gary Tee, whom our Garry has identified as being a pop singer in the UK and USA!—is a kind, generous person, ever willing to put himself out, alike to supply information and for the comfort of guests. For Garry, to be inadequately informed is to be uncomfortable, and he flatters his numerous friends around the world by supposing that they feel the same way, sending them the occasional care package of historical miscellanea of mathematical or scientific interest—perhaps some report of relics he has discovered of Charles Babbage or Michael Faraday in Australia or New Zealand. This is also a special part of Garry's charm as a host in Auckland, and several visitors of scientific prominence have subsequently remarked how much more vivid and memorable their stay was made by Garry's ministrations to their interests and needs. The only word of caution is not to drop names when in a hurry since Garry will want to stop to pick them up with some arresting detail.

With all his friends—and with the Institute of Mathematics and its Applications—we salute Garry Tee, as a most worthy and deserving recipient of the Honorary Doctorate from the Auckland University of Technology; and we warmly congratulate the Council of the University in making an award that will give so much satisfaction and pleasure in the way it recognizes the professional values Garry has so long epitomised.

Professor Graeme Wake
Professor of Industrial Mathematics, Massey University at Albany, Auckland
Professor Les Woods
Emeritus Professor of Mathematics, University of Oxford

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THE LIBERAL ART OF GEOMETRY

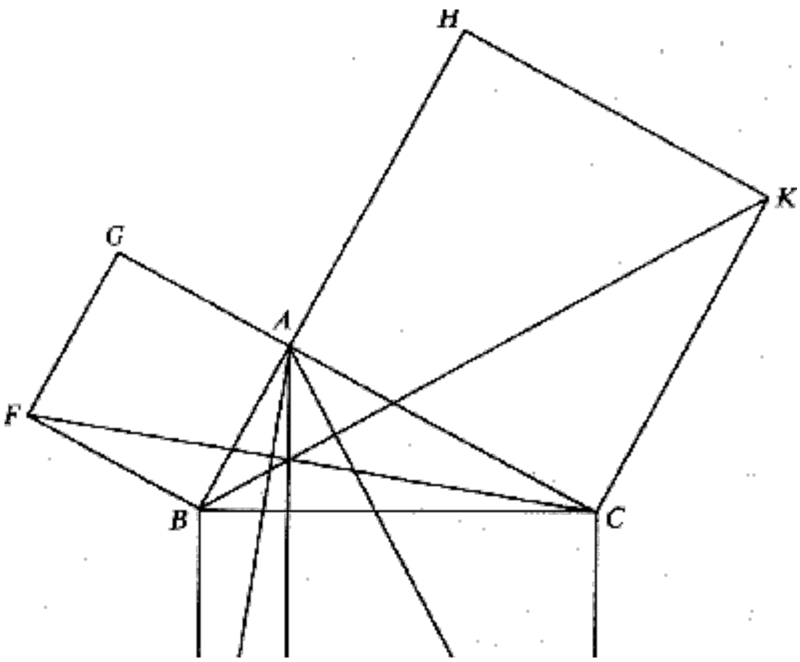
Garry J Tee

A Freemason asked me to give an after-dinner talk to his Lodge about geometry. He explained that the constitution of the Freemasons commends the noble art of geometry as being worthy of study—but very few members of that Lodge knew anything about geometry.

Accordingly, I gave a short talk to that Lodge on "The Liberal Art of Geometry", in which I explained that many mathematical documents have been recovered from the early civilizations. Some ancient Greek philosophers were the first to develop mathematics systematically, starting from explicitly stated ideas and using logical reasoning to prove many results within a coherent structure. Pythagoras, who was born at Samos in about −569, became one of the most influential founders of mathematics. He discovered the numerical relation between lengths of vibrating strings and musical harmonies, and that inspired him to declare that "everything is number". He created the Pythagorean Brotherhood, a secret society which flourished throughout the Mediterranean region for about 200 years. The Pythagoreans were devoted to some religious and ethical doctrines, and they systematically studied arithmetic, geometry and music. I indicated some striking similarities between the ancient Pythagorean Brotherhood and the modern Freemasons.

Some parts of Euclid's "Elements" appear to be based on Pythagorean writings. I explained that Chapter 1 of Euclid's "Elements" culminated in his superb proof of the (miscalled) Pythagorean Theorem, about the square on the hypotenuse. I displayed the intricate and beautiful "windmill" diagram in Euclid's proof, and I noticed that the Masons displayed intense interest in that diagram.

After the talk and the ensuing questions, the Master of the Lodge introduced himself to me as a former student of mine (in 1970). He displayed to me his ceremonial regalia, with an ornate collar suspending a silver plaque. Euclid's "windmill" diagram is engraved on that plaque!



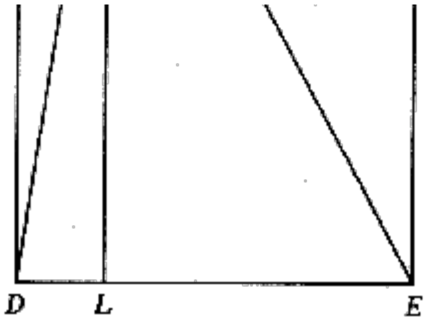
(e) Proposition 47

In right-angled triangles the square on the side subtending the right angle is equal to the squares on the sides containing the right angle.

Let *ABC* be a right-angled triangle having the angle *BAC* right; I say that the square on *BC* is equal to the squares on *BA, AC*.

For let there be described on *BC* the square *BDEC*, and on *BA*, *AC* the squares *GB*, *HC* [I. 46]; through *A* let *AL* be drawn parallel to either *BD* or *CE*, and let *AD*, *FC* be joined.

Then, since each of the angles



BAC, BAG is right, it follows that with a straight line *BA*, and at the point *A* on it, the two straight lines *AC*, *AG* not lying on the same side make the adjacent angles equal to two right angles; therefore *CA* is in a straight line with *AG* [I. 14].

For the same reason *BA* is also in a straight line with *AH*.

And, since the angle *DBC* is equal to the angle *FBA*: for each is right: let the angle *ABC* be added to each; therefore the whole angle *DBA* is equal to the whole angle *FBC* [C.N. 2].

And, since *DB* is equal to *BC*, and *FB* to *BA*, the two sides *AB*, *BD* are equal to the two sides *FB*, *BC* respectively; and the angle *ABD* is equal to the angle *FBC*; therefore the base *AD* is equal to the base *FC*, and the triangle *ABD* is equal to the triangle *FBC* [I. 4].

Now the parallelogram *BL* is double of the triangle *ABD*, for they have the same base *BD* and are in the same parallels *BD*, *AL* [I. 41].

And the square *GB* is double of the triangle *FBC*, for they again have the same base *FB* and are in the same parallels *FB*, *GC* [I. 41].

[But the doubles of equals are equal to one another.]

Therefore the parallelogram *BL* is also equal to the square *GB*.

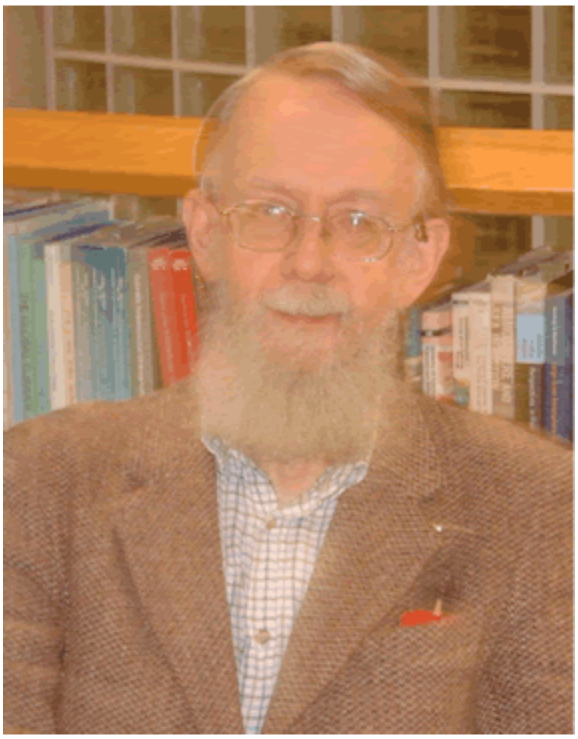
Similarly, if *AE, BK* be joined, the parallelogram *CL* can also be proved equal to the square *HC*; therefore the whole square *BDEC* is equal to the two squares *GB*, *HC* [C.N. 2].

And the square *BDEC* is described on *BC*, and the squares *GB*, *HC* on *BA*, *AC*. Therefore the square on the side *BC* is equal to the squares on the sides *BA*, *AC*. Therefore etc. Q.E.D.

Euclid's proof of the Pythagorean Theorem,
from Thomas L. Heath's standard edition of
"The Thirteen Book of Euclid's Elements", Cambridge University Press, 1908

CENTREFOLD

Professor Michael McIntyre



Michael McIntyre is Professor of Atmospheric Dynamics in the Department of Applied Mathematics and Theoretical Physics (DAMTP), University of Cambridge. Apart from a short break as a postdoc, he has worked in DAMTP since 1963, but spent much of his early life in Dunedin.

Michael's father, Archie, who died only last year at the age of 89, was a physiologist interested in the nervous system. He had a distinguished career in New Zealand and Australia—and the Australian Physiological and Pharmacological Society has established an A K McIntyre Prize in his honour. (His contributions included the discovery of electro-receptors in the platypus bill and later in the echidna snout.) Archie was a graduate of the University of Sydney and continued his early medical training and research career in Sydney, where Michael was born. Archie moved to University of Otago at Dunedin in 1949, beginning the period of Michael's residence in New Zealand.

Whilst on the subject of family, one of Archie's grandfathers and Michael's great-grandfathers was Sir Edgeworth David, Australian geologist. David was a member of Shackleton's Antarctic Expedition of 1907-09 (the 'Nimrod' expedition) and (at the age of 50) one of a group of three who trekked 1260 miles to become the first to reach the Southern Magnetic Pole. (At the same time a larger group including Shackleton made an unsuccessful attempt to reach the geographical South Pole, beating Scott's previous "further south" record, but were forced to turn back 97 miles from the Pole.)

Michael attended the University of Otago and obtained his undergraduate degree in Mathematics from the University in 1963. He then won a Commonwealth Scholarship to study for a PhD in DAMTP. When he arrived in Cambridge there were four new research students in fluid or solid mechanics, and four staff members who wanted new research students. Michael found himself assigned to the supervision of Francis Bretherton, then a young lecturer. (Over a period of four or five years Bretherton was supervisor to Michael, Peter Rhines, Chris Garrett and Brian Hoskins, all of whom have subsequently become international leaders in meteorology and oceanography.)

Being supervised by Francis Bretherton was a daunting experience, especially for a young man whose experience of fluid dynamics was limited and who liked to understand things thoroughly. Michael would spend an hour listening to Francis throwing out ideas for important or at least interesting topics that Michael should investigate. He would then spend all afternoon and evening going carefully through all these ideas and working out what Francis had in mind. Next day he would go to Francis with a question or two, and Francis would say 'Oh, there's no need to go into that—I solved the problem last night'. But, of course, Michael learned, and mastered, a lot.

In his second year as a PhD student, Michael—a brilliant violinist—committed a lot of his energy into entering the annual BBC Violin Competition. He reached the semi-final round (last 14) in a year in which the winner was Iona Brown. Michael shared a flat in the house by the river Cam owned by J R A (Anthony) Pearson and his wife, and his flat-mates (all Trinity College PhD students in applied mathematics or astronomy) recall cycling home at night across the fen with the solo part from the Brahms Violin Concerto clearly audible through the open skylight of the small attic room which was the only place Mrs Pearson allowed him to practise. At this time Michael was offered a place in a professional string quartet, and was sorely tempted to join it. Science can be glad that he did not.

After his PhD Michael moved to MIT as a postdoc, where he worked with Jule Charney and Norman Phillips, and he returned to DAMTP in 1969 as Assistant Director of Research in Dynamical Meteorology and DAMTP has been his professional home ever since.

Michael is well-known for his contributions to theoretical fluid dynamics and to atmospheric dynamics. In the 1970s he and his student David Andrews carried out fundamental work on the interaction between waves and mean flows, deriving some very powerful general results (the Generalised Lagrangian Mean theory) as well as more specific results with direct relevance to atmospheric dynamics and transport, particularly to the stratosphere. These resolved much confusion and the techniques that Andrews and McIntyre employed (Eliassen-Palm fluxes and the transformed Eulerian mean formalism) now underpin the majority of diagnostic studies of the circulation in observations and in numerical models.

In the 1980s Michael wrote a succession of papers that have not only left a lasting mark on atmospheric science in ideas and techniques, but also in vocabulary. His Nature paper with Tim Palmer showed some of the first potential vorticity maps calculated from observations, and described them as showing the 'breaking' of planetary-scale Rossby waves in the stratospheric 'surf zone'. The use of the term 'breaking' was troubling to many and much debate, both in correspondence and in the scientific literature, ensued. The Hoskins, McIntyre and Robertson paper in the Quarterly Journal of the Royal Meteorological Society combined a whole range of ideas from synoptic meteorology and from geophysical fluid dynamics to argue for the use of potential vorticity, together with the 'invertibility principle', as the key to understanding large- and synoptic-scale dynamics.A second Nature paper with Michael's PhD student Martin Juckes described high-resolution numerical simulations of the stratosphere, which showed clearly the implications of planetary-wave breaking for the dynamical structure of the stratosphere (the formation of a sharp edge to the polar vortex through the process of 'vortex erosion' and the robustness of the vortex as a material dynamical entity) and for the distributions of chemical species (highly filamentary structure in the 'surf zone' and a vortex isolated from the surrounding surf zone and hence with very different chemical character). These simulations were important subsequently in understanding the wealth of chemical and meteorological data that came out of the many observational campaigns prompted by the discovery of the Antarctic Ozone Hole. Michael himself was a participant in one of these campaigns and spent three months based at Stavanger during the first Airborne Arctic Stratospheric Expedition in 1989.

Michael's more recent interests have included the mean meridional circulation, stratosphere-troposphere exchange, the emission of gravity waves by vortex motion and the effect of gravity waves on the large-scale circulation. A notable contribution was his work with Phil Mote and others on the annual cycle in water vapour in the tropical stratosphere in which the annual variation in water vapour concentration set by tropopause temperatures is carried upwards by the mean circulation. Michael named this the tropical 'tape recorder' and that term is now in common use.

For this work Michael has received many notable honours and prizes. He is a Fellow of the Royal Society, was awarded the Carl-Gustav Rossby medal (the highest award of the American Meteorological Society) in 1987 and the Julius Bartels medal of the European Geophysical Society in 1999.

Michael has regularly supervised or co-supervised PhD students and postdocs and several now hold senior positions in universities and research institutes. These include two New Zealanders, Warwick Norton (now Oxford/Reading) and Darryn Waugh (now Johns Hopkins). He was one of those at DAMTP who seized the opportunity to set up a Summer School in Geophysical and Environmental Fluid Dynamics, which has now been running for 13 years. Each year, for two weeks, Michael makes the School his first priority and spends many hours getting to know the students and discussing their research.

Two characteristics of Michael are first his focussed enthusiasm and energy and second his generosity and inclusivity. Most of his collaborators have experienced the phenomenon that once Michael's attention is focussed on something the pace is very hot indeed. In years past the result was often a succession of late-night phone calls. Nowadays it may be a succession of emails. Michael's desire to be inclusive makes him an enthusiastic user of the 'Cc:' line. A typical experience for a McIntyre collaborator or correspondent is to be 'Cc'ed into an email exchange, perhaps on solar effects on climate or something similar, which then proceeds at breakneck speed, too fast for a casual observer to follow the details, before expiring a few days or weeks later. Reviewing the messages at this stage is often interesting and informative.

For many years Michael gave up his intense musical life in order to concentrate on science, although music still had an important place in the McIntyre household since his wife Ruth is a professional pianist. Many of us had not heard Michael play the violin until relatively recently. Two occasions are particularly memorable. The first was the funeral of Rupert Ford, Michael's PhD student and subsequently a lecturer at Imperial College, who tragically died suddenly at the European Geophysical Society Meeting in Nice in 2001. As the funeral ended Michael played, unaccompanied, the solo violin line from 'A Lark Ascending'. The second was a concert later in 2001 performed by Michael, Ruth and one of their musical friends in memory of David Crighton, who had died of cancer a year earlier whilst Head of DAMTP. The concert was performed to a packed and enthusiastic audience at the University Music School Concert Hall. (Characteristically Michael seemed to spend the week before worrying about the fact that large numbers of tickets seemed unsold and spent several months afterwards energetically marketing the resulting CD, sold in support of two funds, one musical, one mathematical, named for David.)

As a fluid dynamicist Michael has also been active in topics outside atmospheric science. With Jim Woodhouse he has made important contributions to understanding of violin mechanics and acoustics and recently with Douglas Gough he has studied the dynamics of the solar tachocline, applying some of the theoretical ideas that he had earlier developed to understand atmospheric dynamics. But Michael's characteristic quality, obvious to anyone who knows him and evident to anyone who visits his website, is that he can be interested in almost anything. He is a true free thinker, who could not be constrained into any sort of programmatic research and who can provide original, informed and perceptive comment on whatever subject grabs his attention. (This is immediately apparent to any seminar speaker or lecturer who has Michael in his or her audience.) Michael and those like him epitomise what makes academic staff at Universities worth supporting.

Peter Haynes
Tim Pedley

Centrefolds Index

OBITUARY

DAVID ALLAN SPENCE, 1926–2003

David Spence, one of the foremost New Zealand applied mathematicians of the second half of the last century, died in Oxford on 7 September 2003. Although his life and career were very largely spent on the other hemisphere, he retained many connections and friendships in New Zealand, and with New Zealand mathematicians at large.

He was born in Auckland on January 3, 1926. His father, a lawyer, died quite early in his childhood of tuberculosis, a disease which was later to cost David a period of his life, spent in hospital, and half a lung. He received his secondary schooling at Kings College, Otahuhu, and won a Junior University Entrance Scholarship in the 1942 examination, coming top of the list for the country. He then made an interesting false start to his university career by going to the University of Otago to study medicine. He must have continued in this at least through the first professional year; for in conversation with the writer of this notice in 1983, when we were climbing Mt Dumblane, in the Hanmer area, he recalled that he had dissected a cadaver up to the neck, and could as a result identify that muscle which gave him a little distress at the time. (It was the sartorius.) However his fascination with and strength in mathematics prevailed; he moved to Auckland University from which he graduated with an MSc, with first class honours, in 1947. In the latter half of that year, after having made a start to his ultimate career as an acting assistant lecturer at Auckland (a colleague still recalls his lectures to Stage I, on symmetric functions) he sailed to England and Cambridge.

It may seem, in retrospect, that he here made another false start, for his first research was done in the Aeronautical Engineering Department, on the turbulent boundary layer, a problem for which the fine tools of mathematical analysis as found in Whittaker & Watson and its modern counterparts find little use. However, it is very likely that it was during this time that another of David's strengths, the ability to model complex physical problems and to attack them with whatever tools seemed appropriate, was developed. It should also be recalled that at that time aerodynamics was going through a period of intense development, and was the subject of research for many applied mathematicians.

He was awarded a PhD in Engineering in 1952, and joined the scientific staff of the Royal Aircraft Establishment, Farnborough, in 1952. Here he continued his research on the turbulent boundary layer, and also did work on the jet flap (an ingenious idea which has never been fully developed in practice, but which required from him the sort of mathematics of which he soon became a master—the solution of boundary-value problems via integral equations, complex analysis, and asymptotics), on the motion of shockwaves in tubes, on heat transfer, and on the flow of chemically reacting gases.

In 1964, he was encouraged by Professor Douglas Holder, FRS, to join the Engineering Department of the University of Oxford, where he was appointed as a University Lecturer, and a Fellow of Lincoln College. Here the scope of his research was broadened to include contact problems in elasticity. This work, together with his mastery of fluid mechanics, led him eventually to a whole spectrum of geophysical problems, in which he conducted a long and fruitful collaboration with Donald Turcotte at Cornell, and later Philip Sharp at Auckland. He was promoted to a Readership in Theoretical Mechanics in 1977.

In 1981 he was appointed to a chair in the Department of Mathematics at Imperial College London, which he held until his retirement in 1991. But notwithstanding this "retirement" (at the mandatory age) he continued to work on geophysical problems as a Senior Research Fellow of both Imperial College and of Lincoln College, until increasing physical infirmity made this impossible.

David was a Fellow of the Royal Aeronautical Society, and of the Institute of Mathematics and its Applications, and served the latter as the editor of the IMA Journal of Applied Mathematics for a number of years.

His career, both at the RAE and later, was punctuated by a number of visiting positions. He took visiting positions at Cornell and Caltech during his aerodynamic phase, and Wisconsin and again Cornell when he turned his hand to elasticity and geophysical problems. He spent a period in New Zealand in 1983, when an Erskine Fellow of the University of Canterbury. Generally, he added to his list of collaborators during these academic visits: David was an enthusiastic and energetic worker, and he loved to explain, to whoever showed an interest, what his latest problem was, and how he was setting about it. The interested party thereby stood a fair chance of learning something new and useful about modelling, mathematical technique, and research strategy. Further, he was open and generous in working with others on their problems, and this made him an ideal collaborator and mentor.

He was also excellent company. Like many New Zealanders of his time, he had little difficulty in fitting into the British academic milieu, and in the end might indeed have been mistaken by a casual observer to have been born into it. But he still retained a certain wry detachment, as of an anthropologist in a very interesting tribe. He had a great taste for, and a detailed knowledge of such quintessentially English writers as Trollope and Anthony Powell, and this taste, for the ironic and understated, was reflected in his letters, which were always a pleasure to read.

In the mid 1980s he was diagnosed as having a form of Parkinson's disease, and advised to retire. He did not do so, but continued as much as possible in all the activities he valued. The writer of this notice spent a happy afternoon in August 1988, when we were both at Grenoble, climbing a modest peak (Chamechaude?) in the Grand Chartreuse in his company, without being aware that he was under any handicap. He may be said to have fought a stubborn rearguard battle against increasing infirmity, and in this he was nobly supported by his wife Isobel, and by his children. His will be mourned by a wide circle of friends, in the mathematical community and outside it, in this country, in Britain, and throughout the world.

Brian Woods

BOOK REVIEWS

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

David Alcorn
Department of Mathematics
University of Auckland
(email: alcorn@math.auckland.ac.nz)

SPRINGER-VERLAG

Aronov B (ed), Discrete and computational geometry. (Algorithms and Combinatorics, 25) 853pp.
Asmussen S, Applied probability and queues. (2nd ed) (Applications of Mathematics, 51) 438pp.
Basu S, Algorithms in real algebraic geometry. (Algorithms and Computation in Mathematics, 10) 602pp.
Ben-Israel A, Generalized inverses. (2nd ed) (CMS Books in Mathematics) 420pp.
Berger M, A panoramic view of Riemannian geometry. 824pp.
Blowey J (ed), Frontiers in numerical analysis: Durham 2002. (Universitext) 349pp.
Böröczky KJ, Higher dimensional varieties and rational points. (Bolyai Society Mathematical Studies, 12) 300pp.
Bourbaki N, Elements of mathematics. Functions of a real variable. 338pp.
Daepp U, Reading, writing and proving. (Undergraduate Texts in Mathematics) 395pp.
Dale AI, Most honourable remembrance. The life & work of Thomas Bayes. (Sources and Studies in the History of Mathematics and Physical Science) 670pp.
Dantzig GB, Linear programming. 2: Theory and extensions. (Springer Series in Operations Research) 448pp.
Dugundji J, Fixed point theory. (Springer Monographs in Mathematics) 690pp.
Emmer M (ed), Mathematics, art, technology and cinema. 242pp.
Göpfert A, Variational methods in partially ordered spaces. (CMS Books in Mathematics) 350pp.
Gustafson SJ, Mathematical concepts of quantum mechanics. (Universitext) 260pp.
Hall B, Lie groups, Lie algebras, and representations. (Graduate Texts in Mathematics, 222) 368pp.
Hassani S, Mathematical methods using Mathematica. (Undergraduate Texts in Contemporary Physics) 256pp.
Hundsdorfer W, Numerical solution of time-dependent advection-diffusion-reaction equations.

(Springer Series in Computational Mathematics) 471pp.
Kushner HJ, Stochastic approximation and recursive algorithms and applications. (2nd ed) (Application of Mathematics, 35) 474pp.
Jünger M (ed), Graph drawing software. (Mathematics and Visualization) 378pp.
Kesten H (ed), Probability on discrete structures. (Encyclopaedia of Mathematics, 110) 351pp.
Knabner P, Numerical methods for elliptic and parabolic partial differential equations. (Texts in Applied Mathematics, 44) 424pp.
Larsson S, Partial differential equations with numerical methods. (Texts in Applied Mathematics, 45) 259pp.
Matveev S, Algorithmic topology and classification of 3-manifolds. (Algorithms and Computation in Mathematics, 9) 478pp.
Oksendal B, Stochastic differential equations. (6th ed) (Universtext) 360pp.
Quateroni A, Scientific computing with MATLAB. (Texts in Computational Science and Engineering, 2) 257pp.
Robert P, Stochastic networks and queues. (Applications of Mathematics, 52) 398pp.
Talagrand M, Spin glasses: a challenge for mathematicians. (Ergebnisse der Mathematik und ihrer Grenzgebiete. 3. Folge, 46) 586pp.
Tweddle I, James Stirling's Methodus Differentialis. (Sources and Studies in the History of Mathematics and Physical Sciences) 295pp.
Vretband A, Fourier analysis and its applications. (Graduate Texts in Mathematics, 223) 269pp.
Zhao X-Q, Dynamical systems in population biology. (CMS Books in Mathematics) 276pp.

BIRKHÄUSER

Gohberg, I, Basic Classes of Linear Operators. 444 pp.
Picco, P, From classical to modern probability. 236 pp.
Albeverio, S Nonlinear hyperbolic equations, spectral theory, and wavelet transformation. 446 pp.
Antreich, K. Modeling, simuation, and optimization of integrated circuits. 376 pp.

APPLIED PROBABILITY

by Kenneth Lange, Springer Texts in Statistics, Springer-Verlag, Berlin, 2003, 300 pp, EUR 84.95. ISBN 0-387-00425-4.

The preface of this book states, "This graduate level textbook presupposes knowledge of multivariate calculus, linear algebra and ordinary differential equations. In probability theory, students should be comfortable with elementary combinatorics, generating functions, probability densities and distributions, expectations and conditioning arguments. My intended audience includes graduate students in applied mathematics, biostatistics, computational biology, computer science, physics and statistics". The breadth of the background potentially creates some difficulties for such an intended audience since many students may not necessarily have such a background. Further this text does not cover the usual Operations Research topics based upon applications of Markov chains and processes to topics such as queueing and reliability. In the space of four pages the elementary theory of Markov chains including limiting properties of n-step transition probabilities, stationary distributions, the ergodic theorem, balance and detailed balance, reversible chains and Kolmogorov's circulation criterion are covered. My recommendation is that students taking a course from this book would much better prepared if they had already taken a more traditional undergraduate course in "applied probability".

Armed, however, with such a preparation, the book would be a delight to use. It contains, admittedly sometimes at a superficial level due to the assumption that the students may not have a rigorous probability background, some of the relatively new topics. The core stochastic process course centres around the chapters on Poisson processes; discrete-time Markov chains (coupling, Markov chain Monte Carlo, simulated annealing); continuous-time Markov chains (calculation of matrix exponentials, Kendall's Birth-Death-Immigration process); branching processes (including multitype processes); martingales (optimal stopping, large deviation bounds) and diffusion processes (first passage time problems, Wright–Fisher process).

This material is preceded by chapters on basic notions of probability theory; calculation of expectations; convexity, optimization and inequalities; combinatorics and combinatorial optimization. The justification for some of this material is its applications to computational statistics and the calculation of bounds on probabilities and moments.

The later optional chapters consider the Poisson approximation and Number theory (leading to the Prime Number Theorem). The author acknowledges that this material is hardly in the mainstream of stochastic processes and is meant for independent reading.

Those of us working in the field recognize that there is a plethora of techniques and applications that could be included and that the better the mathematical preparation of the students the easier it is to present the material by not getting immersed in the mathematical details. Lange has produced an enjoyable, highly readable book, one that presents the mathematical facts without proof rather than omitting them altogether. I found much of the material of interest, but I am of the opinion that some of the additional material is more suited to a course on "probability theory". All of the chapters come with exercises—some of them challenging. For well-prepared students, a course based on this material would be a joy.

Jeffrey J Hunter
Institute of Information and Mathematical Sciences
Massey University

NEW VISUAL PERSPECTIVES ON FIBONACCI NUMBERS

by Krassimir Atanassov, Vassia Atanassov, Anthony Shannon and John Turner.

World Scientific, 2002, 332pp, US$64.00; US$32.00 (pbk). ISBN 981-238-114-7, 981-238-134-1(pbk).

These four authors, two from Bulgaria, one from Australia, and John Turner of Waikato have combined to produce a book of discoveries linked to the Fibonacci sequence and the golden section. It is intended to appeal to "the research mathematician or the recreational mathematician who wants to enjoy the puzzles inherent in the visual approach." In this it certainly succeeds. Time and again I was diverted from my note-taking for this review to follow up some idea that arose from my reading, whether an explicit problem or just a parallel idea it triggered in my mind. The trouble and the glory of this area of mathematics is that the combinations and ramifications are endless.

The book is in two parts and each part in two sections with different combinations of authors. The sections are largely independent, but there are cross links. Different readers will find their greatest involvement and enjoyment in different sections. Part A deals with number-theoretic perspectives.

The first section, by KA and AS, explores coupled recurrence relations; two sequences of integers are each involved in the generation of the other in a symmetrical manner. One option is

$$a_{n+2} = b_{n+1} + a_n$$
$$b_{n+2} = a_{n+1} + b_n.$$

Solutions for all the combinations are found in terms of the "standard" Fibonacci sequence $\{F_n = \{0, 1, 1, 2, 3, 5, 8, 13...$ There are also coupled versions of the 'Tribonacci' sequence, in which each term is the sum of the three previous terms, and the multiplicative analogue $a_{n+2} = a_{n+1}.a_n$.

The second section of the part, by KA, AS and JT, is titled 'Number trees' and deals with sequences of binary rooted trees with nodes labelled with numbers or letters in accordance with various rules. The tree are each built up by taking a new root and mounting above it copies of the last two, or later three, trees in the sequence. This is the shortest of the sections, and to me the least exciting.

Part B, two thirds of the book, deals with geometric perspectives. Its first section, Fibonacci vector geometry, by JT, moves the context to the integer space Z^3. Vectors are created from three consecutive terms of the standard Fibonacci sequence, which may be extended in the negative direction:

...(2,-1,1), (-1,1,0), (1,0,1), (0,1,1), (1,1,2), (1,2,3),(2,3,5),...

These vectors are then connected by the vector version of the Fibonacci equation. Three consecutive vectors define a triangle, which JT found could be written as

$$(1/2)(F_{2n+1} + F_{n-1}.F_n).$$

In this, F_{2n+1} can be replaced by its equivalent as $(F_{n-1})^2 + (F_n)^2$.

While the standard Fibonacci points are in Z^3, they in fact all lie in the plane $x + y - z = 0$. If the points are plotted in this plane and joined to the origin, the rays for positive n approach a ray L with direction ratios $1{:}a{:}a^2$, where a is the golden mean, $(1+\sqrt{5})/2$. If n is negative the rays lie alternately close to the two rays L' and L'' which make up another line.

Any point of the plane $x + y - z = 0$ can be written in the form $(a, b, a + b)$, so belongs to exactly one general Fibonacci vector sequence. It is surrounded by six points at distance $\sqrt{2}$ from it and forming the vertices of a regular hexagon. They are defined by adding or subtracting 1 to/from either or both of the first two coordinates and altering the third coordinate to retain it as the sum of the first two. Thus the plane is referred to as the 'honeycomb plane'.

Further geometry of this plane includes that the three consecutive points of a general Fibonacci vector sequence define a triangle whose area is a constant for the sequence, and with the origin they form a rhombus. There are no triangles with integer coordinates and angles 90, 45, 45 degrees. Every directed pair of integer points *AB* defines two equilateral triangles with *AB* as common edge. The new vertices are defined as the left and right *ET*-transforms of *AB*. Starting with *AB*, two *ET*-transforms give a rhombus with side *AB* and three allow construction of a 90-60-30 degree triangle with *AB* the short side.

One of the topics I found of most interest was the generalisation of both the objects and the operation of the sequence, so that

$$x_{n+2} = x_{n+1} * x_n,$$

here the x_i are members of some set *S* and * is a binary operation on *S*. The recurrence relation generates a sequence

$$\{a, b, a*b, b*(a*b)...$$

which is called a track. The situation is simplest when the structure is a finite group. Then the tracks close. Tracks are equivalent if they have the same cyclic sequence. The set of inequivalent tracks is the trackset and the periods of the tracks (lengths of the cycles) form the period spectrum *P*. The spectrum *I* records the periods of those tracks which contain the identity. The trackset contains all the information about the group and can therefore function as a replacement for the group (Cayley) table. Apart from the labelling it is an isomorphism invariant, as are the *I* and *P* period spectra. The group axioms can be expressed in terms of triples *(a, b, a*b)*.

It is not known whether non-isomorphic groups could have the same *P* and *I* spectra: JT doubts it could be so. It is known that non-isomorphic non-group operations defined by latin squares can have the same period spectrum. The book contains listing of the tracksets for all groups of order up to 8. JT wonders how differently group theory might have developed if Cayley had represented groups by their tracksets instead of their tables.

The last of the four sections of the book is Goldpoint Geometry by VA and JT. We are now dealing with the real plane. 'Goldpoint' is a term coined by JT for a point which divides a line segment in golden section. A simple construction is given for a goldpoint based on the fact that a triangle with sides 1:a:a^2, has an angle of 60 degrees opposite the $\sqrt{2}$ side.

Goldpoint versions of the Cantor set, fractal stars and other figures are described.

Suppose a number of equal equilateral triangles is cut out. One goldpoint is marked on each edge of each triangle. This can be done in four ways inequivalent for rotation. Now fit the triangles together as in a jigsaw, where triangles only fit if the goldpoints on the edges in contact are also in contact. Nets are given for solids which can be built up in this way. Similarly there are six inequivalent squares with goldpoints on their edges, which can be fitted together under the same rule. But in fact the actual ratio in which the goldpoint divides the edge is unimportant for this enterprise; any scheme of dividing each edge in some fixed unequal proportion would do as well.

The book ends with descriptions (not all serious) of goldpoint versions of various games: dominoes, solitaire, noughts and crosses, chess (with goldpoints on the square bases of the pieces and restrictions on the possible places to which a piece can move dependent on the pieces on neighbouring squares) and Rubik's cube.

The title and the authors stress the importance of the visual. In practice the use of figures varies considerably through the book. It is natural that there are more in the second part and especially in the goldpoint geometry section, where figures make plain what is much less evident in the form of words. It is hard to imagine how the material presented here could have been discovered without a visual element.

My main quibble with the book is that it makes no attempt to set out the 'traditional' theory of Fibonacci sequences and recurrence relations in general and assumes it wherever needed. It is true that the material here presented has little reliance on the traditional results, but there are points of contact and much of the number-theoretic work gains a good deal of interest if the reader has some knowledge of these traditional results and techniques. I consider that a short introductory chapter would have been a useful addition.

The content of the book is secondary to the aims of the authors. While they would welcome developments extending the ideas they have set out, their greater aim is to encourage readers to use visual tools in mathematical exploration and exposition. With this aim I thoroughly agree. But I must confess that for me the greatest stimulation came not from the figures but the algebra, which I turned into my own figures. For other readers it could well be different. There is plenty here to stimulate in various ways.

David Robinson
University of Canterbury

REVIEW OF FIBONACCI'S LIBER ABACI

A translation into modern English of Leonardo Pisano's Book of Calculation
translated by L. E. Sigler, Springer-Verlag, 2002.

Leonardo of Pisa is better known to us these days as Fibonacci. His *Liber Abaci* was first published in 1202, with a revised version appearing in 1228. For its first readers much of its interest probably lay in its advocacy of the "new" Arabic numerals. But, for me at least, it is much more interesting as an episode in the development of algebra. Leonardo inhabits a world where most mathematical problems can solved quite adequately without algebra. There is a rudimentary, and non-symbolic, algebra but it's about as important as mammals seem to have been in the age of the dinosaurs. On the other hand there is much that could be called algebraic thinking, techniques like elimination and the use of proportion, thriving in a non-symbolic world. Perhaps this would be a good place to look for ideas on how to introduce modern-day students to algebra.

Leonardo begins with an introduction to Arabic numerals. (He calls them Indian.) The first hundred or so pages (Chapters 1 to 7) are devoted to showing his readers how to perform the standard arithmetic operations firstly on whole numbers, and then on fractions. An interesting aspect of his exposition is his emphasis on checking answers, sometimes by using a different method, but often by casting out nines, or other numbers, along with an explanation (p. 70) of how to choose the number to be cast out, and why. This may be a way of alleviating a mistrust of answers derived from the unfamiliar number system, or it may simply be a desire to be sure of answers you might be held accountable for.

Intriguing too is the way higher level mathematics appears quite early in the text. For example, Leonardo often represents fractions over factorized denominators so that

$$\frac{5\ \ 11}{12\ 20}17 \quad \text{means} \quad 17 + \frac{11}{20} + \frac{5}{20 \times 12}.$$

This has obvious advantages when dealing with non-decimal systems of units (Pisan pounds, soldi and denari, in this case), but it means that when Leonardo uses division he sometimes needs to factorize quite large denominators. So in a chapter which is really just about how to divide integers, we find Leonardo explaining (p. 67) that 2543 must be prime because it is not divisible by any number smaller than its square root.

In the next few chapters (8 to 11), Leonardo shows how to use the arithmetic operations to solve what were presumably typical problems facing his readers: calculating prices of goods from specified rates, exchange rates for barter or money, distributing profits to shareholders of a company, designing coinage with a specified proportion of silver.

The basic technique in all these problems is some form of proportional reasoning. As an algebraist, I would be tempted to solve all these problems using a simple linear equation, or a chain of such equations. But Leonardo's reasoning is always easy to follow, and no algebra is needed.

There is an air of real world application about these chapters, with references to the typical produce of various ports around the Mediterranean, and mention of practical issues, such as the difficulty of making precisely measured alloys of copper and silver.However, as the text proceeds the grip of reality is gradually relaxed. An early symptom is an unrealistically complicated problem:

> A certain man has 240 monies, of which the first is with $\frac{1}{20}$ of one ounce of silver in one pound, the second is with $\frac{2}{20}$, namely $\frac{1}{10}$, the third is with $\frac{3}{20}$, the fourth is with $\frac{4}{20}$, and so on always in order for the remaining monies, there will be $\frac{1}{20}$ more up to the last money which will be with $\frac{240}{20}$, namely 12 ounces of silver ... from these he will wish to make a money with $\frac{1}{2}2$ ounces. (p. 247)

which is used to show that Leonardo's methods are unaffected by the complications.

In some history books Leonardo is credited with popularizing the Arabic numeral system (**E**, p. 162) but it seems unlikely that such a large, theoretical work would have had a direct effect on the merchants of the middle ages. It is on the other hand easy to imagine this book having a profound influence on mathematicians. Its emphasis on proof or other forms of explanation is aimed more at teachers of practitioners rather than at practitioners themselves. This becomes even more evident in Chapter 12, where all pretence of applicability is dropped. Here Leonardo reveals a vast store of problems which nowadays are often the haunt of the recreational mathematician, but which in the middle ages may have played a more crucial role in the mathematical challenges in which a court mathematician displayed his virtuosity and maintained his prestige.

Chapter 12 is by far the longest chapter (almost 200 pages), offering an encyclopedic catalogue of problems and the various methods which can be used to solve them. Here we meet sums of arithmetic and geometric series, and sums of squares (pp. 260–263), the Chinese Remainder Theorem (p. 428) and even the famous rabbit problem (p. 404). However, the bulk of the chapter deals with what we would now call homogeneous systems of linear equations. There are many types, all with their own methods of solution. Where we might label them by the type of matrix they give rise to (tridiagonal, circulant, Toeplitz and so on), Leonardo labels them according to the typical wording of the problem: finding of purses, buying of horses, travellers, companies, divinations and so on. Here is a complex example "on a purse found by five men":

> ... there are 5 men, and the first having the purse proposes to have two and one half times as many as the others, and another, if he has the purse, proposes to have three and one third times the others. Also the third with the purse has four and one fourth times as many as the others, the fourth with the purse truly has five and one fifth times as many as the others; the fifth moreover with the same purse affirms that he has six and one sixth times as many as the others. (p. 320)

Is your instinct to write down a system of 5 homogeneous linear equations in 6 unknowns? Yet Leonardo solves this and similar problems almost exclusively by verbal reasoning, rather than algebra. Sigler describes the dominant method as "false position" page 268, note 3; see p. 624 but it is really a form of proportional reasoning, accompanied in most cases by ingenious elimination techniques. Algebra does make an appearance. It is called the "direct method that is used by the Arabs" and it takes the form of calculation using an unknown "thing" which is solved for using algebraic manipulation. Sometimes two unknowns called "thing" and "sum" are manipulated and solved for simultaneously. However this is just one of several competing methods and it is by no means clear that this could become what we now see as a universal problem solving tool. Indeed, it is one of the ironies of history that Chapter 13 is devoted to a method with which "nearly all problems of mathematics are solved" and yet that method is not algebra!

Chapter 13 must have seemed a terrific tour-de-force to 13th century readers. After the huge compendium of different methods in the previous chapter, Leonardo now picks one example each of his various problem types and shows how they all succumb to what he calls *elchataym* or *double false position*. (A modern numerical analyst would probably recognize this as ordinary false position, but as the problems are all linear the method gives exact solutions.) Furthermore, new problems also succumb, most notably (what we would now call) non-homogeneous variations of his earlier linear problems. He even finds a superficially quadratic problem which can be solved by this technique:

> On a certain ground there are two towers, one of which is 30 feet high, the other 40, and they are only 50 feet apart; at an instant, two birds descending together from the heights of the two towers fly to the center of a fountain between the towers, and they arrive at the same moment; the distances from the centre to both towers are sought. (adapted from pp. 462 and 544)

Leonardo offers no rules to tell whether the method works or not, and this problem poached from his later chapter about quadratic problems conjures up the image of him trying out double false position on all his problems, just to see how universal it is.

Chapter 14 is something of an interlude, discussing square and cube roots and how to do arithmetic with them. On the one hand they are seen as exact quantities to be carried through calculations rather in the manner that a package like Maple or Mathematica would do symbolic algebra, but on the other hand Leonardo offers algorithms for calculating such roots to any desired accuracy.

The final chapter begins with a theoretical discussion about proportion and a series of related problems whose solutions need various roots to be found. There follows a section of supposedly geometric problems, but in many cases the geometry seems to consist of the use of squares and cubes (or higher powers) and their roots, as in the following example:

> Again a certain man had 100 pounds with which he made one trip, and the profit is I know not what, and then he takes another 100 pounds from the company, and with all this the profit is by the same rule that was the profit in the first trip, and thus he has 299 pounds; it is sought how much profit there is. (p. 546)

where it transpires that Leonardo wants to find the rate of return, or the rule mentioned in the problem.

The book closes with a theoretical discussion of what we would now call quadratic equations, and a collection of problems. Most are of the form: separate 10 into two parts so that such-and-such is true, but some have contexts:

> I divided 60 by a number of men, and each had an amount, and I added two more men, and I divided the 60 by all of them, and there resulted for each $\frac{1}{2}$2 denari less than that which resulted first. (p. 562)

This problem is solved geometrically (using techniques from Euclid's Book II), but more complicated later problems are solved algebraically using "things, roots, census, cubes" and so on (our 1, x, x^2, x^3, ...). So, from our point of view, the book concludes with a foretaste of the future, where cubic and quartic equations will be solved by similar methods, and where algebra will develop from those same methods. According to Rashed [**R**], Leonardo's work really only brought Europeans up to date with tenth century Arab scholarship, but on the other hand he also set them on the road to Cardano and Viete. Such a key work should be part of every history of mathematics library.

A few words about the translation may be appropriate. The examples above should give an idea of the style of translation Sigler has aimed at—the modern fashion is for literal but stilted English. The aim is to let the original text speak for itself. (Yet still I find myself hankering occasionally for the good old days when Richmond Lattimore could translate Homer into iambic pentameter, or Ronald Knox could begin each verse of an alphabetic psalm with the letters of the English alphabet!) Sigler died before this translation went to the printer, so much of the editorial work seems to have fallen on his wife and former colleagues. Perhaps inevitably in such a long book, there are quite a few misprints. Fortunately all the ones I found were easy to correct from the context. There is also one page which is completely wrong, with page 284 having been accidently replaced by a duplicate of page 224. The correct page is available from the publisher as a pdf file via the link www.springer-ny.com/supplements/0387954198/Errata.pdf.

Reference

[**E**] H. Eves, *Great moments in mathematics*, Mathematical Association of America, 1983.
[**R**] R. Rashed, Fibonacci et les mathématiques arabes, in *Le scienze alla corte di Federico II*, 145–160, Brepols, 1994.

John Hannah
University of Canterbury

TWELVE SPORADIC GROUPS

by Robert L. Griess, Jr. Springer Monographs in Mathematics, Springer-Verlag, Berlin, 1998, 169 pp, US$79.95. ISBN 3-540-62778-2

One of the crowning achievements of mathematics in the 20th century has to be the classification of the finite simple groups. Completed in 1980, this involved research by dozens of mathematicians over the course of decades, and published in some 10,000 pages of journal articles. One of the final steps (in 1980) was a proof by Robert Griess of the existence of the *Monster*, a group of order 2^{46}&m· 3^{20}· 5^9· 7^6· 11^2· 13^2· 17· 19· 23· 29· 31· 41· 47· 59· 71. % Every finite group G can be decomposed as a subnormal series $\{1\} = G_0 \lhd G_1 \lhd \ldots \lhd G_{m-1} \lhd G_m = G$ of subgroups $\{G_i\}$ with simple factors G_i/G_{i-1}, such that no further refinement is possible, and in this way the finite simple groups are the "building blocks" for all finite groups — somewhat analogous to the elements in chemistry. The classification says that every finite simple group lies in one of four main classes: cyclic groups C_p of prime order p, alternating groups of degree A_n of degree $n \geq 5$, various simple groups of Lie type (certain families of matrix groups over finite fields, including the classical groups as well as exceptional families), and 26 "sporadic" groups that do not fall into of the first three classes.

The largest of the sporadic simple groups is the Monster, and 20 of the 26 sporadics are involved in the Monster as subgroups or as quotients of subgroups. These 20 (called the "Happy Family") themselves occur naturally in three generations, and this book concerns the 12 groups in the first two of these generations, all related to the Golay codes and the Leech lattice (namely the five Mathieu groups, the three Conway groups, and the groups of Hall-Janko, Higman-Sims, Suzuki and McLaughlin). The book aims to promote the understanding of these groups, and complements two other books on the sporadics: "Sporadic groups" by Michael Aschbacher (Cambridge Univ. Press, 1994), and "Geometry of sporadic groups" by Sasha Ivanov (Cambridge Univ. Press, 1999). The two latter texts are important but rather technical, while the book under review is written in a way to help the reader "appreciate their beauty, linger on details and develop unifying details in their structure theory". It is certainly accessible to graduate students having a good basic knowledge of linear and abstract algebra, permutation groups and matrix groups.

The first two chapters provide some necessary background from the theory of groups, modules, finite geometry, group cohomology (including extensions and Schur multipliers), bilinear forms, group presentations, and root systems. Most of this is given without proofs (but with some helpful references). Chapters 3 to 7 deal with linear error-correcting codes and their automorphism groups, the Hexacode (a linear code of length 6, dimension 3, and minimum weight 4 over the field GF(4)), the binary Golay code (a [24,12,8]-code over GF(2)), the Mathieu group M_{24} and its subgroups, the ternary Golay code (constructed from a [4,2,3] ternary code), and its automorphism group $2\cdot M_{12}$ (the covering group of the Mathieu group M_{12}). Detailed analysis is given, including existence and uniqueness proofs, but some aspects are (deliberately) incomplete. Chapters 8 to 10 deal with lattices, the Leech lattice Λ (a lattice in $\mathbb{R}^{24}$ with extremely nice properties) and its automorphism group, the Conway groups (each of which is a subgroup of quotient of a subgroup of Aut(Λ)), and the other four sporadic simple groups involved in Aut(Λ). Details of many proofs are suppressed, but additional information is given in appendices to Chapter 10. Finally Chapter 11 offers a brief account of the eight remaining groups in the Happy Family (all of which are involved in the Monster), plus the six "pariahs" (the remaining six of the 26 sporadic groups, namely three of the four Janko groups, plus the Lyons, O'Nan and Rudvalis groups).

This book is interesting and informative, and achieves its aims well. The exposition is spoiled a little by numerous misprints and errors (some transposed from their source, but many new, giving the impression of insufficient proof-reading), and a few unfortunate personal comments about historical attribution. These aside, the book contains some beautiful and significant mathematics, presented in a user-friendly style, and is well worth reading

Marston Conder
The University of Auckland

CONFERENCES

REMARKABLE DELTA '03

The Delta series of conferences are held specifically to provide a forum for Southern Hemisphere counties on the teaching and learning of mathematics at the tertiary level. Hence the main participants for the Remarkable Delta '03 conference held in Queenstown from November 21 to November 27th, 2003, came from Australia, New Zealand and South Africa. In addition though we had delegates from Samoa and Uruguay, and, of course, the Northern Hemisphere countries of Canada, Great Britain, the USA and France. Altogether there were 115 participants with 26 accompanying persons.

The conference was organized around four plenary speakers, four panels, seven workshops, and 71 contributed papers. Plenary sessions were given by

Johann Engelbrecht, South Africa;
Anna Sierpinska, Canada;
Lynn Steen, USA; and
Chris Wild, New Zealand.

The panels topics were on Bridging Courses and related matters, Statistics, Technology, and Undergraduate Mathematics. Contributed papers were divided into "full" and "short" presentations. All papers were refereed and the full papers appeared in a special Proceedings edition of the New Zealand Journal of Mathematics. These paper were generally the result of theoretically based research projects, while the short papers were in the main based on practical experience. Short papers were published in the Remarkable Delta '03 Communications volume. Abstracts of the various sessions can be found in the conference programme booklet or on the website www.maths.otago.ac.nz/delta03. Copies of the Proceedings ($30) and the Communications ($15) can be obtained by emailing me at dholton@maths.otago.ac.nz.

The conference was organized by three committees; the International Steering Committee (ISC), the

Programme Committee (PC) and the Local Organising Committee (LOC). All of these committees are named on the conference website but I would like to single out the following people for their help in the successful running of the conference:

John Curran, treasurer, for keeping us within budget;
Irene Goodwin, for a million positive contributions, from being a friendly and helpful face at the registration desk to organizing extremely popular conference packs;
Robert Lewis, for cheerfully helping out whenever necessary;
Greg Oates and Mike Thomas, for spending many hours editing the Proceedings; and
Greg Trounson, for maintaining technological devices in the electronically hostile environment of the conference venue.

Derek Holton
University of Otago

THE 6th AUSTRALIA–NEW ZEALAND MATHEMATICS CONVENTION

7–11 July, Darling Harbour, Sydney 2003

The 6th joint meeting of the Australian and New Zealand Mathematical Societies was run as an embedded meeting of the 5th International Congress on Industrial and Applied Mathematics. This gave the gathering a different character to the usual annual meetings and even to the previous joint meetings. From the point of view of the scientific programme, there was a larger than usual international component with many eminent mathematicians attracted to the Congress. On the other hand, from the cultural side, participants enjoyed the museums, cafés and plazas of the Darling Harbour location afforded by the encompassing event. All aspects were boosted by better than average weather for mid-winter Sydney.

There were 5 invited (40 minute) lectures held at the Sydney Convention and Exhibition Centre. These inspiring colloquium style presentations were given by Charles Fefferman (Princeton Univ.), Hillel Furstenberg (Hebrew Univ. of Jerusalem), Hendrik Lenstra (Univ. of California, Berkeley), Cheryl Praeger (Univ. of Western Australia) and Wilfried Schmid (Harvard Univ.). In addition there were over 100 shorter talks covering Analysis, Algebra, Geometry, Discrete Mathematics and the History of Mathematics. These were grouped into 29 sessions, each of 2 hours duration and consisting of 3 or 4 talks. Most these sessions were organised as specialised minisymposia and held at the University of Technology Sydney, Haymarket site. The grouping and organisation of the minisymposia was very effective giving partly the impression of small informal and specialised meetings. This neutralised to an extent some problems with the programme book.

Attendance was very good overall with over 200 registrants. However, although it seemed there were a good number of New Zealanders at the total ICIAM event, there were disappointingly few speaking or in attendance at the ANZ Mathematics Convention. Probably this was in part due to the significant registration and accommodation costs on top of the airfare.

The official ANZMC dinner was held at a well positioned Harbourside room of the Sydney Convention and Exhibition Centre on the Thursday night (the 10th). This was competing with a spectacular dinner cruise on Sydney Harbour as part of the social programme of the broader meeting. The latter included an "Icebreaker" reception at the Powerhouse Museum on the Sunday followed by the official ICIAM reception on the Monday and a variety of other cultural and culinary possibilities for each night and most days of the week. Among the New Zealanders attending the ANZMC dinner were Graeme Wake, Robert McKibbin, Mark McGuinness, Shaun Hendy, Tammy Smith, Alona Ben-Tal, and Nicolleen Cloete as well as our New Zealander on loan Shona Yu, a former undergraduate from Massey University and a current PhD student at the University of NSW. Graeme Wake spoke on behalf of the New Zealand contingent, thanking the Australians for their excellent organization of both the ICIAM and embedded ANZMC. At past AusMS Annual Meeting dinners, Prof. Neumann has presented the B. H. Neumann Prize (awarded for the most outstanding talk presented by a student at the Annual Meeting). He presented it last year to Sivajah Somasundaram (University of Waikato) just weeks before passing away on 21 Oct 2002. His absence this year was noted with sadness, but the tradition of the award continues and it was presented jointly at the dinner to Mr Ben Burton (Melbourne University) and Mr William Hart (Macquarie University).

The conference was financially supported by several Australian Government organisations and a range of private sponsors. It was directed by David Hunt of the University of New South Wales.

Rod Gover
The University of Auckland

Conferences in 2004

January 3–11 (Nelson) **NZMRI meeting on Computational Algebra, Number Theory and Geometry**
website: http://math.auckland.ac.nz/conferences/2004/NZMRI/

January 12–16 (Nelson) **NZIMA meeting on Logic and Computation**
website: http://www.clk.vuw.ac.nz/LandC.shtml

January 18–22 (Dunedin) **Australasian Computer Science Week**
website: http://www.cs.otago.ac.nz/acsw/

January 26–30 (Auckland) **2004 Mathematics-in-Industry Study Group**
website: http://misg2004.massey.ac.nz

February 1–5 (Hobart, Tasmania) **ANZIAM 2004**
website: http://www.maths.utas.edu.au/anziam/

February 9–13 (Wellington) **VIC 2004**
website: http://www.mcs.vuw.ac.nz/~mathmeet/vic2004/

February 16–20 (Whakapapa) **Annual New Zealand Phylogenetics Meeting**
website: http://awcmnee.massey.ac.nz/

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

MISG 2004

26–30 January 2004
at The University of Auckland

The 2004 MISG (Mathematics-in-Industry Study Group) will be held at The University of Auckland (City Campus) from Monday 26th January to Friday 30th January 2004, and you are cordially invited to participate. This workshop brings together professional mathematicians and industrial researchers for five days of intense collaboration on approximately seven projects presented by Australian and New Zealand industry and business groups. Details including the registration and projects (when available) etc are on the website

http://misg2004.massey.ac.nz

Please register as soon as possible. Accommodation should be booked separately, and there is no registration fee for academic and student participants. The Director is Professor Graeme Wake, Centre for Mathematics in Industry, Massey University at Albany, Auckland. Details available from the administrator: Nikki Luke: n.luke@massey.ac.nz

7th DEVONPORT TOPOLOGY FESTIVAL

The 7th Devonport Topology Festival will be held in Devonport on Friday, February 13 2004. The invited speaker Dr Chris Good (University of Birmingham) will speak on "Possible monotonizations of countable paracompactness". Anyone interested in attending should contact Sina Greenwood, at s.greenwood@auckland.ac.nz.

NOTICES

NEW FELLOWS

Congratulations to two of our members who have recently been elected Fellows of the Royal Society of New Zealand. They are:

David Murray Ryan, Professor of Operations Research, The University of Auckland

Professor Ryan is a leading researcher in mathematical optimisation and set partitioning problems, whose work on solving massive scheduling problems with optimisation methods has been of enormous benefit to Air New Zealand and is recognised worldwide.

Michael Anthony Steel, Professor in Mathematics and Statistics, University of Canterbury

Professor Steel spearheaded the development of new mathematical theory to help biologists better recover evolutionary relationships from genetic data, including the first efficient "supertree" method for allowing biologists to combine evolutionary trees in different sets of species.

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), and Rod Gover (2003).

Call for nominations 2004

Applications and nominations are invited for the NZMS Research Award for 2004. This award will be based on mathematical research published in books or recognised journals within the last five calendar years: 1999-2003. 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: 1999-2003.
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 in advance of the receipt of nominations. 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) around the time of the AGM of the Society in 2004.

All nominations (which no longer need to include the written consent of the candidate) and applications should be sent by 31 March 2004 to the NZMS President, Mick Roberts, at the following address:

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!

JEFF HUNTER AWARDED NZS&T BRONZE MEDAL

Professor Jeffery Hunter of the Institute of Information and Mathematical Sciences at Massey Albany has been awarded a New Zealand Science and Technology bronze medal by the Royal Society of New Zealand.

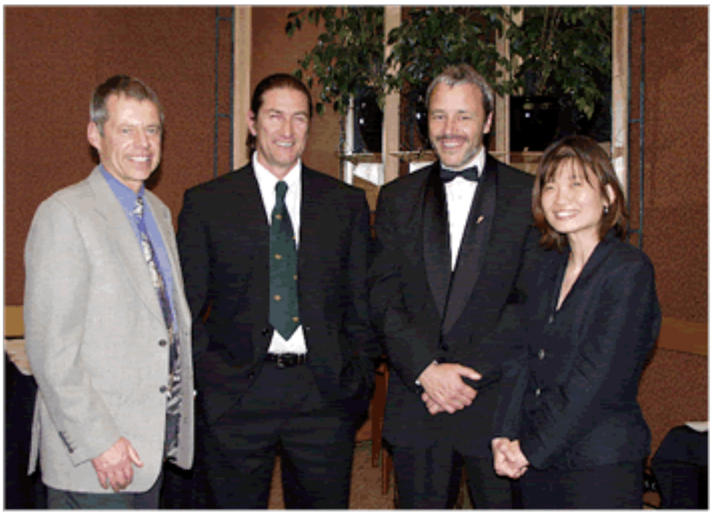
Professor Hunter was awarded his bronze medal for his significant contribution over an extended period to the public understanding of the role and importance that the mathematical and information sciences play in all spheres of the community including business and industry.

Professor Hunter has served as a Councillor of the RSNZ and was Chair of its Committee on Mathematical and Information Sciences. He was President of the New Zealand Statistical Association and Chair of a committee that reviewed the state of the Mathematical Sciences in New Zealand and produced a major report on the exercise in 1998. He was elected a Fellow of the NZ Mathematical Society in 2002 in recognition of his contribution to mathematics and professional standing in the New Zealand mathematical community.

He is also a long-standing member of the Operational Research Society of New Zealand and was Founder and Foundation President of the North Shore Branch of RSNZ. In these activities he has sought to increase public understanding of the role and importance that the mathematical sciences—mathematics, statistics and operations research—play in all spheres of the community.

RSNZ SCIENCE HONOURS DINNER

13 November 2003, Stamford Plaza Hotel, Auckland



A "classy occasion", according to MC Paul Callaghan. Mick Roberts (left) presented the NZMS Research Medal to Rod Gover (2nd from left) and the NZMS Aitken Prize to Cynthia Wang. Robert McLachlan received the NZAS Research Medal from NZAS Past President Dr Janet Grieve. Other members present at the dinner included Graeme Wake, Jeff Hunter, Marston Conder, and Robert McKibbin.

GRANTEE REPORTS

I would like to thank the New Zealand Mathematical Society for providing me with financial assistance to attend two conferences in Europe. I had the opportunity to give two talks, "On the constructive existence of a utility function" at the Fifth Congress of Romanian Mathematicians, and "On the order dual of a Riesz space" at DMTCS'03.

The congress was organized by the Section of Mathematical Sciences of the Romanian Academy, the Faculty of Mathematics of the University of Bucharest, the Institute of Mathematics of the Romanian Academy, and the University of Piteşti. It was held in Piteşti, Romania, from 23 to 28 June 2003.

More than two hundred mathematicians from Romania and many other countries attended the congress. The University of Canterbury was represented by Professor Douglas Bridges, Dr Luminiţa Viţă and two PhD students, Marian and Mihaela Baroni.

The Fourth International Conference on Discrete Mathematics and Theoretical Computer Science (DMTCS'03), Dijon, France, 7–12 July 2003, was jointly organized by Universitè de Bourgogne, Dijon, and the Centre for Discrete Mathematics and Theoretical Computer Science (CDMTCS), The University of Auckland.

The conference talks covered a large area of theoretical computer science, mathematical biology, discrete mathematics and constructive mathematics. There were five invited speakers: Gregory Chaitin (IBM, New York), Cunsheng Ding (Hong Kong University), Sorin Istrail (Celera Genomics, Rockville, USA), Maurice Margenstern (Universitè de Metz, France), and Timothy Walsh (UQAM, Montreal, Canada).

The proceedings have been published by Springer Verlag, in the LNCS series (Volume 2731).

It was an excellent opportunity for me to attend the two conferences and meet people working in constructivism (my PhD research topic) and not only, not to mention the pleasant trips and other social activities. I am most grateful to the NZMS, as well as the Department of Mathematics and Statistics of the University of Canterbury, for their financial support. I would also like to thank my supervisor, Professor Douglas Bridges, for his continuous advice and encouragement.

Marian Baroni
University of Canterbury

I would like to express my gratitude to the New Zealand Mathematical Society for providing support which enabled me to attend my first overseas conference, the International Conference on Scientific Computation and Differential Equations, Trondheim, Norway, from 30th June to 4th July.

Attending this conference not only allowed me to present the results of joint work with Dr Robert Chan and Dr Pierre Leone, but also gave me the opportunity to listen to the talks of many well known specialists in various fields of numerical ordinary differential equations. The title of my talk was "Two-step Hybrid Methods for Separable Hamiltonian Problems" and it was scheduled as part of the mini-symposium on Hamiltonian Problems. I also got to know about the latest research work currently undertaken by some of the active research workers in this area, especially the work on geometric integration and Hamiltonian problems, for example, the talks given by Ernst Hairer, Arieh Iserles, Christian Lubich, Sebastian Reich, and others.

It has been really exciting for me to be a participant at the conference. The benefits I have gained will assist me greatly in my ongoing and future research. Please convey my thanks to the NZMS once again for this wonderful experience.

Yi-Jing Angela Tsai
The University of Auckland

Stochastic Dynamics
Modeling Solute Transport in Porous Media

Professor Don Kulasiri
Dr. Wynand Verwoerd

Centre for Advanced Computational Solutions (C-fACS),
Applied Computing, Mathematics and Statistics Group,
PO Box 84, Lincoln University, Canterbury, New Zealand

Description

Most of the natural and biological phenomena such as solute transport in porous media exhibit variability that cannot be modelled by using deterministic approaches. There is evidence in natural phenomena to suggest that some of the observations cannot be explained by using the models that give deterministic solutions. Stochastic processes have a rich repository of objects, which can be used to express the randomness inherent in the system and the evolution of the system over time. The attractiveness of the stochastic differential equations (SDE) and stochastic partial differential equations (SPDE) come from the fact that we can integrate the variability of the system along with the scientific knowledge pertaining to the system.

One of the aims of this book is to explain some useful concepts in stochastic dynamics so that the scientists and engineers with a background in undergraduate differential calculus can appreciate the applicability and appropriateness of these developments in mathematics.

The ideas are explained in an intuitive manner wherever possible without compromising rigor. The solute transport problem in porous media saturated with water had been used as a natural setting to discuss the approaches based on stochastic dynamics. The work is also motivated by the need to have more sophisticated mathematical and computational frameworks to model the variability one encounters in natural and industrial systems.

This book presents the ideas, models and computational solutions pertaining to a single problem: stochastic flow of contaminant transport in the saturated porous media such as that we found in underground aquifers. In attempting to solve this problem using stochastic concepts, different ideas and new concepts have been explored, and mathematical and computational frameworks have been developed in the process. Some of these concepts, arguments and mathematical and computational constructs are discussed in an intuitive manner in this book.

Bibliographic and Ordering Information

Year 2002
Hardbound
ISBN: 0-444-51102-4
xii + 240 pages
Price: USD 100, EUR 100

For ordering information see: www.elsevier.com/locate/[illegible]

MATHEMATICAL MINIATURE 22

Dennis McEldowney; Snow through a spectrum darkly

Dennis McEldowney who died on 23 September was for many years in charge of Auckland University Press. I became acquainted with him when, in 1971, Auckland University Press published a Festschrift for H. G. Forder, former Professor of Mathematics at this University. Dennis proposed the name *A Spectrum of Mathematics* for this collection of mathematical papers and, although I had some misgivings about this title, I couldn't think of anything better and I agreed with it. Perhaps my instinct against such a poetic title, without a clear-cut meaning that I could understand, was a small example of the difficulty of communication between what C.P. Snow called "The Two Cultures".

Certainly Dennis McEldowney came from the Arts side of this great divide and I came from the Science side. I suspect that *A Spectrum of Mathematics* was never thought of as a predominantly commercial venture, but more as a tribute to one of the University of Auckland's distinguished Emeriti. In those days Universities had no money but they did have a culture of graciousness. Eventually the book was taken out of stock, and only the intercession of Garry Tee stopped the remaining copies from being pulped. Garry has kept these surplus copies and gives them out to people whom he feels might be interested.

My contact with Dennis McEldowney left me in awe of the man. He had incredibly fine judgement about editorial and literary matters and also an ability to get things done. By this I mean he knew how to cajole contributors to the Festschrift to deliver their work more or less on time and how to carry out the proof-reading of their individual contributions with high standards of literary style. Many of the authors were experienced and distinguished mathematicians and required no urging, but this was not true in every case; indeed some of the contributors were a little sloppy. I remember the many hours that Dennis and I sat side by side working through the proofs to impose our own standards on the work.

But Dennis McEldowney was more than an efficient and accomplished editor. He has been described as the New Zealand Samuel Pepys and he knew everything that was going on, especially in the University. He was a distinguished writer and literary critic in his own right, and his autobiographical writings are particularly prized. Not only was he great at writing about his own life, but he had a remarkable life to write about. He was born with "a hole in the heart" and thus had a very limited life expectancy. At the age of 8 he overheard his doctor telling his mother that she shouldn't worry because he would not live past 12. This gave him quite a challenge and he lived to 24 before Sir Douglas Robb performed the, at that time revolutionary, surgery on him to repair his heart abnormality.

He married Zoë Greenhough, also a hole in the heart survivor, and they had many years together until her death in 1990. Now Dennis himself has passed on at the age of 77 and left his own outstanding literary legacy. For me, a significant part of this legacy is *A Spectrum of Mathematics* which could not have existed as the beautiful tribute to Professor Forder that it is, without his support and assistance.

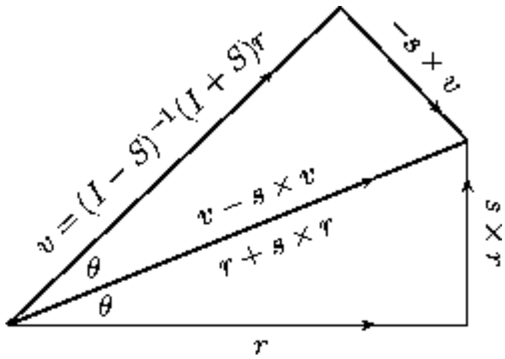
Amongst the list of 23 authors appears the name of Frederick Chong. Professor Chong was H. G. Forder's successor as Professor of Mathematics and, in a way, I am F. Chong's successor, in that I once held the chair that he inherited. The Chong paper is little more than one page long and I want to acknowledge this elegant contribution by giving my own presentation of his work 32 years later. He aimed to prove a standard result in linear algebra but in a manner that would have been dear to the heart of the Geometer that Forder was.

Let *S* denote a 3 x 3 skew-symmetric matrix, related to a vector $s \in \mathbb{R}^3$ by

$$S = \begin{bmatrix} 0 & -s_3 & s_2 \\ s_3 & 0 & -s_1 \\ -s_2 & s_1 & 0 \end{bmatrix}.$$

Then the Cayley transformation of *S* is $A = (I - S)^{-1}(I + S)$.. The aim is to prove that this transformed matrix is orthogonal and proper.

Let $\tan\theta = \|s\|$. If $r \in \mathbb{R}^3$ is orthogonal to *s*, then $(I + S)r = r + s \times r$. The two terms in this expression are orthogonal and their norms are ||r|| and ||r|| tan θ respectively. Hence,
$\|r + s \times r\| = \sec\theta\|r\|$



This means that multiplication of a vector in the plane orthogonal to *s* by *I*+*S*, is equivalent to a rotation about a vector in the direction of *s* through an angle θ and multiplication by a factor sec θ. Since multiplication by *I*-*S* is a similar magnification combined with a rotation by an angle - θ, multiplication by $(I - S)^{-1}$ corresponds to rotation through θ combined with scalar multiplication by cos θ. Thus multiplication by *A* is equivalent to rotation by 2θ and scalar multiplication by cos θ sec θ = 1. Since an arbitrary vector $r \in \mathbb{R}^3$ can be written in the form a*s*+*r* where r is in the plane orthogonal to *s*, the result generalizes to $\|Ax\| = \|x\|$, because Ax is a rotation of *x* about *s* of 2θ. In the diagram, $Ar = (I - S)^{-1}(I + S)r$ is denoted by *v*.

To find out more about Dennis McEldowney, do a Google search. To find a review of *A Spectrum of Mathematics* consult MathSciNet. To obtain a copy, see if Garry Tee still has one for you.

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

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