THE NEW ZEALAND
MATHEMATICAL SOCIETY (INC.)

NEWSLETTER

CONTENTS

NUMBER 72 April 1998 ISSN 0110-0025

PUBLISHER'S NOTICE

The Newsletter is the official organ of the New Zealand Mathematical Society Inc. This issue was assembled and printed at Massey University. The official address of the Society is:

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 Stephen Joe,
Department of Mathematics,
The University of Waikato, Private Bag 3105, Hamilton, New Zealand.

Items for submission to this journal should be submitted as text files to g.dejoux@massey.ac.nz

Editorial enquiries to m.hendy@massey.ac.nz

NZMS COUNCIL AND OFFICERS

Dr Dennis McCaughan (University of Otago), to 2000

Dr Robert McLachlan (Massey University), to 1999

Dr Mick Roberts (AgResearch), to 2000

Membership Secretary Dr John Shanks (University of Otago)

Newsletter Editor Professor Michael Hendy (Massey University)

Legal Adviser Dr Peter Renaud (University of Canterbury)

Archivist Professor John Harper (Victoria University)

Visitor Liaison Dr David McIntyre (University of Auckland)

Publications Convenor Dr David McIntyre (University of Auckland)

NEWSLETTER CORRESPONDENTS

Sub-Editors

Book Reviews Mr David Alcorn (University of Auckland)

Conferences Dr Michael Carter (Massey University)

Visitors to New Zealand Dr David McIntyre (University of Auckland)

Mathematical Miniatures Professor David Butcher (University of Auckland)

Honorary Correspondents

Greg Arnold Statistics (Massey University)

John Burnell Industrial Research Ltd (Lower Hutt)

Michael Doherty Statistics NZ (Wellington)

Bram Evans Mathematics and Statistics (University of Otago)

David Harte Statistics and Operations Research (Victoria University)

Stephen Joe Mathematics (University of Waikato)

Mark McGuinness Mathematics (Victoria University)

Robert McLachlan Mathematics (Massey University)

Judi McWhirter Statistics (University of Waikato)

Donald Nield Engineering Science (University of Auckland)

Aroon Parshotam Landcare (Palmerston North)

Chris Price Mathematics (University of Canterbury)

Mick Roberts AgResearch (Wallaceville)

Garry Tee Mathematics (University of Auckland)

EDITORIAL

Good Will?

Recently I enjoyed a viewing of the double Oscar winning film "Good Will Hunting", a film in which mathematicians and their activities are portrayed. Although the representation of mathematical research may not be as accurate as we might like, at least it is not in the "Nutty Professor" category! Mathematics provided a motivation for the main story line, the interaction between Will and his therapist. Among the highlights for me was the

monologue given by young Will in response to the CIA officers keen to recruit his talents for their cryptographic activities.

One interesting comment was that Unabomber Ted Kaczinsky might be the widest known contemporary mathematician in the US! I wonder if the general public in New Zealand are able to recall our own Fields Medallist, Vaughan Jones, given the publicity he has received locally? I was disappointed that our local film critic replaced "Fields Medallist" by "Nobel Laureate" in his review.

An excellent review from a mathematical perspective appeared in the April 1998 issue of the Notices of the AMS. Very briefly, for those who are not aware of the story, imagine if you can, how you might handle a socially maladjusted young Ramanujan appearing in your neighbourhood. Although such a once-in-a-century discovery is unlikely to appear locally, we do from time to time become

aware of young talented students who have mathematical and other talents well in advance of their peers. Because of our extramural teaching programme, Massey mathematicians have been, and still are teaching university level mathematics to students who might otherwise still be at Primary School.

It is common for the more able proportion of students at some Secondary School to be accelerated in their mathematics curriculum, frequently coming into their 7th form year already having achieved a good bursary mark. However I am not aware of any discussion of the potential benefits and disadvantages of curriculum acceleration for these students. I feel that a long-term study should be carried out. What is the effect of these accelerations when they do enter university? Direct entries seem less common than in earlier years, and degree programmes have less flexibility in today's more tightly regulated frameworks.

Previous generations of students had the very challenging Scholarship syllabus and examination as an extension at the end of their secondary careers, an option now not widely available. What is there now to excite and extend the most mathematically able of this generation? We only cater for a few of these students with the Olympiad training programme, a programme not suited to all of them anyway.

Mike Hendy

AgResearch

There have been visits from universities. Graeme Wake (Auckland) has recently held workshops with several biologists at Ruakura: Tom MacFadden (lactation physiology), John Bass (action of myostatin gene), Gil Le Roux (microbiology) to introduce dynamical systems modelling to those areas. Judi McWhirter (Waikato) visited Roger Littlejohn (Invermay) during February and March, to work on methods and software for analysing hormone profiles.

We have visited each other. Tony Pleasants and Tanya Soboleva (Ruakura) attended a recent workshop on gene mapping at Wallaceville. Simon Woodward and Dave McCall visited Grasslands to demonstrate progress withtheir pasture growth model.

Mick Roberts and Rowland Kao attended ANZIAM'98 at Coolangatta, and both presented papers based on dynamical systems models for tuberculosis in possums.

Congratulations to Tracey Flux who has been awarded an MSc with distinction for her thesis on "Dynamical Systems Models of Ryegrass and Clover Growth". This work was a joint project between the Mathematics Department at Massey University (supervisor Robert McKibbin) and Harry Clark, Paul Newton and Ken Louie at AgResearch (Grasslands).

Mick Roberts

IRL, Applied Maths

We have had a number of new faces at Applied Maths over the past few months. Towards the end of 1997 we were visited by a German student, Micol Martini as part of the requirements of her degree. She worked with Graham Weir on transient heat flows under the Taupo Volcanic Zone.

Over the university vacation, Katy Espie worked with Karen Garner developing models to optimise the benefits of wind generated electricity. In February, Shaun Hendy returned to New Zealand from Alberta, Canada, where he completed a PhD entitled "Cosmic Strings and Black Hole Space Times". He has a 4 month appointment with IRl, where he will be working with Applied Maths and the Superconducting group.

In December, Karen Garner attended the Asian Pacific Operations Research Societies Conference in Melbourne, where she gave a paper entitled "Optimising the value of wind generated electricity in New Zealand". Kit Withers

attended a NIWA conference to strengthen his contacts in the climate area.

John Burnell

UNIVERSITY OF AUCKLAND

School of Mathematical and Information Sciences

On Thursday February 19, Professor Hans Schupp (Universität des Saarlandes) had started to deliver a seminar in the Department of Mathematics, when the Auckland power system failed. Twentyfive hours later the last major cable supplying power to the central city exploded - and Auckland closed down for 16 days. The University of Auckland opened 1 week late on Monday March 9, when Auckland began limping after 16 days of total paralysis. Lights are restricted throughout the central city, lifts and air-conditioners are unusable, e-mail has crashed repeatedly and it has been very difficult to operate any laboratories. Some lectures still have to be cut short, for lack of ventilation. On Friday March 27, Mercury Energy announced that full power had been restored to the city - and the power supply promptly crashed for 90 minutes. As of April 2, many buildings in the city are keeping their hired diesel generators chugging away.

The 1997 SMIS Director's Awards for teaching were awarded to Richard Lobb (Computer Science), Geoff Nicholls (Mathematics) and Ilze Ziedins (Statistics).

Department of Computer Science

Peter Fenwick has been promoted over the bar in the Senior Lecturer's scale, Hans Guesgen has been promoted within the Senior Lecturer's scale, Bakh Khoussainov has been promoted to Senior Lecturer, S. Manoharan has been promoted within the Lecturer's scale, and Robert Sheehan has been promoted within the Senior Tutor's scale.

Seminars

Dr Ryszard Kozera (University of Western Australia), "Review of shape from shading - open problems for shape reconstruction algorithms".

Professor Robert O'Callahan (Carnegie-Mellon University), "Bright lights, big city", and "Scalable program analysis and understanding based on type inference".

Dr Qiwen Xu (United Nations University, Macau), "Towards a formal semantics of Verilog using duration calculus".

Dr Cyrus Nourani (METAAI and The University of California), "Intelligent multimedia - new technique and paradigms".

Professor Hermann Maurer, "How modern WWW systems can support teaching and training".

Dr Brian Henderson-Sellers (Swinburne University of Technology, Melbourne), "OPEN's support for UML?".

Department of Mathematics

Dr Mohan Chinnappan, from Curtin University and Queensland Institute of Technology, has been appointed as Lecturer in the Mathematics Education Unit.

Congratulations to Professor David Gauld, who has been awarded a New Zealand Science and Technology Medal by the Royal Society of New Zealand. These medals were instituted by the New Zealand Government in 1990 to recognise significant contributions to the advancement of science and technology, and they bear a likeness of Ernest Lord Rutherford on one side and the emblem of the Royal Society of New Zealand on the other. The 1997 medals were presented by the Governor-General at a ceremony in Wellington on March 19th. The NZ S&T Gold Medal for 1997 was awarded to Emeritus Professor Thomas William Walker, a soil scientist from Lincoln University.

Norm Levenberg has been promoted over the bar in the Senior Lecturer's scale; and Jianbei An, Colin Fox and Margaret Morton have each been promoted to Senior Lecturer.

Garry Tee retired at the end of January, and he is continuing to teach courses on the History of Computing and on the History of Mathematics.

Vivien Kirk's baby Joshua arrived on January 16 in the early evening, and he weighed 3.11 kg at birth. Both Vivien and Joshua are very well (Marc too!).

Andrew Stafford, head of the Mathematics Department at Manurewa High School, has a Royal Society New Zealand

Science and Technology Teacher Fellowship, and he will be spending 1998 in the Department. He is joined by Julia Horring (Kelston Girls High School) and Christine Kiernan (Lynfield College), who both have 1-year Study Awards from the Ministry of Education.

Warren Moors has accepted a 2.5 year Fellowship at Victoria University under Vladimir Pestov, starting on 1998 February 1.

Emily Lane and Louise Parsons, who have both recently completed MSc theses in Applied Mathematics, are temporary Tutors for the first part of the year, and Louise is also employed as a temporary programmer to assist staff and senior students at the Tamaki campus. Wendy Stratton is taking a joint part-time appointment as a Tutor in Engineering Science and in Mathematics.

Five new Honorary Research Fellows are attached to the Department this year: Dr Kim Myung Ho (topology), Dr Ali Jabballah (interests in algebra), Dr Majid Ali (algebra), Dr Kuo-Jye Chen (partitions and q-series), and Dr Manoj Kantroo (fuzzy sets).

Professor Vadim Adamjan, visiting from the Department of Theoretical Physics at the University of Odessa, gave a course of 9 lectures on Financial Mathematics. Professor Satya Deo, from Jabalpur, is visiting until the end of June, for joint work with David Gauld.

David Smith has undergone surgery on his back, and he expects to be back in the Department after 4 weeks.

Norm Levenberg has returned from leave at Indiana University and the University of Toronto, and Eamonn O'Brien has returned from short leave. Boris Pavlov is on leave, Jianbei An is on leave, and Michael Thomas is on leave until June, at Open University and Warwick University, John Pearson has completed his PhD, on computational results in topological graph theory.

Alona Ben-Tal and Ed Clark have been awarded University of Auckland Doctoral Scholarships from 1998. Tamsin Roberts is a new PhD student, who came from Australia to work with Bill Barton on the topic of mathematics education for indigenous cultures. Two former PhD students, Sina Greenwood and Peter Johnston, are re-activating their PhD registrations this year, under the supervision of David Gauld and John Butcher respectively, and both plan to complete in the near future. John MacCormick completed a Masters degree with Distinction in Mathematics at the University of Auckland, before going to Oxford to study for a doctorate in computer imaging towards the end of 1996. He has been awarded a Jowett Senior Scholarship at Balliol College in Oxford, carrying a stipend, dining rights and guaranteed accommodation.

A 1-day "String Seminar" was held at the university marae on March 11. Six members of the Department spent the day with 6 experts in whai (string games), sharing ideas and experiences. This joining of experts from mathematics and from Maori culture was filmed by the Audiovisual Unit, to produce a videotape for schools.

On Tuesday March 31, John Butcher was ambushed by a group of graduate students, who heartily sang "Happy birthday to you" for John's 65th birthday.

A Mini-Symposium on "Ordinary and Stochastic Differential Equations: Numerical Methods and Applications", organized by John Butcher, Robert Chan, Nicolette Goodwin and Allison Heard, was held on January 21 and 22. The principal speakers were Professor Kevin Burrage and Pamela Burrage (University of Queensland), and the other speakers included Robert Chan, Wiremu Solomon, Igor Boglaev (Massey University), Margot Gerritsen (Department of Engineering Science), Graeme Wake and Nicolas Roubidoux (Massey University).

Seminars

Dr Mark Nelson (Royal Society of London Research Fellow), "A Mathematical insight into the design of fire-resistant materials".

Abdul Mohamad, "Autohomeomorphism groups of manifolds".

Dr Margaret Morton and Dr David McIntyre, "Undergraduate mathematics: report of a conference".

Professor David Gauld, "When is a manifold metrisable if chunks of it are?", and "Matveev's property (a) and related properties".

Professor John Dempsey (Clarkson University), "Scale effects in sea-ice fracture".

Dr James Lawry (Oxford Centre for Industrial and Applied Mathematics), "Exponential asymptotics".

Professor Vaughan Jones, "On the Poincare series of a planar algebra".

Professor Alan Camina (University of East Anglia), "Sizes of conjugacy classes in finite groups", and "Some infinite

designs".

S. Adi Purnomo and Angela Tsai (4th year Technology Students), "Epidemiology of measles".

Professor Hans Schupp (Universität des Saarlandes), "Mathematics didactics in Germany".

Professor Tao Qui, (University of New England, Armidale), "Fourier analysis on starlike Lipschitz surface in the quaternion and Euclidean Space", and "Mathematical aesthetic principles/nonintegrable systems".

Professor John Butcher, "Almost Runge-Kutta methods".

Professor Michael J. D. Powell (University of Cambridge), "Radial basis function methods for global optimisation".

Professor John Hearne (University of Natal), "Optimal management of multispecies herbivores".

Dr Murray Muraskin (Queensland), "Mathematical aesthetic principles/nonintegrable systems".

Professor Al Taylor (University of Michigan), "Which linear partial differential equations can be solved by a formula?", and "Teaching undergraduate mathematics: a view from the chair".

Cameron Walker, "The infinitude of 7-arc-transitive graphs".

Dr Paul Gartside (University College of Galway), "Near-metric properties of hyperspaces", and "Ubiquity of free subgroups".

Dr Sergei Federov, "On one recent result on the intersection of weighted Hardy spaces".

Professor Boris Pavlov, "Quantum and acoustic waveguides, resonators and networks".

Dr Sing K. Nguang (Department of Electrical and Electronic Engineering), "Robust control of a class of continuous fermentation processes".

Dr Paul Bonnington, "Non-isomorphic triangulations of complete graphs".

Associate Professor Gordon Mallinson and Dr Andrew Reztsov, (Department of Mechanical Engineering), "Structural surfaces in three-dimensional vector fields".

Dr Norm Levenberg, "Hulls and envelopes".

Professor Satya Deo (University of Jabalpur), "Discrete groups and discontinuous actions".

Dr Shayne Waldron, "Multivariate polynomial interpolation".

Department of Statistics

Vera Eastwood has been promoted to Senior Lecturer, and Renate Meyer has been promoted within the Lecturer's scale. Joss Cumming has been appointed as Senior Tutor.

For this year, Robert Gentleman is spending half of his time as Senior Research Fellow at the Clinical Trials Unit of the School of Medicine.

Thomas Yee has returned from leave at Stanford University. Professor Carl Schwartz (Simon Fraser University) is visiting for this year, to work with George Seber, Alan Lee and Chris Triggs on their Marsden Research Project Mohammed Salehi has completed his PhD; with a thesis on biassed sampling.

George Seber's 60th birthday was celebrated by a Seminar and Dinner on April 7. At the seminar, Chris Triggs spoke on "The Linear Hypothesis - a review after more than 30 years", and Professor Carl Schwartz (Simon Fraser University) spoke on "The estimation of animal abundance and related parameters". After the Dinner, George departed to Australia for the rest of his leave.

Seminars

Dr Shane Henderson (Department of Engineering Science), "A numerically stable one-pass algorithm for computing variance estimators in simulation".

Dr Sharon Guy Browning (University of Washington), "Monte-Carlo estimation of relationship likelihood from genomic identity by descent data".

Professor David R. Brillinger (University of California - Berkeley), "Estimating the characteristics of space debris".

Professor Edward A. Silver (University of Calgary), "Suggested heuristic approaches for dealing with probabilistic combinatorial decision problems".

Dr Geoffrey Pritchard, "Empirical second-largest eigenvalues for Markov chains".

Dr Grace Chen (UNSW), "An effective method for simulating Gaussian and related random fields".

Garry J. Tee

UNIVERSITY OF CANTERBURY

Department of Mathematics and Statistics

Dr Alan Wilms has joined us recently at canterbury, strengthening the department's biomathematics research group. Dr Frank Lad has recently retired from the department, and will be greatly missed by all. The department is enjoying visits from Professors John Dennis (Rice University), Kees Onneweer (University of New Mexico), and Zelda Zabinsky (University of Washington), who have respectively given seminars on industrial optimization, harmonic analysis, and global optimization.

Chris Price

MASSEY UNIVERSITY

Institute of Fundamental Sciences (Mathematics)

Dr Kathi Huber, a recent graduate from the University of Bielefeld, Germany, and more recently from mid Sweden University at Sundsvall, has arrived to take a post doctoral fellowship with Dave Penny and Mike Hendy in their Marsden-funded phylogenetic analysis research project. Kathi studied under Andreas Dress (New Zealand Maths Society visiting lecturer in 1993) in the field of T-theory, a mathematical theory developed to better express the complex relationships inferred by comparative biological data.

One of the specific projects they are engaged in is the development of graphs which highlight evolutionary relationships, where the signal is too complex for traditional evolutionary tree methods to analyse. Their recent work with former PhD student Liz Watson, on the human mitochondrial sequence data she gathered in Africa, has already proved invaluable in shedding light on early human migration. Kathi has worked on the Buneman graph construction problem with Mike Hendy and with Andreas, who both have close links with the developers of the network and splitsgraph algorithms.

Glenda Anthony, Mike Carter, and Gillian Thornley attended the Symposium on Modern Undergraduate Mathematics, held in Brisbane from 24 to 27 November 1997. Mike talked about the design of the paper he teaches for Applied Science students, and Gillian talked about her experiences with the introduction of computer-based assignments in a calculus paper. This was a very valuable conference addressing some of the issues which are currently exercising all our minds, concerning what and how we should be teaching in these days of declining student numbers and increasingly powerful technology.

In July, Igor Boglaev was appointed to the permanent staff as a Senior Lecturer. Igor had been at Massey University for the previous two years on a temporary appointment.

Adrian Swift took early retirement in February 1998 and has moved north to live in Auckland, where he has part-time duties at the Albany campus. He and his wife Gillian are becoming acclimatized to the City of Sails, and all it can offer them.

Mike Hendy has been appointed member of the Marsden Fund Panels in 1998. Gillian Thornley, Charles Little and Dean Halford were made Fellows of the New Zealand Mathematical Society. Marijcke Vlieg has been appointed as an Honorary Associate in Mathematics. Robert McKibbin has been elected a member of the Executive Committee of ANZIAM (Australia and New Zealand Industrial and Applied Mathematics).

Four Massey University Doctoral Scholarships were awarded to mathematics postgraduate students.

Five students in the initial intake of MEdStuds (Mathematics) have completed their masterate program: Phillipa Arnold, Learning through language: Implications in a mathematics class; Alison Fagan, The Effects of Using Manipulatives on the Transfer of Three Dimensional Spatial Visualisation to Two Dimensions; Derek Glover, Mathematics Achievement in the Transition from Intermediate School to High School; Jan Savell, Using Parent Newsletters to Enhance Junior Primary School Mathematics; and Derek Smith, Graphical Calculators in the

Classroom. It is a credit to all of these students that they have continued to advance in their careers throughout their program of study: Alison, Derek, Phillipa and Derek all hold senior positions in secondary mathematics departments and Jan has recently joined the College of Education at Massey University. The programs were all completed extramurally, with several receiving a half year study leave to assist with thesis completion. This year it is expected that another five students will complete their MEdStuds (Mathematics) thesis research.

Grant Allen has graduated with an MSc in Mathematics. In his thesis "On the acoustical theory of the trumpet: Is it sound?", on acoustical modelling, discussing in particular the fluid dynamics near a trumpeter's lips and how this flow interacts with the rest of the trumpet system. He is now working for PEC in Marton.

Tracey Flux has graduated with an MSc with Distinction, in Mathematics. Her thesis, "Dynamical systems models for growth of ryegrass and clover," is a study and analysis of a compartmental model for grass growth. She is currently doing programming work for AgResearch in Palmerston North. Grant and Tracey both studied under Dr Robert McKibbin.

Mary Day recently defended her PhD thesis "From the Experiences of Women Mathematicians: a Feminist Epistemology for Mathematics", having studied under Dr Gillian Thornley. She is teaching maths at Freyberg High School at present.

Seminars

John Hudson, "Three-Manifolds".

Robert McLachlan, "A Unified Presentation of Systems with Integrals and/or Lyapunov Functions".

Robert McLachlan

Institute of Information Sciences and Technology (Statistics)

Massey still has statisticians although the Statistics Department exists no longer. Most of the Palmerston North group are now in the Institute of Information Sciences and Technology with computer scientists and technologists. At Albany statisticians are still grouped with mathematicians in an Institute that looks a little like our short lived Faculty of Information and Mathematical Sciences. Jeff Hunter is now at Albany as head of this Institute. After three years without a full Professor of Statistics we look forward to the arrival of Graham Wood in September. Dick Brook, who has had the stressful job of holding statistics together over this period of restructuring, hopes to retire later in the year.

In the next NZMS newsletter I will report on the beneficial effects of all these changes.

Greg Arnold

UNIVERSITY OF WAIKATO

Department of Mathematics

We welcome Ali Jaballah to our department as a half-time lecturer for 1998. His research interests are in commutative ring theory and fuzzy sets with applications to algebraic structures. He is originally from Tunisia, but did his postgraduate studies in Germany and was a Honorary Research Fellow at the University of Auckland before joining us. He is fluent in English, Arabic, French, and German.

With Ali's arrival and Ingrid Melchert also being half-time this year, our department currently has eight full-time equivalent academic staff members. This is a significant drop on the ten and a half we had at the beginning of last year.

Douglas Bridges was in Calcutta for two weeks in late January to early February as the Rani and Asutosh Ganguli Visiting Professor. While there, he delivered several lectures gathered together under the title "Constructivity in Mathematics". Douglas also conducted a two-hour seminar for the Calcutta Logic Circle. In early April, a reception was held here to mark the publication of his book titled "Foundations of Real and Abstract Analysis".

Ian Craig is still on study leave. He has been in Hamilton for the first few months of the year, but has recently gone to the USA where he will be spending time in Montana and the University of New Hampshire in Durham.

Our senior computing laboratory used by students in both mathematics and statistics has recently been upgraded. The new layout is a vast improvement on what we had previously. Also, ten new PC's running a mixture of Linux and Windows NT have been installed. The upgraded laboratory will be of great benefit to students in their course work and research.

Seminars

A. Jaballah, "The number of intermediary rings in normal pairs".

O. Braun (Institute of Theoretical Physics, Kiev), "Traffic jams and hysteresis in driven one-dimensional systems".

D. Nield (University of Auckland), "Fluid flow in a saturated porous medium".

M. Vlach (Japan Advanced Institute of Science and Technology), "Local approximations in optimization theory".

S. Fanelli (University of Rome), "Finding fast and efficient solutions of linear systems of general type".

D. Bridges, "The weak operator topology and the existence of adjoints".

Stephen Joe

Department of Statistics

Dave Whitaker has recently returned from his leave, spent at the University of Lancaster. He spent his leave working with Michael Wright on methods in optimisation. Judi McWhirter is currently on leave. She is spending part of her leave working at Invermay (Dunedin) with Roger Littlejohn on the application of the EM algorithm to fitting models for pulsatile data.

Visiting the department is Hans Hockey, statistics graduate and former biometrician at Ruakura. Hans is a statistical consultant who does work for Pfizer Pharmaceuticals in the UK and collaborates with researchers from the Natural Resources Institute (NRI) who are interested in participatory research in developing countries. During his stay he is working with Ray Littler in the Waikato Centre for Applied Statistics. Hans will be here until the end of March 1998 when he and his wife Tracey and sons Thomas and Michael (born here very recently) will be returning to the UK.

The department welcomes Sharon Gunn who replaces Jane Andrew as a tutor. Sharon is on a 10 month contract. She is currently involved in a Masters research thesis at Monash University in Melbourne which will be upgraded later this year to a PhD. Her research area is the development of cultural curriculum for statistics and as part of her research she will be tutoring in the management statistics course that Professor Nye John has implemented. During her time at Waikato, she will be under the tutelage of Andy Begg in the Science, Mathematics and Technology Education Centre.

Two of our senior students have recently completed Masters Degrees, both with First Class Honours. Max Whitaker's completed dissertation is entitled "An application of Arc Routing to Rural Delivery Routes" and Ben Bolstad's dissertation is entitled "Comparing some Iterative Methods of Parameter Estimation for Censored Gamma Data".

Judi McWhirter

VICTORIA UNIVERSITY

School of Mathematical and Computing Sciences

Life goes on here at MCS, one year after restructuring the departments of Mathematics, Computer Science, the Mathematics and Science Education Unit and the Institute of Statistics and Operations Research into the School of Mathematical and Computing Sciences. We await with interest the impact of our new VC's arrival at Easter.

One outcome of the amalgamation is the proposal for our first joint-venture course, Social and Historical Impact of the Computational Sciences. It will be taught by staff from all of the groups in the School. It is about the computational sciences rather than in them, and will examine historical, cultural and social implications of key developments. There is escalating pressure to account for everything in dollar terms, and to increase student to staff ratios in the mathematics and statistics disciplines. Computer Science has more students than it can handle, creating interesting tensions within the School. The planning for the 1998 New Zealand Mathematics Colloquium is going smoothly. So it has been busy for most of us, and here are some of the highlights:

Vistors include David Reed Solomon, recently out of his PhD from Cornell University to work with Rod Downey for four months, before taking up a postdoc at the University of Madison, Wisconsin. He is supported by a Marsden Fund grant. Rod went to visit the University of Western Florida, Berkeley and UCLA late in January.

Professor Dominic Welsh, Chairman of the Mathematics Institute at Oxford, visited Geoff Whittle for 3 weeks. He gave a seminar on his work on the computational complexity of the Jones knot polynomial. Jim Geelen, University of Waterloo, Ontario, visited Geoff for 3 weeks in February, and James Oxley, Louisiana State University, will visit Geoff for 1 week in May.

Professor Mike Fellows from Canada visited with Geoff Whittle and Rod Downey for three months this year, funded by the Marsden Fund.

Vladimir Pestov performed a Mediterranean journey from November 1997 to January 1998 as a two-months chunk of his research and study leave: he held a one-month Visiting Professorship at SISSA - International Institute for Advanced Studies, Trieste, Italy, a one-month CNR Visiting Professorship at the Group of Mathematical Physics, University of Genoa, Italy, and spent two weeks at The Ben-Gurion University of the Negev, Israel.

For the most part of his journey, Vladimir was accompanied by Irene and their two children. Irene visited the Geothermal Institute in Pisa and gave a seminar talk, and also delivered a talk at The Ben-Gurion University.

In Trieste Vladimir and Irene met ex-Victoria mathematics honours graduate Finlay Thompson, who is successfully pursuing at SISSA his PhD studies of geometrical aspects of theoretical physics, speaking rather fluent Italian (though his small children Isabella and Joel are already much better at it), and hoping to eventually come back to Wellington.

Warren Moors has been appointed as a Research Fellow to work with Vladimir Pestov on his Supergeometry Marsden project.

Phillip Rhodes-Robinson has returned from 14 months Research and Study Leave in Manchester. Jim Neyland leaves the School for a Senior Lectureship in the School of Education here at VUW. Thora Blithe takes early retirement in April this year. Peter Donelan takes over the duties of Mathematics Programme director from Lindsay Johnston this year.

Steffan Berridge has completed a Master of Financial Mathematics degree, the first such degree to be awarded here at VUW.

Stephen Binns has a scholarship to do a Phd at Penn State University.

Freda Goodall is just completing her PhD and has this to say about her work:

My dissertation subject is: The development of individualised diagnostic tests in mathematics for use with seven to fourteen year old students by teachers in order to give such focused teaching as will make mathematics recovery possible in order to enable students to become proficient in mathematics knowledge and the skills involved.

I am intending to send my work away for examination during April 1998. I have sent three papers away based on my dissertation research. They are :

Proof of the reliability of the individualised diagnostic tests in mathematics for students with from three to nine years schooling.

The importance of validity in test construction and how to test for it in individualised diagnostic tests in mathematics.

An investigation into the use of active reading skills in individualised mathematics diagnostics and their impact on mathematics education.

As part of my work I have directed the making of two video films. One is an 8 minutes video which has been entered in the Video Maths Competition being held in Berlin, August 1998. The other is a 35 minute video film for teacher education in how to conduct the diagnostics. Both videos include ideas for changing mathematics teaching so that it follows the best teaching methods used in other subjects and can be described as holistic, or humanistic, in its approach. The videos are both called "Children Love To Learn".'

My concern is for the below average assessments in mathematics of middle school age children, and third form students in New Zealand when compared with world standards, together with the low assessments of Maori and Pacific Island students .(IEA, 1987, TIMSS, 1996,1997, Garden, 1984.) I taught in a predominantly Maori school on the East Coast of New Zealand in the seventies where every class had students achieving in the 90th percentile in the N.Z.C.E.R P.A.T. tests in mathematics. I did not experience similar results in any of the other schools I taught in throughout my teaching career.

Wherever I work with children and students they ask the following question: 'Why do we have to learn Maths?' This indicates a failure on the part of the adult population to see the relevance of this major discipline which opens so many avenues for highly paid employment. I am interested in developing an interest in mathematics, among our preschoolers, as was done in reading. This to be followed up with mathematics classes taught in a holistic way which would make them relevant to the child and the student".

Mark McGuinness

BOOK REVIEWS

A First Course in Discrete Dynamical Systems

by Richard A. Holmgren, Second Edition, *Universitext*,

Springer-Verlag, New York, 1996, 223pp, US$29.95, ISBN 0-387-94780-9

This book is an inviting introduction to one-dimensional discrete dynamical systems. The main theorems of the subject are carefully developed and supported by numerous concrete examples and illustrations. Holmgren's style of exposition is lucid and personable. His book has been tested in the classroom and is suitable for good second or upper-year mathematics or science students who have at least two courses in calculus with some analysis. This book fills two kinds of needs. First, it is definitely a text of choice for a single or two-semester terminal course in discrete dynamical systems at the undergraduate level. As well, it is a solid preparatory text for those wishing to pursue dynamics at a higher level such as that found in Devaney's book, *An Introduction to Chaotic Dynamical Systems*, or the definitive works, *Iterated Maps on the Interval as a Dynamical System*, by Collet and Eckmann, and, *One-Dimensional Dynamics*, by de Melo and van Strien.

In simple terms a one-dimensional discrete dynamical system is a continuous real-valued function of a real variable which is composed with itself over and over again. The main goal in the subject is to understand the asymptotic behavior of the set of points obtained by successive compositions of the function at a given point. Such iterative systems are very easy to motivate and illustrate via examples. They appear in diverse settings such as models of biological, chemical, and economic phenomena, fractal geometry, and numerical solutions of differential equations, just to name a few. Given this, and the wide availability of inexpensive and powerful graphing computers, one can quickly access complex mathematical phenomena which lie at the heart of dynamics.

In Holmgren's book the subject of discrete dynamical systems is developed in fifteen chapters. There are 186 exercises, 56 illustrations, and appendices containing a half-dozen Mathematica programs for graphing. Beyond the introduction, the second and third chapters give a solid review of elementary real analysis and topology. This background material could well be assigned reading for students who have taken a respectable course in analysis where the writing of rigorous proofs was emphasized. However, this reviewer agrees with the author's remarks in the preface that most students will probably benefit from a careful revision of these topics right at the start of a course. The fourth chapter marks the beginning of the subject of one-dimensional dynamics proper. Here the basic concepts of fixed point, periodic point and periodicity, orbit, and stable sets are introduced and illustrated. A remarkable result in dynamical systems, and in all of analysis, is Sarkovskii's theorem. This beautiful theorem describes a certain ordering on the natural numbers which completely characterizes the periodicity of prime periods of a continuous function. The fifth chapter contains a statement and full proof of the so-called "period three" special case of Sarkovskii's theorem. This two-page proof is detailed and is a nice example of some rather intricate analysis which is accessible to undergraduate students. Although the general statement of Sarkovskii's theorem is not proved in Holmgren's book, he does encourage further study by suggesting two excellent references: Huang's proof in the 1992 issue of the Mathematics Magazine and a proof in Devaney's text.

Differentiation enters the subject matter in the sixth chapter. This chapter is particularly appealing because it contains many applications of theorems in classical analysis to fundamental results in dynamics. For example, the mean value theorem is used to prove the result on the uniqueness of fixed points, and the size of the derivative in terms of absolute value is used to motivate the concepts of hyperbolic, attracting, and repelling Families of functions which are indexed by a single parameter are introduced in chapter seven. The goal in studying such families is to understand how dynamics are affected by changing the parameter. This idea leads naturally into the notion of bifurcations. In chapter seven several types of bifurcations are described and motivated by examples and illustrations.

The next four chapters are devoted to exploring four core topics in dynamical systems via the logistic function. This function is the parameterized family $h(r;x) = rx(1-x)$ where $r > 0$ is the parameter and x is the variable. The approach Holmgren takes by using the logistic equation as the recurring example is concrete. He first uses this example in chapter eight to introduce Cantor sets and chaos. In studying the dynamics of the logistic function on a Cantor set, the concepts of chaos and topological transitivity appear in a straightforward way. Devaney's definition of chaos is adopted. There are thirteen exercises in chapter eight and one of these is devoted to exploring periodicity, transitivity, and chaos via the so-called tent map.

Two real functions are said to be topologically conjugate if they commute with a homeomorphism. Topological conjugacy is introduced in chapter nine and is developed by way of commutative diagrams. In fact, it is this part of the book that may well be an undergraduate student's first encounter with commutative diagrams, particularly in analysis. In chapter ten the period-doubling cascade is studied also via the logistic map. There are several bifurcation and iteration diagrams which encourage the reader to explore dynamics further with a computer. The Feigenbaum constant is discussed both in the text and in the exercises Basic facts of metric spaces are reviewed in the beginning of chapter eleven. A very important metric space in dynamics is the symbol space consisting of sequences of 0's and 1's. In chapter eleven one sees how the dynamics of the logistic map are encoded via topological conjugacy in the symbolic dynamics of the 0-1-sequence space.

Chapters twelve and thirteen are devoted to two important applications of one-dimensional dynamical systems: Newton's method for approximating zeros of a function and numerical solutions to differential equations. Chapter twelve on Newton's method will be of considerable interest to students who have had some exposure to numerical analysis. The treatment of Newton's method is quite thorough and Holmgren is careful in showing how the theory of dynamics developed in previous chapters is put to good use. One of the appendices contains Mathematica code for computing stable sets for Newton's method, although it is noted that this code is not time-optimal. In chapter twelve Euler's method for approximating solutions to ordinary differential equations is viewed in a dynamics context. As in the previous chapter, the development is detailed and well- motivated.

The last two chapters introduce complex dynamics. Here one is interested in the behavior of iterations of a complex-valued function of a single complex variable. Complex numbers, functions, and differentiability are reviewed in chapter fourteen. This material is straightforward and self- contained, so it is probably unnecessary for students to have had much prior exposure to complex analysis beforehand in order to appreciate Holmgren's treatment of complex dynamics. The dynamics of Newton's method in the complex setting is also studied In the fifteenth and final chapter the quadratic family of maps is introduced. This family of functions leads naturally to Julia sets and the celebrated Mandelbrot set.

The reader is encouraged to explore this set by experimenting with a computer graphics package. In short summary, this textbook comes well-recommended. Richard Holmgren has obviously taken considerable care in writing a thorough introduction to discrete dynamical systems in a style and with content that students will appreciate. This textbook is very much a mathematics book, although there are many opportunities to explore with a computer. Holmgren's book will be a pleasure to read and to learn from.

*Raymond Grinnell , University of the West Indies***Advanced Analysis on the Real Line**

R Kannan and Carole King Krueger, *Universitext,*

Springer-Verlag, Berlin-New York-London, 1996, 260pp, DM 68.00, ISBN

0-387-94642-X

SPRINGER-VERLAG PUBLICATIONS

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

Abraham R, Chaos in discrete dynamical systems. 246pp.

Beardon AF, Limits. A new approach to real analysis. (Undergraduate Texts in Mathematics) 170pp.

Berggren L, Pi: a source book. 735pp.

Blum L, Complexity and real computation. 430pp.

Bridges DS, Foundations of real and abstract analysis. (Graduate Texts in Mathematics, 174) 345pp.

Buskes G, Topological spaces. (Undergraduate Texts in Mathematics) 320pp.

Colton D, Inverse acoustic and electomagnetic scattering. (2nd ed) (Applied Mathematical Sciences, 93) 334pp.

Cornell G, Modular forms and Fermat's Last Theorem. 590pp.

Elstrodt J, Groups acting on hyperbolic space. (Springer Monographs in Mathematics) 524pp.

Fine B, The fundamental theorem of algebra. (Undergraduate Texts in Mathematics) 229pp.

Gardner M, The last recreations. 392pp.

Gordon H, Discrete probability (Undergraduate Texts in Mathematics) 255pp.

Gray A, Introduction to ordinary differential equations with Mathematica. 920pp.

Harville DA, Matrix analysis from a statistician's point of view 648pp.

Hoppensteadt EM, Weakly connected neural networks. (Applied Mathematical Sciences, 126) 380pp.

Jech T, Set theory (2nd ed). (Perspectives in Mathematical Logic) 634pp.

Kallenberg O, Foundations of modern probability. (Probability and its Applications) 530pp.

Kitchens BP, Symbolic dynamics. (Universitext) 252pp.

Klimek G, Discovering curves and surfaces with Maple. 250pp.

Kushner HJ, Stochastic approximation algorithms and applications. (Applications of Mathematics Stochastic Modelling and Applied Probability, 35) 440pp.

Lee JM, Riemannian manifolds. (Graduate Texts in Mathematics, 176) 240pp.

Li C, Invariant manifolds and fibrations for perturbed nonlinear Schrödinger equations. (Applied Mathematical Sciences, 128) 170pp.

Lickorish WBR, An introduction to knot theory. (Graduate Texts in Mathematics, 175) 230pp.

Loday J-L, Cyclic cohomology. (2nd ed). (Grundlehren der mathematischen Wissenschaften, 301) 513pp.

Osserman R (ed), Geometry V. Minimal surfaces. (Encyclopaedia of Mathematical Sciences, 90) 272pp.

Parshin AN (ed), Number theory IV. Transcendental numbers. (Encyclopaedia of Mathematical Sciences, 44) 345pp.

Petersen P, Riemannian geometry. (Graduate Texts in Mathematics, 171) 415pp.

Polak E (ed), Optimization. (Applied Mathematical Sciences, 124) 785pp.

Prokhorov YV (ed), Probability theory III. Stochastic calculus. (Encyclopaedia of Mathematical Sciences, 45) 254pp.

Remmert R, Classical topics in complex function theory. (Graduate Texts in Mathematics,172) 340pp.

Saff EB, Logarithmic potentials wit hexternal fields. (Grundlehren der mathematischen Wissenschaften, 316) 505pp.

Serre J-P, Galois cohomology. 210pp.

Sharpe RW, Differential geometry. (Graduate Texts in Mathematics, 166) 360pp.

Stillwell J, Numbers and geometry. (Undergraduate Texts in Mathematics) 275pp.

Thomee V, Galerkin finite element methods for parabolic problems. (Springer Series in Computational Mathematics, 25) 302pp.

Vasconcelos WV, Computational methods in commutative algebra and algebraic geometry. (Algorithms and Computation in Mathematics, 2) 394pp.

Willems JC, Introduction to mathematical systems theory. (Texts in Applied Mathematics, 26) 455pp.

CONFERENCES

****** 1998 ******

June 21-26 (Singapore) **5th International Conference on Teaching Statistics (ICOTS-5)**

Contact Brian Phillips, School of Mathematical Sciences, Swinburne University of Technology, P O Box 218, Hawthorn, Victoria 3122, Australia.

email: bphillips@swin.edu.au

June 29-30 (Perth) **Optimization Day V: 1998 Miniconference on Optimization**

Contact X Q Yang, Department of Mathematics, University of Western Australia.

email: yangx@maths.uwa.edu.au

June 29 - July 10 (Auckland) **Workshop on Numerical Ordinary Differential Equations in Theory and Practice**

email: ANODE@math.auckland.ac.nz website: http://www.math.auckland.ac.nz/~anode/

July 2 - 4 (Toowoomba, Queensland) **Bridging the Distance: Bridging Mathematics Network 8th Annual Conference**

Contact Janet Taylor, University of Southern Queensland.

email: taylorja@usq.edu.au

July 6 - 9 (Wellington) **1998 New Zealand Mathematics Colloquium**

Contact Chris Atkin, School of Mathematical and Computing Sciences, Victoria University of Wellington.

email: Chris.Atkin@vuw.ac.nz website http://cantor.maths.vuw.ac.nz:1998/

July 6-10 (Brisbane, Queensland) **23rd Australasian Conference on Combinatorial Mathematics and Combinatorial Computing**

Contact Elizabeth Billington, Department of Mathematics, University of Queensland, Brisbane, Queensland 4072, Australia.

email: ejb@maths.uq.oz.au

July 9 - 10 (Hervey Bay, Queensland) **Workshop on New Methods in Applied and Computational Mathematics (NEMACOM `98)**

Contact NEMACOM `98, C/- Dr S Olliveira, Department of Computer Science, Texas A&M University, College Station , TX 77843-3112, USA,

email: nemacom98@cs.tamu.edu

website: http//www.cs.tamu.edu/faculty/oliveira/nemacom98/

July 13 - 15 (Gold Coast) **4th Australian Conference on Mathematics and Computers in Sport**

Contact Neville de Mestre, Bond University.

email: neville_de_mestre@bond.edu.au

July 13 - 16 (Adelaide) **3rd (Biennial International) Engineering Mathematics and Applications Conference (EMAC `98)**

Contact Conference Chair EMAC 98, Associate Professor Jagannath Mazundor, Department of Applied Mathematics, The University of Adelaide, Adelaide, SA 5051, Australia,

email: jmazunda@maths.adelaide.edu.au

website: http://www,maths.adelaide.edu.au/Applied EMAC98

September 7 - 12 (Mission Beach, Queensland) **International Conference on Partial Differential Equations and Related Topics**

email: pde98@maths.anu.edu.au

September 28 - October 1 (Sydney) **1998 Annual Meeting of the Australian Mathematical Society**

Contact R Howlett, School of Mathematics and Statistics, University of Sydney.

email: R.Howlett@maths.usyd.edu.au

Call for Papers

DMTCS'99,

Discrete Mathematics and Theoretical Computer Science and CATS'99, Computing: The Australasian Theory Symposium,

University of Auckland and CDMTCS, Auckland, New Zealand,

18-21 January 1999

DMTCS'99 and CATS'99 will be part of the Australsian Computer Science Week (ACSW'99). Original papers are solicited in all areas of discrete mathematics and theoretical computer science. Typical, but not exclusive, topics of interest include: (a) abstract data types and specifications, (b) algorithms and data structures, (c) automata and formal languages, (d) computability and complexity, (e) computational algebra, biology, geometry, logic and number theory, (f) concurrency, distributed systems and parallel computing, (g) constructive mathematics, (h) discrete mathematics, combinatorial computing and category theory, (I) formal semantics, specification, synthesis and verification, (j) hybrid systems and nonmonotonic logic.

Authors are invited to submit papers either in hard copy by post, or electronically by email, to the address below. Electronic submissions should be in PostScript format, printable in a standard Unix environment. LaTeX source of final versions of accepted papers will be required. Submissions should not exceed 15 pages and include an e-mail address of the corresponding author.

Joint submissions to other conferences are not permitted. At least one author of each accepted paper is expected to register by Nov. 6th and present their work at the conference. The proceedings will be published by Springer-Verlag, Singapore in the DMTCS Series, and will be made available during the conference. Invited Speakers:

R. Downey (UVW, NZ) J. Goguen (UCSD, USA)

A. Nerode (Cornell, USA)

J. Pach (Hungarian Academy of Sciences)

A. Restivo (U. Palermo, Italy)

Address For Submissions DMTCS'99+CATS'99, (Attn: Michael Dinneen), Department of Computer Science, University of Auckland, Private Bag 92019, Auckland, New Zealand, Email: mjd@cs.auckland.ac.nz

The registration fee is A $400 (which includes the dinner, excursion and proceedings), or A $100 for students (including only the proceedings).

For More Information, see the home-page of the conference http://www.tcs.auckland.ac.nz/~acsw99/, or contact the local chair Bakh Khoussainov at bmk@cs.auckland.ac.nz.

Conference Committee:

C.P. Bonnington

C.S. Calude (general chair)

E. Calude

R. Coles,

P.B. Gibbons

U. Guenther

B. Khoussainov (local chair)

ACSW'99 Contact Members:

R.W. Doran (general chair)

P. Fenwick

Programme Committee: R.J. Back, TUCS, Finland, Goncharov, Novosibirsk U., Russia; J. Harland, RMIT, Australia; R.E. Hiromoto, UTSA, USA; H. Ishihara, JAIST, Japan; M. Ito, Kyoto S.U., Japan; M. Li, U. Waterloo, Canada; X. Lin, UNSW, Australia; R. Shore, Cornell U., USA; T. Tokuyama, IBM, Japan; D. Wolfram, ANU, Australia; Proceedings Editors: C.S. Calude and M.J. Dinneen

Important Dates:

Submissions Due: 31 July 1998

Notification Date: 09 Oct. 1998

Final Copies Due: 30 Oct. 1998

Registration Date

(for authors): 06 Nov. 1998

(for others): January 1999

1998 SUMMER RESEARCH WORKSHOP AT NAPIER

The 4th summer research workshop on "Analysis and Geometry" was held in Napier, during the week 3-10 January 1998. This workshop was run under the auspices of the New Zealand Mathematics Research Institute, and supported financially by the Marsden Fund, the University of Auckland's Mathematics Department, the School of Mathematical and Information Sciences at Auckland, and the USA National Science Foundation (through Vaughan Jones).

Six principal speakers each gave three 90-minute lectures aimed at a graduate-level audience, and covering quite a spectrum of mathematics within the broad theme of analysis and geometry. There was something for everyone, the topics and speakers being as follows:

Bruce Palka, University of Texas at Austin (USA), Quasiconformal mappings.

Pekka Koskela, Jyväskylä University (Finland):, Local to global problems.

Kari Astala, Jyväskylä University (Finland):, Holomorphic motions.

Klaus Schmidt, University of Vienna (Austria):, Algebra and geometry of combinatorial tilings.

John Hutchinson, Australian National University, Random fractals.

Tadeusz Iwaniec, Syracuse University (USA), Nonlinear elasticity.

Among just over 40 conference participants attending the lectures, there were about 20 graduate students from around New Zealand and also a few from Australia, plus other participants from universities in Australia, New Zealand, USA and Sweden. Many participants came with their families. Some notes from the lectures are available to those interested (on request by email to <martin@math.auckland.ac.nz>).

Also during the workshop a meeting was held to formally establish the New Zealand Mathematics Research Institute (NZMRI), which now has a growing list of members in New Zealand and overseas, and the Directors would welcome suggestions for future workshops. That Institute was initially known as the New Zealand Institute of Mathematics, as reported in the April 1997 issue of the New Zealand Mathematical Society Newsletter, but it got renamed during the workshop. Ideas may be conveyed to any one of the 5 Directors: Vaughan Jones, David Gauld, Marston Conder, Rod Downey and Gaven Martin.

The conference venue was the Napier Conference Centre, adjacent to the Masonic Hotel where all participants had rooms and meals provided, and conveniently located: a short stroll to the beach and other facilities (including the Napier Soundshell, where entertainment in the form of singing by Vaughan Jones and some students could be heard some evenings!).

Napier proved to be an attractive venue, with good weather and lots to see and do. Most of the local attractions (including Cape Kidnappers) were enjoyed by all, with the emphatic exception of the downstairs disco at the Masonic Hotel blasting into the early hours of Saturdays and Sundays.

The conference wound up with a dinner at an open-air restaurant at Clearview Estate, one of the local wineries. Bruce Palka, in his brief after-dinner speech, made an apt quotation from Mark Twain. He was then delighted to learn that Mark Twain had given a lecture at Napier on 1895-11-28, and that Twain had then stayed at the Masonic Hotel! (That first building was destroyed by fire in 1896, and the second was destroyed by the 1931 earthquake.)

Gaven Martin

UMC'98

FIRST INTERNATIONAL CONFERENCE ON

UNCONVENTIONAL MODELS OF COMPUTATION

University of Auckland, 1998 January 5-9**.**

For 60 years the Turing machine model of computation has defined what it means to "compute" something; theoretical computer science is based upon it. From 1943 until 1980 the power of computers doubled about every 2

years - now it doubles every year. But despite that superexponential growth in computing power (and cheapness), many important problems will remain computationally intractable, and significant further progress in tackling such problems demands novel technologies.

The question of possible alternative computing technologies was addressed at a conference organised by the Centre for Discrete Mathematics and Theoretical Computer Science (Auckland, New Zealand) and the Santa Fe Institute. UMC'98 brought together leading researchers in unconventional computing from a wide variety of disciplines, including computer science, mathematics, physics, psychology, engineering, biology and chemistry.

The conference featured seven invited speakers and 21 contributed talks. The Proceedings have already been published: C.S. Calude, J. Casti and M. J. Dinneen (editors), "Unconventional Models of Computation", Springer-Verlag, Singapore, 1998. They contain material grouped into three main themes: quantum computation, biologically-inspired computing and reversible models of computation. The search for models of computation that are able to break the "Turing barrier", that is, to efficiently solve problems that are difficult or impossible to solve using the Turing (or equivalent) model, is the principal goal of this work.

Artur Ekert (Oxford) explained that quantum computers offer the prospect of exponential speed-up in computation due to massive parallelism. Seth Lloyd (MIT) focussed his presentation on several unconventional quantum computing devices, including fermionic and bosonic quantum computers.

Mark Butler (Liverpool) interpreted biological systems aa examples of computational systems possessing cognitive, self-modifying and self-repairing properties. By integrating the properties of biological systems and conventional computers, we might surpass the properties of both systems. Arto Salomaa (Turku) looked at DNA computing from a language-theoretical perspective. The central theoretical component of DNA computing is Watson-Crick complementarity, which underlies the universality of models of DNA computing. The other central feature is the massive parallelism, which is responsible for rendering tractable some computational problems which sre (classically) intractable. Martyn Amos (Liverpool) talked about the practical implementation of the parallel filtering model, and John Reif (Duke) discussed a number of distinct ways of using biotechnology to do computation or processing at the molecular scale. Animesh Ray (Rochester) presented a seemingly minimum DNA computation model, which assumes the biochemical basis operations of merge, detect, synthesize, anneal and length-specific separation, but not sequence-specific separation as in many other DNA computational models.

The third main topic was reversibility. The laws of physics are themselves reversible at a microscopic level; but modern conventional computers are irreversible since they constantly discard information about their state in order to perform computation. Reversible computing devices are likely to dissipate much less energy, and hence they promise a real revolution in hardware. Tom Knight predicted that reversible computers will be faster and are soon going to be a reality. The aim of his research group is to build a reversible computer with all the accompanying software and hardware. Karl Svozil (Vienna) talked about two aspects of the physical side of the Church-Turing thesis: Zeno's argument of Achilles and the Tortoise, and the issue of one-to-one computation, that is, the bijective evolution of computations and its relation to the measurement process. Herbert Wiklicky (London) extended classical models of computing by introducing general machine models called Hilbert machines, which are more related to physical processes. In contrast to Turing and other symbol-manipulating machines, linear machine models are able to deal also with infinity and similarity. Cris Moore (Santa Fe) talked about analogue computers as dynamical systems with a finite number of continuous degrees of freedom.

The conference ended with a panel discussion chaired by Alan Gibbons (Liverpool) and Seth Lloyd, which addressed the future of these unconventional models of computing. While it is still an open question as to whether any of these unconventional models will ever go out of the laboratory, the drawing together of the disciplines of computing, mathematics, physics, engineering and biology in this pursuit has already produced new ways of thinking, a better understanding of old problems (e.g., understanding the evolution of genes and DNA sequences, or successful experiments with trapped ions or with atoms and photons in tiny cavities), and new insight.

As usually happens in research, the unpredicted discoveries and ideas which evolve during the research are likely to prove to be more interesting than the original destination.

Garry J. Tee

CENTREFOLD

Douglas Bridges

Douglas Bridges has been an active member of the mathematics community in New Zealand since he took up the Chair of Mathematics at the University of Waikato in 1989. Since this time he has figured significantly in the affairs of this community and has made people aware of the presence of mathematics from the constructive point of view. Douglas was already known to some of us before he came in 1989 as he had been a Sabbatical Visitor at Massey University during the last three months of 1976 and 1981.

Born in Edinburgh in December 1945, Douglas was educated at George Watson's College and was joint Dux of the College in his final year in 1963. He did his undergraduate studies at the University of Edinburgh (1963-67) where he majored in mathematics. This resulted in a B.Sc. degree with First Class Honours. From Edinburgh he went to the University of Newcastle-upon-Tyne (1967-68) where he completed his M.Sc with a thesis titled "Algebraic and spatial *-isomorphisms between von

Neumann algebras". Returning to the University of Edinburgh (1968-69), he undertook studies for a DipEd. This was immediately put to use at Clifton College in Bristol (1969-71) where he was mathematics master and House Tutor. He then went to Oxford University in 1972 to undertake DPhil studies. He obtained his doctorate in 1975 with a thesis titled "Constructive mathematics - its set theory and practice".

After completing his doctorate, he worked for a short while as a mathematician at GCHQ in Cheltenham (1975). He then started his academic career at the University of Buckingham where he began as a lecturer in 1975. He quickly rose through the ranks becoming Senior Lecturer in 1979, and was promoted to a Personal Chair in Mathematics in 1982. It was from the University of Buckingham that he came to the University of Waikato in 1989 to take up the Chair of Mathematics. He was Chairperson of the (then) Department of Mathematics and Statistics from 1989 to 1996.

Vivien (from Palmerston North) and Douglas were married in Oxford in 1979 and they have three children; two sons and a daughter. His hobbies are classical music (especially Schubert and Beethoven), singing, and various sports including running, golf, cricket, tennis, and soccer. He holds New Zealand Level 1 Coaching Certificates in soccer and cricket, and a Waikato Soccer Referees Badge. His weekends are seldom spent quietly: on winter Saturdays he can be seen refereeing senior soccer matches; on summer ones he will be umpiring high school cricket; and on many Sundays he leads the 8.00 am service at St Francis Church in Hillcrest.

For nearly thirty years Douglas has been an active researcher in constructive mathematics. This field originated in controversy, in 1907, when Brouwer first put forward the intuitionistic thesis that in mathematics "existence" should be interpreted strictly and uniquely as "constructibility", so that the only admissible objects in mathematics were those constructed by the human intelligence. Such a view of mathematics led Brouwer and other constructivists to reject certain laws of classical logic, and eventually to the formulation of a logic, known as intuitionistic logic, whose laws reflect constructive practice. Nowadays Douglas and several other leading researchers in constructive mathematics tend to view their activity as mathematics carried out with whatever mathematical objects are at hand, but using only intuitionistic logic. The advantage of using this logic is that the theorems and their proofs have more interpretations; in particular, they can be interpreted in recursive mathematics, classical (traditional) mathematics, and any of the several formal systems designed to model computable analysis. The disadvantage (if it is one) is that certain principles of classical logic - most famously, the law of excluded middle - cannot be used.

Douglas has carried out constructive research in a number of areas of analysis, with particular emphasis on operator theory and measure theory. In addition, he has research papers on mathematical economics, computability theory, and formal set theory.

While at Waikato he has supervised a number of graduate students. One of his PhD students recently

completed a thesis on constructive PDE theory; his current student, supported by a grant from the Marsden Fund, is studying constructive aspects of operator algebras; and another two will shortly start on constructive operator theory and Banach algebra theory, respectively.

Douglas has over 70 publications in refereed international journals. He is on the editorial boards of the New Zealand Journal of Mathematics, Philisophica Mathematica, and the Journal of Universal Computer Science. He has written a total of six books in topics such as constructive mathematics, computability, and real analysis. A reception was recently held to mark the publication of his latest book titled "Foundations of Real and Abstract Analysis".

He has held Visiting positions at institutions all over the world. These institutions include New Mexico State University, Oxford University, University of Queensland, Japan Advanced Institute for Science and Technology, Technische Universität in Vienna, and Fern Universität in Hagen, Germany. More recently, he was the Rani and Asutosh Ganguli Visiting Professor at the University of Calcutta. He has been an invited speaker at numerous conferences, the most recent being at conferences in Padova (Italy), and Essen (Germany).

At the national level, Douglas was President of the New Zealand Mathematical Society from 1995 to 1997. He is also on the Royal Society Standing Committee on Mathematical and Information Sciences. He was an Invited Member on the International Advisory Panel for the Faculty of Information Technology at the University of Malaysia, Sarawak.

He was instrumental with Professor C. S. Calude (Department of Computer Science, University of Auckland) in setting up CDMTCS, the Centre for Discrete Mathematics and Theoretical Computer Science. This Centre was founded in 1995 to support basic research on the interface between mathematics and computing.

The contribution of Douglas to the mathematics community has been significant and we expect this to continue.

Ernie Kalnins and

Stephen Joe

NEW ZEALAND MATHEMATICAL SOCIETY NOTICES

FINANCIAL SUPPORT FOR STUDENTS TO ATTEND THE

1998 NZ MATHEMATICS COLLOQUIUM

The 1998 New Zealand Mathematics Colloquium will be held at Victoria University of Wellington from Monday 6 July until Thursday 9 July. Students who wish to apply for financial assistance to attend this Colloquium should do so when they send in their registration form. The Colloquium organisers are empowered to distribute funds on behalf of the New Zealand Mathematical Society. Further information about the Colloquium may be found on the WWW page

http://cantor.math.vuw.ac.nz:1998/.

AITKEN PRIZE

(NEW ZEALAND MATHEMATICAL SOCIETY STUDENT PRIZE)

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

Named in honour of the New Zealand born mathematician Alexander Craig Aitken, this prize will be offered for the fourth time at the 1998 Colloquium to be held at the Victoria University of Wellington during the week 6-9 July 1998.

The prize will consist of a cheque for NZ$250, accompanied by a certificate. Entrants for the prize must be enrolled (or have been enrolled) for a degree in Mathematics at a universityor other tertiary institution in New Zealand in the year of the award.

During the Colloquium, they should give a talk on a topic in any branch of the mathematical sciences.

A judging panel will be appointed by the New Zealand Mathematical Society Council, and make recommendations to the New Zealand Mathematical Society President and Vice-President for the prize. Normally the prize will be awarded to one person, but in exceptional circumstances the prize may be shared, or no prize may be awarded.

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

NOTICE OF

ANNUAL GENERAL MEETING

The Annual General Meeting of the New Zealand Mathematical Society will be held at the 1998 New Zealand Mathematics Colloquium at the Victoria University of Wellington during the week 6-9 July 1998. The exact time and place of the AGM are currently being arranged.

Items for the Agenda should be forwarded by Monday 25 May 1998 to the New Zealand Mathematical Society Secretary, Dr Stephen Joe, Department of Mathematics, The University of Waikato, Private Bag 3105, Hamilton (fax number: (07) 838 4666, email address:

stephenj@math.waikato.ac.nz).

CALL FOR NOMINATIONS FOR NEW ZEALAND

MATHEMATICAL SOCIETY COUNCIL POSITIONS

As the terms of office of the Immediate Past President (Douglas Bridges) and two Council members (Mike Hendy and Stephen Joe) come to an end in 1998, nominations are called for the resulting vacancies on the New Zealand Mathematical Society Council:

Incoming Vice-President

Council members (two)

The term of office of the Incoming Vice-President is one year, after which that person is expected to become President for a two-year period, and then Immediate Past President for a further year.

The term of office of a Council member is three years. Council members may hold office for two (but no

more than two) consecutive terms.

Nominations should be put forward by two proposers. The nominee and the two proposers should be current Ordinary or Honorary members of the New Zealand Mathematical Society. The nominations, including the nominee's consent, should be forwarded by Monday 8 June 1998 to the New Zealand Mathematical Society Secretary, Dr Stephen Joe, Department of Mathematics, The University of Waikato, Private Bag 3105, Hamilton (fax number: (07) 838 4666, email address: stephenj@math.waikato.ac.nz). If nominations are sent by email, the two proposers and the nominee should each send separate email messages to the Secretary.

FORDER LECTURESHIP

The Forder Lectureship was established in 1985 following a bequest to the London Mathematical Society from the late Professor Henry George Forder (Professor of Mathematics at the University of Auckland 1934-55).

Under the terms of this Lectureship, every two years an eminent mathematician in the United Kingdom is selected (by the London Mathematical Society Council in consultation with the New Zealand Mathematical Society Council) to tour New Zealand for a period of three to four weeks and to give lectures in the six main New Zealand university centres.

The first Forder Lecturer was Professor Christopher Zeeman in 1987, and was followed by Professor Sir Michael Atiyah in 1989, Professor Peter Whittle in 1991, Professor Roger Penrose in 1993, Professor Elmer Rees in 1995, and Professor Ian Stewart in 1997.

The Forder Lecturer for 1999 will be Professor Sir Michael Berry of the University of Bristol. The arrangements of his visit are currently being organized. The contact person for his visit is Dr Stephen Joe (University of Waikato), email: stephenj@math.waikato.ac.nz.

New Zealand Mathematical Society Grantee Report

Bill Barton: University of Auckland

Duing the early part of January I attended the AMS/MAA Joint Meeting in Baltimore, Maryland and the associated one-day seminar in honour of Ubiratan D'Ambrosio, the father of Ethnomathematics. Not only was I able to attend sessions on the History of Mathematics,

Mathematics Education Reform, and Mathematics for Minorities, and to present some of my own work on ethnomathematics; but I was also able to access an overseas group of point set topologists for a research project on the conceptions of topology held by researchers from different language groups.

The Seminar for D'Ambrosio was a veritable "Who's Who" in the field, and a highlight was a twenty-minute presentation by the 103-year-old Dirk Struik on the origins of sociological investigations in mathematics. In the History of Mathematics session John Fauvel gave a delightful presentation on Barnes Wallis which I hope he repeats on his visit here this year. Also worth noting for those interested was Judith Grabiner's study on Colin McLaurin, and Marcia Ascher's analysis of the mathematical aspects of divination systems in Madagascar. The programmes for minority groups in the USA which I heard about confirmed for me that, while there is still a long way to go, the development of Maori mathematics education in New Zealand is at the forefront of such work. I hope that support for these programmes continues to grow.

But perhaps the most relevant sessions I attended were those on Mathematics Education Reform. On the one hand it was heartening to find a significant group of university mathematicians interested in what is happening in schools and ready to get involved in the debate at a fundamental level. While acknowledging the effort of those such as Derek Holton and Megan Clarke in our community, there is room in New Zealand for much more involvement and informed debate about the nature of mathematics and the directions of curriculum reforms. On the other hand I found it dismaying to hear yet again that Australian and New Zealand experiences of Unit Standards and similar developments were "successfully operating systems with positive outcomes" which should be adopted more or less uncritically. I heard the same thing in South Africa last year. I believe that Unit Standards are, at worst, harmful mathematically and unworkable at the classroom level, and at best are still being trialled with many changes taking place. That they should be promoted as a model of successful mathematics education is a serious worry.

I would like to thank New Zealand Mathematical Society for their support for my travel to the AMS/MAA Joint Meeting and for the many varied ways it provided for pursing my work and interests in cultural and historical aspects of mathematics.

LOGOS #3

Practitioners, Mathematicians, Researchers:

Mathematics Teacher Pre-Service Education

The third Mathematics Education Unit

1-day seminar in the LOGOS series was held at the University of Auckland on Wednesday 1997 December 3rd. This seminar made use of the opportunity of simultaneous visits by two Professors of Mathematics Education from our partners in Universitas 21: Professor Susan Pirie from the University of British Columbia, and Professor Kaye Stacey from the University of Melbourne.

The seminar had four presentations: Professor Pirie talked about the innovative teacher education programme at UBC; Professor Stacey used her research on learning algebra to discuss the role of research in teacher education; Judy Paterson from our own teacher education programme discussed the role of associate teachers; and Megan Clarke from Victoria University of Wellington reminded the audience of four critical factors in teacher education in this country, in particular the mathematical knowledge and the need for action in the area of Maori and Pacific Island mathematics education. Each presenter was followed by a commentator. They were: Dr Kay Irwin (School of Education), Greg Lomas (Auckland College of Education), Graeme Aitken (School of Education) and Bronwen Cowie (Waikato University).

Each presentation was followed by an equal time for discussion, and the 30 participants engaged in vociferous debate on a variety of issues. This was a strength of the seminar. The other factor contributing to the success of the day was the geographical and ideological diversity of participants. Visitors from Dunedin, Christchurch, Wellington and Hamilton were attracted to this seminar. Graduate students, teachers, College of Education and University lecturers, and private educational contractors were represented.

Bill Barton

TACKLING MATHS TEACHER SHORTAGE

A totally new way of tackling New Zealand's chronic shortage of maths teachers is being trialled. The University of Auckland is taking experienced teachers of other subjects and retraining them as maths teachers. The one-year course is the first of its kind in New Zealand. The Ministry of Education has made a grant of $250,000 to cover the costs of the trial, which include nine months full pay for the six teachers taking the course. The six teachers have been teaching a range of subjects at Auckland schools including geography, English, food technology, junior French, social sciences, biology, physical education, as well as primary teaching. Latu Huakau, for instance, is a teacher of English and social sciences at Kelston Girls' High School. She has been involved in a school initiative to increase by 10% the number of Pacific Island girls at Kelston passing School Certificate English and maths, before the year 2000. She believes that by taking part in the maths retraining programme she can act as a role model to Pacific Island girls who often have particular problems with maths. Without any background in maths and three children under the age of four, the retraining course will be a huge challenge for her. But she is determined to see it through: "I want to show the girls that if I can do it they can too." The one-year retraining programme will cover mathematics, statistics, mathematics curriculum and issues in mathematics education. Some of the participants will take summer school courses in statistics before the main programme begins in March. The six experienced teachers will be studying alongside ten students with degrees in mathematics but no teaching experience.

"We believe that each group can help the other," says Professor Ivan Reilly, director of the School of Mathematical and Information Sciences. With the teacher retraining trial in place, the University is now developing a second approach to solving the shortage of maths teachers. "A large number of immigrants have both maths degrees and teaching experience," explains Dr Bill Barton, from the Department of Mathematics. " They are not getting teaching jobs because of language difficulties, and also because they lack knowledge of the New Zealand curriculum and the culture of the New Zealand classroom." The University is now developing a proposal for a one-year diploma programme for immigrants, which would include both a language component and a classroom placement.