DEPARTMENT OF MATHEMATICS

ANNUAL REPORT 1998

PREAMBLE

The Department of Mathematics is one of three departments in the School of Mathematical and Information Sciences, together with Computer Science and Statistics, offering courses at all levels for students in several Faculties. It comprises over 70 established and temporary academic staff, based on two sites (the City campus and Tamaki campus), and with the number of its equivalent full-time students totalling 950 again in 1998 the Department is one of the largest at the University of Auckland.

The Department has two units which operate with a certain degree of autonomy: the Applied & Computational Mathematics Unit, and the Mathematics Education Unit, and also some staff have been actively involved in the Acoustics Research Centre, the Centre for Discrete Mathematics and Theoretical Computer Science, and the Mathematical Biology Research Unit. The Department has particular research strength in algebra, combinatorics, complex analysis, differential equations and mathematical modelling, functional analysis and operator theory, history of mathematics, mathematics education, numerical analysis, and topology.

Highlights in 1998 include the award to Professor David Gauld of a New Zealand Science & Technology Medal, the award to Dr Jianbei An of the New Zealand Mathematical Society's Research Award, and the election of Professor Marston Conder as a Fellow of the Royal Society of New Zealand.

Our major concern (which has not been adequately addressed by the Dean of Science despite several pleas over the last few years and some major recommendations in this year's Review of our Department and School) is the inadequate resourcing of our Department. Although recent budgetary measures have forced some reduction in the excessive cross-subsidisation of other parts of the University using the income generated by the students we teach, we continue to face a high student:staff ratio coupled with a severe shortage of desk space for postgraduate students, tutorial and computer laboratory facilities for undergraduate students, and office accommodation for staff and visiting researchers. Many of these issues were addressed in a comprehensive and very positive external review of the Department in 1998, and we look forward to substantial improvements to resourcing and line management of the Department as a result of the review's recommendations.

I. DEVELOPMENTS IN TEACHING

The Department of Mathematics provides teaching in papers for students in several faculties, traditionally Arts, Engineering and Science, but now also a very large number of students in Commerce.

For the 1998 academic year, student numbers totalled approximately 950 effective full-time students (EFTS), including 900 undergraduate EFTS (780 on the City campus and 120 at Tamaki), and just over 50 postgraduate EFTS. These numbers have plateaued this year following considerable increases in recent years, and it is particularly pleasing that the significant growth in our postgraduate enrolments over recent years has been maintained, but it is far from pleasing that this growth has not been matched by corresponding improvement of resourcing (especially space). It is also of great concern that undergraduate numbers on the Tamaki campus have declined (we believe due to the partial withdrawal of Arts and Commerce involvement at Tamaki).

Resourcing continues to be a major concern for the Department. We find ourselves in a situation where the Department has a net expenditure budget which falls well short of 50% of the income it generates to the University through government subsidies and tuition fees for students enrolled in Mathematics, and also has less than 45% of the space recommended by the UK UGC norms. In fact recent figures on occupancy costs show the Department has less than one fifth the space of another department in the Science Faculty which has fewer than half the number of students, and seven other departments in the Faculty have more space than Mathematics, despite the facts that computerisation of all disciplines has led to more uniform space requirements internationally and that Mathematics has by far the largest number of students of all departments in this Faculty! All other resource indicators such as student:staff ratios (benchmarked with other universities in the Universitas 21 group in Australia) show just how badly Mathematics is resourced while at the same time most other Departments in the Science Faculty continue to be relatively much better funded.

The effect is that we are unable to meet the learning needs of a large number of students (in terms of tutorial assistance and computer laboratories), or to offer scholarships and other support to research students competitive with those offered in other places, and face a severe shortage of desk space for postgraduate students and office space for staff and research fellows. Our current facilities are over-crowded and cannot be made available to all students without there being a significant increase in resources. Urgent improvement is required, to enable the

Department to provide a high quality environment for teaching and learning for both undergraduate and postgraduate students, and to maintain the high profile it has established in research.

Moreover, the fact that the majority of the undergraduate students in the Department receive most of their mathematics learning in large tiered lecture theatres is contrary to the findings of educational research. This problem was specifically addressed in our review this year (as in the Department's previous review in 1987) with the recommendation "The Department of Mathematics give high priority to providing space and staffing resources to support a programme of small group tutorials (of no more than 30 students in each group) for all large enrolment papers (i.e. with 100 students or more) at Stages 1 and 2, and that a Co-ordinator be appointed for the tutorial programme and all aspects of assistance in the large Stage 1 and 2 papers".

The first four graduates from the BTech (Industrial Mathematics) programme were capped at the May graduation ceremony, and another eighteen students competed in 1998. This 4-year programme at the Tamaki campus is supported across two Faculties (Science and Engineering) and includes contributions from three Departments (Engineering Science, Mathematics and Statistics). It has a problem-solving focus involving quantitative methods in mathematics, operations research, and statistics, and is strongly driven by applications. Specific papers are included which are case studies and/or project-based, designed to produce graduates with good problem-solving and communication skills. Completing students gave presentations of their project work at the end of the year, and the quality of these presentations and the fact that the majority of the students have found suitable employment is a very good reflection of the value and further potential of the programme.

Dr David McIntyre has developed a very useful and efficient computer-based system for processing examination results (enabling cross-comparisons and monitoring of pass rates etc.). Another innovation in teaching at the Tamaki campus occurred with the incorporation by Dr Paul Bonnington of graphical software (developed for research purposes) into undergraduate papers in discrete mathematics.

Paper 445.109 (Further Mathematics) was introduced in 1998, to provide a bridge between papers 445.107/8 and core papers in mathematics at higher levels. This will be continued at the Tamaki campus in 1999, but the City campus stream of 445.109 will be dropped in favour of the revised version of 445.152. Other new papers offered in 1998 on a trial basis (under Stage 3 special topics numbers) were 445.381 (Applied Discrete Algebra) and 445.388 (Mathematical Biology). Paper 445.381 had a pleasingly large enrolment of almost 50 students, while 445.388 appealed to a more select group of students. Both papers will be continued in 1999.

At the beginning of 1997 the Department initiated a revolving three-yearly cyclic review of the papers we offer. The first grouping of papers, considered in 1997, were the core Stage 1 and 2 papers 445.151, 445.152, 445.162, 445.251, 445.252 and 445.260, and teams were formed to review the remaining stage 1 and 2 papers in 1998. The following modifications were ratified at a Department meeting in December:

- New syllabi for the core papers 445.251 (Mathematics 5) and 445.252 (Mathematics 6) are to be introduced in 2000, with content as previously agreed upon. The resulting new version of 445.251 will be re-numbered as 445.253, and the replacement for 445.252 be re-numbered and re-named as 445.255 Principles of Mathematics. If resources allow then paper 445.255 should be offered every semester from the first semester of 2000 onwards.
- The papers 445.230 (Advanced Mathematics 2) and 445.231 (Advanced Mathematics 3) will be discontinued from the year 2000, due to low numbers of enrolments in these papers and their lack of success in channeling students through to a major or graduate study in Mathematics. It is felt that the new papers 445.253 and 445.255 offer sufficient choice and advantage for students who successfully complete the accelerated Stage 1 paper 445.130, and will provide a better platform for advancing to Stage 3 and 700-level Mathematics.
- Minor changes will be made to papers 445.107/108 and 445.207/208, and the distinction between numbers will be discontinued, with 445.107 and 445.207 being removed and 445.108 and 445.208 re-named as Mathematics for Business and Technology 1 and Mathematics for Business and Technology 2 respectively. (Uncertainty about the future direction of the Tamaki Campus made planning difficult for future papers there, but it was decided to pursue the possibility of discontinuing 445.109 (Further Mathematics) at Tamaki in favour of a new paper 445.209, with the desired result being that the sequence 445.108/208/209 at Tamaki would have approximately equivalent content to the sequence 445.151/152/253 at the City campus, enabling Tamaki BA and BSc students to advance to 445.255 and Stage 3 papers at the City Campus if they wish.)
- Minor changes will be made to the prerequisites for the applied mathematics papers 445.267 (Applied and Computational Mathematics) and 445.270 (Numerical Computation).
- The limit on enrolment for 445.202 (Tutoring in Mathematics) will be increased to 30 students. (Students in this paper normally assist with tutorials for paper 445.102 (Mathematics 2). In 1998 a few students were engaged as tutors in 445.151 (Mathematics 3) on a trial basis, and it is hoped to increase the number of students with this capability in 1999.)
- The viability of a "Mathematics for Humanities" paper at Stage 1 or 2 will be explored concurrently with the delayed review of paper 445.210 (Contemporary Topics in Mathematics) in 1999.

- The increased emphasis on proof techniques trialled in 445.225 (Discrete Mathematics) in 1998 has proved satisfactory and will be continued, and the prerequisites for this paper will be slightly strengthened.

All Stage 3 papers are to be reviewed in 1999, and the review cycle will start again in 2000.

The Mathematics Education Unit (MEU) is continuing to strengthen its involvement in teacher training and mathematics education:

- Eleven pre-service students enrolled in the Mathematics curriculum papers in 1998, and were joined by five "New Directions" teachers who were sponsored by the Ministry of Education to spend a year upskilling in Mathematics (having previously been successful teachers of other subjects). Of the eleven pre-service students, six have already obtained teaching jobs for 1999, four are still looking, and one withdrew from the course to have a baby. The New Directions teachers were successful in their mathematics content studies and have returned to their schools.
- A mathematics preparatory course suitable for primary teacher education has been developed, in conjunction with the School of Education.
- A 700-level paper in Statistics Education is being developed to complement the existing suite of mathematics education papers for Masters students.
- The fourth LOGOS Seminar was held in November, with two international speakers on the theme of graduate supervision in mathematics education.
- An SMIS seminar on Undergraduate Assessment was organised at the end of the year, with the main theme exploring alternative methods of assessment.

During the year the Department continued with its initiatives to improve teaching resources, consistency of the standard of core papers, and the interface with students. Information summaries for the majority of papers are posted on Departmental web pages, to facilitate ready access by both staff and students. Folders containing study guides, assignments and solutions, tests and final examinations for each paper are available in the Mathematics Education Unit's library/archive in the Department (and also databanks of lecture notes, past assignments etc. are available for some papers on disc). Recent historical information is particularly helpful to staff members who are unfamiliar with the contents and standard of a paper.

Close scrutiny continues to be given to two of the most important interfaces with students, namely the Department's Assistance Room, and the marking of assignments. Both of these facilities have been reviewed to try to ensure a consistent standard and to provide those tutors and markers involved with the appropriate training and support. During the year three workshops were held for student tutors working in the Assistance Room, and these students were also encouraged to attend workshops offered by the Centre for Professional Development and to obtain the CPD Tutoring Certificate.

Teaching initiatives continue to be severly hampered by poor facilities in some lecture theatres and the lack of computer laboratories and rooms for holding small group tutorials. At the very least the Department needs all lecture rooms in which its papers are taught to have extensive working blackboards, an overhead projector with a screen which does not obliterate the blackboard, and adjustable lighting so that both the blackboard and screen are
simultaneously visible. Also the majority of lecture rooms should be fitted with facilities for projecting output from small computers.

II. OTHER STUDENT MATTERS

Scholarships and Prizes

Senior Scholarship in Applied Mathematics	Edward Rosser
Senior Scholarship in Mathematics	John Duncan
Annual Prize in Applied Mathematics	Edward Rosser
Annual Prize in Pure Mathematics	John Duncan
Collins Prize in Mathematics	Shaun McRae
Mathematics Education Prize	Julia Horring and Christine Kiernan
University of Auckland Masters Scholarships	Colette Christiansen
	Lara Jamieson
Fowlds Memorial Prize	Emily Lane
Dean of Science Prize	Robyn Curtis
University of Auckland Doctoral Scholarships	Alona Ben-Tal
	Tina Chan
	Sanja Todorovic-Vasiljevic

Summer Scholarships

Some 25 students were engaged in research projects over the summer 1997/98, with scholarship support from the Department. Some took part in the Mathematics summer workshop on geometry and analysis at Napier in January, while others assisted staff with computational or practical aspects of individual research projects, or in the preparation of papers and other resource materials. This programme of summer scholarships has proved invaluable to both students and staff and we hope to continue to be able to offer it in the future.

Student/Staff Liaison Committee

A Student/Staff Liaison Committee (comprised of staff and student representatives from all levels) met informally four times in the year, providing a successful means of two-way communication between students and staff in the Department on matters of common concern such as course and degree structures, and more general issues such as tutorial facilities and course assessment.

III. EEO & EEdO

The Mathematics Department and its staff are strongly in favour of principles of Equal Employment Opportunity (EEO) and Equal Educational Opportunity (EEdO), in particular those pertaining to the fair treatment of all staff and students, and have acted accordingly. Over recent decades the actions and decisions made by the Department have been made with concern for the spirit of EEO and EEdO, and often initiatives have been taken specifically to deal with EEO and EEdO issues.

In 1994 an SMIS committee was set up to deal with EEO and EEdO, and immediately achieved two objectives: some improvements were made for students in wheelchairs (in liaison with Works and the University Disability Officer), and a large amount of material was written and distributed on Treaty of Waitangi Issues. Following a lapse in its activity, this committee was set up again in 1998 by the SMIS Administrator with representatives from all three Departments.

Over the years, staff in the Mathematics Department have continued independently to evolve means by which disadvantaged groups can be helped. For example: Dr Bill Barton has organised summer language schools for many students with limited knowledge and skills in English; Drs Bill Barton and Wiremu Solomon have continued to run individual and group tutorials for Maori students (often sent to them by the Student Learning Centre or Nga Tauira Puaho); Sina Greenwood organised a similar tutorial for Pacific island students this year; and Drs Liao Ke-Cheng and Jianbei An have offered Mathematics tutorials in Mandarin (and also Cantonese and Huk Ga) to students of Chinese origin.

The Department continues to run courses at foundation levels to meet the needs of students whose background in mathematics is weak. These include the Wellesley Programme and papers 445.101 Mathematics 1 and 445.102 Mathematics 2, complemented by the work of some staff through the Student Learning Centre and the Centre for Continuing Education.

We have attempted to encourage more female students to study mathematics, with some success: the percentages of women in 1997 were 44% in the Wellesley programme, 36% at Stage 1, 36% at Stage 2, 40% at stage 3, and 28% at Masters level (cf. percentages in the mid 20s fifteen years ago). In recent years some members of the Department have made visits to schools to encourage students into mathematics, particularly students from under-represented groups, and offered short courses for the math anxious. Also many EEdO issues have been discussed in our courses in Maths Education.

More recently the Mathematics Department (in conjunction with the Departments of Computer Science, Engineering Science, Statistics and Physics) has supported open days for female high school students, sponsored visiting speakers on the subject of encouraging students to follow careers in the mathematical sciences and computing, and held seminars on multi-cultural mathematics issues. Many of these initiatives have been continued by the Liaison Officer for Women in Physical Sciences and Engineering, whose appointment was strongly supported by our Department. Together with the EQUALS network in Auckland, the Department applied for and received funding for three Fulbright visitors who were based in the Department each for a period of three months in 1990, 1991 and 1994, and held workshops in Auckland and throughout New Zealand.

Some of our intervention programmes have been more successful than others, and the search continues to find a range of helpful interventions. Part of our long-standing attempt to acquire more space involves setting up dedicated space for our Maori students and Pacific Island students. Also a recent suggestion has been made to help deal with students who do not understand English well, by monitoring tests and exams and tests to find if/how they can be understood better.

Efforts are made in the assistance room and computer labs to have a balance of tutors with regard to gender and ethnicity. In addition to running courses for students without much background in mathematics, the Department offers advanced courses for more able or more qualified students, to meet their needs. The principle of giving students every opportunity has shown itself also in concern for individuals as well as groups of people: for example long ago the Department introduced an assessment formula by which a student's final mark for a course can be taken as the better of their exam mark and a combination of their exam and coursework marks. The Department runs assistance rooms, computer labs and some tutorials, and all staff have office hours, to assist those who need help to learn.

The issue of EEO has been faced mainly by trying to appoint female academic staff where possible. This has nearly always been achieved through personal contacts, although positions have all been advertised in the Bulletin of the Association of Women Mathematicians. There have been women on the permanant staff of the Department since the fifties, but not continuously, and very few. We still have only 2.5 FTE women in a total of 37.5 FTE established academic staff. Our women academics are involved in selecting new staff.

Temporary staff are a target group for EEO. Temporary tutors involved in the Wellesley programme say they have been treated very well by the Department, but now face the uncertainty of a 1-year contract (following two successive 3-year contracts) while the programme is under review. Another target group is general staff. Our secretary/typists have a copy of the report by general staff on EEO and support its findings, and also endorse the Department's stated need for more programming and technical staff support, for example to provide a consolidated programme of in-service training in the use of computer systems (especially the TeX and LaTeX mathematical typesetting packages).

Many staff with heavy family responsibilities find the support of colleagues and the environment of the department quite helpful, for example in matters of timetabling lectures or parental leave. Staff with illnesses and temporary disabilities have been treated most considerately.

The Department takes the issue of Maori staff seriously. We have only one academic staff member who is Maori. We have PhD students with Maori and Polynesian ancestry. It should be noted that we often take it for granted that staff of the Department form an international group with various religions and ancestry and first languages.

IV. RESEARCH

1. GENERAL/HIGHLIGHTS

The Department of Mathematics has a very strong research programme, with several of its staff among the world leaders in their fields, and attracts a large number of visitors each year as well as an increasing number of postgraduate students and significant research awards and funding. In 1998 no fewer than eight staff gave invited/plenary lectures at international conferences, and ten staff were involved as principal or associate investigators in successful grant applications to the Marsden Fund — in fact of the 90 or so Marsden Fund grants awarded to the University of Auckland staff so far, 13 have been awarded to members of the Mathematics Department, reflecting the very high international standing it enjoys in research.

Of particular note are three awards in 1998 to staff of the Department for their outstanding achievements:

In March Professor David Gauld was presented with a New Zealand Science & Technology Medal by the Governor-General, for significant contributions to mathematics and to science administration. Professor Gauld is a topologist who has published numerous research articles and one book, served three terms as Head of the Mathematics Department between 1981 and 1994, and served as Assistant Vice-Chancellor (Research) for the University from August 1994 to February 1997.

In July Dr Jianbei An was presented with the N.Z. Mathematical Society's Research Award for 1998, with the accompanying citation *"for his contributions to the study of modular representations of groups, in which he has established his leading expertise through a combination of deep understanding, ingenuity and technical skill"*. These awards were initiated in 1990 to foster and promote mathematical research in New Zealand and to recognise the research achievements of N.Z. mathematicians. Of a total of eleven such awards, this is the sixth award to a member of our Department, the previous award winners including Professors John Butcher (1991), Marston Conder (1993), Gaven Martin (1994), M.K. (Vaman) Vamanamurthy (1996), and Peter Lorimer (1997).

In November Professor Marston Conder was elected to a Fellowship of the Royal Society of New Zealand. Professor Conder's research interests are in combinatorial group theory, and especially its applications to discrete geometry, graph theory and topology. He was appointed to a chair at the University of Auckland at the age of 38 in 1993, and has a strong international reputation for his work on discrete objects with maximum symmetry and his use of computers to answer questions in algebra and combinatorics.

The Mathematics Education Unit was awarded research grants from both the Ministry of Education and the NZ Qualifications Authority, and held its fourth LOGOS Seminar (with two international speakers), this year on graduate supervision.

Another major highlight of the year was the beginning of a series of research workshops in Auckland on the numerical analysis of ordinary differential equations (ANODE), supported by the Mathematics Department and by a grant from the Marsden Fund. Three workshops were held in January, July and December, with distinguished speakers and numerous participants from New Zealand and overseas, including many local postgraduate students. The third of these workshops also served as an international symposium in honour of our world-renowned colleague Professor John Butcher DSc FRSNZ, preceding his official retirement in January 1999.

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3. OTHER MATTERS RELATED TO RESEARCH ACTIVITIES

Diploma, Honours and Masters Students

Name	Thesis Topic/Title	Supervisor(s)
Alex Butt	Earthquake paths in a solid Earth	Dr Steve Taylor
Andy Ka Tim Cheng	Theory & simulation of traffic network paradoxes	Dr Wiremu Solomon
Yee Hoe Cheng	Graph colourings	Dr Paul Bonnington
	Exploring structure of finitely-presented groups	Dr Eamonn O'Brien
	Colouring tessellations	Dr Margaret Morton
Hyuck Chung	Conductance Imaging	Dr Colin Fox
Stephen Yau Chung-Biu	Numerical studies of index-2 differential-algebraic equations	Dr Robert Chan
Nick Davey (Engineering)	Modelling piezo-electric chips	Dr Philip Sharp & Dr Poul Nielsen (Engnrg)
Nigel Ellis	Signal processing for acoustics	Dr Colin Fox & Dr Sze Tan (Physics)
Artemiza Filimon	Quantum computing	Prof. Boris Pavlov
	Lie groups & algebras and their applications	Dr Arkadii Slinko
Philip Ganchev	Coding, cryptography and complexity	Dr Arkadii Slinko
Jianhua Gong	Quasiconformal mappings	Prof. Gaven Martin
	Algebraic topology	Prof. David Gauld
Nicolette Goodwin	Numerical methods for ODEs	Prof. John Butcher
Alexander Grant	Convergence of improper intervals	Prof. Boris Pavlov
Diane Hall	Children's understanding of the use of variable in algebra	Dr Michael Thomas
Evaline Ha'angana	Tongan concepts of statistics	Dr Bill Barton
Michael Harré	Numerical methods for Hamiltonian problems	Dr Robert Chan
	Fractal dynamics	Chris King
Mark Holmes	Basic stochastic calculus and the Black-Scholes option pricing model	Dr Wiremu Solomon
Julia Horring (Education)	Evaluating expert mathematics teaching, mathematical thinking, and mathematical learning through discussion	Dr Bill Barton
Shih-Chang Huang	Sylow and Hall subgroup structures of the Ree groups of type G_2	Dr Jianbei An
Bethana Jackson	Numerical methods for ODEs	Prof. John Butcher
Lara Jamieson	Torsion-free subgroups in Coxeter groups	Prof. Marston Conder & Dr Eamonn O'Brien
Christine Kiernan	Exploring concepts of integration with a TI-92	Dr Michael Thomas

Alexander Krägeloh	Unstable dynamics on a Markov background	Prof. Boris Pavlov
Hisako Kure	Matrix theory	Dr Shayne Waldron
Emily Lane	Switching induced by complex eigenvalues in a structurally stable heteroclinic network	Dr Vivien Kirk
Vicky Leung	Boundary feedback stabilisation of a string-mass system	Dr Steve Taylor
Hsin-lee Lin	Optimisation of bread delivery schedules	Dr Alastair McNaughton
Chi Hang Lui	Bidirectional traffic	Dr Wiremu Solomon
Sione Ma'u	Studies on the Laplace transform	Dr Joel Schiff
Mac McKenzie (Education)	Maori language mathematics discourse	Dr Bill Barton
Kazantaka Nagata (Physics)	Chaos, fractals and bifurcations	Chris King
Rani Nalam	The effect of data presentation on students' solutions of linear equations	Dr Michael Thomas
Kate Niederer	The one day school	Dr Bill Barton
Gregory Oates	Students' collaborative problem solving in a first year calculus course	Dr Michael Thomas
Louise Parsons	Mathematical models for the foraging strategy of dairy cows	Dr Vivien Kirk
Saidur Rahman	An explicit Runge-Kutta scheme for equations with one constant delay	Dr Philip Sharp
Amanda Rubick	Improving Year 7 student learning in statistical investigations	Ms Maxine Pfannkuch
Sasha Rubin	Differential topology	Prof. David Gauld
	Elementary submodels in topology	Dr David McIntyre
Maureen Sheldon	Influences of format & context on mathematical performance	Ms Maxine Pfannkuch
Chun Wai Sin	Redirection in queues	Dr Wiremu Solomon
Jamie Sneddon	Tournaments	Dr Margaret Morton
Hugh Sorby	Vented loudspeaker design	Dr Colin Fox
Sepideh Stewart	Hidden treasure from the East	Dr Bill Barton
	Character Theory	Prof. Marston Conder
	Chaos, fractals and bifurcations	Chris King
	Introduction to group presentations	Dr Eamonn O'Brien
Simon Toon	Chaos theory for schools	Dr Bill Barton
Tony Trinick (Linguistics)	Maori language mathematics discourse	Dr Bill Barton
Chung-Ju Tsai	Quasiconformal mappings	Prof. Gaven Martin
	Sylow and Hall subgroup structures of the Suzuki groups	Dr Jianbei An
	Topological graph theory	Dr Paul Bonnington
Bernie Tsang	Variational methods for boundary value problems	Dr Steve Taylor & Prof. Graeme Wake
San Kwai Tse	Comparison of population models	Dr Wiremu Solomon
Ieuan Wickham	Dynamical systems models of the protein pool	Prof. Graeme Wake
Lara Wilcocks	Coherence in sea-ice dynamics	Dr Colin Fox
Shaun Wilson	Approximation theory	Dr Shayne Waldron
William Wright	Numerical methods for ODEs	Prof. John Butcher
Agnes Young	Extension of forest harvesting to incorporate specific block-harvesting dates	Dr Alastair McNaughton

PhD Students

Name	**Thesis Topic/Title**	**Supervisor(s)**
Alona Ben-Tal	Dynamical systems models of ferro-resonance	Dr Vivien Kirk & Prof. Graeme Wake
Jiling Cao	Topology	Prof. Ivan Reilly & A/Prof. M.K. Vamanamurthy
Tina Chan	Algebraic structures for the analysis of numerical methods	Prof. John Butcher & Dr Robert Chan / Dr Philip Sharp (adviser)
David Chen	The effective order of singly implicit methods for stiff differential equations	Prof. John Butcher & Dr Robert Chan / Dr Philip Sharp (adviser)
Hyuck Chung	Dynamics of inhomogeneous sea ice	Dr Colin Fox
Nathaniel de Lautour (Physics)	Mathematical Acoustics	Dr Colin Fox & Dr Sze Tan
Peter Dobcsanyi	Applications and adaptations of the low index subgroups process	Prof. Marston Conder & A/Prof. Peter Gibbons (Computer Science)

Grant Emms	Active Control of Periodic Noise	Dr Colin Fox
Jianhua Gong	Geometry & Analysis	Prof. Gaven Martin & Dr Norm Levenberg
Rose Gong	Spontaneous ignition of wet materials	Dr John Burnell (Industrial Research) & Prof. Graeme Wake
Sina Greenwood	Nonmetrisable manifolds	Prof. David Gauld & Dr David McIntyre
Mark Harmer	Scattering and inverse scattering on graphs	Prof. B oris Pavlov & Dr Colin Fox (adviser)
Gareth Hegarty	Boundary feedback stabilisation of a nonlinear elastic system	Dr Steve Taylor
Ye Yoon Hong	Promoting versatile understanding in integration using a computer	Dr Mike Thomas & Prof. Ivan Reilly
Peter Johnston	Numerical methods for ODEs	Prof. John Butcher
Andrei Korobeinikov	Analysis of spatial population patterns	Dr Robert Chan & Prof. Graeme Wake
Saraswathi Kota	The role of affective factors in algebra problem solving	Dr Mike Thomas & Prof. Ivan Reilly
Sanka Liyanage (Education)	A comparison of Sri Lankan and NZ teachers' use of informal assessment	Dr Mike Thomas & Dr Kay Irwin (Education)
Charlotte Martindale	Soil sulphur dynamics	Dr Bruce Thorrold (AgResearch) & Prof. Graeme Wake
Colleen McMurchy-Pilkington (Education)	Mathematics as a Gatekeeper	Dr Bill Barton & Dr Kay Irwin (Education)
Barbara Miller-Reilly	Effects of an innovative approach in a new bridging maths course	Dr Constance Brown, Dr Kay Irwin (Education) & Dr Margaret Morton
Abdul Mohamad	Topology	Prof. David Gauld & Dr David McIntyre
Guinevere Nalder (Engineering)	Waves on curved river channels	Prof. John Fenton (Melbourne) & Prof. Graeme Wake
John Pearson	Computational aspects of topological graph theory	Dr Paul Bonnington , Prof. Marston Conder & Prof. Peter Lorimer
Mark Polletti (Physics)	Assisted reverberation systems	Dr Colin Fox & Dr George Dodd (Acoustics)
Kerry Richardson	Set-theoretic topology	Prof. David Gauld & Dr David McIntyre
Tamsin Roberts	Curriculum and language for indigenous mathematics education	Dr Bill Barton & Dr Kay Irwin (Education)
Anjana Singh	Numerical methods for ODEs	Prof. John Butcher & Dr Robert Chan / Dr Philip Sharp (adviser)
Yun-Ming Tang	Functional analysis	Dr Bruce Calvert & Dr Warren Moors (adviser)
Sanja Todorovic-Vasiljevic	Symmetries of non-orientable surfaces	Prof. Marston Conder & Dr Eamonn O'Brien
Chung-Ju Tsai	Complex analysis & geometry	Prof. Gaven Martin & Dr Norm Levenberg
Brian van Dam	Geometry and topology	Prof. David Gauld & A/Prof. M.K. Vamanamurthy
Cameron Walker	Symmetric graphs with large vertex-stabiliser	Prof. Marston Conder
Ian Whaley (Physics)	Auralisation	Dr Colin Fox & Dr Sze Tan
Shinji Yamamoto	Age-structured epidemic models	Dr Michael Roberts (AgResearch) & Prof. Graeme Wake
Tsukasa Yashiro	Immersions of 3-manifolds	Prof. Gaven Martin

Research Fellows & Visitors

Name	**Affiliation**
Prof. Vadim Adamjan	University of Odessa, Ukraine
Dr Amal Al-Amleh	University of Rhode Island
Dr Majid Ali	Honorary Research Fellow, Auckland
Prof. Kari Astala	University of Jyväskylä
Prof. Christopher Baker	University of Manchester

Seminars by Visitors, Honorary Research Fellows, Staff and Research Students

Prof. Vaughan Jones FRS (University of California at Berkeley, and Department of Mathematics)
On the Poincare series of a planar algebra
Dr James Lawry (Oxford Centre for Industrial and Applied Mathematics)
Exponential Asymptotics
Prof. Kevin Burrage and Mrs Pamela Burrage (University of Queensland)
Several lectures on *Numerical Solution of Stochastic Ordinary Differential Equations*
Prof. Alan Camina (University of East Anglia)
Sizes of conjugacy classes in finite groups
Some infinite designs
S. Adi Purnomo and Angela Tsai (BTech students)
Epidemiology of measles
Prof. Vadim Adamjan (Odessa, Ukraine)
Several lectures on *Financial Mathematics*
Prof. Tao Qui (University of New England, Armidale)
Fourier analysis on starlike Lipschitz surfaces in quaternion and Euclidean space
Dr Murray Muraskin (Queensland)
Mathematical aesthetic principles/nonintegrable systems
Prof. Hans Schupp (Universität des Saarlandes)
Mathematics Didactics in Germany
Prof. B.A. Taylor (University of Michigan)
Which linear partial differential equations can be solved by a formula?
Teaching undergraduate mathematics: a view from the Chair
Prof. John Butcher (Department of Mathematics)
Almost Runge-Kutta methods
Dr Cameron Walker (Department of Mathematics)
The infinitude of 7-arc-transitive graphs
Dr Sergei Fedorov (Department of Mathematics)
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Prof. Boris Pavlov (Department of Mathematics)
Quantum and acoustic waveguides, resonators and networks
Dr Paul Gartside (University College, Galway)
Near metric properties of hyperspaces
Ubiquity of free subgroups
The space of subgroups of a compact group
Dr Sing K. Nguang (Department of Electrical and Electronic Engineering)
Robust control of a class of continuous fermentation processes
Prof. David Gauld (Department of Mathematics)
Matveev's property (a) and related properties
Dr Paul Bonnington (Department of Mathematics)
Non-isomorphic triangulations of complete graphs
Dr Norm Levenberg (Department of Mathematics)
Hulls and envelopes
Assoc. Prof. Gordon Mallinson and Dr Andrew Reztsov (Department of Mechanical Engineering)
Structural surfaces in three-dimensional vector fields
Prof. Satya Deo (R.D. University, Jabalpur)
Discrete groups and discontinuous actions
On Hopfian and co-Hopfian spaces which are compact zero-dimensional
Alexander-Spanier cohomology of powers of the long line
Dr Shayne Waldron (Department of Mathematics)
Multivariate polynomial interpolation
The eigenstructure of the Bernstein operator
Prof. Gaven Martin (Department of Mathematics)
Analytic continuation, transformation groups and the Hilbert-Smith conjecture
Dr Stephan K. Matthai (Australian National University)
A characteristics-based mixed finite-element/finite-difference method for chemical advection in fractured rock
Prof. Herb Freedman (University of Alberta)
Single species models of diffusion in a patchy environment
Dr Mark Wilson (Department of Mathematics)
Algebras of my acquaintance
Emily Lane (Department of Mathematics)

Heteroclinic cycles, networks and switching

Dr John McKenzie (Department of Mathematics)
Metrics, curvature and modifying 4-manifolds
A family of hyperbolic 4-manifolds

Dr Warren Moors (Victoria University of Wellington)
On the Choquet-Dolecki Theorem

Dr Wiremu Solomon (Mathematics and Statistics Departments)
Models of measles

Stephen McDowall (University of Washington, Seattle)
An electromagnetic inverse problem in chiral media

Prof. Tony Bracken (University of Queensland)
Modelling of drug uptake by the liver

Kerry Richardson (Department of Mathematics)
A new window on the consistency of the NMSC

Prof. Shamil U. Galiev (Department of Mechanical Engineering)
Nonlinearities, singularities and local resonant wave phenomena in Nature

Tsukasa Yashiro (Department of Mathematics)
An invariant of immersed 3-manifolds in R^4

Assoc.Prof. Don Nield (Department of Engineering Science)
Mathematical modelling of fluid flow in porous media

Dr Colin Bailey (Victoria University of Wellington)
Bounding exponentials in cardinal arithmetic

Abdul Mohamad (Department of Mathematics)
Cleavability over manifolds

Dr John Pearson (Mathematics and Statistics Departments)
Three problems involving graphs and surfaces

Louise Parsons (Department of Mathematics)
Mathematical models for the foraging strategies of dairy cows

Sina Greenwood (Department of Mathematics)
Type I manifolds

Niels Hendriksen (Exchange student from Denmark)
Should a mathematics teacher know something about the History of Mathematics?

Dr Cai Heng Li (University of Western Australia)
On automorphism groups and isomorphisms of finite vertex-transitive graphs

Sanja Todorovic-Vasiljevic (Department of Mathematics)
Bounds on the number of automorphisms of a non-orientable surface of given genus

Prof. David Gauld (Department of Mathematics)
Some highlights of the Topology conference in Mexico
Manifolds at and beyond the limit of metrisability

Prof. Geoffrey Robinson (University of Leicester)
Minimizing a quadratic form -- with applications to Character Theory

Dr Amal Al-Amleh (University of Rhode Island)
A difference equation with strong negative feedback
Boundedness of solutions of a plant-herbivore system

Dr Stuart Scott (Department of Mathematics)
Primary N-groups

Dr Dane Flannery (National University of Ireland, Galway)
Hadamard matrices and cocycles

Assoc.Prof. M.K. Vamanamurthy (Department of Mathematics)
Generalised elliptic integrals

Sina Greenwood and Jiling Cao (Department of Mathematics)
Constructing type-I manifolds with given Upsilon-trees and topological games and multifunctions

Dr Michael Meylan (Department of Mathematics)
A novel numerical solution method for the linear Boltzmann equation

Dr Shaun Cooper (Massey University, Albany)
Powers of Euler's product: theorems and conjectures

Prof. Leslie Woods (University of Oxford)
Some principles in mathematical modelling

Dr Margaret Morton (Department of Mathematics)
Infinite planar graphs

Dr Bruce Calvert (Department of Mathematics)
Operating points for infinite networks

Brian van Dam (Department of Mathematics)
Dowker and (a)-Dowker spaces via resolutions
Prof. Elwyn Berlekamp (University of California at Berkeley)
The orthodox method for evaluating game positions
Dr Colin Fox (Department of Mathematics)
Physically-based likelihoods for imaging from wave-scattering via sampling
Dr Jamanadas Patadia (Maharaja Sayajirao University, Baroda, India)
Expansive homeomorphisms on topological spaces
Lacunary Fourier Series
Dr Philip Sharp (Department of Mathematics)
Websites: information vs presentation and availability
Dr John Fauvel (Open University)
The role of history of mathematics within a university: mathematics curriculum for the 21st century
Teaching versus research? The Oxford experiences of John Wallis, J.J. Sylvester and G.H. Hardy
Dr Nick Dudley Ward (I.H.E.S. Paris, France)
Wavelets and the reconstruction of analytic signals: their uses in the modelling of linear systems
Tsukasa Yashiro (Department of Mathematics)
Immersions of surfaces in R^3, Part I: Deformations of surfaces
Immersions of surfaces in R^3, Part II: A classification of immersed surfaces
Dr Arkadii Slinko (Department of Mathematics)
Computable rings, groups and their isomorphisms
Dr Shane Henderson (Department of Engineering Science)
Rostering for call centres
Prof. Volker Mayer (Universite de Lille, France)
Uniformly quasiregular mappings of Lattes-type
Shirley Huang (University of Western Ontario)
Numerical study of the growth kinetics for TDLG equations
Prof. Walter Hayman FRS (Imperial College, London)
Successive zeros of ordinates of the Riemann zeta function
Dr John McKenzie (Department of Mathematics)
Using geometry to classify 3-manifolds: work in progress
Prof. Michael Saunders (Stanford University)
n ways to solve least-squares problems
Dr Patty McKenna (Department of Mathematics)
Embedding digraphs in orientable surfaces
Prof. Boris Pavlov (Department of Mathematics)
Few faces of Hardy's inequality
Abdul Mohamad (Department of Mathematics)
Diversity of p-adic analytic manifolds
Prof. Rua Murray (University of Victoria, BC, Canada)
Discretization effects in computational dynamical systems
Kerry Richardson (Department of Mathematics)
Characterisations of general resolutions
Garry Tee (Department of Mathematics)
Brachistochrones under central forces
Dr Alice Niemeyer (University of Western Australia)
Recognising classical groups over finite fields
Prof. Hiroshi Yamaguchi (Shiga University, Japan)
Function theory on moving domains
Prof. Chaitin Gupta (University of Nevada-Reno)
A Wirtinger-type inequality and a three-point boundary value problem
Jiling Cao (Department of Mathematics)
Generalized metric spaces and topological games
Prof. Manfred Trummer (Simon Fraser University, BC, Canada)
Computing Jacobians in spectral methods for differential equations
Prof. Charles Leedham-Green (Queen Mary and Westfield College, London)
William Steadman Aldis: Senior Wrangler and first Smith's Prizeman
Prof. Reinhard Mennicken (University of Regensburg)
On the spectrum of unbounded off-diagonal 2x2 operator matrices and applications
Dr Bakhadyr Khoussainov (Department of Computer Science)
Computable models of theories
Assoc.Prof. Malcolm Grimson (Department of Physics)

The spatio-temporal growth of bacterial colonies
Prof. Boris Pavlov (Department of Mathematics)
Quantum networks with resonance properties
Dr David McIntyre (Department of Mathematics)
Souslin trees and forcing
Dr Alan Champneys (University of Bristol)
Solitary waves and fourth-order ordinary differential equations: a review
Prof. Anant Vyawahare (Nagpur University, India)
Vedic Mathematics

Research Grants

During the year the following research grants were held by or awarded to members of the Department:

MARSDEN FUND GRANTS

Drs P. Bonnington & M. Morton	Characterisations of planar infinite graphs ($43500 incl. GST)
Prof. J. Butcher	Innovative numerical methods for ordinary differential equations ($41625 incl. GST)
Prof. J. Butcher & Dr R. Chan	Investigations in Numerical Analysis ($45000 incl. GST)
Prof. M. Conder	Combinatorial methods in mathematics and applications ($31500 incl. GST)
Prof. M. Conder, Drs J. An & E. O'Brien	Effective computational approaches to questions in group theory and applications ($80000 incl. GST)
Drs C. Fox & G. Nicholls	New statistical methodologies for physics-based inference ($65000 incl. GST)
Prof. D. Gauld	The theory of non-metrisable manifolds ($30000 incl. GST)
Prof. V. Jones	Interactions between mathematical physics, topology & group theory ($34025 incl. GST)
Profs V. Jones, M. Conder & D. Gauld	Interactions between mathematical physics, topology & group theory ($80000 incl. GST)
Prof. G. Martin	Dynamics and discrete groups ($80625 incl. GST)
Prof. G. Martin	Geometry and analysis ($112000 incl. GST)
Prof. B. Pavlov	Geometry of Hilbert space and spectral theory of nonselfadjoint operators ($150000 incl. GST)

OTHER EXTERNAL GRANTS

Dr B. Barton & Ms J. Paterson	Ministry of Education: Mathematics pre-service teacher education ($8000)
Dr C. Fox	FRST: Sea ice and Southern Ocean processes (part of $370000 grant to NZ Programme in sea-ice studies (IRL))
Prof. G. Martin	EPSRC (UK): Discrete groups (£2000), DAAD (Germany): Dynamics ($1000), Finnish Academy: QC maps ($1000), Polish Academy: QC maps ($1000)
Dr E. O'Brien	DAAD & AvHumboldt Stiftung (Germany): Algorithms for polycyclic groups ($3000)
Prof. B. Pavlov	EC: Esprit (part of US$150000 grant to Solvay Institute)
Dr M. Thomas & Andrew Stafford	RSNZ Science & Technology Teacher Fellowship: Spreadsheets resources for mathematics teaching ($53500)
Dr M. Thomas	NZQA: TI-92 and Bursary Calculus ($5000)
Prof. G. Wake	FRST/Landcare: RCD Project - model of RCD ($11555 excl. GST)
Dr S. Waldron	Various grants for Surface Approximation & Visualisation Conference: Wolfram Research ($300), NZ Math Society ($500), ANZIAM (A$500)

AUCKLAND UNIVERSITY STAFF RESEARCH GRANTS

Dr B. Barton & Prof. I. Reilly	Mathematics differentiated by culture and language ($6500)
Dr M. Chinnappan & Dr M. Thomas	Investigating and developing teachers' mathematical understanding of algebra ($6000)
Prof. M. Conder	Computational group theory & applications ($4000)
Dr N. Levenberg	Pluripotential theory ($3400)
Ms B. Miller-Reilly et al	Affective change in adult students returning to study mathematics ($1000)
Dr M. Morton	Tournaments and infinite planar graphs ($4550)
Dr E. O'Brien	Constructing the automorphism groups of p-groups ($6000)
Prof. I. Reilly	Mathematics differentiated by culture and language ($1000)

A/Prof. M. Vamanamurthy	Conformal invariants ($4000)
Dr S. Waldron	Multivariate polynomial interpolation ($10000)

AUCKLAND UNIVERSITY GRADUATE RESEARCH GRANTS

Ms S. Greenwood	Nonmetrisable manifolds ($3000)
Mr K. Richardson	Set-theoretic topology ($2000)
Ms S. Todorovic-Vasiljevic	Bounds on the number of symmetries of a non-orientable surface ($1800)

AUCKLAND UNIVERSITY RESEARCH INFRASTRUCTURE GRANTS

Dr P. Bonnington et al	High-performance computing in the mathematical sciences ($30000)

V. STAFF LEAVE AND CONFERENCES

Invited/plenary lectures marked with an asterisk (*)

Mr David Alcorn	New Zealand Mathematics Colloquium, Victoria University of Wellington (July)
Dr Jianbei An	Research and Study Leave (all year) International Conference on Representation Theory, Shanghai (June/July) *
Dr Bill Barton	Special Leave (January) and Conference Leave (August/September) Ubiritan D'Ambrosio Seminar, Baltimore (January) * Joint Meeting of the American Mathematical Society and Mathematical Association of America, Baltimore (January) First International Conference on Ethnomathematics, Granada, Spain (August) * Conference on Mathematics Education & Society, Nottingham (September)
Dr Paul Bonnington	Spectrum Education: Conference on Accelerated Learning, Auckland (November)
Prof. John Butcher	Auckland Numerical Analysis of Ordinary Differential Equations workshops, Auckland (January, July, December *) New Zealand Mathematics Colloquium, Victoria University of Wellington (July)
Dr Robert Chan	Auckland Numerical Analysis of Ordinary Differential Equations workshops, Auckland (January, July, December)
Prof. Marston Conder	Workshop on Geometry & Analysis, Napier (January) Symmetries of Graphs, Maps & Complexes, Flagstaff, Arizona (July) * Workshop on Discrete and Conformal Geometry, Vasterås, Sweden (August) * RSNZ Conference on Priorities in Science & Technology, Wellington (November)
Dr Ganesh Dixit	New Zealand Mathematics Colloquium, Victoria University of Wellington (July)
Dr Colin Fox	International Symposium on Optical Science, Engineering & Instrumentation, San Diego, California (July) International Symposium on Ice, Potsdam, New York (July)
Prof David Gauld	Research and Study Leave (1st semester) Workshop on Geometry & Analysis, Napier (January) 13th Summer Conference on Topology & Applications, Mexico City (June) Second Galway Topology Colloquium, Oxford (September) Conference on Transformation Groups, Calcutta, India (December) *
Dr Paul Hafner	International Congress of Mathematicians, Berlin (August)
Dr Allison Heard	Auckland Numerical Analysis of Ordinary Differential Equations workshops, Auckland (July, December)
Mrs Pamela Hurst	8th Annual Bridging Mathematics Network Conference, Toowoomba (July) New Zealand Mathematics Colloquium, Victoria University of Wellington (July)
Dr Vivien Kirk	Parental leave (January-July), reduction to part-time appointment (August-October)

	New Zealand Mathematics Colloquium, Victoria University of Wellington (July)
Dr Norman Levenberg	Conference leave (May) and special leave (August) Conference on Pluripotential Theory, Mid-Sweden University, Sundsval (May)
Prof. Gaven Martin	Workshop on Geometry & Analysis, Napier (January) Computational & Geometric Aspects of Modern Algebra, Edinburgh (July) Conference on Geometric Analysis, Jyväskylä, Finland (July) * ICM Satellite Conference on Conformal Geometry and Geometric Function Theory, Berlin (July) * Annual Meeting of Australian Mathematical Society (September/October) RSNZ Conference on Priorities in Science & Technology, Wellington (November)
Dr David McIntyre	New Zealand Mathematics Colloquium, Victoria University of Wellington (July) Second Galway Topology Colloquium, Oxford (September)
Dr Alastair McNaughton	New Zealand Mathematics Colloquium, Victoria University of Wellington (July) Annual Conference of Operational Research Society of NZ (August) Biennial Conference of the Institute for Operations Research and Management Sciences, Seattle (October)
Ms Barbara Miller-Reilly	Research and Study Leave (2nd semester)
Dr Margaret Morton	Joint Meeting of the American Mathematical Society and Mathematical Association of America, Baltimore (January) New Zealand Mathematics Colloquium, Victoria University of Wellington (July)
Dr Geoff Nicholls	Research and Study Leave (2nd semester) International Symposium on Optical Science, Engineering & Instrumentation, San Diego, California (July)
Dr Eamonn O'Brien	Special leave (September) Conference on Groups and Probability, Jerusalem (March) * New Zealand Mathematics Colloquium, Victoria University of Wellington (July)
Prof. Boris Pavlov	Research and Study Leave (1st semester) Conference on Mathematical Problems of Quantum Mechanics, Solvay Institute, Brussels (June) Conference on Operator Theory, University of Groningen, Netherlands (July) * International Congress on Mathematical Theory of Networks and Systems (MTNS98), Padova, Italy (July) *
Ms Maxine Pfannkuch	5th International Conference on Teaching Statistics, Singapore (June)
Prof. Ivan Reilly	Research and Study Leave (2nd semester)
Dr Joel Schiff	Research and Study Leave (all year)
Mrs Moira Statham	8th Annual Bridging Mathematics Network Conference, Toowoomba (July) New Zealand Mathematics Colloquium, Victoria University of Wellington (July) Conference on Building Maths Bridges, by internet (July)
Mr Roy Swenson	New Zealand Mathematics Colloquium, Victoria University of Wellington (July)
Dr Stephen Taylor	4th SIAM Conference on Control and its Applications, Florida (May) New Zealand Mathematics Colloquium, Victoria University of Wellington (July)
Dr Michael Thomas	21st Maths Education Research Group of Australasia Conference, Brisbane (July) New Zealand Mathematics Colloquium, Victoria University of Wellington (July)
Dr Shayne Waldron	9th International Conference on Approximation Theory, Nashville (January) New Zealand Mathematics Colloquium, Victoria University of Wellington (July)

In addition several staff and graduate students contributed significantly to the organisation of conferences, notably the Mathematics Summer Workshop at Napier in January, the ANODE workshops (on numerical methods for ordinary differential equations) at Auckland in January, July and December, and the 3rd Conference of the Centre for Discrete Mathematics and Theoretical Computer Science at Auckland in January 1999.

VI. COMMUNITY SERVICES

In 1998 as in previous years, staff of the Mathematics Department contributed fully and at various levels to the work of the University, in teaching and research programmes in and with other Departments and Faculties, service on University and Faculty committees and as conveners of Standing Committees of the Board of Studies for the Mathematical and Information Sciences.

Staff regularly provide professional advice to the public and scientific community. Often this advice is routine and given free of charge (as a valuable public relations exercise), while in other cases this advice can be quite involved, requiring much skill and expertise. Also members of staff continue to play a full part in the national and international mathematics communities, contributing for example to professional societies as members of their executives and conveners of special committees, organising conferences and workshops, and serving on the editorial boards and as referees of international mathematics journals.

Items referred to in the following paragraphs are selections from an enormous range of contributions:

David Alcorn continued his work as chair of the committee responsible for publishing the NZ Journal of Mathematics, and Prof. Gaven Martin took over as Editor after Prof. John Butcher retired from this position during the year. Also David Alcorn served as Book Reviews Editor for the NZ Mathematical Society Newsletter.

Dr Jianbei An delivered an invited series of seminars at Peking University and conducted a workshop at Beijing Normal University. He also acted as Examiner/Assessor of three PhD and three Masters theses in Mathematics at Peking University, Capital Normal University and Southwest-China Normal University, and was a member of the Scientific Committee of the International Conference on Representation Theory held at Shanghai.

Dr Bill Barton served on the Editorial Board of the journal Educational Studies in Mathematics and as Assistant Editor of the Mathematics Education Research Journal and as Review Editor of the journal For the Learning of Mathematics. He also supervised two visiting scholars from Denmark, served as a panel member for the CPD seminar on PhD studies, organised problem-sheets for national distribution in universities and polytechnics for Mathematics Week, organised the fourth LOGOS seminar (on graduate supervision in mathematics education), served on the National Executive of the NZ Association of Mathematics Teachers, gave invited lectures at the University of Illinois and the State University of Michigan, and gave numerous invited lectures at schools and other tertiary institutions in the Auckland region. Also together with Drs Paul Hafner and Arkadii Slinko he organised and supervised a local examination for the Ibero-American Mathematics Olympiad.

Dr Paul Bonnington served (as Vice-President) on the Council of the Combinatorial Mathematics Society of Australasia.

Prof. John Butcher served on the Editorial Boards of five international journals, and for part of the year as Editor of the NZ Journal of Mathematics. He also served as a member of the Mathematical and Information Sciences advisory panel for the Marsden Fund, wrote a series of popular articles for the NZ Mathematical Society Newsletter and the NZ Mathematics Magazine, and together with Dr Robert Chan organised two international workshops in Auckland on the numerical analysis of ordinary differential equations.

Dr Bruce Calvert served on the Editorial Board of the Journal of Abstract and Applied Analysis.

Dr Mohan Chinnappan coordinated the special interest group on Mathematics Cognition/Instruction for the Mathematics Education Research Group of Australasia (MERGA), and contributed to a workshop on "Maths Meets People" for the Wellington Mathematics Association.

Prof. Marston Conder served on the Foundation for Research, Science & Technology's Advisory Committee for NZ Science & Technology Postdoctoral Fellowships, and together with Profs David Gauld, Vaughan Jones and Gaven Martin and Prof. Rod Downey (VU Wellington) he co-founded the NZ Mathematics Research Institute, of which he now serves as a co-Director and Treasurer. He also served as External Examiner for the Mathematics Division of Nanyang Technological University (and National Institute of Education) in Singapore, a member of the University's Postgraduate Committee, and convener of the Arts Faculty promotions sub-committee.

Drs Colin Fox and Geoff Nicholls were members of the organising committee for an international conference on Bayesian Methods for Inverse Problems, held in San Diego in July under the auspices of SPIE (the International

Society of Optical Engineering). Also Dr Fox acted as Head of the University's Acoustic Research Centre, and served on the Committee of the NZ Acoustical Society.

Prof. David Gauld gave invited lectures at the University of Alaska at Fairbanks, Shandong University, Zhangzhou Normal University and Xiamen University in China, and RD University (Jabalpur) and APS University (Rewa) in India. Also he served as Secretary of the NZ Mathematics Research Institute, and as Examiner for the NZ Educational Scholarships Trust.

Lynne Gilmore served as coordinator of the Tamaki Science & Technology Staff/Student Consultative Committee, a member of the Auckland branch committee of the Association of University Staff, AUS Status of Women representative, and a member of the AUS Academic Staff Collective Employment Contract negotiation team. She also participated in the University's "Resolve" Harassment Contact Network, and as a Marker for the 1998 Bursary Examination in Mathematics with Statistics.

Dr Paul Hafner served as a member of the Science Faculty's panel for Distingished Teaching Awards.

Chris King is completing a 600-page biogenesis encyclopedia "Genesis of Eden", now available in research format as an audio-visual CD. He is also helping facilitate numerous other biodiversity restoration initiatives, including serving as a contributory planner for a major millennial Wisdom Conference to he held at the Dead Sea in December 1999, and as a director of Conservation Reserve.

Dr Vivien Kirk served on the Council of the NZ Mathematical Society.

Dr Norm Levenberg acted as "rapporteur" for the thesis defence of a PhD student at the Université Paul Sabatier (Toulouse, France).

Prof. Gaven Martin organised the summer workshop on geometry and analysis at Napier in January.

Dr David McIntyre served as an Editor of the Topology Atlas, and as Publications Convener and Visitors Coordinator for the NZ Mathematical Society.

Dr Alastair McNaughton was an invited participant in a panel for the University's "Top Teachers" seminar (run by the CPD), and was engaged in consultation on forest harvesting and the NZEST scholarships examination for Mathematics with Calculus.

Dr Margaret Morton continued to present courses for the Centre for Continuing Education, and served on the University's Education Committee and on Lecturers' Association.

Dr Eamonn O'Brien served on the Advisory and Editorial Council for the computational algebra system GAP (advising on development of the system and acting as an editorial board for software submitted for the system). He has also been invited as Guest Editor for a special issue of the Journal of the Australian Mathematical Society to appear in 1999.

Maxine Pfannkuch served on the Editorial Board for SAME Papers (University of Waikato).

Prof. Boris Pavlov conducted a conference at the Solvay Institute (Brussels) on Mathematical Problems of Quantum Mechanics. He also gave invited lectures at Birmingham University (Alabama), the University of Calgary (Alberta) and the University of St Petersburg, and he served on the University's search committee for a Chair in English Literature.

Prof. Ivan Reilly, Dr Arkadii Slinko and retired Assoc. Prof. Gordon Hookings all continued their important work in the training and selection of NZ participants for the International Mathematical Olympiad, and Dr Slinko was co-Leader of the NZ team for the 1998 IMO which took place in Taipei (Taiwan). Also Prof. Reilly carried out the role of Esquire Bedell for numerous official functions and graduation ceremonies the first semester.

Dr Joel Schiff served as Executive Editor of the NZ Journal of Mathematics, and as Editor and Publisher of the journal "Meteorite!".

Dr Wiremu Solomon served as a member of the Executive Committee of the New Zealand Statistical Association, the Science Faculty's Staffing Committee and its Committee for Maori Equity in Science, and the University's Operations Research Committee. He was also a Marker for the 1998 Bursary Examination in Mathematics with Statistics, and continued to offer tutorials for Maori and Pacific Island students in mathematics.

Moira Statham served as Deputy Coordinator of the Wellesley Programme, and together with Pam Hurst was involved in interviewing prospective students for the programme, their subsequent orientation to the University, pastoral care, and giving them advice on options for further study upon completion.

Dr Steve Taylor assisted with the Coca-Cola Youth Expo, and gave an invited talk on careers and opportunities in mathematics at the Selwyn College Careers Expo.

Dr Mike Thomas served as a member of the RSNZ Science & Technology Teacher Fellowship Panel, the Auckland College of Education BEd Advisory Board, and the Executive of the Auckland Mathematics Association.

Dr Shayne Waldron is serving on the organising committee for an international conference on Surface Approximation and Visualisation, to be held at Christchurch in February 1999.

Drs Wayne Walker and Rhys Cullen have become involved in serious and ongoing debate over infectious diseases and vaccination issues, with North Health and the Department of Health.

VII. OTHER MATTERS

Staffing

Two long-standing members of the Department, Peter Lorimer and Garry Tee, retired from their positions (a personal chair and a senior lectureship respectively) at the end of January. One of these positions was re-advertised as a Lectureship in Mathematics Education, and offered to Dr Mohan Chinnappan (of Curtin University) who took it up in July. Dr Chinnappan's interests are in the use of technology in mathematics education, and cognitive aspects of learning mathematics. Prof. Graeme Wake resigned from his chair in Industrial and Applied Mathematics in order to take up the Chair of Applied Mathematics at the University of Canterbury at the end of May. Dr Ramankutty vacated his position (a senior lectureship) in September. The Department hopes to re-fill two sub-professorial positions in Mathematics and to make a joint appointment (with Engineering Science and Statistics) to a chair in Industrial Mathematics as soon as possible.

Short-term visiting positions were held by Professors Tony Bracken (Queensland), Satya Deo (Jabalpur), Geoff Robinson (Leicester), Rosamund Sutherland (Bristol), Al Taylor (Michigan), Manfred Trummer (Simon Fraser), and Dr Paul Gartside (Galway). Also several postdoctoral researchers and PhD students were appointed as Temporary Lecturers and Temporary Tutors.

Sabrina Young resigned from her position as Secretary/Typist in May, and was subsequently replaced by Min-Young Lee, who has considerable computing experience and a degree in Statistics. Ray Maharaj was appointed to a new position as Computer Services Manager for the Mathematics and Statistics Departments in June. Also three part-time temporary general staff appointments were made for the Mathematics group at Tamaki: Louise Parsons (computer programming and software support), Shao-Zheng Zhou (unix system support) and Scott Wackrow (head lab demonstrator), the latter two positions being shared with the Statistics Department. Bev Grove resigned from her position as Department Assistant in December. This position has been upgraded to one of Department Manager, and will be taken up by Ross McCallum in January 1999.

Alastair McNaughton (Senior Tutor) completed his PhD in Engineering Science on forest harvesting schedules ("Long-term scheduling of harvesting with adjacency and trigger constraints").

The following academic staff were successful in their applications for promotion:

Dr Jianbei An	Special increment in Senior Lecturer scale
Dr Eamonn O'Brien	To Senior Lecturer.

Prof. Gaven Martin has been appointed Head of Department of Mathematics for a 3-year term commencing 1st February 1999, in succession to Prof. Marston Conder who has completed his term.

In December the Department honoured one of its most illustrious members by celebrating the scientific work of Professor John Butcher, with a 3-day international symposium (as part of the ANODE series mentioned earlier). Numerous speakers from overseas and other parts of New Zealand and the University as well as the Department presented lectures and speeches in honour of John, including guest lecturers Professor Christopher Baker (Manchester) and Professor Gerhard Wanner (Geneva), and visiting dignatories Sir John Scott, President of the Royal Society of NZ, and Professor Rob Goldblatt, President of the NZ Mathematical Society. Further speeches and congratulatory letters were delivered during a special session one afternoon and the Department Annual Dinner held one evening.

Department Administration

Many staff members have made substantial contributions to the effective administration of the Department. Thanks are especially due to the Department Assistant (Bev Grove) and all the general staff, and to the following staff for taking on key responsibilities in the Department:

Head of Department's Advisory Group	Prof. John Butcher, Prof. David Gauld, Dr Vivien Kirk
Department Staffing Advisory Committee (Academic Promotions)	Dr Bill Barton, Prof. John Butcher, Prof. David Gauld, Prof. Gaven Martin, Dr Margaret Morton, Prof. Boris Pavlov
Academic Staff Performance Reviewers	Prof. John Butcher, Prof. David Gauld, Prof. Gaven Martin, Prof. Boris Pavlov, Prof. Ivan Reilly, A/Prof. Vamanamurthy
Head of Applied & Computational Maths Unit	Prof. John Butcher
Head of Mathematics Education Unit	Dr Bill Barton
Head of Tamaki Mathematics Group	Dr Robert Chan
Director of Graduate Studies	Prof. Gaven Martin
Research Coordinator	Prof. John Butcher
Teaching Coordinator	Dr Margaret Morton
Computing Services	Dr Paul Bonnington, Dr David McIntyre, Dr Philip Sharp, Dr Mike Thomas
BTech (Industrial Maths) Programme Coordinator	Dr Steve Taylor
Enrolment Coordinator	David Alcorn
Timetable Administrator	Chris King
Examinations Coordinator	Chris King
Publicity Officer	Dr Bill Barton
Regulations/Handbooks	Dr David Smith
EEO/EEdO Representative	Dr Bruce Calvert
NZ Mathematical Society Correspondent	Garry Tee
Webmaster	Dr Shayne Waldron
Overseas Students & Ad Eundum Admissions	Assoc. Prof. M.K. Vamanamurthy
Library Liaison Officer	David Alcorn
Convener of Staff/Student Liaison Committee	Greg Oates
Safety Officer	John Pemberton
Lab Demonstrators Coordinator	John Pemberton
Markers Coordinator	Roy Swenson
Department Research Report Series	Olita Moala
Seminars:	
Algebra, Geometry & Combinatorics	Dr Eamonn O'Brien
Analysis	Dr Norm Levenberg
Applied, Computational & Industrial Maths	Dr Robert Chan
Mathematics Education	Ms Judy Paterson
Topology	Prof. David Gauld and Sina Greenwood
Faculty Representatives:	
Arts	David Alcorn
Commerce	Dr Joel Schiff
Engineering	Dr Geoff Nicholls

New Zealand Journal of Mathematics

The New Zealand Journal of Mathematics is jointly produced by the Department and the New Zealand Mathematical Society, with Editorial staff consisting of Prof. John Butcher (outgoing Editor), Prof. Gaven Martin (new Editor), Dr Joel Schiff (Executive Editor), Dr Jianbei An (Associate Editor), Sabrina Young and Jean Martin (Editorial Assistants), and Betty Fong (Production Assistant). Two issues of Volume 27 (Numbers 1 and 2) of the NZJM were published during the year. Members of Department who have served on the Editorial Board are Professors Marston Conder, David Gauld, Vaughan Jones, Gaven Martin and Graeme Wake, and the Department's representatives on the Management Committee are David Alcorn (who is also convener of the Committee) and Prof. Ivan Reilly.

VIII. OVERALL COMMENTS ON WORK AND PROGRESS WITHIN THE DEPARTMENT

The Department is actively pursuing the broad aims set out in the University's "2001: Missions, Goals and Strategies" document, encouraging a high quality environment for teaching and learning, continuing to undertake world class research in several areas, and attracting and supporting an increasing number of postgraduate students. Our ability to achieve these aims is however being severely hampered by a relatively low level of resourcing, not only in terms of staffing and operating budget but also particularly in terms of a severe shortage of office accommodation and desk space (for staff, visiting researchers and postgraduate students), and a lack of adequate tutorial and computer laboratory facilities for undergraduate students.

The Department was externally reviewed in 1998, and received a laudatory report on its research and teaching programmes, along with some constructive suggestions for further developments. The lack of a properly mounted system of tutorials was highlighted, along with serious concerns about the Department's resourcing and line management through the Faculty of Science.

As pointed out in Section I, but significantly worth repeating:

Resourcing continues to be a major concern for the Department. We find ourselves in a situation where the Department has a net expenditure budget which falls well short of 50% of the income it generates to the University through government subsidies and tuition fees for students enrolled in Mathematics, and also has less than 45% of the space recommended by the UK UGC norms. In fact recent figures on occupancy costs show the Department has less than one fifth the space of another department in the Science Faculty which has fewer than half the number of students, and seven other departments in the Faculty have more space than Mathematics, despite the facts that computerisation of all disciplines has led to more uniform space requirements internationally and that Mathematics has by far the largest number of students of all departments in this Faculty! All other resource indicators such as student:staff ratios (benchmarked with other universities in the Universitas 21 group in Australia) show just how badly Mathematics is resourced while at the same time most other Departments in the Science Faculty continue to be relatively much better funded.

The effect is that we are unable to meet the learning needs of a large number of students (in terms of tutorial assistance and computer laboratories), or to offer scholarships and other support to research students competitive with those offered in other places, and face a severe shortage of desk space for postgraduate students and office space for staff and research fellows. Our current facilities are over-crowded and cannot be made available to all students without there being a significant increase in resources. Urgent improvement is required, to enable the Department to provide a high quality environment for teaching and learning for both undergraduate and postgraduate students, and to maintain the high profile it has established in research.

I wish to record my gratitude to staff of the Department and SMIS for their assistance, cooperation and support through the year.

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