THE NEW ZEALAND
MATHEMATICAL SOCIETY (INC.)

NEWSLETTER

VACANCY: EDITOR

The Newsletter needs a new Editor to take over now, or at the very latest, by the end of the year. To find out what's involved, contact the Editor, and to register interest, contact the Editor or any member of the Council of the Society.

Mark Schroder, Editor;
University of Waikato.

CONTENTS

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SECRETARIAL

NOMINATIONS FOR COUNCIL

So far, three nominations have come to hand for the three vacancies on the Council of the N.Z.M.S:

Dr Chris Triggs, Mt Albert Sub-Station, A.M.D. of the D.S.I.R., nominated by Murray Jorgensen and Ernest Kalnins,

Dr Alfred Sneyd, Maths Department, University of Waikato, nominated by Murray Jorgensen and Ernest Kalnins, and

Prof. R.I. Goldblatt, Maths Department, Victoria University, nominated by J. F. Harper and P. J. Thomson.

None of them offered a 'thumb-nail sketch'.

D.R. Breach,

Secretary.

NOTICE OF ANNUAL GENERAL MEETING

The Annual General Meeting of the N.Z. Mathematical Society will take place at 16.30h (4.30pm) on Thursday 21 May, 1987, in room L4 at the University of Waikato, Hamilton.

D.R. Breach,

Secretary.

Publisher's Notice

The Newsletter is the official organ of the New Zealand Mathematical Society. It is produced in the Mathematics Department of the University of Waikato and printed at the University of Otago Printery. The official address of the Society is:

New Zealand Mathematical Society (Inc.)

c/- The Royal Society of New Zealand,

Private Bag,

Wellington.

However, correspondence should normally be sent direct to the Secretary, Dr Derrick Breach, Department of Mathematics, University of Canterbury, Christchurch, New Zealand.

EDITORIAL

"QUALITY AND PERFORMANCE OF STUDENTS"

Professors N.C. Phillips and E.A. Horsman convened a working party, which presented its report under this title to the N.Z. Universities Conference in May 1969. So many of their comments remain valid, that I found it hard to select. Dig out their report, and read it! Though not concerned with this topic, the quotations below strike with some force again nowadays.

> #81 ... Universities are established "for the advancement of knowledge and the dissemination thereof by teaching and research". Only a proportion of each new staff member's salary, accommodation and supporting services is in respect of teaching additional students. [Editor's note: However, the 'trigger mechanism' makes this a steadily increasing proportion.] Presumably, if scientific research and scholarly work is not carried on in a University, it will have to be done and paid for somewhere else. Its association in the universities with the training of future scholars is an efficient and economical way of supplying the needs of the present and the future together. [Editor: I would like to believe this - but is there any evidence for it?]
>
> #82 What proportions should be allowed for teaching and research respectively, it is difficult to say. It might be argued that if student numbers do not expand, other university work will not expand. But we can expect that new knowledge and fresh problems requiring solution will grow at least as fast as student numbers. It is not unreasonable to suggest that only half of the increased cost of additional staff should be attributed to the teaching of students.

The correlation implied above, between student numbers and scholarly work and research, could hardly be justified even then; nowadays, it is clearly false. However interesting these quotations may be, they do not have much to do with the 'quality and performance of students'. Since 1969, at least two syllabus changes have been made, one too recently for its effects to appear. Nevertheless, many of us feel, without much in the way of hard evidence, that the quality of the intake has gone down steadily in the last ten or fifteen years. Some research has been done, though: by the O.E.C.D., for example.

Whether this deterioration has occurred or not, university students and staff have become aware of the problems that deficiencies in elementary maths can cause. Indeed, students sometimes find to their horror that the maths they had joyfully left behind at school surfaces again, in those subjects commonly seen as refuges for the un- or anti-mathematical. In response, some have called for maths departments to put on various sorts of 'remedial programme'. Mathematicians seem divided on this issue.

Some say: it's not our problem, the answer lies in the schools, we do not have the staff numbers to do this, and in any case, most of us know very little about **teaching** such elementary maths and have no idea where the blocks and difficulties lie for such students.

Others reply: that may be true, but if **we** do not try to break the cycle caused by the shortage of teachers with an adequate training in maths, it will never be broken... and that means that **we** must shoulder the load, with the help and cooperation of the teacher's colleges and the Department of Education.

Overseas, various types of remedial programmes have run for ten years or more, and their results have begun to appear. We do not have to live in a vacuum and we can learn from this accumulating experience, unless we choose to turn our backs on the whole problem.

M.S.

SUB-EDITORIAL

Contents

This issue lacks some expected or promised features: the Centrefold has not come to hand yet (I hope it will appear in August), I still have not found time to produce a questionnaire, and a written version of Dr Noel Barton's Wairakei address, 'Mathematical Modelling: a personal view', has not turned up in my computer mail-box yet.

Acknowledgement

Ever since I became Editor, Janice Walker typed all this material quickly, accurately and above all, cheerfully – even under the provocation of my indecision and alterations. On her departure from the Department (see later), I am only too happy to record my gratitude for her work beyond the call of normal duty.

Production

Up till now, I produced the Newsletter by 'cut and paste' from typescript: Frank Bailey, the University draughtsman, kindly gave me the run of one of his equipment. (He also drew 'pi in the sky', which graced the cover of issue 34, and which I should have given credit for at the time.)

Early this year, Janice Walker finally overcame her distrust of keyboards and disembodied screens, and 'found' the University's Mass11 word-processor. Further, Phil Taylor (Royal Holloway and Bedford New College, University of London) visited our Computer Scientists a few weeks ago, and some of us caught his enthusiasm for \TeX . So Rex Croft in Computer Services quickly enabled a version with preview on Tektronics (using TROFF fonts, I believe), and then in response to my query, created a Mass11-to-\TeX translator. In short, parts of this issue were typed as usual, Janice pushed a lot of it through Mass11, and finally, I used the whole lot to learn \TeX on. Please excuse my mistakes!

HONORARY CORRESPONDENTS

Prof. R.H.T. Bates	Electrical and Electronic Engineering, University of Canterbury
Dr K.A. Broughan	Mathematics, Waikato University
Dr M.R. Carter	Mathematics and Statistics, Massey University
Mr M. Doherty	Department of Statistics, Wellington
Dr J.F. Harper	Mathematics, Victoria University
Dr R.A. Littler	Ministry of Agriculture and Fisheries
Mr R.S. Long	Mathematics, University of Canterbury
Mr J.H. Maindonald	D.S.I.R., A.M.D., Mt Albert
Dr G. Olive	Mathematics and Statistics, University of Otago
Department Secretary	Mathematics and Statistics, University of Auckland
Prof. D.A. Nield	Theoretical and Applied Mechanics, University of Auckland
Mr G.J. Tee	Computer Science, University of Auckland
Dr G.J. Weir	D.S.I.R., A.M.D., Wellington

NOTICES

REMINDER
NZMS Research Survey

The December issue of the Newsletter included a lift-out questionnaire which those involved in research in the mathematical sciences were asked to complete. So far I have had 27 responses (for which much thanks) - but THERE MUST BE MORE OF YOU OUT THERE! I'd be most grateful if those who have not yet responded would dig the questionnaire out of their files, complete it and return it to me. We need information which is as complete and accurate as possible in order to prepare a soundly based report for inclusion in the Science and Technology Reviews. These were published by the (now defunct) National Reseasrch Advisory Council, and this aspect of its activity is expected to continue.

Mike Carter,

Massey.

COLLOQUIUM 87

Some excellent speakers have accepted our invitation to address the Colloquium, including –

Professor P.J. Hilton (SUNY, Binghampton) Algebra/Topology,

Professor J. Pedersen (Santa Clara) Geometry/Education, and

Dr P.J. Thompson (VUW) Statistics.

We hope to put on the special sessions listed below: to contribute, please contact the coordinator.

Mathematics and Statistics in Industry Dr R.A. Littler (Ruakura and the Waikato Centre for Applied Statistics)

Mathematics and Computing Professor R.J. Hosking (U. Waikato)

Mathematics Education Mr M.R. Carr (U. Waikato)

The last of these sessions will form part of a Maths Education Day, being organised by Mr. Carr for Friday, 22 May. More details shortly.

We have also arranged for a book display, and a display of computer hard- and soft-ware of interest to mathematicians, and in particular, the Sun workstation will be on show.

For information or registration, please contact the Colloquium Secretary –

Dr M.A. Jorgensen,
Mathematics Department,
University of Waikato,
Hamilton, N. Z.

MASSEY UNIVERSITY
POST-GRADUATE SCHOLARSHIP IN MATHEMATICS

(Tenure: three years)

An opportunity has arisen for a post-graduate student to participate in a program of Ph.D research into the mathematical modelling of the ignition characteristics of coal. The project will involve working with a group concerned with the formulation, solution, and experimental verification of the appropriate differential equation model. Considerable scope exists for the appointee to influence the thrust of the project. The funding has been provided by the Department of Scientific and Industrial Research. It is expected that the appointee will have considerable mathematical expertise, computing experience, some sympathy for experimental work, and have qualified for an honours degree in engineering or science. Emolument will be equivalent to the University Grants Committee Post-graduate scholarship (currently $8520 p.a.) and is tax free. Some supplementary funding should be available from either the Department of Mathematics and Statistics or the Department of Production Technology.

Persons interested should contact Professor Graeme Wake, Department of Mathematics & Statistics, Massey University, Palmerston North. Full applications should also be sent to Professor Wake at this address as soon as possible and should contain a statement of academic record, and the name of a person to whom reference can be made, and a starting date.

THE UNIVERSITY OF AUCKLAND
New Zealand
SENIOR TUTORSHIP IN MATHEMATICS

(Department of Mathematics and Statistics)

Applications are invited for this full-time position. Candidates should have a good honours degree or a Ph.D. in mathematics together with proven expertise as a teacher at tertiary level, particularly in algebra and calculus. An interest in the use of microcomputers in teaching, particularly the ability to develop software for remedial and undergraduate mathematics courses would be an advantage.

Commencing salary will be determined in accordance with qualifications and experience within the range NZ$30,500 - $38,000 per annum.

Conditions of Appointment and Method of Application are available from the Assistant Registrar (Academic Appointments), University of Auckland. Applications, in accordance with the Method of Application, should be forwarded as soon as possible but no later than the closing date, 22 May 1987.

W.B. Nicoll, Registrar,

University of Auckland,

Private Bag, Auckland, N.Z.

NEW ZEALAND STATISTICAL ASSOCIATION
38th Annual Conference
Announcement and Call for Papers

The 38th Annual Conference of the New Zealand Statistical Association will be held at the University of Canterbury, Christchurch, New Zealand from Monday 24 August to Wednesday 26 August 1987. The Conference will dovetail with the Australasian Meeting of the Econometric Society which is to be held at the same location from August 26 to August 28 1987.

In addition to papers of general statistical interest, it is proposed that the Conference include a session on the Census on the Monday, a session on Statistical Education and a session on Time Series on the Tuesday, and a session on Medical Statistics on the Wednesday. This arrangement will minimise any overlap with, and will complement, the Australasian Meeting of the Econometric Society.

Abstracts of all presented papers will be published in the New Zealand Statistical Association Newsletter. Speakers are also encouraged to submit written versions of their papers to 'The New Zealand Statistician'.

A Special General Meeting of the Association will be held during the Conference and a public lecture is planned for the Tuesday night prior to the Conference dinner. Hostel accommodation will be available: the current cost for bed and breakfast is NZ$25.30 per day.

Conference Fee

	Full Fee	One Day Fee
NZSA Member	$30	$15
Non NZSA Member	$40	$20
Full-time Student	$10	$5

August is the height of the ski season and the close proximity of Christchurch to the ski fields should be a substantial inducement for any statistician/skiers.

For further information and registration forms please write to:

Conference Chairman,

NZ Statistical Association,

P.O. Box 1731,

Wellington, N.Z.

O R S N Z
23rd Annual Conference 1987
CALL FOR PAPERS
Guest Speaker: Professor G.G. Brown

Dates: Monday 24 August and Tuesday 25 August 1987

Venue: Victoria University of Wellington

Speaker: ORSNZ has invited Professor Gerald Brown from the Naval Postgraduate School at Monterey to be the Keynote Speaker at the 1987 Annual Conference. Jerry Brown is one of the leading developers of optimisation technology in the world and co-authored GENNET and the X-system. He has published extensively and applied large scale optimisation in a variety of companies.

Papers: Papers are invited on all aspects of the theory and practice of Operational Research. Astracts of intended papers should be sent to the conference organisers **before 4 May 1987.** Papers to be presented at the conference will be approximately 30 minutes duration. Further details on the form of the final paper will be sent to authors after receipt of abstracts. These will be published in a special issue of NZOR. Deadline for papers is **2 June 1987.**

Students: Student papers are especially welcome. Student travel grants may be available - obtain details from the Conference Organisers.

Poster Sessions: If interested, contact the Conference organisers for details.

Registration Forms: Obtain them from the Conference organisers. Members will receive them nearer the date. Send abstracts and papers to:

ORSNZ Conference Secretary,

c/- DSIR/AMD,

P.O. Box 1335,

Wellington, N.Z.

Enquiries: Rona Bailey, WN 727-855 x 861 and Cheryl McDonald, WN 733-465 x 79

PHYSICAL SCIENCE AND MATHEMATICS TEACHING

The papers listed below were presented to the Symposium on Physical Science and Mathematics Teaching, 56th ANZAAS Congress, January 1987, and are now available in a booklet:

'Science for Everyone?' (Glynn Lorrigan)

'Senior School Physics' (Trevor Castle)

'South Seas Science – Sinking or Swimming?' (Brian Rivers)

'Mathematics and Science Teaching – Who Helps Who?' (Andy Begg)

Copies can be obtained from: The Dean of Science, Massey University, Palmerston North. Enclose $5 per copy with your order. Cheques should be made payable to Massey University.

BEATRICE HILL TINSLEY
more information

Newsletter 35 reported that the Education Committee of the NZ Institute of Physics and Massey University had published a 97 page book, edited by Scott Whineray, on 'Beatrice (Hill) Tinsley 1941-1981: Astronomer' in November 1985, and that it was being distributed to secondary schools to encourage girls to study science. (Her dates were misprinted in that report as 1914-1981, to the editor's regret.)

Her father, Edward Hill, has written 'My Daughter Beatrice: A Personal Memoir of Dr Beatrice Tinsley, Astronomer', and he distributed copies privately to her friends. Some were so impressed by it, that they had it published by the American Physical Society (New York, 1986, ISBN 0-88318-493-1). Dr Miriam A. Foreman, Deputy Executive Secretary of the APS, explains that the APS published the memoir 'to encourage young people, particularly women, to choose careers in physics and to help their families and teachers understand the preparation, struggles and enormous satisfaction involved in such a choice'.

G.J. Tee

WORLD DIRECTORY OF MATHEMATICIANS

The 8th edition of the World Directory of Mathematicians is now available. This 976 page directory contains the names and addresses of approximately 40 000 individual mathematicians from 83 countries – about one-third more names than its predecessor.

The price of the Directory is $30, plus shipping and handling, and no discounts are allowed. Shipping and handling charges are: for surface delivery – $2 for the first copy, $1 for each additional copy; for air delivery – $5 for the first copy, $3 for each additional copy. Orders should be sent to:

American Mathematical Society,

Sales Department,

P.O. Box 6248,

Providence, RI 02940, U.S.A.

All orders must be prepaid. For institutions which require invoices before payment can be made, proforma invoices will be sent upon receipt of unpaid orders.

ADVANCE NOTICE

1988 Australian Applied Mathematics Conference

The conference will be held at Leura in the Blue Mountains near Sydney from 7 February to 11 February, 1988 Further information is available from Prof R Grimshaw or Dr WD McKee at the School of Mathematics, UNSW, Box 1, Kensington, NSW 2033, Australia

LOCAL NEWS

D.S.I.R.

A.M.D., Mt Albert

Nye John left us at the end of January to return to the University of Southampton. He was visited very soon after his return by David Whitaker, who'd been to Brussels for a conference on "Microcomputers and Decision Making". Work they'd done together while Nye was at Mt Albert featured in a joint seminar, at Southampton, on "Non-linear Programming in Statistical Designs".

Peter Thakurdas left us in February to start as a graduate entrant in the Auckland University School of Medicine. We wish him well as he trains for his new career.

J.H.M.

A.M.D., Wellington

Both TEX and LATEX are in full production on the NCN microvax, with output to an Apple laserwriter. Recently, an automated graphics facility using PLOT79 has been incorporated at AMD into LATEX.

Robin Wooding retired officially at lunchtime on February 5. His longterm association with AMD, and his contribution to the theory of porous media, will be missed.

Euan Drummond has retired from ANU and settled in Waikanae.

Mark McGuinness has returned after six weeks collaboration at Lawrence Berkeley Laboratory, together with brief visits to Caltech and Canada.

David Whitaker delivered an invited paper at Brussels on microcomputer modelling for the small firm, and presented talks on joint work with Nye John and Chris Triggs at Warwick and Southampton.

Kit Withers is spending several weeks at ANU collaborating with Prof. Chip Heathcote.

Geoffrey Thomas visited AMD on 22 January, presenting a seminar on salt transport in the River Murray system.

An extremely successful seminar session between AMD and some of our DMS, CSIRO counterparts (including Noel Barton, Tony Miller, Frank de Hoog, David Jenkins, David Jackett and Nick Stokes) was held over Waitangi weekend. Ivar Stakgold, Graeme Wake and John Harper also attended. Thirteen seminars were presented, together with a round table discussion about mathematics in industry.

Brian Gray from MacQuarie presented a seminar on some of the outstanding mathematical problems in combustion theory.

The Mathematical Physics and Operations Research groups presented papers and poster sessions at the AMS meeting at Wairakei.

G.J.W.

MASSEY UNIVERSITY

Dick Brook returned in January from a year on leave in India, England and Australia. He found that academic visitors to India were made extremely welcome. A shortage of foreign exchange makes it hard for Indian academics to travel, and overseas visitors help to reduce the feeling of isolation. Dick feels that others travelling on sabbatical to the northern hemisphere should consider the possibility of spending some time in India - cheap or free accommodation can often be made available to a visitor who is doing some work at a University or Research Institute.

"Ganes" Ganesalingam took a short period of overseas leave during November and December. He attended the International Congress on Mathematical Ecology at Trieste, where he presented an invited paper on his work on the mixture approach to clustering.

Professor Ivar Stakgold of the University of Delaware visited us during January and February, mainly to continue collaborative work with Graeme Wake. He was also an invited speaker at the Australian Applied Mathematics Conference at Wairakei.

Wayne Burrows, Shirley Dixon, Gerard Palmer and Mike Steel have been appointed as Junior Lecturers, and Robert Crawford, John Koolard and Paul Rhodes, as Graduate Assistants for 1987.

Seminars:

Prof. Martin Golubitsky (Houston), 'Hopf bifurcation with symmetry'

Prof. Ivar Stakgold (Delaware), 'Extinction and dead zones in reaction-diffusion problems'.

M.R.C.

OTAGO UNIVERSITY

It was exciting for us to have Professor Saunders Mac Lane visit our Department for 4 weeks as the '1987 NZMS Visiting Lecturer'. His vitality and magnetic qualities were reflected in both his mathematical and extra-curricular activities – and resulted in the exhilaration of many staff members and students, as well as the exhaustion of his "Appointments Secretary", the undersigned.

It was easy to see why he is in great demand as a lecturer, for his lectures were enthusiastic, entertaining, and inspiring. He gave Open Lectures on "The rise and fall of abstraction in mathematics and art" in the Science Faculty and on "Scientific advice on government policy - can this be objective?" for the Royal Society of New Zealand, a short course of four lectures on the "Philosophy of mathematics", as well as one philosophy and four mathematics seminars (listed below), all to overflow audiences. His lectures attracted staff and students from various departments (including Dr Mark Schroder from the University of Waikato who came here for two weeks to hear and meet Professor Mac Lane, and who, as editor of this Newsletter will be writing a special report on his visit elsewhere in this issue). [Editor's Note: If I can find time...]

Professor Mac Lane also had consultations with administrators and various staff members in the Mathematics, Statistics, and Philosophy Departments, and visited classes in some local schools so that he could chat with both students and staff.

His non-mathematical activities included: bicycle rides, swims in the sea (at St Clair, Warrington, Waikouaiti, and Long Beach), hikes to Flagstaff, Swampy, and Signal Hill (in which some of the others had a hard time keeping up with him), as well as visits to Larnach's castle, the albatross seal, and penguin colonies, and attendance at a musical at the Fortune Theatre.

A large number of academic and non-academic people had memorable meetings with Professor Mac Lane, and his visit will have lasting effects on many of us.

Dr Ray Enlow has returned from his 1986 leave at the Aerospace Engineering Department at the University of Michigan (in the U.S.A.). While there he investigated "turbulent boundary layers", the state of the art in computer-aided design equipment and finite element codes, with regard to how such developments might be put to use in teaching applied mathematics..., and gave lectures on both "finite element analysis" and "structural analysis (solid mechanics)".

Graham Haase (former HOD of mathematics at both Kings High School (10 years) and Kaikorai Valley High School (14 years), as well as former N.Z. chess champion) has been appointed as "Organising Tutor" for the Department.

Barry Wansbrough (who has a first class B.Sc. Honours degree in mathematics from Otago) has been appointed as Assistant Lecturer.

The 1986 regional meeting of the CMSA (Combinatorial Mathematical Society of Australasia) was organised by Professor Holton and held at the University of Otago, December 1-5. It was attended by 25 participants with 15 coming from Australia, Canada, Britain, Israel, and Hungary. Its proceedings will be published in Ars Combinatoria.

Professor Bill Jackson of Goldsmith College of University of London visited the Department in December and January, primarily to attend the regional meeting of the CMSA and collaborate with Professor Holton.

Mr Andy Begg of the Department of Education addressed the Otago Mathematics Association on "Where are we going in mathematics?"

Seminars:

Professor Mac Lane (University of Chicago), 'Set theory and category theory', 'Topos theory: logic meets geometry', 'Algebraic topology', 'The life of mathematics', 'Formalism versus realism' (with the Philosophy Department)

Dr Tohru Ozaki (Institute of Statistical Mathematics, Tokyo, Japan) , 'Statistical identification of non-linear dynamics in macro-economics using non-linear time series models'.

G.O.

VICTORIA UNIVERSITY

Dr Michael Moses has been appointed to a postdoctoral fellowship in mathematical logic, especially recursion theory. He is now at Western Illinois University, and will be working mainly with Colin Bailey and Rod Downey.

Steve Haslett now has a Ph.D. and a baby son; congratulations!

Thora Blithe, Rob Goldblatt and Lindsay Johnston hae all returned from sabbatical. While in Australia, Lindsay joined in the Mathematics in Industry Study Group - WHY HAS N.Z. NOT YET DONE ANYTHING SIMILAR?

Rob Goldblatt went away thinking he would be Chairman of the Mathematics Department on his return, but the University now insists he is a Chairperson. Rob will also be an invited speaker at the annual meeting of the Australian Mathematical Society in May.

Drs Tohru and Valerie Ozaki are currently visiting VUW. Both are time series analysts working with Peter Thomson; Tohru has already given an excellent seminar explaining an economic model which encompasses both the Keynesian and the monetarist views.

J.F.H.

UNIVERSITY OF AUCKLAND

Computer Science

By the end of the first week of the academic year, 436 students had enrolled for the course Introduction to Computing (in the first half of the year), and 463 had enrolled for its sequel Introduction to Computer Science (in the second). The comparable numbers for 1986 were 432 and 425. The service course Introduction to Computing had 240 enrolments (225 in 1986).

For Stage 2 courses, 230 students enrolled with 594 enrolements for papers (615 in 1986); for Stage 3 courses, 153 students enrolled with 436 enrolments for papers (391 in 1986); and for postgraduate courses, 37 students enrolled with 97 paper enrolments (102 in 1986). Pre-enrolment was required for most papers (except for Stage 3, B.Sc. or B.Com. students for 100/105, and paper 101).

John Butcher spent much of his leave for 1986 at Bell Laboratories, at Acadia University (Nova Scotia), at Imperial College and at the Technical University of Denmark, and visited numerous universities in England, Netherlands and the Federal German Republic. He attended conferences at Valladolid (Spain), Zeist (Netherlands) and Miskolc (Hungary). Immediately after his return in January 1987, he received a large parcel from John Wiley Publishers, his monograph on 'The Numerical Analysis of Ordinary Differential Equations: Runge-Kutta and General Linear Methods.'

Barbara Reilly is on leave at University of California, at Davis. She will use her Winston Churchill Fellowship to travel to conferences and various universities to develop her research into the educating of women to become scientists.

Peter Fenwick is on leave at the University of Wisconsin, Madison, and Bruce Hutton is on leave at the University of Kent at Canterbury.

Jo Williamson has been appointed as Tutor for the period of Barbara Reilly's leave.

Rob Burrowes, who had been our chief technician, is now working as our programmer. Niall Teh is now our technician, replacing Matthias Otto who left at the end of 1986.

Fred Chipman is here until August 1987, on leave from Acadia University, to further his research into numerical methods for ordinary differential equations.

The Second New Zealand Conference on Expert Systems (NZES'87), organised by John Hosking and Rick Mugridge, was held at the Conference Centre of the University of Auckland from February 2 to 4. Approximately 80 delegates attended that conference, where about 25 papers were presented, covering a wide range of applications and techniques. Each delegate received a bound volume of the papers: Proceedings of the Second New Zealand Conference on Expert Systems, NZES'87. Copies of those Proceedings have been deposited in each of the six university libraries in New Zealand, in the General Assembly Library and in the National Library. Copies are available from John Hosking or Rick Mugridge (for $50).

Seminars:

Dr Michael Wesley (IBM Manufacturing Research Center, Yorktown Heights), 'Geometric modelling of products and manufacturing processes'

Professor John Bennett (University of Sydney), 'Information retrieval, past and future'

Dr Libor A. Spacek (University of Essex), 'The Essex Parallel PROLOG'

G.J.T.

Mathematics & Statistics

It was with regret that we received the resignation of Senior Tutor, Dr Peter McInerney.

Dr Laslo Szekely, Postdoctoral Fellow with the Department for the past 12 months, returned to Eotvos L. University, Budapest at the end of January.

Ms Sina Greenwood has been appointed as a Teaching Fellow and is registered for a Ph.D. degree.

Professor Jan Jaworowski, Indiana University, has joined the staff until August 1987, in an exchange with Professor J.A. Kalman.

Professor Reilly, Dr Conder and Dr Smith departed on sabbatical leave at the end of 1986, for 12 months.

On Saturday, 7 February 1987, Professor George Seber married Sandra Spry.

Adam Grove, Andrew Hill, Robert Lum and Howard Wong-Toi have all been appointed as half-time tutors, Dr Jocelyn Dale and Mr John Good as part-time lecturers, and Mr R. Chan, Mr P. Mullins, Dr M. Morton, Mr M. Barker, Mr P. Hughes and Dr C. Triggs have all been re-appointed on a part-time scale.

Seminars:

Professor Robert C. Elston (Louisiana State University Medical Center, New Orleans), 'Generalised modulus power transformations'.

Mr Robin Pemantle (M.I.T., Cambridge, Massachusetts) 'Random reinforced walks on acyclic graphs'.

D.S.

Theoretical and Applied Mechanics

The good news is that Ian Collins has agreed to serve as H.O.D. for another five years. The bad news is that ill health has forced Ian Medland to resign his Associate Professorship. The arrival of Sue Byrne (from Massey) and Andy Philpott (after completing a Ph.D. at Cambridge) as Lecturers has substantially strengthened the OR group. Your correspondent has now got used to being an engineer (of sorts), but has left a coffee cup in the Mathematics and Statistics Common Room. Later this year we will welcome James Graham-Eagle (from VUW, Oxford and Delaware), who has been appointed to a Lecturership (the vacancy resulting from Gordon Hookings' resignation). Peter Hunter is now back from leave in North America, Europe and India. Robert McKibbin will be on sabbatical (Indonesia and Norway) during 1987 and Ian Collins and Mike O'Sullivan plan to take leave in 1988. As visitors we currently have Lewis Waldman from UCSD who is working with Peter Hunter on cardiac mechanics, and Ron Roblee from Michigan who is helping us with software development for the Macintosh. Gary Prentice has just joined us as a Program Analyst, replacing Andrew McCulloch and Poul Nielsen, who are taking up Postdoctoral Fellowships at UCSD and McGill respectively.

In 1986, TAM took responsibility for teaching "mechanics and related applied mathematics" courses in the Science Faculty. The Mathematics and Statistics paper numbers continue to be used. Last year the courses were unchanged from previous years, but in 1987 there are substantial changes. The mechanics paper 170 is now 270 and a more widely based mathematical modelling paper has been introduced at Stage I. At Stage III one paper is now in common with an Engineering Science paper on continuum mechanics, and there are half-year papers on analytical mechanics, applied partial differential equations, waves and control theory.

In the last year Sue Byrne and David Ryan have explored the Gold Coast and other parts of Australia, Ian Collins has been in England helping to organise the next IUTAM Congress to be held in Grenoble 1988, and Mike O'Sullivan, who has been trying to warn politicians and others of what is happening at and below Mururoa Atoll, has also visited Japan and Australia.

We have had brief visits from Professors J. Dempsey (Clarkson University, New York), R. Bilger (University of Sydney), R. Tomlinson (University of Warwick), D. Solow (Case Western Reserve University, Ohio) and S. Gass (University of Maryland).

Most readers will be aware that TAM organised the 1987 Applied Mathematics Conference of the Australian Mathematical Society which was held at Wairakei in February, but for the record I mention that Ian Collins was Director, David Ryan and Sue Byrne were the Secretaries and Don Nield was Treasurer.

D.A.N.

UNIVERSITY OF CANTERBURY

Electrical and Electronics Engineering

The astrophysicist W. John Cocke (Steward Observatory, University of Arizona) is spending the second term here as an Erskine Fellow and will work with me and some of my students on theory and algorithms for new astronomical imaging techniques. One of John's peripheral interests, which he tells me that he is as yet uncertain of how seriously it should be taken, is the (apparent) quantisation of extra-galactic red-shifts.

New Zealand applied mathematicians concerned with information processing problems may be interested to glance at the paper "automatic multidimensional deconvolution" (in the January issue of the Journal of the Optical Society of America Part A), by Richard G. Lane and myself. We think it could significantly influence future work on image restoration (but not, strangely enough, signal processing, because the theory only applies to functions of more-than-one independent variables).

R.H.T.B.

Mathematics

Kevin O'Meara returned in January from a year's study leave spent at the University of Connecticut. He also gave talks at eight universities in the U.S.A. and Canada. He attended the Winter Meeting of the Canadian Mathematical Society in Ottawa where one mid-day temperature was -17°C.

Dr H-Q. Bui is the latest addition to our staff. He arrived in January, from the University of Sydney. His field is analysis, and he graduated from the Universities of Saigon and Hiroshima.

After a lengthy period in which very few visitors appeared, we have recently been pleased to welcome several. In particular, we currently have with us two visiting Erskine Fellows, Professors Charles Broyden and Michael Perlman.

Professor Broyden, of the University of Essex, will be with us for three months. He will be lecturing to the Honours III class on Optimization, and will also be giving several seminars.

Professor Perlman, of the University of Washington, Seattle, will be with us until mid-April, and will give a series of talks on 'Algebraic aspects of multivariate statistics.' He has worked closely with the Copenhagen School of Multivariate Analysis. This school has shown that every classical hypothesis testing problem can be viewed as a special case of a general problem which itself can be expressed terms of group-invariant models. This work tends to be inaccessible to the classically trained statistician. Being in both camps, Professor Perlman is uniquely placed to explain these new ideas.

Seminars:

Professor Gilbert Strang (MIT), 'Engineering Mathematics at MIT'

Professor John W. Miles (University of California, San Diego), 'The history of stability criteria for stratified shear flows'

Professor Michael L. Overton (Courant Institute of Mathematical Sciences), 'Numerical methods for smooth and non-smooth optimization problems.'

Professor Saunders Mac Lane (University of Chicago), 'The structure and philosophy of mathematics', and 'The rise and fall of abstract mathematics'.

R.S.L.

DEPARTMENT OF STATISTICS

Mathematical Statistics Division

Recently there have been a number of arrivals and departures from Mathematical Statistics -

Ramesh Bhula has gone to Pay Research, and

Lindsay Plank to Auckland University.

Bee Hoon Sung has just returned from a visit to her family in Singapore, and we congratulate Helen Zarifeh on her recent marriage.

Peter Buonpane, from the U.S. Bureau of Census, visited the Wellington and Christchurch offices, talking on recent developments in the U.S. Bureau.

M.J.D.

WAIKATO UNIVERSITY

This is the report you get, when the local correspondent (Kevin Broughan) labours under such pressure that he can't find time to write: instead, it comes straight from the Editor's scrambled wits!

Planning for the new School of Computing and Mathematical Sciences takes a great deal of our time. Details of courses, streams and options had to be thrashed out with our colleagues in Computer Science, Philosophy and Physics in time to get the nod from all the other Schools

of Study; so far, Dean Designate John Turner has steered the proposals through Management, Humanities, Social Science and Science. Then the Curriculum Committee (UGC) has to approve, before we induct the first students next year.

Largely because of a great increase in (probably low-grade) students enrolled in Management, our first year Basic Maths course had to split (it grew from 350 to 550). The mainstream maths courses also grew, but not nearly as much. Second and third year enrolments varied, but overall they fell slightly.

Deidre Shea, our expert on computer-aided remedial maths, left suddenly at the end of last year, in her family's move to Auckland.

Early this year, the University acknowledged the illiteracy and innumeracy of (a sadly high fraction) of otherwise competent students, by releasing funds for "Basic Mathematical Skills": Heather Gardiner took up this new and different challenge as well as her normal work, and now sits down by the duck pond for a few hours a week (with the other "Study Skills Advisers" in the Lady Goodfellow Chapel).

In the last promotions round, Fay Sharples rose to the rank of Senior Lecturer. But to her chagrin, her travels to ICOTS last August and her poster paper there passed without mention in the Newsletter: perhaps this may make amends.

Bill Bolstad returned from six months on leave at Minnesota, St Paul.

Murray Carr joined us for a year as a Visiting Teaching Fellow, with interests in the transition from school to university (and in the nature and style of first-year maths courses, in the context of the latest curriculum change).

Has anyone out there got a spare secretary? We farewell both of ours on Monday: Anne Hill will take her O.E. in Old England, and Janice Walker decided to teach typing ... We shall miss them.

Seminars:

G.A. Thomas (A.N.U.), 'Statistical Models for Solute Travel Time under Unsteady Flow Conditions'.

Prof. K. Neumann (U. Karlsruhe), 'Stochastic Single Machine Scheduling with O.R. Network Precedence Constraints' (in Management Studies).

Mr G.J. Tee (Computer Science, Auckland), 'The computing and mathematical sciences - their role in your future' (public lecture).

M. Schroder, 'Proto-Seminar on Professor Mac Lane's Seminar'.

Prof. S. Mac Lane (U. Chicago), 'Topos Theory: Logic meets Geometry', and 'The Rise and Fall of Abstract Mathematics' (public lecture).

K.A.B./M.S.

REPORTS

THE 1987 AUSTRALIAN APPLIED MATHEMATICS CONFERENCE, Wairakei, NZ, February 8-12

General

The 1987 Conference of the Division of Applied Mathematics of the Australian Mathematical Society was held at Wairakei in the centre of the North Island, 8 km north of Taupo, 270 km from Auckland and 400 km from Wellington. The venue was the T.H.C. Wairakei Resort Hotel, ideally situated with excellent recreational facilities nearby including thermal swimming pools, tennis courts and two golf courses and with a well organised staff accustomed to hosting Conferences.

Because a number of Conferees had to be taken back to Auckland at the end of the Conference to catch the afternoon flight to Sydney, the Conference began and ended slightly earlier than usual: it opened at 3.00 pm on Sunday with the first invited address at 3.15 pm and closed at 10.15 am on Thursday.

In all, there were 7 invited addresses, 57 contributed papers and 17 student papers, a record total for these conferences. Further, 115 people attended, accompanied by 30 others. The organisers were particularly pleased with the number of student papers and with the number of students who made the trip across the Tasman.

A Welcome Party, funded by the University of Auckland, was held on the Sunday, and a traditional Maori Hangi, followed by a cultural display including a Haka (which gave Neville de Mestre and David Ryan a chance to bare their chests), was staged on the Monday evening. Tuesday afternoon was reserved for a number of alternative recreational pursuits, whilst the annual Conference Dinner took place as usual on the Wednesday evening. The Applied Mathematics Division held an executive meeting on the Sunday evening, and the A.G.M. took place on the Tuesday evening, together with a display of mathematical exhibits.

The Workers

Director	Ian Collins
Secretaries	Susan Byrne, David Ryan
Treasurer	Don Nield

All are members of the Department of Theoretical and Applied Mechanics, University of Auckland. In addition many others in the Deprtment and from other New Zealand Universities gave invaluable help and support before and during the Conference, for which we sincerely thank them.

Accommodation

Nearly all the Conferees stayed at the Wairakei Resort Hotel or at the DSIR Student Hostel in Wairakei Village. The accommodation cost per person per night at the Hotel varied from NZ$35.75 to NZ$46.75 (twin share). At the hostel, students received very comfortable overnight accommodation, an excellent breakfast plus a cut lunch for the princely sum of $14 per day. The

availability of such cheap accommodation close by adds considerably to the attraction of Wairakei as a venue for a conference of this type. Most overseas visitors were put up in budget hotels in Auckland, before and after the Conference, and transported to and from Wairakei by coach. This proved to be quite a complex logistic exercise and the credit for its smooth execution goes almost entirely to Susan Byrne, who impressed us all with her Conference data base.

Theme and Visiting Speakers

We set out to give Engineering Mathematics and Operations Research a higher profile than usual at these conferences. To this end, we invited Gil Strang (MIT), Mike Saunders (Stanford), Alan Taylor (Oxford) and Ivar Stakgold (Delaware) to be four of our seven speakers - the last two of whom intended to be in this part of the world anyway. In addition to his research work in optimisation theory and variational principles, Gil is very well known as a brilliant writer of textbooks. His latest, entitled 'Introduction to Applied Mathematics', brings his unique, informal but penetrating style to bear on the whole spectrum of applied mathematics. Mike, a New Zealander who has settled in California, is a world leader in the development of optimisation software. In his talk, he demonstrated a droll sense of humour as well as a mastery of his subject. This was Alan's second time as an invited speaker at an Australian Applied Mathematics Conference - the first was at Bundanoon in 1982. He discussed the advances he and the Oxford Study Group for Industry had made in the last five years, particularly with reference to nonlinear moving boundary problems in diffusion processes. Ivar, who collaborates extensively with Graeme Wake and Alex McNabb, discussed similar problems of the type which arise in reaction/diffusion processes.

We were very fortunate to have Professor Fritz John (Courant Institute - New York) visiting New Zealand at the time of the Conference. As well as telling us of his latest research on nonlinear hyperbolic equations, he charmed many of us with stories of his early career in Germany, the U.K. and the U.S.A. Mike O'Sullivan (T.A.M.) provided the local colour, describing his work on modelling the hydrology of Mururoa Atoll and generally lambasting the applied mathematics community over its inertia in getting actively involved with issues of real public concern. The Conference was concluded by a masterly presentation from John Miles (U.C.S.D.), who is more active than ever, although officially retired, and is currently applying the recent developments in nonlinear dynamics and chaos to the theory of water waves. John is also going to be one of the two principal speakers at the next IUTAM Congress to be held in Grenoble in August 1988. After the Conference, John cycled down to Christchurch.

Sponsors

The organisers are very grateful to the following Companies and Institutions who sponsored the Conference in a number of different ways:

New Zealand Steel Co. Ltd,

Air New Zealand Ltd,

Beca Carter Hollings and Ferner Ld,

Fletcher Development and Construction Ltd,

Geothermal Energy New Zealand Ltd,

Wilkins and Davies Ltd,

Australian Mathematical Society,

New Zealand Mathematical Society,

New Zealand Operational Research Society,

University of Auckland,

Bank of New Zealand.

Programme

The seven invited lectures each lasted for 60 minutes, and the 74 twenty-five minute contributed papers were organised into triple parallel sessions. In order to give the Cherry Prize Judging Committee the opportunity to hear all the student papers, no two student papers were put on at the same time. With the large number of such papers this year, this put quite severe constraints on the programme format. There were 32 sessions of contributed papers in all, which means 32 persons kindly took the chair. We thank them all for running the sessions so efficiently.

The T.M. Cherry Prize was won by Michael Rumsewicz from Adelaide, for his joint paper with P. Taylor on 'A Spot Welding Reliability Problem'. The prize this year was NZ$150. I am sure this added greatly to Michael's enjoyment of the Conference and of his honeymoon, and more than made up for the fact that he was the only member of the fishing trip on the Tuesday afternoon to miss out on catching a Lake Taupo rainbow trout. (The Conference Director, quite appropriately, caught the largest!)

Recreational Programme

In addition to the fishing trip, several other activities were oganised, including white water rafting on the Tongariro River, a coach trip to Rotorua, a boating trip on Lake Taupo and a guided walk to Huka Falls via the Aratiatia Rapids. The excellent weather with which we were blessed throughout the whole period of the Conference, made for a highly enjoyable afternoon for all.

The programme for those accompanying the conferees included visits to Huka Falls and Taupo on the Monday and to the thermal area at Orakei-Korako on the Wednesday. Both trips were very well received.

Conclusions

The Conference organisers were very well pleased with the way the Conference took shape, both academically and socially. We feel it was well worth all the careful preparation we put into it and, judging by the comments we received, this view was shared by all. We believe we have demonstrated the strength of New Zealand Applied Mathematics and that we can successfully stage International Conferences. We hope it will not be too long before the Conference is held in New Zealand again - possibly in the South Island. Finally, our thanks go to the members of the Executive of the Applied Mathematics Division for supporting this venture.

Ian Collins,

for The Workers.

VISITORS: 11 March 1987

The information is arranged as follows: name of visitor; home institution; whether accompanied; principal field of interest; dates of visit; principal host institution; principal contact; comments.

Definite Visits

Professor G.D. Anderson; Michigan State University; spouse and son; complex analysis, extremal rings and quasiconformal mappings; September 1986 - September 1987; University of Auckland; Dr M.K. Vamanamurthy.

Professor Charles G. Broyden; University of Essex; numerical analysis, optimization; March - May 1987; University of Canterbury; Dr R. L. Broughton; Professor Broyden is an Erskine Fellow.

Professor Charles K. Chui; Texas A. & M. University; approximation theory, multivariate spline approximation, digital filter design; September - November 1987; University of Canterbury; Dr R.K. Beatson; Professor Chui is an Erskine Fellow.

Dr Herbert Huppert; University of Cambridge; geophysical fluid mechanics; April 1987; University of Canterbury; Professor B.A. Woods; Dr Huppert is an Erskine Fellow.

Professor Jan Jaworowski; University of Indiana; spouse and child; algebraic topology; January - July 1987; University of Auckland; Professor D.B. Gauld.

Professor Michael D. Perlman; University of Washington; wife and children; multivariate statistics; 21 February 1986 - 11 April 1987; University of Canterbury; Dr G.R. Wood; Professor Perlman holds an Erskine Fellowship.

Dr Richard Slansky; Los Alamos; spouse; particle physics, group theory, strings, Kac-Moody algebras; 15 March - 24 April 1987; University of Canterbury; Professor B.G. Wybourne, Department of Physics; Dr Slansky is an Erskine Visitor.

Dr John Strathdee; Trieste; spouse; particle physics, strings; 20 - 25 April 1987; University of Canterbury; Professor B.G. Wybourne, Department of Physics.

Professor Anne Penfold Street; University of Queensland; combinatorics; September - November 1987; University of Canterbury; Dr D.R. Breach; Professor Penfold Street is an Erskine Fellow.

Professor Christopher Zeeman; University of Warwick; wife; topology, catastrophe theory; 21 March 1987 - 11 April 1987; University of Auckland; Professor D. B. Gauld. Professor Zeeman holds the Forder Lectureship for 1987.

Very Likely Visit

Professor Gerald C. Brown; Naval Postgraduate School, Monterey, CA; wife; large-scale mathematical programming, combinational analysis and data structures, digital operations research and numerical methods; 24 - 28 August 1987; Operational Research Society; Mr B.R. Benseman, DSIR, Applied Mathematics Division, Wellington.

Aims and Policy

One of the main aims of this listing is to enable institutions other than the principal host institution to invite visitors to spend time with them. Anyone wishing to issue such an invitation should do so through the contact person listed.

Please Note:

The production of these lists and the co-ordination of visits depends upon my receiving information. When you have information about a visit, whether it be definite, very likely or possible, would you please forward it to me at the earliest convenience.

Gillian Thornley,

Department of Mathematics and Statistics,

Massey University.

BOOK REVIEWS

INTRODUCTION TO APPLIED MATHEMATICS, by Gilbert Strang, Wellesley-Cambridge Press, Box 157, Wellesley, Massachusetts 02182 (1986); 758 pages; hardback. 1

The opening sentence to Professor Strang's new textbook has a familiar ring to anyone who has read his previous books2: "I believe that the teaching of applied mathematics needs a fresh approach". This book offers that "fresh approach", both in style and in content. First, the style is very much Strang's own: delightfully elegant and economical use of language which constantly stimulates and ofen provokes the reader - as exemplified by that opening sentence. Second, familiar (and some unfamiliar) topics are presented with a coherence which is surely unique for a mathematics book with this breadth of coverage.

Linear algebra comes first. It provides the foundation upon which later chapters are built and unified. The fundamental subspaces of a matrix A are illustrated with the incident matrices which play an important role in subsequent chapters. Factorizations of A based on elimination and on eigenvalues (diagonalization) are followed by factorizations of A^TA (the QR algorithm, singular value decomposition and polar decomposition). Minimization principles are introduced with, as always, the mathematical theory and the physical problems continually reinforcing one another.

Equilibrium equations for discrete systems come next and with them, a framework for many subsequent applications. An electric circuit provides the most basic model: the edge-node incidence matrix A acts on a set of nodal potentials x to provide the potential differences e which, together

1 The book can be ordered directly in New Zealand from Dr Andrew Philpott, TAM Dept, Engineering School, University of Auckland, Private Bag, Auckland. The cost is $NZ75 plus $2.50 for packing and postage.

2 **An Analysis of the Finite Element Method**, by G. Strang and G. J. Fix, Prentice-Hall (1972), and **Linear Algebra and its Applications**, by G. Strang, Academic Press, 2nd edition (1980).

with the potential sources b, satisfy Kirchhoff's voltage law $e = b - Ax$. Material properties contained in a matrix C (conductance) act on the potential differences to generate edge flows y (Ohm's law). The transpose of that same matrix A, acting on the flows, balances the external flow sources $f = A^T y$ (Kirchoff's current law), and the framework is complete. Written in terms of the potentials, the equations are $A^T CAx = f$ (for zero b). Analysis of the deflections x and forces f in a structural mechanics problem leads to the same equations, with $A^T CA$ now identified as the stiffness matrix. Equilibrium variational formulations are never far behind.

Equilibrium equations in the continuous case provide the motivation for moving from matrix equations to differential equations, but the equilibrium framework remains the same: potential differences are replaced by gradients and (for inviscid fluid flow), velocity = grad u satisfies zero curl (the continuous analogue of Kirchhoff's voltage law). Conservation of current (Kirchhoff's current law) becomes conservation of mass, and a new material description is required. Thus $A^T CAx = f$ in the discrete case becomes $-\mathrm{div}(C\mathrm{grad}u) = f$ in the continuous one, and the divergence operator is exposed as the'transpose' (adjoint) of grad. Similarly, curl is its own transpose and one vector identity, $\mathrm{curlgrad}u = 0$, is seen as the transpose of another, $-\mathrm{divcurl}u = 0$. Even Maxwell's equations are treated within that framework. Other topics included here are vector calculus in three dimensions and the calculus of variations.

The next chapter considers analytical methods. With the preceeding background in linear algebra, Fourier Series appear naturally as an expansion in orthogonal eigenvectors (the discrete case) or eigenfunctions (the continuous case) and the stage is set for applications to Fourier and Laplace Transforms, signal processing and convolution, sampling problems and problems in dynamics. The important point is that the eigenfunctions are exponentials, the eigenvalues are the transforms and the equations are uncoupled in the frequency domain. The chapter ends with conformal mapping and complex integration.

The following example from that chapter is typical of the many insights provided by linear algebra: the convolution $f * g$ of two vectors $f = (f_0, \ldots, f_{n-1})$ and $g = (g_0, \ldots, g_{n-1})$, is written Cg, where C is the circulant matrix containing $(f_0, \ldots, f_{n-1})$ in the first column, $(f_{n-1}, f_0, \ldots, f_{n-2})$ in the second, and so on. But the eigenvectors of C are the columns of the Fourier matrix F whose entries are w^{jk}, where $w = \exp(2\pi/n)$ is an n-th root of unity. Thus $C = F\Lambda F^{-1}$, where the diagonal matrix Λ contains the eigenvalues of C (n times the Fourier coefficients of f), is the matrix form of the convolution rule (in which $f * g$ is found by multiplying the Fourier transforms of f and g and then taking n times the inverse transform of that product).

The next chapter presents numerical methods for equilibrium equations and eigenvalue problems: direct methods for $Ax = b$, nonlinear equations (Newton, quasi-Newton, steepest descent, conjugate gradients), orthogonalization and eigenvalue problems (Gram-Schmidt, QR, Householder), semi-direct and iterative methods (Jacobi etc, ADI, preconditioned conjugate gradients, power and Lanczos methods for eigenvalues), the finite element methods (Galerkin, Rayleigh-Ritz) and the Fast Fourier Transform. Much of the basis for understanding these methods has been laid in previous chapters. It is an essential part of Strang's philosophy that scientific computing, "the right combination of mathematical models and numerical analysis and good software", is an integral part of applied mathematics. A survey of some available software is given in an appendix.

Initial value problems are the subject of Chapter 6. Once again the range of topics covered is impressive but the unity of their treatment even more so. The coverage of first and second order linear o.d.e.s. with first, constant and then, variable coefficients is traditional, as is the treatment of phase plane methods for analysing the stability of linear and nonlinear systems. Less traditionally, they are followed by strange attractors and a very lucid account of the quadratic model of chaos. The solution of differential and difference equations by transform methods comes

next, Laplace for continuous time and the z-transform for discrete time. The heat equation and the wave equation provide the models for a discussion of the mathematical and physical properties of parabolic and hyperbolic partial differential equations. They are followed by a discussion of advection-diffusion equations, dispersion relations and group velocity. In keeping with Strang's philosophy that numerical methods belong with the problems they solve, the next section of the chapter covers difference methods for initial value problems (from Crank-Nicolson to Lax-Wendroff). Once more we are reminded to "watch the eigenvalues" - this time for stability. The chapter ends with nonlinear conservation laws.

The last two chapters cover Network Flows and Combinatorics (spanning trees and shortest paths, the marriage problem, matching algorithms, maximal flow in a network and the transportation problem) and Optimization (linear programming, game theory, optimization and nonlinear programming). Linear programming is approached first through geometrical arguments, then computationally via the tableau of the simplex method, and then algebraically, both for the revised simplex method and for the very recent Karmarkar's method. The theory of duality brings back that by now very familiar framework, first introduced in Chapter 2 for Kirchhoff's laws. (Potential differences have become economic price differences, and now the price drives the flow through a new form of Ohm's law!)

This is a beautifully written book - quite easily the best advanced level "introduction" to applied mathematics I have seen. It is a book about **understanding** the subject - not a cookbook of mathematical recipes - and does not have the myriad of worked examples often found in introductory texts. It will not therefore suit all courses, but we have adopted it as a prescribed text for our 2nd and 3rd professional Engineering Science students in Auckland and the response so far has been enthusiastic.

Peter Hunter,

TAM, Auckland University.

PROBLEMS AND QUERIES

Mind your P's and Q's

Again we did not receive very much mail for this section. Are we wasting your/our time? We'll ask this question at the AGM in May. You could cheer us up by bringing along your favourite problem, query, or anecdote to Waikato. Here's my (GCW) daughter's breakfast puzzle from this morning:

Q. What kind of book gives you splinters?

A. A log book.

(I shall buy her a calculator next year!)

Mike Hendy,

Graeme Wake,

Massey University.

State of our problems:

P.1 The infinite sequence (August 1986) and its solution by Ted Zulauf (December 1986).

P.2 The mean value theorem in the complex plane (August 1986) and the proposer's solution, given below.

P.3 The Hendy graph (December 1986), still unsolved.

P.4 Dimensionless ratios (December 1986), also unsolved.

P.5 Factorisation of a function of many variables – we have the proposers' solution, but are there any others for this important question?

Two New Problems:

P.6 (from Trevor Boyle, Assessment Unit, Education Department and Mike Hendy, Massey University):

A recurrence relation (A_n) is defined by: $A_1 = 0$, $A_2 = 2$ and $A_{n+2} = A_n + A_{n+1} + 1$, for all other positive integers n. Prove or disprove the following statements:

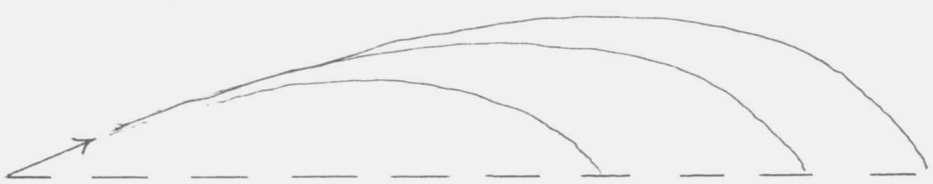
(i) For $n>1$, $A_n \equiv 0$ modulo n iff n is prime.

(ii) For p an odd prime, if $n \equiv 1$ or $n \equiv p$ modulo m_p, then $A_n \equiv 0$ modulo p, where

$$m_p = \begin{cases} p-1, & \text{if } p \equiv 1, 5 \text{ or } 9 \text{ modulo } 10, \text{ and} \\ 2p+2, & \text{if } p \equiv 3 \text{ or } 7 \text{ modulo } 10. \end{cases}$$

P.7 A Bowling Problem (from Mark Schroder, Waikato University):

The weight and bias of all bowls are constant. Bowlers tend to find that - on a given green and a calm day - all bowls delivered with the same initial direction and coming to rest between 20m and 34m away, come to rest on a straight line. Is this just an old bowler's tale? If not, what is the explanation? (See the sketch below.)



Solution of P.2 by the proposer, John Harper, VUW:

(a) Construct examples to show that the mean value theorem fails for analytic functions, in the sense that even if the function f is analytic in the whole complex plane, the solutions w of

$$\frac{1}{z}\int_0^z f(t)\,dt = f(w) \tag{1}$$

may not exist, or could all lie arbitrarily far from z if they do exist.

(b) Find simple conditions that ensure the existence of solution(s) to equation (1), with $|\,w\,| < |\,z\,|$.

The Mean Value In The Complex Plane

(a) Suppose $z = 2\pi i\alpha$ and $f(t) = \exp(t)$. Then

$$\frac{1}{z}\int_0^z f(t)dt = \frac{\exp(2\pi i\alpha) - 1}{2\pi i\alpha} \tag{2}$$

If $\alpha = 1$, the RHS of (2) vanishes, and so for no w is $f(w) = 0$.

If $\alpha = 1$, the RHS of (2) tends to 0, and so $|\,w\,|$ tends to infinity, for every solution w.

(b) **Theorem** If $f(z)$ is analytic and univalent (one-to-one) in the disc $|\,z\,| < r$, then $|\,z\,| < 0.2102r$ is sufficient for a value of w in equation (1) to exist, with $|\,w\,| < |\,z\,|$.

Proof: Under the given conditions, $f'(0)$ cannot vanish. Let

$$\begin{aligned} g(z) &= \big(f(z/r) - f(0)\big)/f'(0) \\ &= z + a_2 z^2 + a_3 z^3 + \cdots \end{aligned}$$

This series converges if $|\,z\,| < 1$, and g is univalent on the open unit disc. Furthermore, the distortion theorems (L. Bieberbach, 1964, "Conformal Mapping", Chelsea) show that the image under g of the unit disk includes the whole of $|\,g\,| < 1/4$, and if $|\,z\,| = M < 1$, then

$$l(M) = \frac{M}{(1+M)^2} \leq |\,g(z)\,| \leq \frac{M}{(1-M)^2} = u(M), \text{say.}$$

Hence $G(z) = (1/z)\int_0^z g$ obeys

$$|\,G(z)\,| < \frac{1}{M}\int_0^M u(t)du = \frac{1}{1-M} + \frac{1}{M}\log(1-M) = U(M), \text{say.}$$

The existence of w such that $g(w) = G(z)$, with $|\,w\,| < 1$ and $|\,z\,| = M$, is thus assured if $U(M) < 1/4$, which is true if $0 < M < 0.3082$. If $l(m) > U(m)$, which is true if $0 < m < 0.2102$, then $|\,w\,| = m < |\,z\,|$. Since the transcendental equations $U(M) = 1/4$ and $l(m) = U(m)$ are easily solved to the necessary accuracy with a pocket calculator and since both l and U are monotonic on $[0, 1]$, the required result follows immediately.

Notes

(1) If f has a zero of order $n>1$ at $z = 0$ then $f(z)/z^{n-1}$ is univalent and analytic in some disc $| z | <r$, and a method similar to the one above will give a number C_n such that $| z | <rC_n \Rightarrow \exists_w$ satisfying equation (1) with $| w | < | z |$.

(2) L. de Branges recently proved that $| a_n | \leq n$ in equation(2); see Fitzgerald (1985 : Notices Amer. Math. Soc. 32, 2-6, "The Bieberbach Conjecture : Retrospective"). The present problem is on a much more elementary level!

CONFERENCES

****1987****

May 28-Jun 1 (Singapore)
Fourth South-East Asian Conference on Mathematical Education
Details from Dr Ong Sit Tui, Department of Mathematics, Institute of Education, Bukit Timah Road, Republic of Singapore 0511

May 31- June 13 (Ottawa)
Algorithms and Order
Details from Algorithms and Order, Department of Computer Science, University of Ottawa, Ottawa, Canada KIN 9B4

June 1-4 (Tampere, Finland)
Second International Tampere Conference in Statistics
Details from Conference Secretary C123, Department of Mathematical Sciences, University of Tampere, PO Box 607, SF-33101 Tampere, Finland

June 1-10 (Dubrovnik-Kupari, Yugoslavia)
Second Annual Meeting of the International Workshop in Analysis and its Applications
Details from C Stanojevic, Department of Mathematics and Statistics, University of Missouri, Rolla, Missouri 65401, USA

June 4-6 (Columbia, Missouri)
Computer Experimentation in Nonlinear Analysis
Details from C Chicone, Department of Mathematics, University of Missouri, Columbia, Missouri 65202, USA

June 4-6 (Rome)
Congress on Educational Computing in Mathematics
Details from M Emmer, Dipartimento di Matematica, Università di Roma I, Piazzale A Moro, 00815 Roma, Italy

June 8-19 (Singapore)
Singapore Group Theory Conference
Details from Singapore Group Theory Conference, Department of Mathematics, National University of Singapore, Kent Ridge Road, Republic of Singapore 0511

June 9-12 (Torino, Italy)
Workshop on Nonlinear Hyperbolic Equations for Applied Sciences
Details from Institute for Scientific Interchange, Villa Gualino, viale S Severo 65, I-10133 Torino, Italy

June 11-13 (Vancouver)
Sixth Pacific Coast Resource Modelling Conference
Details from C Clark, Institute of Applied Mathematics, University of British Columbia, Vancouver, British Columbia, Canada

June 14-21 (Oslo)
Number Theory, Trace Formulas and Discrete Groups
Details from K Aubert, Department of Mathematics, University of Oslo, PO Box 1053, Blindern, 0316 Oslo, Norway

June 15-19 (Chicago)
Conference on Combinatorics and Complexity
Details from W Maass, Department of Mathematics, Statistics and Computer Science, University of Illinois at Chicago, Box 4348, Chicago, Illinois 60680, USA

June 15- July 3 (Berkeley)
Microprogram on Commutative Algebra
Details from Mathematical Sciences Research Institute, 1000 Centennial Drive, Berkeley, California 94720, USA

June 16-19 (Ithaca, New York)
Second Annual Conference on Structure in Complexity Theory Details from S Mahaney, Room 2C-454, AT & T Bell Laboratories, 600 Mountain Ave, Murray Hill, New Jersey 07974, USA

June 17-19 (Dublin)
Nasecode V - Fifth International Conference on the Numerical Analysis of Semiconductor Devices and Integrated Circuits
Details from Nasecode V, Conference Management Services, PO Box 5, 51 Sandycove Road, Dun Laoghaire, Co Dublin, Ireland

June 22-25 (Ithaca, New York)
Second Annual Symposium on Logic in Computer Science
Details from A Chandra, IBM Thomas J Watson Research Centre, PO Box 218, Yorktown Heights, New York 10598, USA

June 23-26 (Dundee, (Scotland)
Dundee Biennial Conference on Numerical Analysis
Details from the Organising Secretaries, Biennial Conference on Numerical Analysis, Department of Mathematical Sciences, The University, Dundee, Scotland DD1 4HN, UK

June 23-26 (Bethlehem, Pennsylvania)
Sixth IMACS International Symposium on Computer Methods for PDE's
Details from IMACS Secretariat, Department of Computer Science, Rutgers University, New Brunswick, New Jersey, 08903, USA

June 23-27 (Dubrovnik, Yugoslavia)
International Conference on Generalised Functions, Convergence Structures and their Applications
Details from Institute of Mathematics (GFCA-87), Dr Ilije Djuricica 4, 21000 Novi Sad, Yugoslavia

June 29-
July 3
(Paris)

First Joint International Conference on Industrial and Applied Mathematics
Details from Deputy Secretary, The Institute of Mathematics and its Applications, Maitland House, Warrior Square, Southend-on-Sea, Essex SS1 2JY, England

June 30-
July 4
(Poznan,
Poland)

Third International Seminar on Random Graphs and Probabilistic Methods in Combinatorics
Details from M Karonski, Institute of Mathematics, Adam Mickiewicz University, Matejki 48/49, 60-769 Poznan, Poland

July 6-10
(Gregynog,
Wales)

Third Gregynog Symposium on Differential Equations
Details from Dr MG Lloyd, Department of Mathematics, The University College of Wales, Aberystwyth, Dyfed, SY23 3B2, Wales, UK

July 6-16
(London)

Research Symposium on Complex Analysis
Details from Dr IN Baker (Research Symposium on Complex Analysis), Mathematics Department, Imperial College, 180 Queens Gate, London SW7 2BZ, England

July 13-17
(Karlsruhe,
Germany)

Fourteenth International Colloquium on Automata, Languages and Programming
Details from International Colloquium on Automata, Languages and Programming, Institut fur Angewandte Informatik und Formale Beschreibungsverfahren, Universität Karlsruhe(TH), Postfach 6980, 7500 Karlsruhe, Federal Republic of Germany

July 13-17
(London)

Eleventh British Combinatorial Conference
Details from Mrs C Whitehead, Department of Mathematical Sciences, University of London, Goldsmith's College, London SE14 6NW, England

July 13-17
(Birmingham)

Inequalities Conference
Details from the Organising Secretary, Inequalities Conference, University of Birmingham, PO Box 363, Birmingham B15 2TT, England

July 19-24
(Prague)

Conference on Potential Theory
Details from E Cermáková, matematicko-fyzikálni fak UK, Solovská 83, CSSR-18600 Praha 8, Czechoslovakia

July 20-25
(Tokyo)

Second International Congress of the International Fuzzy Systems Association
Details from Second IFSA Congress Secretariat, c/- The Society of Instrument and Control Engineers, 1-35-28-303, Hongo, Bunkyo-ku, Tokyo 113, Japan

July 27-29
(Canton,
New York)

SLU-GTE Conference on Commutative Harmonic Analysis
Details from D Colella, Department of Mathematics, Saint Lawrence University, Canton, New York 13617, USA

July 27-31 (Campinas, Brazil)
International Symposium on Information and Coding Theory
Details from P Rathie, Universidade Estadual de Campinas, 13083 Campinas, SP, Brazil

August 1-6 (People's Republic of China)
Fifth Conference on Graph Theory of China
Details from Z Zhong-fu, Lanzhou Railway Institute, Lanzhou, Gansu, People's Republic of China

August 3-7 (Athens, Georgia)
Georgia Topology Conference
Details from C McCrory, Department of Mathematics, University of Georgia, Athens, Georgia 30602, USA

August 3-21 (Montréal)
Mathematical and Statistical Developments of Evolutionary Theory
Details from G David, Département de Mathématiques et de Statistique, Université de Montréal, Carte Postale 6128, Montréal H3C 3J7, Canada

August 4-7 (St Louis, Missouri)
Sixth International Conference on Mathematical Modelling
Details from E Rodin, Department of Systems Science and Mathematics, Washington University, Campus Box 1040, One Brookings Drive, St Louis, Missouri 63130, USA

August 9-15 (Ithaca, New York)
Statistical Inference from Stochastic Processes
Details from Ms Jean Smith, 806 15th Street NW, Washington DC 20005, USA

August 9-15 (Nedlands, W Australia)
International Conference on Abelian Groups
Details from Dr P Schultz, Mathematics Department, University of Western Australia, Nedlands, Western Australia 6009, Australia

August 9-22 (Brunswick, Maine)
Harmonic Analysis on Real and p-adic Groups
Details from W Barker, Department of Mathematics, Bowdoin College, Brunswick, Maine 04011, USA

August 10-21 (Toronto)
Set Theory and its Applications - Conference at York
Details from A Dow, Department of Mathematics (STACY), N520 Ross Building, York University, North York, Ontario, Canada M3J 1P3

August 16-21 (Stanford, California)
Sixteenth Conference on Stochastic Processes and their Applications
Details from D Iglehart, Department of Operations Research, Stanford University, Stanford, California 94305-4022, USA

August 17-20 (Hobart, Tasmania)
International Conference on Rings, Modules and Radicals
Details from Dr BJ Gardner, Mathematics Department, University of Tasmania, GPO Box 2520, Hobart, Tasmania 7001, Australia

August 17-22
(Moscow)
Eighth International Congress of Logic, Methodology and Philosophy of Science
Details from I Frolov, Volkhonka 14, Moscow 119842, USSR

August 18-21
(Nis,
Yugoslavia)
Third Conference on Numerical Methods and Approximation Theory
Details from G Milovanovic, Faculty of Electronic Engineering, Department of Mathematics, PO Box 73, 18000 Nis, Yugoslavia

August 24-26
(Christchurch)
38th Conference of the New Zealand Statistical Association
Details from RN Penny, Mathematical Statistics Division, NZ Department of Statistics, Private Bag, Christchurch, New Zealand

August 24-27
(Sydney)
International Conference on Computational Techniques and Applications
Details from Dr CAJ Fletcher, CTAC-87 Department of Mechanical Engineering, University of Sydney, NSW 2006, Australia

August 24-28
(Xanthi,
Greece)
Equadiff '87 (Differential Equations)
Details from J Schinas, Equadiff '87, Democritus University of Thrace, Section of Applied Mathematics, 67100 Xanthi, Greece

August 24-28
(Canberra,
Australia)
Second International Conference on Combinatorial Mathematics and Computing
Details from B McKay, Computer Science Department, Australian National University, PO Box 4, Canberra, ACT 2601, Australia

August 24-28
(Seattle,
Washington)
Sixth National Conference on Artificial Intelligence
Details from L Cooper, American Association for Artificial Intelligence, 445 Burgess Drive, Menlo Park, California 94025, USA

August 24-28
(Szeged,
Hungary)
Internat. Conference on Web Geometry and Related Fields
Details from P Nagy, Bolyai Institute, Szeged University, Aradi Vértanúk tere 1, H-6720 Szeged, Hungary

August 24-29
(Mons,
Belgium)
Meeting on Geometry of Banach Spaces
Details from C Finet, Université de l'Etat à Mons, Faculté des Sciences, 15 avenue Maistriau, 7000 Mons, Belgium

August 26-28
(Christchurch)
1987 Australasian Meeting of the Econometric Society
Details from Professor DEA Giles, Department of Economics and Operations Research, University of Canterbury, Christchurch, New Zealand

August 31- September 4 (Neuchâtel, Switzerland)	**First International Conference on Statistical Data Analysis Based on the L 1 -Norm and Related Methods** Details from Y Dodge, Conference Organiser, Université de Neuchâtel, Groupe d'Informatique et de Statistique, Pierre-à-Mazel 7, CH-2000 Neuchâtel, Switzerland
Sept 7-9 (Edinburgh)	**Summer Conference on Category Theory and Computer Science** Details from D Pitt, Department of Mathematics, University of Surrey, Guildford, Surrey GU2 5XH, UK
Sept 8-11 (Kassel, W Germany)	**Third International Conference on the Teaching of Mathematical Modelling and Applications** Details from W Blum, Universität Gesamthochschule Kassel, Fachbereich Mathematik, Heinrich-Plett-Strasse 40, D-3500 Kassel, Federal Republic of Germany
Sept 8-16 (Tokyo)	**46th Biennial Session of the International Statistical Institute** Details from International Statistical Institute, 428 Prinses Beatrixlaan, Voorburg, Netherlands
Sept 9-11 (Louvain-la- Neuve, Belgium)	**Seventh GAMM Conference on Numerical Methods in Fluid Mechanics** Details from M Deville, Unité de Mécanique Appliquée, 2 Place du Levant, B-1348 Louvain-la-Neuve, Belgium
Sept 9-12 (Kassel, Germany)	**Internationale Konferenz über Anwendungen und Modellbildung in Mathematikunterricht** Details from W Blum, Univ GHS Kassel, FB Mathematik, Heinrich-Plett-Str 40, D-3500 Kassel, Federal Republic of Germany
Sept 13-19 (Ulm, Germany)	**Journ é es Arithm é tiques 1967** Details from E Wirsing, Univ Ulm, Abt Mathematik II, Postfach 4066, D-7900 Ulm, Federal Republic of Germany
Sept 17-19 (Tokyo)	**First Satellite Meeting of the International Association of Statistical Computing** Details from C Hayashi, 23-11 Inokasira, 2-Tyome, Mitaka-Sei, Tokyo, Japan
Sept 28-30 (Valencia, Spain)	**International Conference on Linear Algebra and Applications** Details from Prof Vicente Hernandez, ETS Ing Industriales, Universidad Politécnica, Apartado 22012, 46071 Valencia, Spain
Oct 12 - Nov 6 (Trieste, Italy)	**Workshop on Mathematical Ecology** Details from ICTP, PO Box 586, 34100 Trieste, Italy

Oct 19-23 (Johannesburg Sth Africa)

20th International Conference on the Application of Computers and Mathematics in the Mineral Industries
Details from Conference Secretary (c31), Mintek, Private Bag X 3015, Randburg 2125, South Africa

Oct 25-31 (Schwerin, E Germany)

International Conference on Population Mathematics
Details from the Secretariat ICPM 87, A Kollat, Gesellschaft fur physikalische und mathematische Biologie der Deutschen Demokratischen Republik, Am Kupfergraben 7, Berlin 1080, German Democratic Republic

Oct 26-30 (Beijing)

Third Asian Conference on Mathematical Logic
Details from Yang Dongping, Institute of Software, Academia Sinica, PO Box 8718, Beijing, People's Republic of China

Oct 26-31 (Sofia)

International Conference on Mathematical Methods in Operations Research
Details from Institute of Mathematics with Computer Centre, Bulgarian Academy of Science, 1113 Sofia, Acad G Bonchev, Block 8, Bulgaria.

Nov 9 - Dec 18 (Trieste, Italy)

College on Riemann Surfaces
Details from ICTP, PO Box 586, 34100 Trieste, Italy

Dec 26-28 (Pune, India)

Ramanujan Birth Centenary Year International Symposium on Analysis
Details from Professor NK Thakare, Department of Mathematics, University of Poona, Pune-411007, India

****1988****

Jan 20 - Feb 5 (Newcastle, NSW)

28th Summer Research Institute of the Australian Mathematical Society
Details from Dr R Eggleton, Department of Maths, Stats and Computer Science, University of Newcastle, Rankin Drive, Shortland, NSW 2308, Australia)

April 17-30 (Banff, Canada)

First Canadian Number Theory Society Conference,
Details from R Mollin, University of Calgary, Department of Statistics, 2500 University Drive NW, Calgary, Alberta, Canada T2N 1N4

May 16-20 (Canberra)	**1988 Mathematical Sciences Congress and 32nd Annual Meeting of the Australian Mathematical Society** Details from Prof CC Heyde, Department of Statistics, Inst. of Advanced Studies, Australian National University GPO Box 4, Canberra, ACT 2601, Australia
May 23-27 (Chiangmai, Thailand)	**Conference on Mathematical Methods and Applications** Details from Prof Suwom Tangmanee, Faculty of Science, Kasetsart University, Bangkok 10900, Thailand
July 18-22 (Paris)	**International Association for Mathematics and Computers in Simulation: 12th World Congress on Scientific Computation** Details from The Secretary, 12th IMACS World Congress, IDN, BP 48, 59651 Villeneuve d'Ascq Cedex, France
July 27 - Aug 3 (Budapest)	**Sixth International Congress on Mathematical Education** Details from Dr MF Newman, Department of Mathematics, Research School of Physical Sciences, Institute of Advanced Studies, The Australian National University, PO Box 4, Canberra, ACT 2601, Australia
Aug 20-26 (Pusan, Republic of Korea)	**Groups - Korea 1988** Details from Prof AC Kim, Department of Mathematics, The Pusan National University, Pusan 607, Republic of Korea
Aug 21-27 (Grenoble, France)	**17th International Congress of Theoretical and Applied Mechanics** Details from D Caillerie, Secretary of the International Congress of Theoreticl and Applied Mechanics 1988, Institut de Mécanique de Grenoble, Domain Universitaire, Boite Postale 68, 38402 Saint Martin d'Heres Cedex, France

MR Carter, Massey University;
Conference Collator

Down:

1. Place a number in the lava. (4)
2. Radical hot shot at Tyler's start. (6)
3. Tumblers from a coast bar. (8)
4. The momentous ellipsoid's way hooped around the left. (7)
5. Did he land in a corn rig the wrong way? (8)
6. Provides a sound distribution? (4)
8. The trousers of failure perhaps 15 twice. (5)
12. Information processor who rasps the flier. (5)
14. Departures set about the side. (5)
16. To hatch a Cuban tie is askew. (8)
18. Of a body of law found amid cult. (8)
19. The ultimate in mathematics. (7)
21. Play of Capek et al applied to country ways. (5)
23. To grasp the measure of 150 going to church. (6)
25. Without a wave. (4)
27. To carry the odds, of course. (4)

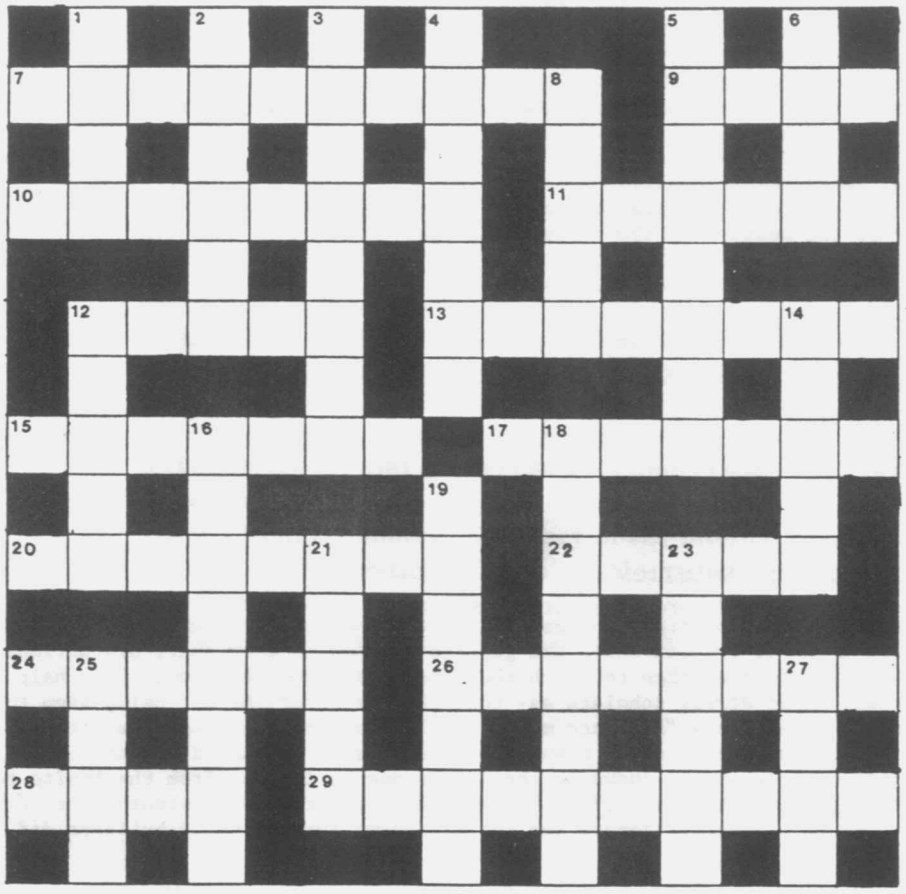
CROSSWORD No. 20: SOLUTION

This is dedicated to H(*oratius*) Cocles, *aliter* the one-eyed, who while on the *Sublician* allowed *nary* a one to *transit* until the gap had *widened* so much that, his actions *suspended* he had to *vault* into the *Tiber* to reach the *ropes* cast from the *ramparts* to help him *clamber* up the *stones*. Some *strict* scholars say that this is *error*, he not being seen to have *risen* from below; to these I say *"Boo"* and may a *troll* give perpetual *alarm*, as it did to Billy Goat Gruff, to these who besmirch his *comet*-like glory. He should be remembered at all crossings; from those of the *Indus* to the famous one at *London*; from the *Rialto* to the one at *Ayr* (where Maggie lost her tail); and let us not forget the *Oscar*-winning one on *the River Kwai*. However we had better ignore the one at *Tacoma Narrows* whose builders did not know the *ropes*.

[Notes: the theme of the puzzle is bridges and the legend of Horatius (see Macaulay's *Lays of Ancient Rome*). The reference to Ayr is in Burns' *Tam O'Shanter*. The reference to Tacoma Narrows concerns a suspension bridge that shortly after completion destroyed itself theregy providing the classical example of wind-induced instability.]

Crossword

CROSSWORD No.21 MAKING TRACKS by Matt Varnish



ACROSS:

7. An enclosed 26 with great start but Swift's pudding in the end. (10)
9. Gosh! A cyma reversa. (4)
10. The patient said, the dentist did; so to what line? (8)
11. Around the Equator it is great, below London a line. (6)
12. Traces of two leaves at least (of Descartes?) (5)
13. Un-negated and non-plussed but, mark indeed, the intended way. (8)
15. In the well, ipse facto, the projected 11. (7)
17. No edict could be a comb in a way. (7)
20. Trail 9 behind 21 engine. Oh no! It's a drag! (8)
22. Almost an insect path (5)
24. It lines an even pressure. (6)
26. The path of the gambler? (8)
28. A wooden defect or bird in a tangled way. (4)
29. Clementia's ribboned way. (10)