Number 130 August 2017

NEWSLETTER

OF THE

NEW ZEALAND MATHEMATICAL SOCIETY

Contents

PUBLISHER'S NOTICE

This newsletter is the official organ of the New Zealand Mathematical Society Inc. This issue was edited by Miguel A Moyers González and Phillip L Wilson. Editorial enquiries and items for submission to this journal should be submitted as plain text or LaTeX files with "NZMS newsletter" in the title of the email to phillip.wilson@canterbury.ac.nz. LaTeX templates are available upon request from the editors.

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The newsletter is available at: nzmathsoc.org.nz/?newsletter

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EDITORIAL

As we began putting this issue together we were saddened and shocked to hear the unexpected news of the death of Maryam Mirzakhani. A bright light has been taken from the mathematical community at such a young age. Because she was an inspiration to so many people, we made the decision to publish her obituary here even though she had no formal connection with the New Zealand mathematical community. Her work and the encouragement and inspiration she gave transcended national borders. We are grateful to Stanford University for permission to publish her obituary.

The minutes of the 2016 NZMS AGM are published below on page 38. Our apologies for how late they are, it was our responsibility to publish these and we did not do so! This entire issue is also slightly late, for which we also apologise.

We hope you enjoy the issue, which also includes the first of what we hope will be an ongoing column from David Gauld. The first of his Mathematical Miseponymy columns is about Stokes's Theorem — or "Stokes's" Theorem — and appears on page 8.

Please drop us a line to let us know what you think about the contents of this issue, and if you would like to write a column or one-off article for us, we'd be delighted to hear from you.

Miguel Moyers and Phil Wilson

PRESIDENT'S COLUMN

It is with great personal sadness that I write about the death of Maryam Mirzakhani, the first woman to win the Fields Medal. Included in this Newsletter you will find a reprint of her obituary from Stanford News. A special page has been set up on the AMS website to celebrate Maryam's accomplishments and to provide a forum for people to share their thoughts. Please pass along the link to your colleagues: ams.org/profession/mirzakhani.

There is a new mathematics competition, called the Simon-Marais Mathematics Competition, which is aimed at undergraduates in locations with time zones between New Zealand Standard Time and Indian Standard Time. The competition is inspired by the Putnam competition. Universities have to apply to register, and then their students can enter individually or in pairs. There is quite a lot of New Zealand involvement with this competition: Lisa Orloff Clark (Victoria University of Wellington) is on the Organising Committee, and Michael Albert (University of Otago) and Chris Tuffley (Massey University) are on the Problem Committee. I hope our undergraduate students will benefit from this competition. See simonmarais.org for more information, and the notice on page 37.

There are several events to look forward to:

- The 2017 Maclaurin Lecturer, Ken Ono from Emory University, will be touring in October. The dates are available at nzmathsoc.org.nz. Ken will be the last Maclaurin Lecturer.
- The NZ Maths and Stats Postgraduate Conference 2017 will be held in Kaiteriteri 26–29 November 2017. The organisers are Emma Greenbank, Jessica Santiago and Sebastian Schuster, all students at Victoria University of Wellington.
- The NZMS Colloquium will be held 4–6 December at the University of Auckland; the convenors are Tom ter Elst and Hinke Osinga. The list of plenary speakers is now available at nzmathsoc.org.nz/colloquium2017.
- The 2018 NZMRI Summer Meeting "Algebra and Representation Theory" will be held 7–13 January 2018 at Thunanui Beach near Nelson; the organisers are Eamonn O'Brien, Marston Conder and Gabriel Verret. See nzmri-conferences.blogs.auckland.ac.nz.

Included later in this Newsletter is a call for nominations for Council, and for applications for student-travel grants and other grants.

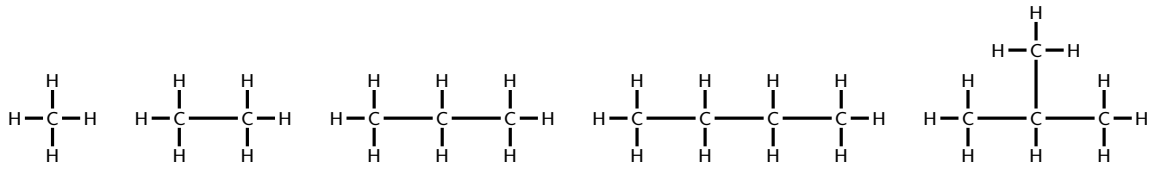
Astrid an Huef

MATHEMATICAL MINIATURE

MM43: Isomers and Taylor series

The amateur mathematician Timothy Swan, whose notebooks I have been struggling through, recorded his curiosity about the bracket-free Polish notation. He didn't live long enough to realise that there can be practical advantages in both prefix and postfix notations. The computer age was just dawning when Timothy died in 1953. As a matter of history, Grace Hopper, at about the same time, had only just built the very first compiler, a precursor to COBOL. Polish notation, or rather reverse-Polish notation, turned out to be a vital ingredient in the parsing and compilation of computer code in scientific programming languages. In the pioneering Hewlett-Packard calculators, reverse Polish was used directly to express the calculation to be performed.

A simple example shows how Polish notation is related to standard chemical notation for the structural isomers of alkanes (paraffins). The first few, with both *n*-butane and *i*-butane shown in the case of $\mathsf{C}_4\mathsf{H}_{10}$, are



CH_4 $\mathsf{CH}_3\mathsf{CH}_3$ $\mathsf{CH}_3\mathsf{CH}_2\mathsf{CH}_3$ $\mathsf{CH}_3\mathsf{CH}_2\mathsf{CH}_2\mathsf{CH}_3$ $\mathsf{CH}_3\mathsf{CHCH}_3\mathsf{CH}_3$

Apart from isobutane, the chemical notation is also Polish notation if some conventions are adopted. First, H should be regarded as an operand. Secondly, C should be regarded as an operator acting on 4 arguments. Thirdly, subscripts signify repetitions. This means that $\mathsf{CH}_4 = \mathsf{CHHHH}$ would be written in traditional functional notation as $\mathsf{C}(\mathsf{H},\mathsf{H},\mathsf{H},\mathsf{H})$. Finally, C acting on three, rather then four, operands, acquires the same syntactic status as H. With these conventions the Polish notation for isobutane given above, has the correct meaning, even though this is not a conventional chemical nomenclature.

A large body of numerical analysis uses Taylor series to assess the accuracy of numerical approximations. In the case of algorithms for solving initial value problems $y' = f(y)$, $y(x_0) = y_0$, the terms in the Taylor series for the flow through a small time-step h, and the approximation to this by a so called "B-series" method, are each of the form

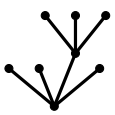
$$h^{|t|}a(t)\sigma(t)^{-1}F(t),$$

where t ranges through all rooted trees. For a specific rooted tree t, $|t|$ is the order (number of vertices) and $\sigma(t)$ is the symmetry (the order of a certain group related to automorphisms of the vertices of t). The coefficients $a(t)$ are characteristic of the particular quantity being expanded. The factor $F(t)$ is formed from the sequence of $\mathbf{f}$ and the Fréchet derivatives $\mathbf{f}'$, $\mathbf{f}''$ ..., in each case evaluated at y_0. These derivatives act like linear and multi-linear operators and they combine together as determined by t. Here Polish notation is very convenient because it allows, for example, $\mathbf{f}''$ acting bi-linearly on say $\mathbf{f}$ and $\mathbf{f}'\mathbf{f}$, to be written as $\mathbf{f}''\mathbf{f}\mathbf{f}'\mathbf{f}$, rather than $\mathbf{f}''(\mathbf{f},\mathbf{f}'\mathbf{f})$. The following table shows the details for all rooted trees such that $|t| \leq 4$

t								
$\lvert t\rvert$	1	2	3	3	4	4	4	4
$\sigma(t)$	1	1	2	1	6	1	2	1
$F(t)$	$\mathbf{f}$	$\mathbf{f}'\mathbf{f}$	$\mathbf{f}''\mathbf{f}\mathbf{f}$	$\mathbf{f}'\mathbf{f}'\mathbf{f}$	$\mathbf{f}^{(3)}\mathbf{f}\mathbf{f}\mathbf{f}$	$\mathbf{f}''\mathbf{f}\mathbf{f}'\mathbf{f}$	$\mathbf{f}'\mathbf{f}''\mathbf{f}\mathbf{f}$	$\mathbf{f}'\mathbf{f}'\mathbf{f}'\mathbf{f}$

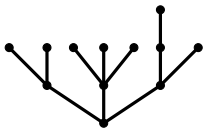
The alkanes shown above, written in Polish notation, correspond to special rooted trees, where H corresponds to $\mathbf{f}$, C in the root position corresponds to $\mathbf{f}^{(4)}$ and C at any other position in the tree corresponds to $\mathbf{f}^{(3)}$; C still has a valency of 4 because there is 1 parent and 3 children.

Here is the tree for $\mathsf{CH}_3\mathsf{CH}_3$ again, but this time written in a manner which better shows the rooted tree structure.



As always, I would very much appreciate some feed-back on these or previous miniatures. In particular, I would like some suggested answers to the questions I posed in MM41 and MM42. One reason I want comments is that it is hard to get things just right. It is easy to write things that are too easy or too hard and I want to avoid either of these.

I will conclude by presenting one final rooted tree with the challenge to guess its significance. I do not plan to announce the answer but I will receive individual guesses and tell the answer to anyone who really wants to know what I have in mind.



J.C. Butcher

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CYBERMATH

This column is focused on a single specialized topic. For almost the last two years I have been involved with several international collaborators (from Australia, Netherlands, UK, France and Germany) in a project to accelerate the conversion of mathematics journals to a model involving open access with no direct payments by authors (sometimes called "diamond open access"). Some of these activities have been reported on in this Newsletter in the last several columns.

We created a legally constituted non-profit foundation (Stichting) called MathOA mathoa.org in the Netherlands in order to oversee the "flipping" of subscription journals to open access. The advisory board for MathOA includes Timothy Gowers, David Mumford, and several strong mathematicians who haven't won the Fields Medal. MathOA is modelled on LingOA, a foundation in linguistics that organized the defection of the board of Lingua from Elsevier and the re-founding of the journal under the name Glossa, published by Ubiquity Press.

LingOA and MathOA have since been joined by PsyOA (in psychology) and we intend to create a loose organization called Fair Open Access Alliance. We have formulated what we call the Fair Open Access Principles, see fairoa.org.

We have also invited existing mathematics journals that (essentially) conform to these principles to join an as yet unnamed network which will become part of FOAA. So far the following have agreed to do so: Australasian Journal of Combinatorics, Discrete Analysis, Discrete Mathematics and Theoretical Computer Science, Electronic Journal of Combinatorics, Epijournal de Geometrie Algebraique, INTEGERS: The Electronic Journal of Combinatorial Number Theory, Internet Mathematics, Journal de théorie des nombres de Bordeaux, Journal of Computational Geometry, Logical Methods in Computer Science, SIGMA. FOAA is in its infancy and we are investigating ways in which we can create synergy between these independent journals, and make them even better (they are already very good or excellent in many respects).

After the administrative details above, the **big news** to report is that the editorial board of Journal of Algebraic Combinatorics, currently published by Springer, has resigned to create a new journal (which is clearly the re-formation of the old one) under the name Algebraic Combinatorics (algebraic-combinatorics.org), published in association with Centre Mersenne. This has been assisted from the start by MathOA.

Conversion of journals to open access is accepted by the large publishers only if it doesn't negatively affect their profits. Thus if they own the journal title, what usually happens is a refusal to negotiate seriously and an attempt to find a new editorial board to continue the old title. In my opinion, it is an attack on the mathematical community (and the wider public, and science itself) for a researcher to accept an offer to run such a zombie journal. Almost always, journals losing their entire editorial board in this way do cease publication within a few years (see my blog post mcw.blogs.auckland.ac.nz/2016/10/08/what-happens-to-journals-that-break-away/) and the new ones thrive.

Although this action by the editors is in some sense obviously ethically correct, and is made easier by legal and practical help from MathOA, it still requires considerable courage from the editors. Leaving aside them having to forego approximately $\$2^{11}$ annual stipend, they need to deal with pestering by publisher representatives (who suddenly discover how important the journal is after years of taking it for granted), media attention, learning new editorial software, and general uncertainty. So I salute Akihiro Munemasa, Hendrik van Maldeghem, Christos Athanasiadis and Hugh Thomas, who to my knowledge are the first editors-in-chief to flip their mathematics journal from a subscription model to one run according to Fair OA principles. May they be followed by many, and soon!

Mark C. Wilson

MATHEMATICAL MISEPONYMY

Stokes's Theorem

Preface

In an article published in the New York Academy of Sciences in 1980 the statistician Stephen Stigler stated what he called **Stigler's law of eponymy**:

> No scientific discovery is named after its original discoverer.

Of course Stigler's naming of this law was somewhat tongue in cheek and also intended to illustrate the truth of the law because, as he noted, many people before him had already enunciated this law. In particular, Stigler referred to prior work of Merton. In an article appearing in *Science* in 1968 Merton calls it **the Matthew effect** after Chapter 25, verse 29 of the Bible's *Gospel according to St Matthew*:

> For unto every one that hath shall be given, and he shall have abundance: but from him that hath not, even that which he hath shall be taken away.

Both articles cover a range of possibilities including co-authorship involving, for example, Nobel laureates where credit tended to be given to the Nobel laureate and little or no credit to his or her co-authors.

Merton, of course, was not the first to discuss this particular topic. The famous blind and deaf American author and lecturer Helen Keller in her book *The Story of My Life* (published 65 years before she died!) describes an incident involving a short story she wrote at the age of 11 about the onset of autumn. She was accused of plagiarism and had a difficult time defending herself considering her age and disabilities. In a letter to her dated 17$^{\text{th}}$ March, 1903, Mark Twain discussed her predicament and had this to observe:

> It takes a thousand men to invent a telegraph, or a steam engine, or ... or any other important thing — and the last man gets the credit and we forget the others.

Closer to home, H. C. Kennedy in an article in the American Mathematical Monthly calls the phenomenon **Boyer's Law**, referring to many examples in C. B. Boyer's *A History of Mathematics*.

> Mathematical formulas and theorems are usually not named after their original discoverers.

I follow Sal Restivo who in his 1994 book *Science, Society, and Values: Toward a Sociology of Objectivity* used the term **the iron law of miseponymy**.

Stokes's Theorem

A modern formulation of Stokes's (Stokes' if you prefer!) Theorem states that for a smooth, compact, oriented manifold M^m with boundary ∂M and a differential $(m-1)$-form ω on M we have $\int_{\partial M}\omega = \int_M d\omega$. Stokes's Theorem in this generality was formulated by Elie Cartan twenty or so years after Sir George Stokes died, though Cartan had already started down this pathway before Stokes's death.

Much of the history of the evolution of Stokes's Theorem is discussed in [1], including a collection of names for early variants of the theorem, where the names frequently depend on the nationality of the person referring to them. There is also reference there to the famous letter from William Thomson (later Baron Kelvin of Largs) to Stokes[1] dated 2$^{\text{nd}}$ July, 1850 in which the version of the theorem later made famous by Stokes is formulated. In his letter Thomson has the following to say in a postscript:

> The following is also interesting, & is of importance with reference to both physical subjects.
> $\int(\alpha dx+\beta dy+\gamma dz)$
>
> $$=\pm\iint\left\{l\left(\frac{d\beta}{dz}-\frac{d\gamma}{dy}\right)+m\left(\frac{d\gamma}{dx}-\frac{d\alpha}{dz}\right)+n\left(\frac{d\alpha}{dy}-\frac{d\beta}{dx}\right)\right\}dS$$
>
> where l, m, n denote the dir$^{\text{n}}$ cosines of a normal through any el$^{\text{t}}$ dS of a (limited) surface; & the integ$^{\text{n}}$ in the sec$^{\text{d}}$ member is performed over a portion of this surface bounded by a curve round w$^{\text{h}}$ the int$^{\text{n}}$ in the 1$^{\text{st}}$ member is performed.

[1] Stokes and Thomson exchanged numerous letters collected, for example, in [2].

Stokes went on to use this equation in the examination for the Smith's Prize in 1854: four years from discovery to use in a University exam!

I don't think I need go into the circumstances of the discovery by Archimedes of Syracuse of his famous principle of buoyancy (his streaking theorem?) but in any case I reckon that Archimedes formulated the essence of the modern-day Stokes's Theorem more than two millennia before Stokes or Thomson or Cartan or ....

Suppose M^3 is a compact manifold with boundary immersed in a fluid. We may choose coordinates so that the fluid occupies $\{(x,y,z) \in \mathbb{R}^3 \,/\, z \geq 0\}$ (so the z-axis is vertically down). Suppose that the fluid has density ρ. Then the function $\mathbb{R}^3 \to \mathbb{R}$ given by $(x,y,z) \mapsto \rho gz$ measures the downward pressure of the fluid when $z \geq 0$: defining $\varphi : \mathbb{R}^3 \to \mathbb{R}^3$ by $\varphi(x,y,z) = (0,0,\rho gz)$ we may also think of φ as the 2-form $\rho gz dx \wedge dy$. Since the fluid exerts equal pressure in all directions, the buoyant force on M is $\int_{\partial M} \varphi$. On the other hand the weight of the fluid displaced is just $\rho g|M|$, where $|M|$ denotes the volume of M. Of course $|M| = \int_M 1$, so the weight is $\int_M \rho g = \int_M d\varphi$; here $d\varphi$ is the divergence of φ. In claiming his principle, Archimedes was stating that $\int_{\partial M} \varphi = \int_M d\varphi$. Admittedly the Principle of Archimedes is a special case of Stokes's Theorem but of course calculus didn't come along for another 1900 years or so and he did have a particular application in mind.

David Gauld

References

[1] Victor J. Katz, *The History of Stokes' Theorem*, Mathematics Magazine, **52**(1979), 146–156.

[2] David B Wilson (ed), *The correspondence between Sir George Gabriel Stokes and Sir William Thomson, Baron Kelvin of Largs*, Cambridge University Press, 1990, 783+lxv.

PROFILE

Rick Beatson

Rick Beatson began his studies in Mathematics at University of Canterbury in 1970. Prior to confirming his enrolment on the final year of honours, he thought to keep his options open and attended a lecture in an engineering department. Luckily for the mathematics community in NZ, it was reputed to be the worst and most boring lecture he had sat in (apparently the lecturer was famous around campus for this), thus cementing his decision to continue studying the subject that we all love. He finished honours in 1973, in an impressive cohort of 33 students, and was awarded the Cook Memorial Prize (for best student in that year's class). He continued his studies in mathematics, graduating with an MSc in 1975 and a PhD in 1978. The topic was approximation theory and the supervisor was Allan McInnes. After graduation, he took a Postdoctoral fellowship in the University of Otago before making the jump across the Pacific to the wild lands of America. He was an Instructor at University of Texas, Austin from 1978 to 1981 and then he held a tenure-track position at the University of Connecticut from 1981 to 1985, with a stint at DSIR–Lincoln in the middle. He returned to NZ in 1985 as a lecturer at University of Canterbury. He has progressed up the ranks, and now holds a Professorship in the School of Mathematics and Statistics.

Rick's field of research is in approximation theory/numerical analysis and his work is of enviable international reputation (including 4947 citations on Google Scholar at time of writing). Throughout his career, Rick has worked on challenging and interesting mathematical problems that have important technological and/or industrial applications. He is famous for his fast evaluation and iterative fitting techniques for many types of Radial Basis Functions (RBFs) which reduce the operations count for interpolating at N data points by orders of magnitude. This breakthrough allowed RBFs to be used for very much larger data fitting problems than was previously possible.

To provide a little detail of the above the problem is to find a radial basis function

$$s(x) = p(x) + \sum_{i=1}^{N} \lambda_i \Phi(x - x_i),$$

which interpolates to given values f_i at the nodes x_i. Here p is a low degree polynomial and Φ some suitable radial function. Fitting the interpolant reduces to solving the linear system

$$\begin{bmatrix} A & P \\ P^T & O \end{bmatrix} \begin{bmatrix} \lambda \\ a \end{bmatrix} = \begin{bmatrix} f \\ 0 \end{bmatrix}.$$

Here $a_{ij} = \Phi(x_i - x_j)$ and $p_{ij} = q_j(x_i)$, where $\{q_1, \ldots q_\ell\}$ is a basis for the space of low degree polynomials involved. In many cases Φ does not have compact support and therefore the $(N+\ell) \times (N+\ell)$ matrix in the linear system is full. Thus direct solution requires $\mathscr{O}(N^3)$ operations and $\mathscr{O}(N^2)$ storage. Rick, and coauthors, developed appropriate fast multipole methods to compute matrix vector products and coupled these with suitable domain decomposition preconditioned iterative methods. Taken together these reduced the computational costs to $\mathscr{O}(N(\log N)^2)$ operations and $\mathscr{O}(N)$ storage. This enabled the use of RBF methods on problems involving hundreds of thousands of points.

A distinguished feature of Rick's research is that he develops both theoretical aspects, and the algorithms to implement these theories. Indeed, his world-class applied mathematics marries deep, insightful and rigorous mathematical analysis with clever algorithms and programming skill to make tools that solve a plethora of scientific and engineering problems. As an example we will focus here on his work with Qui Bui on the technique of "implicit smoothing". One begins with a "noisy" data set. First, the data is interpolated with an RBF yielding an approximation $s(x) = p(x) + \sum_{i=1}^{n} \lambda_i \Phi(x - x_i)$. Then this initial approximation, s, is smoothed via convolution with a mollifier k. For some practically important basic functions Φ, a suitable choice of k yields a simple and easy to evaluate $\Psi = \Phi * k$. Then the smoothed approximation is $s * k(x) = p * k(x) + \sum_{i=1}^{N} \lambda_i \Psi(x - x_i)$. In practical terms, this substantially reduces the cost of implementing a smoothing process, as calculating the convolution is "free" once the function Ψ is known. This technique has been successfully applied to lidar and laser scanners in his consulting work with ARANZ (Applied Research Associates New Zealand Limited), a technological firm in Christchurch. In this application, a natural choice for Φ is $\Phi(x) = |x|, x \in \mathbb{R}^3$, the biharmonic spline basic function in $\mathbb{R}^3$, and a judicious choice of k results in a simple mollification formula $\Psi = \Phi * k$, with $\Psi(x) = \sqrt{|x|^2 + c^2}$, where $c > 0$ is a parameter related to the "scale" and "error bounds" of the smoothing process. The mathematics underlying this smoothing process was done in a collaboration with Qui Bui at Canterbury, where they also established analogous formulas for a number of other important RBF basic functions. The mathematical tools used include results from Schwartz distribution theory, harmonic analysis and complex variables. This is a testimony to Rick's versatility and willingness to work with people from other branches of mathematics.

Rick has had many international collaborators over the years. These include a number of eminent mathematicians, such as (the late) Mike Powell and (the late) Will Light (UK), Charles Chui (USA), Nira Dyn (Israel). He has been invited to be a plenary speaker at a number of large international conferences in his fields. For his collaboration with industry, he was awarded the Innovation Medal by the University of Canterbury in 2015.

Finally, Rick is an excellent colleague. He is an inspiring and effective teacher, with a particular penchant for ensuring the smooth running of exceedingly large enrolment undergraduate courses ("Instructions to Lecturers" have been know to include an elaborate incentive system for minimising errors in tutorial sheets, facilitated by exponential growth in the provision of chocolate bars). He has served on the NZMS Council, organised Colloquia, and is a diligent contributor to departmental life.

Qui Bui, Rua Murray and Miguel Moyers

LOCAL NEWS

AUCKLAND UNIVERSITY OF TECHNOLOGY

SCHOOL OF ENGINEERING, COMPUTER AND MATHEMATICAL SCIENCES

Events

The Mathematical Sciences Research Group (MSRG), within the School of Engineering, Computer and Mathematical Sciences, is planning to host a Mathematical Sciences Symposium over the period 23–24 November 2017 in AUT city campus. Researchers in Applied Mathematics, Analytics and Statistics areas are welcome to attend.

Dr Hyuck Chung, Dr Wenjun Zhang and several postgraduate students from AUT participated in the 2017 MINZ Workshop, held at Massey University in Palmerston North. At this year's MINZ Directors' meeting, it was decided that the 2018 MINZ Workshop will be hosted by the Department of Mathematical Sciences in the AUT City Campus, over the period 25-29 June 2018.

Analytical talent is in short supply and high demand in today's business world. SAS Global Academic Program offers joint certificates in Analytics, by partnering with over 80 universities. In 2016, the Master of Analytics at AUT joined in this global program. In July 2017, the first group of 3 graduands in the Master of Analytics at AUT were awarded AUT-SAS joint certificates in Advanced Analytics.

Travel and Conference Participation

Dr Sarah Marshall attended the SAS Users Conference (SUNZ) in Wellington on 11th May 2017. This event provided the opportunity to hear about new developments at SAS as well as interesting industry-based applications of statistics and analytics.

Prof Jeff Hunter delivered an invited talk on "Mean First Passage Times in Markov Chains — How best to compute?" at the 17th Applied Stochastic Models and Data Analysis Conference (ASMDA 2017) held at De Morgan House, the home of the London Mathematical Society. London over the period 6–9 June 2017.

Dr Robin Hankin has created a new learning resource for students of modern physics consisting of 200 video-taped lectures discussing the mathematical basis of Einstein's theory of general relativity. He has also been working in the field of formal likelihoods in competitive events and has submitted a paper to the Journal of Statistical software outlining a generalisation of Bradley-Terry likelihoods as applied to Australian Masterchef.

Dr Murray Black presented six sessions on the statistics used to analyse data obtained from food tasting at the Rotary National Science and Technology Forum. This forum was held over two weeks with AUT being one of the participating universities. There were six groups of 28 Year 12 secondary school students at the Forum from all around NZ sponsored by Rotary clubs. He also has been involved in an advisory capacity with respect to the assessment of Pacific Islanders from Samoa, Cook Islands and Fiji in the raising of statistical capacity in the workplace. These assessments form parts of a national Certificate in Official Statistics.

Dr Kate Lee delivered a invited talk at the computational inverse problem workshop, 13-23 June 2017, at the MATRIX, Melbourne, Australia. This workshop aims to address open challenges and recent advancements in computational inverse problems. Currently, Kate is on sabbatical leave, working with her collaborators in Oxford University.

New Staff

Dr Nuttanan Wichitaksorn (Nate) is a newly appointed lecturer in the Department of Mathematical Sciences at AUT. Nate obtained a PhD in Econometrics from University of Sydney, Australia, and two MAs in Economics from Rutgers University, USA, and Chulalongkorn University, Thailand. His current specialization is in Econometrics and Statistics with emphasis on Bayesian approach and applications in economics, finance, health science, and social science. His research interests also lie in the fields of computational statistics using Monte Carlo methods, financial analytics, skew distributions, copula modeling, robust quantile regression, and GPU-based parallel computation. Prior to joining AUT, Nate has been a research fellow at Thailand Development Research Institute and was a lecturer in Statistics at the University of Canterbury, where he is now an adjunct fellow.

Dr Petelo Raass (Puna) is a newly appointed fixed-term lecturer in the Department of Mathematical Sciences at AUT. Puna obtained his PhD from the University of Waikato. His PhD topic was to study the critical sets of full Latin square. His research interests include critical sets of full Latin squares and completability of partial Latin arrays (Combinatorics). Puna was a high school teacher teaching Maths, Physics and Chemistry in Tonga from 2003–2007.

Dr Xingjiang Chen (Jason) is a newly appointed fixed-term lecturer in the Department of Mathematical Sciences at AUT. Jason obtained his PhD in Applied Mathematics from the University of Auckland in 2015. His PhD thesis looked at mathematical modeling study of a GnRH neuron, which relates to computational neuroscience and mathematical physiology. He also had a Bachelor of Science in Applied Mathematics with First Class Honors at the University of Auckland in 2011

From left to right: Nate, Puna and Jason

and a Bachelor of Science in Mathematics and Applied Mathematics at the same university in 2010.

Visitors

Prof Jeong-Hoon Kim (Yonsei University, Republic of Korea) and Dr Hui Zhao (Tianjin University, China) visited the Department of Mathematical Sciences in July-August. During the period of their visit, both of them were working with the Financial Mathematics Research Group, led by Prof Jiling Cao and Dr Wenjun Zhang.

Wenjun Zhang

UNIVERSITY OF AUCKLAND

DEPARTMENT OF ENGINEERING SCIENCE

The Department is proud to announce that one of its alumni, Prof. Karen Wilcox from the Massachusetts Institute of Technology, was named a Member of the New Zealand Order of Merit in this year's Queen's Birthday Honours. Prof. Wilcox is known not only for her leading research on the design and operation of next-generation aircrafts, but also as a passionate educator, currently co-chairing MIT's Online Education Policy Initiative. For more on Karen, and her recent recognition, see auckland.ac.nz/en/about/news-events-and-notices/news/news-2017/06/aeronautics-engineer-named-in-queens-birthday-honours.html.

The Department is also very proud of another of its recent alumni, Elise Beavis, who recently won back the Auld Mug as part of Team New Zealand. The computational modelling work undertaken by Elise was instrumental to the success of the cyclors, one of the innovations credited with giving TNZ the competitive edge. To learn more about Elise's story, see nzherald.co.nz/sport/news/article.cfm?c_id=4&objectid=11861731.

Those of you who have been following the news about one of the University's recent spin-out companies may have seen another one of our recent graduates, in digital form. Rachel Love is working as an Avatar Engineer for Soul Machines, developing technology aimed at humanising the interface between Man and Machine. For more, see newshub.co.nz/home/money/2017/07/kiwi-startup-soul-machines-reveals-latest-artificial-intelligence-creation-rachel.html.

The Department has enjoyed a number of recent research funding successes. Professor Martyn Nash leads a 5 year, $5M HRC funded project to look at biomechanical factors relevant to the health of the heart, in collaboration with colleagues in Physiology, the National Heart Foundation and the Auckland Bioengineering Institute. John Cater, Andrea Raith, Poul Nielsen, Martyn Nash and Andrew Taberner were awarded funding in the latest round of Seed Grants from the Science for Technology and Innovation National Science Challenge. Andrea's project, titled "Modelling and improving emissions/energy efficiency in NZ's transport systems" will look to model vehicle emissions using strategic transport modelling tools. John Cater's project "Deployable Nano-Satellite Synthetic Aperture Radar for Monitoring NZ's EEZ", aims to develop the underlying science and technology needed to provide NZ with an overhead monitoring capability using space-based as-

sets, in collaboration with colleagues in the Department of Physics. Poul, Andrew and Martyn were awarded a SfTI three year seed project grant to develop and commercialise 3D displacement reconstruction algorithms for a range of applications in agriculture, bioengineering, and non-destructive testing. Poul Nielsen has also received funds from MedTech CoRE ($50k) and NZ Artificial Limb Service ($20k), and Martyn Nash and Poul Nielsen were awarded a two year project grant from the NZ Breast Cancer Foundation to develop clinical software for improving breast cancer image interpretation using biomechanical modelling.

Recent seminars by international visitors include those by Prof. Glenn Sinclair (Louisana State University), who gave a seminar on "Practical Convergence-Divergence Checks for Finite Element Stresses", Prof. Maciej Floryan (University of Western Ontario) on "Induced Polarization Effects in Liquid Droplets", and Prof. Steven Galbriel (University of Maryland) who spoke on "Optimization and Equilibrium Problems in Engineering".

Also, please note that registrations and abstracts are now open for EMAC2017, the 13th Engineering Mathematics and Applications Conference: emac2017.com.

Richard Clarke

DEPARTMENT OF MATHEMATICS

Igor Klep was a Simons Visiting Professor at the Mathematisches Forschungsinstitut Oberwolfach, where he was awarded a Research in Pairs (RiP), and he gave an invited talk at the Real Algebraic Geometry meeting. His paper (with J. William Helton & Scott McCullough) on "The tracial Hahn–Banach theorem, polar duals, matrix convex sets, and projections of free spectrahedra" was published in the *J. Eur. Math. Soc.* v.**19** (2017) 1845-1897, and his book (with Sabine Burgdorf & Janez Povh) on **Optimization of polynomials in non–commuting variables** was published by Springer–Verlag as SpringerBriefs in Mathematics, XV, 104.

Jean-François Maheux, after a year as Senior Lecturer in Mathematics Education, is now in the Département de Mathématiques at the Université du Québec à Montréal.

Julia Novak has been appointed as Associate Dean, Teaching and Learning.

Jeroen Schillewaert has arranged a Hood Fellowship ($17,000), for Prof. Hendrik Van Maldeghem of Ghent University to visit the University of Auckland for 6 weeks in 2018. Jeroen gave an invited seminar talk on July 18 at UCL Louvain-La-Neuve (in Belgium), entitled "The geometries of the Freudenthal-Tits magic square".

Gabriel Verret has been awarded an Early Career Research Excellence Award by the Faculty of Science. That is a clear recognition of the strength of his research in Discrete Mathematics.

Gillian Frankcom-Burgess has passed her PhD oral examination, with minor corrections to the thesis. Jeremie Moerenhout successfully completed his PhD oral examination, with his very good thesis (on "Chiral polytopes arising from almost–simple groups with socle PSL(2,q)") requiring only minor revisions. Two papers from his thesis have been accepted, for the *Journal of Algebraic Combinatorics* and the *Journal of Geometry*. Jeremie's main supervisor was Dimitri Leemans.

Dimitri Leemans came in August 2011 from the Vrije Universiteit in Brussels, with his wife and daughter and with his stepson. Dimitri was a Senior Lecturer and then an Associate-Professor in our Department, he received a Marsden grant of $580,000 and he received the 2014 NZMS Research Award. In 2014 he and his family applied for residence in New Zealand. The University of Auckland sent a letter supporting Dimitri's application, explaining that the University of Auckland and the nation would be disadvantaged without him. But in September 2015 Immigration NZ refused his application, because his 13-year old stepson is intellectually handicapped. An article in *The New Zealand Herald* on 2016-2-13 quoted Dimitri as saying "For me the New Zealand story ends". He resigned from the University of Auckland at the end of 2016 Semester 1 and returned to the Vrije Universiteit in Brussels, where he was soon promoted to Professor. Some months ago, somebody reported that in 2011 some citizen of USA and Germany visited NZ, and after 12 days he became also a citizen of NZ. (He happens to be a billionaire.) Many eyebrows were raised at that uncharacteristically speedy action by the Minister of Internal Affairs. A pungent cartoon about the contrast appeared in *The New Zealand Herald* on 2017-6-30

Nick Wormald was a member of our Department from February 1984 to January 1992, after which he moved to the University of Melbourne. He is one of the world's top graph theorists, and became a Laureate Fellow of Monash University. He has now been elected as one of 21 new Fellows of the Australian Academy of Science.

Alastair John Scott graduated as B.Sc. and M.Sc. from the University of Auckland, and he returned to the Department of Mathematics in 1972. He became Head of the Department of Mathematics and Statistics, and when that underwent binary fission he became Head of the Department of Statistics. He was a very eminent statistician, renowned particularly for his work on public health. He was awarded many honours, culminating in November 2016 when the RSNZ awarded him the Jones Medal. Alastair has died at the age of 77, from brain cancer. The memorial service for him at MacLau-

rin Chapel was the largest gathering that I have ever seen there, with standing room only. An obituary article is reprinted on page 28, from the *Newsletter of the New Zealand Statistical Association* No.**79**.

Recent visitors include:

Dr Sylvain Barbay (Laboratoire de Photonique et de Nanostructures — CNRS-UPR20), Dr Stephane Barland (Institut Non-Lineaire de Nice), Prof. Peter Brooksbank (Bucknell University, Pennsylvania), Dr Ban Heng Choy (NIE Singapore), Dr Johannes Eser (Colorado School of Mines), Dr Dane Flannery (NUI Galway), Dr Alejandro Giacomotti (Laboratoire de Photonique et de Nanostructures — CNRS-UPR20), Dr Mariana Haragus (Université de Franche-Comté), Dr Lina Jaurige (TU–Berlin), Prof. Hiroshi Kokubu (Kyoto University), Dr Laurent Larger (UMR CNRS FEMTO-ST), Prof. Martin Liebeck (Imperial College London), Dr Benjamin Lignau (TU-Berlin), Dr Kathy Luedge (TU-Berlin), Dr Maike Massierer (UNSW), Prof. Luke Morgan (UWA), Prof. Katharina Neusser (Charles University, Prague), Prof. Hiroe Oka (Ryukoku University), Dr Cami Sawyer (Massey University), Prof. Csaba Schneider (Federal University of Minas Gerais, Brazil) Prof. Anna Svard (University of Haifa), Prof. Andrew Waldron (UC Davis), A–Prof. Rachel Weir (Allegheny College, Pennsylvania), Prof. James Wilson (Colorado State University), Dr Travis Willse (Universität Wien) and Dr Nicholas Witte (Massey University).

Garry J. Tee

DEPARTMENT OF STATISTICS

Binyamin Oz: The poetry in mathematical modelling

Binyamin Oz says mathematical modelling is like poetry. "You take some abstract idea or a message you want to deliver, and you do it with a minimal amount of words (in poetry) or mathematical symbols and expressions (in modelling). You always try to do it in the most elegant and concise way that still captures your abstract message."

For Dr Oz, an Israeli who has joined the Department of Statistics as a Post-doctoral Research Fellow to work alongside Associate Professor Ilze Ziedins, poetry exists in modelling strategic behaviour in queues, which can have important real-life applications in fields like healthcare and transport management. His bachelor studies in Israel were in economics and statistics, and he was fascinated by the mathematical modelling he employed in both disciplines. He gained his PhD in the Department of Statistics and the Federmann Center for the Study of Rationality in the Hebrew University of Jerusalem.

Binyamin Oz

One of his projects here explores the regulation of strategic joining to queues. "The basic problem with customers' joining decisions is that too many decide to join, and from a social point of view, we would prefer to see fewer joiners," explains Dr Oz. "This is why queues and also roads are usually overcrowded. The root cause of this phenomenon is that when deciding whether to join, strategic customers do not take into account the extra waiting they inflict on future arrivals. We study ways to make customers internalise those extra costs they usually ignore in order to elicit a socially optimal behaviour from their side."

Another project looks at how different information structures affect the joining pattern of customers to queues: "If a queue is concealed and customers can't see how long it is, we would expect a different joining behaviour than if the queue is observable."

Dr Oz has moved to New Zealand with his wife Liat, an archaeologist, and their three small children. But how does an Israeli end up on the other side of the world? It all came about through Dr Oz's supervisor, Professor Moshe Haviv, who was a visitor in the Department of Statistics in 2015. Professor Haviv heard that there was a position available and suggested Dr Oz apply.

"After doing some research about the department

and in particular about Ilze's research interests," says Dr Oz, "I realised that this is the best place for my post-doc. This is without mentioning the fact that New Zealand is one of the best places on Earth in so many aspects. You can assume it wasn't so hard to talk my wife into moving here."

Using statistics to test cricketing superstitions

Oliver Stevenson has used statistics to find out whether there is any truth to the cricketing superstition known as the 'nervous 90s'. This refers to the belief that players' batting deteriorates as they near the milestone of scoring 100 runs – but Oliver's recently completed masters thesis has found little evidence to support that contention.

Oliver Stevenson

"That's not to say players don't get nervous in the 90s," says Oliver, a keen cricket player and follower. "Rather, for most players, nerves do not significantly affect batting ability while on scores between 90 and 99."

Oliver played cricket competitively between the ages of 6 and 18, but now "it's mostly social stuff with mates such as Twenty20 and indoor cricket — and watching international and domestic cricket."

It's the variable nature of the game that appeals, he says: "One day the game can be heavily dictated by the batsmen and the very next day by the bowlers. The contest between bat and ball is always fascinating – a bowler can bowl the exact same ball to a batsman a number of times, with each delivery producing a unique result. Additionally, cricket is one of few sports where external factors such as the pitch and weather can have a massive bearing on how the match is played out."

Oliver wanted to combine his love of sport and statistics in his studies, and when Dr Brendon Brewer, a keen cricket fan, posted a notice that he was looking for a student to investigate the "nervous 90s", Oliver jumped at the chance.

Oliver's masters work has interested Cricket New Zealand to the extent that he will be doing a PhD in collaboration with the national body, with Brendon again his supervisor. The topic has not yet been settled, but will be around advanced player performance and contribution metrics, using statistics in areas of the game that are underutilised.

In general, says Oliver, cricket offers a lot of opportunities for statisticians. "Firstly, the large number of statistics collected during each game means we have a lot of raw data to work with," he explains. "Secondly, the closed nature of the skills of batting and bowling ties in nicely with some of our statistical assumptions. Unlike sports such as rugby and football, this generally allows for the large amounts of data collected each match to be treated independently of the specific match scenario."

Oliver, who is from Auckland, did a Bachelor of Science majoring in Statistics and minoring in Psychology at the University of Otago, and in 2015 completed a Bachelor of Science (Honours) in Statistics in the Department of Statistics.

Source: stat.auckland.ac.nz/en/about/news-and-events-5/news/news-2017/2017/06/using-statistics-to-test-cricketing-superstitions.html.

Associate Professor David Scott retires

Associate Professor David Scott retired at the end of the semester – but don't think he'll be putting his feet up. Oh no. David and his wife Bronwyn Holcombe are keen orienteers, and an orienteering trip to Portugal is in the diary. He has plans to do some voluntary work. And he'll still be doing consulting, as well as tweaking the R packages he either wrote or supports and posting his statistics-driven rugby union and rugby league predictions on the department's popular blog, Stats Chat.

David's abiding memories of the department will be "the people I have worked with and the students I have supervised – supervising student projects has been one of the most enjoyable parts of my work," he says. "The

David Scott

department has been a really enjoyable environment. I have said this often, but the excellence of the undergraduate teaching here and the resulting numbers of students taking those courses has been fundamental to the success of the department."

Melbourne-born David got his BA and PhD at the Australian National University. He started his university teaching career at La Trobe University, also in Australia, in 1972, later becoming head of department there. He has also worked at the University of Sheffield in the UK, Bond University in Australia and Colorado State University in the US. He came to New Zealand in mid-1995.

David, a past President of the New Zealand Statistical Association, has a particular interest in heavy tailed distributions, which are typically used to model risk and survival, so they have applications in insurance, finance, engineering and health. One of his favourite consulting projects was a risk analysis of flights into Queenstown airport for an airline, and another involved using spectral analysis to compare different makes of continuous positive airway pressure (CPAP) devices used to assist those with breathing difficulties.

Outside the department, David is well known for his Stats Chat posts predicting the outcomes of games in Super Rugby, NRL, the ITM Cup, and South Africa's Currie Cup — and he's right most of the time. "I give precise statistical weightings to various factors such as a team's long-term performance, the margin between teams, whether a team is at home or away, and tweak team rankings week by week," he explains. "And then I can indicate the likelihood of a team winning and the size of the margin."

David started doing the predictions as an exercise to show people the relevance of statistics to everyday life. He's been pleasantly surprised in the interest his techniques have garnered, but he says that more data doesn't necessarily mean you'll clean up at the TAB.

"There seems to be a belief that if you have more data about teams and conditions, you will be able to greatly improve your predictions," he says. "I don't believe that. More data and improved methods will make a bit of difference but there is definitely a limit, which varies from competition to competition."

But don't worry, retirement won't mean the end of the posts — David is hoping to automate his predictions. "That means getting web-scraping working — but I haven't had much success with that yet."

Source: stat.auckland.ac.nz/en/about/news-and-events-5/news/news-2017/2017/06/david-scott-retires.html.

Yalu Wen: Fighting serious disease with statistics

Yalu Wen's career was forged from a shattering experience. Two of her grandparents died of cancer, and that drove her to pursue an undergraduate degree in pharmaceutical engineering in her native China. "I really wanted to know if there was any way to postpone cancer development or fully cure cancers," Dr Wen says.

Yalu Wen

She found that that the chemistry and biology her undergraduate degree required wasn't her thing – but maths and computer science were. Statistical modelling, in particular, fascinated Dr Wen: "I really enjoyed building and validating models to understand disease mechanisms, and I realised how important modelling is in many areas."

From that point, Dr Wen's drive to curb diseases went down a different path – genetic epidemiology, or studying the effects of genes on diseases. She gained an MSc and a PhD from Michigan State University, the latter on genetic variations and their effects on coronary heart disease and cervical cancer. Dr Wen came to the Department of Statistics in 2014.

She is still driven by the memory of what happened to her grandparents. "The reason I chose to work in statistical genetics is that I believe everything happens for a reason," says Dr Wen. "Other than lifestyles, I believe genetic susceptibilities should be related to many common diseases, such as cancer. If we can fully understand the disease mechanisms from the molecular level, we may be able to identify the therapeutic targets and thus deliver the right treatment to the right person."

A prolific researcher, Dr Wen has been published in prestigious journals such as Genome Research, Genetic Epidemiology, Bioinformatics and PLoS ONE and holds a patent for an algorithm used to get accurate genotype calling from DNA microarrays. Last year, she won the New Zealand Statistical Association's Worsley Early Career Award, named after the brain mapping expert Keith Worsley, which recognises outstanding published research from a New Zealand statistician in the early stages of their career. The award is not only a compliment, says Dr Wen, but it "makes me love my own work more."

At present, Dr Wen is developing and evaluating statistical genetic risk prediction models, using population-based data as well as family-based genetic studies, where the correlation between family members is used as a surrogate variable to improve prediction accuracy. The latter leads to some fascinating work: Dr Wen recently analysed data from the Michigan Twins Study that looked at twins aged three to five years and their non-twin siblings in an effort to find out if children carrying particular genetic markers were more likely to have aggressive behaviour.

"If those markers can be found, we further want to know the percentage of variations these genetic markers can explain and whether these genetic markers can be used to predict kids' aggressive behaviour," she explains. "If the predictive model is accurate enough, we could use this model to identify kids who are more likely to have aggressive behaviour and develop special education programmes for them."

Source: stat.auckland.ac.nz/en/about/news-and-events-5/news/news-2017/2017/05/yalu-wen-fighting-serious-disease-with-statistics.html.

CensusAtSchool

Six in 10 schoolchildren taking part in the national CensusAtSchool TataurangaKiTeKura reported that they received pocket money, an allowance or a cash gift the week before participating, getting a median of $15.

The insight has emerged from early results of CensusAtSchool, an online, biennial statistics project run by the Department of Statistics that shows students the relevance of statistics to everyday life. In class, Year 5 to Year 13 students (aged 9 to 18) use digital devices to answer 35 online questions in English or te reo Māori, providing a unique snapshot of Kiwi childhoods. Read more here: stat.auckland.ac.nz/en/about/news-and-events-5/news/news-2017/2017/03/how-much-pocket-money-do-kiwi-kids-get.html.

CensusAtSchool also showed that eight in 10 teens and six in 10 primary school children say there are no limits on their screen time out of school — whether that's playing computer games, using their phones, or browsing the internet. Read more here: stat.auckland.ac.nz/en/about/news-and-events-5/news/news-2017/2017/03/most-kids-have-no-screen-time-limits.html.

Steffen Klaere & Julie Middleton

UNIVERSITY OF WAIKATO

DEPARTMENT OF MATHEMATICS AND STATISTICS

Programme developments

Now that the BSc major in Data Analytics has been approved, a master of science programme with the same title is in the works. Interesting to note the business world attempting to take over as usual: the Waikato School of Management wants to offer a qualification with the same title.

The so called curriculum renewal project of the Deputy VC Alister Jones, with many gratuitous required changes to papers and programmes, is still making its way through the implementation processes. So far no faculty other than Computing and Mathematical Sciences has asked us to teach their digital literacy or numeracy for, what is to be, a compulsory paper for every faculty.

Civil engineering is to commence next year, just in time for major developments around the city, such as a $100 million bridge across the Waikato river, commencement of the Tainui inland port project, and completion of the Waikato expressway.

Changing of the guard Nick Cavenagh has stepped down as Chair of Department having finished his term — thanks Nick — his efforts, together with those of our programme administrator Tim Stokes, have been

greatly appreciated. The new Chair is Sean Oughton. His email is sean.oughton@waikato.ac.nz.

Cecilia's continued running success

Cecilia Flori was first home in the Routeburn Classic in April, stopping along the way to enjoy the scenery. "That was really the most beautiful race I've ever run", was her published response. Not finding its way into NZ news feeds was her great success winning an Austrian ultra marathon in June. The distance was 105 km and her time just over 12 hours! The route was a closed curve with winding number 1 from Salzburg to Lake Fuschl and then back to the city.

Cecilia crosses the finishing line. **photo credits: mozart 100, published with permission.**

Workshops and conferences

Waikato hosted the Third NZ Number Theory Workshop in April. Talks were given by Shaun Cooper, Steven Galbraith, Alex Ghitza and Nora Ganter (Melbourne), and Kevin Broughan (Waikato). Daniel Delbourgo was the organizer. He will be heading off to Bendigo Australia in late September, with his students Chris King and Hamish Gilmore, to participate in the "Number Theory Down Under 5" conference.

Waikato hosted a very successful "Cyber security challenge" in early July - readers will recall mathematics contributes cryptography teaching to the masters programme in cyber security. There were over 400 registrants with spooks, movers and shakers participating - well done Ryan Ko, the organizer.

Kevin Broughan

MASSEY UNIVERSITY

INSTITUTE OF FUNDAMENTAL SCIENCES

Massey hosted the third Mathematics in Industry New Zealand (MINZ) meeting at the end of June. Six companies brought problems for groups of mathematicians

Number Theory Workshop dinner. **photo credits: Chris King, published with permission**

from around the country to work on in focus groups for a week. There was a great turnout from departments across the country, including many extremely capable students, and the groups were able to make substantial contributions to the problems they were working on. One-page summaries of the work will appear soon, and longer articles will appear next year in a special edition of the ANZIAM journal.

David Simpson managed the visit of Prof. Paul Glendinning from the University of Manchester. Prof. Glendinning works in the area of dynamical systems, particularly bifurcation theory, and visited Massey University, Palmerston North, for $2\frac{1}{2}$ weeks in May for collaborative research. During his visit Prof. Glendinning also gave a well-received public lecture at Palmerston North City Library titled "From fleas to forensics: Science in Shakespeare's words".

Richard Brown

VICTORIA UNIVERSITY OF WELLINGTON

SCHOOL OF MATHEMATICS AND STATISTICS

An unexpected trip to the UK for family reasons by your correspondent intervened as the last edition was being prepared. So, this report covers events since December 2016. It now seems a long time since the 2016 NZ Mathematics Colloquium took place in that month, celebrating 50 years since the first colloquium, also held at Victoria in 1966. A report on the colloquium appears elsewhere in this Newsletter on page 30.

There has been a large number of staffing changes during 2017. In no particular order, Astrid an Huef, Lisa Orloff Clark and Iain Raeburn have moved north from Dunedin to Wellington and joined the School early in July. It is a great pleasure to have them among us, though Astrid and Iain have quickly headed off to

Canada on research and study leave. Lisa remains and is heavily engaged in the teaching programme already. The three have been joined by their Marsden-funded post-doctoral fellow, James Fletcher. James had a brief sojourn at Victoria as a summer scholar in 2010/11 before completing Honours and Masters degrees in Auckland and his PhD under the supervision of Aidan Sims and Adam Rennie at the University of Wollongong (his graduation was in late July 2017). Needless to say, this foursome substantially strengthens the School's presence in analysis.

We have been sad to farewell George Barmpalias, who decided to return to the Software Institute of the Chinese Academy of Sciences in Beijing, and also David Balduzzi who has been with us for the past three years. David has been forging a name for himself in the deep learning research community. So successful was he, that he was offered and accepted a position with DeepMind, creators of AlphaGo, in London. To address the resulting shortfall in teaching staff for the second half of the year, we have been fortunate to employ Reshma Ramadurai on a fixed-term lectureship, lately a post-doctoral fellow at the University of Waikato. Reshma strengthens and extends the combinatorics research group here. Matroid post-doc Nick Brettell has also saved our bacon, doubling as a teaching fellow and proving a popular addition to the teaching staff among students.

Monique Ladds arrived in January as a post-doc working with Nokuthaba Sibanda, supported by her NSC Fisheries grant held in collaboration with NIWA. We are also very pleased to be joined by Thuong Nguyen as fixed-term lecturer in the statistics group. Thuong, who recently completed her PhD under the guidance of Estate Khmaladze, temporarily replaces Peter Smith while he holds a James Cook Fellowship. Rolando Coto-Solano has taken up a 0.2FTE lectureship for two years to complement his 0.8FTE in the School of Linguistics and Applied Language Studies. Rolando is contributing to our statistics and data science courses. His research applies machine learning algorithms to study tonal languages. Lisa Woods, our University statistical consultant, has had her role made permanent and we are delighted that she will continue to be part of the School's family.

The School also had a change of personnel in our administrative team. Patricia Huambachano moved to the School of Economics and Finance (so now she doesn't need to walk up the hill everyday). Her place has been taken by Alec Rodger, another 'Sarf' London boy, like your correspondent. Alec is providing great support for students and staff alike.

Back to the negative side of the ledger, Dan Turetsky, who has held a fixed-term lectureship during Geoff Whittles James Cook Fellowship, is moving back to the USA to take up a position at the University of Notre Dame. Roy Costilla, who recently completed his PhD on "Cluster analysis of longitudinal ordinal dat" and has subsequently been a post-doctoral fellow working with Ivy Liu and Richard Arnold, has moved to Australia to take up a position at the University of Queensland. Rutger Kuyper has just come to the end of his tenure as a post-doctoral fellow working with Noam Greenberg and Rod Downey but he will be staying in Wellington for now, having found it a fine city to call home. Bhujanga Chakrabarti, who has been teaching in our optimisation course over the last 3 years since Mark Johnston's departure, has moved to Hamilton to take up an OR position at Waikato Institute of Technology.

Finally, on the staffing front, the university is pleased to welcome its new director of the Actuarial Science programme, Associate Professor Eric Ulm. Eric has joined us from Georgia State University where he ran their actuarial science programme. Our programme has been jointly mounted by this School and the School of Economics and Finance and Eric will make his primary home in the latter but we have a home away from home for him in SMS.

Mark McGuinness visited Ireland and the UK during June, collaborating with colleague Andrew Fowler who has one foot on each island — he has positions at the University of Limerick and at Oxford University. Mark reports, "We spent a week in Donegal working on our Chaos book, a week in Oxford at the Mathematics Institute, and a week at the Department of Mathematics and Statistics in the University of Limerick, attending the 128th European Study Group with Industry". Mark co-moderated a challenge brought by a large Russian-owned and Irish-operated alumina company on measuring the moisture content of bauxite in real time as it comes off a ship on a conveyor belt. He returned to New Zealand just in time to moderate a challenge brought by Transpower to the Mathematics in Industry New Zealand study group at Massey University in Palmerston North, on predicting corrosion and maintenance requirements for the NZ electricity grid.

Rod Downey, who recently returned from a couple of months in Germany as part of his Humboldt Award, has been awarded the Shoenfield Prize for his book, "Algorithmic Randomness and Complexity. Theory and Applications of Computability", co-authored with Denis Hirschfeldt (Chicago). This is Rod's second Shoenfield, having previously won the Prize for an article in 2010. The prizes are awarded every 3 years by the Association for Symbolic Logic.

In April, Noam Greenberg gave his inaugural professorial lecture entitled "Computing the Truth". He talked on the same topic with Kathryn Ryan on the Radio NZ Nine to Noon programme, available on podcast here radionz.co.nz/national/programmes/ninetonoon/audio/201843839/computing-the-truth.

Maths Challenge

In late April, we ran our annual Maths Challenge for secondary schools and 185 students formed 23 teams from 14 schools in the Wellington region. It was pleasing to meet our goals of both new, and more girls and co-educational schools, attending. Introduced to the programme this year was a new creative section featuring an online quiz and a mathematical art challenge. Many of our senior and postgraduate students and the School's administrative staff contributed to the day's success by helping with coaching, marking and general organisation.

Visitors and seminars. Gerassimos Athanassoulis (National Technical University of Athens) visited Dimitrios Mitsotakis in April and gave a talk on "A new Hamiltonian approach to the fully nonlinear water-wave problem over arbitrary bathymetry". Peter Forrester (University of Melbourne) accompanied Nicholas Witte from Massey, Palmerston North for a visit in July and spoke on "Random matrix theory and the Riemann zeros". The School's research colloquium series, featuring our own speakers, has recently included talks by Matt Visser, "Entropy Rising"; Dillon Mayhew, " Finite fields vs. infinite fields: a dichotomy in matroid representation"; and Richard Arnold, "Modelling correlated failures in multicomponent systems".

Peter Donelan

UNIVERSITY OF CANTERBURY

SCHOOL OF MATHEMATICS AND STATISTICS

As part of their project raise interest in mathematics through maths and craft within the cross-agency programme Unlocking Curious Minds, *Jeanette McLeod* and *Phil Wilson* held the first ever Christchurch Maths Craft Day on Sunday 18th June in the Great Hall at the Arts Centre. The day-long event was a great success. It combined eight hands-on craft stations with a series of public talks. Nearly 1,800 visitors tried their hands at a range of mathematical crafts including creating string art, folding an origami octahedron, building a fractal sculpture, making a Möbius strip, flexing a hexaflexagon, crocheting a hyperbolic plane, drawing and colouring mathematical objects, and exploring Penrose tilings. The craft stations and the large crafting area were staffed by an enthusiastic team of volunteers, drawn from University of Canterbury students and staff, and local school teachers. Doors opened at 10am, and the Great Hall was buzzing when Lisa Davies of One News arrived at 11am. Her piece on the Christchurch Maths Craft Day, including interviews with Jeanette and Phil, aired on the news that Sunday evening, and was shown later on Seven Sharp.

As well as celebrating maths and crafts, the Christchurch Maths Craft Day was also a celebration of the return of the University of Canterbury to the city centre, and a resurgence in city life after the 2010-2011 earthquakes. Following extensive restoration, the Great Hall has regained the beauty of its glory days when it was the Great Hall of Canterbury College, constructed in 1882. With its polished wooden floors, lofty ceiling, carved stonework, and giant stained glass windows, the space is an attraction in its own right.

Events under this project are still scheduled in Auckland and Dunedin, see mathscraftnz.org for details.

In early June *Fabian Dunker* joined the School as a statistics lecturer. Fabian gained his PhD from the University of Göttingen in Germany in 2012. Since then he held Postdoc positions in Göttingen and Bochum and visited Boston College for one semester His research interests are on statistical inverse problems with applications in econometrics.

In June former staff member John De la Bere passed away, aged 94. John was retired for almost thirty years, but is still remembered for the contribution to administration in the then department.

At the end of April the School welcomed Erskine Fellow Glen van Brummelen from Quest University at Squamish, British Columbia. Glen is an eminent Canadian historian of mathematics, specialising in the history of trigonometry. He won the HAIMO award, the

Fabian Dunker

most prestigious teaching award for mathematicians in North America, and this year he was one of ten winners of the 3M National Teaching Fellowship, Canada's highest teaching award. During his five weeks at UC Glen has been teaching into MATH380. He was hosted by *Clemency Montelle*.

June saw the arrival of another Erskine Fellow, Alberto Roverato from the Department of Statistical Sciences at the University of Bologna, Italy. As part of his 11 weeks visit Alberto is teaching into STAT213. His research interests are in graphical models, Bayesian belief networks, probabilistic expert systems, influence diagrams; model selection and Bayesian model determination; bioinformatics, microarray data analysis, gene regulatory networks; genetic algorithms. Alberto is hosted by *Marco Reale*.

Abstracts of PhD theses

Duy Quan Ho, University of Canterbury

Supervisors: Günter Steinke, Brendan Creutz

Date: June 2017

Title: **On the classification of toroidal circle planes.**

We consider the problem of classifying toroidal circle planes with respect to the dimension of their automorphism groups. With tools from topology, we prove that these groups are Lie groups of dimension at most 6. From the results on flat Minkowski planes by Schenkel, we classify planes whose automorphism group has dimension at least 4.

In the case of dimension 3, we propose a framework for the full classification based on all possible geometric invariants of the automorphism group. When the group fixes exactly one point, we characterise two cases completely with a new family of planes called (modified) strongly hyperbolic planes and the family constructed by Artzy and Groh. Using these results, we determine the automorphism group of the planes constructed by Polster.

Günter Steinke

UNIVERSITY OF OTAGO

DEPARTMENT OF MATHEMATICS AND STATISTICS

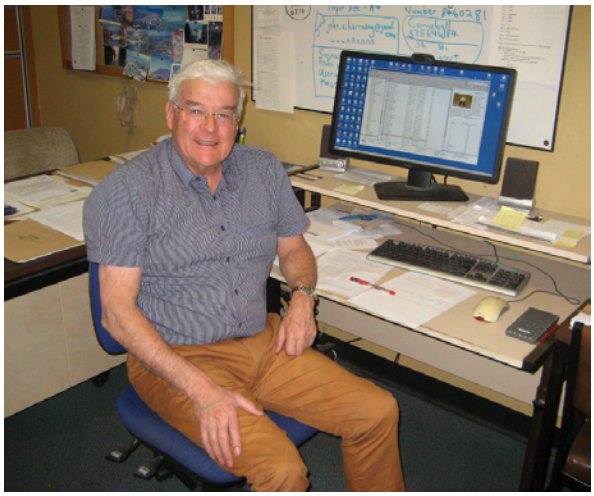
With great sadness we announce the death of our dear colleague and friend *John Clark*, who passed away on July 15. John joined the Department in 1970, after completion of his PhD at the University of Aberdeen. Through his work in algebra and his collaboration with ring theorists around the world, he became an accomplished and internationally respected mathematician. He also spoke at numerous international conferences and was a highly regarded teacher. When he retired in 2013, his contribution to the theory of rings and modules was recognised and his 70th birthday celebrated with an International Conference on Algebra. Even in retirement, John still came to his office very regularly and continued his work. This April we had the pleasure to hear John speaking in the Department's mathematics seminar and to experience once more how much he loved his research. In recent years John bravely dealt with the onset of Parkinson's disease and stoically carried on with his life. John had a great sense of humour and a delightful turn of phrase, always delivered with his special Scottish twinkle. The Department expresses sincere condolences to his wife Austina, also a long serving member of the Department, and to his two sons and their families.

In the past couple of month several staff members have been leaving Otago, while some new colleagues started their positions.

Firstly, we bid farewell to *John Harraway* at his retirement function. Many friends have joined us to celebrate his remarkable achievements in statistics research and education. John has been lecturing at the Department since 1966, and last year we celebrated his remarkable anniversary of 50 years teaching. In 2010 his dedicated teaching was recognised with a University of Otago Teaching Excellence Award. John has been President of the International Association for Statistical Education (2011–2013), Chair of the Advisory Board of the International Statistical Literacy Project (2011–2013), and he is an Elected member of the International Statistical Institute (since 2002). Over the years, John

John Clark (1943–2017)

has taught thousands of students and is remembered by many students that he introduced to statistics in their first and second years of studies. We wish you all the best for a happy retirement, John, but we are delighted that you are still around for some more teaching and research in the second half of the year.



John Harraway in his office

We also farewelled *Lisa Orloff Clark*, *Astrid an Huef* and *Iain Raeburn*, as well as their postdoc *James Fletcher*, who have left to take up positions at the Victoria University of Wellington. Astrid joined the Department in 2009 as Chair of Pure Mathematics. Her partner Iain came to Otago one year later. Again one year later, in 2011, Lisa was appointed as Lecturer, and in 2014 promoted to Senior Lecturer. The three functional analysts specialise in the general area of operator algebra and are interested in the applications of operator algebra across a broad spectrum of modern mathematics. Their lively research group was very successful in attracting students and securing research grants. We wish you all the best for your future, Lisa, Astrid, Iain, and James.

Just a few months ago we celebrated the remarkable 70th birthday of our Department Manager *Lenette Grant*. Lenette has now retired. We are really going to miss you, Lenette, and we hope you will enjoy every minute of your retirement. Lenette first started working for the University of Otago in 1964, and she has been at the Maths Department since 1980. We are truly grateful to her for running the department successfully over so many years. Best wishes, Lenette.

We welcomed *Melissa Tacy*, who has taken up her position as a Lecturer. Her research interest is within the intersection of microlocal, semiclassical and harmonic analysis. Melissa did her PhD at the Australian National University, after which she had positions at the Institute for Advanced Study (Princeton), the Northwestern University (Illinois), the University of Adelaide and the Autralian National University. She joined our Department in June. Welcome, Melissa!

We also welcomed a second new Lecturer, *Fabien Montiel*. Fabien is not actually new to the department, having completed his PhD at Otago in 2012, followed by a postdoc position. Fabien's research is on multiple scattering theory, polar marine modelling, acoustics and marine renewable energy. We are delighted that we can now welcome you as a permanent staff member, Fabien.

Melissa and Fabien

Furthermore, we have welcomed two new Postdocs, *Watcharintorn Ruksasakchai (Eve)* and *Markus Antoni*. Eve is working on matching extensions with Robert "Tank" Aldred, and Markus's research is on the

regularity of stochastic evolution equations with Boris Baeumer. Moreover, we are very happy to have the support of a very friendly temporary Department Manager, *Kath McGilbert*. A warm welcome to all of you, Eve, Markus and Kath.

Congratulations to *Peter Dillingham*, who has been appointed to a 0.3 FTE position as Associate Dean (Applied Sciences).

Ting Wang and *Tilman Davies* have both received University of Otago Early Career Awards for Distinction in Research. The Early Career Awards were introduced in 2004 to recognise and nurture the University's most promising early career researchers. Very well done, Ting and Tilman!

Visitors

Fabien Montiel had two visitors, Chris Horvat (Harvard Unversity) and Hyuck Chung (Auckland University of Technology). Fabien is working with Chris on modelling the floe size distribution in the marginal ice zone, and the project with Hyuck is on numerical methods to model active acoustic control.

Abstracts of PhD theses

Ilija Tolich, University of Otago

Supervisors: Astrid an Huef and Iain Raeburn

Date: 2017

Title: **C*-algebras generated by semigroups of partial isometries**

This thesis examines the C*-algebras associated to semigroups of partial isometries. There are many interesting examples of C*-algebras generated by families of partial isometries, for example the C*-algebras associated to directed graphs and the C*-algebras associated to inverse semigroups.

In 1992 Nica introduced a class of partially ordered groups called quasi-lattice ordered groups, and studied the C*-algebras generated by semigroups of isometries satisfying a covariance condition. We have adapted Nica's construction for semigroups of partial isometries associated to what we call doubly quasi-lattice ordered groups. For each doubly quasi-lattice ordered group we construct two algebras: a concretely defined reduced algebra, and a universal algebra generated by a covariant family of partial isometries. We examine when representations of the universal algebra are faithful, and this gives rise to a notion of amenability for doubly quasi-lattice ordered groups.

We prove several recognition theorems for amenability. In particular, we prove that the universal and reduced algebras are isomorphic if and only if the doubly quasi-lattice ordered group is amenable. Further, we prove that if there is an order preserving homomorphism from a doubly quasi-lattice ordered group to an amenable group, then the quasi-lattice ordered group is amenable and the associated universal algebra is nuclear.

Yosafat Eka Prasetya Pangalela, University of Otago

Supervisors: Iain Raeburn and Lisa Orloff Clark

Date: 2017

Title: **Analogues of Leavitt path algebras for higher-rank graphs**

Directed graphs and their higher-rank analogues provide an intuitive framework to study a class of C*-algebras which we call graph algebras. The theory of graph algebras has been developed by a number of researchers and also influenced other branches of mathematics: Leavitt path algebras and Cohn path algebras, to name just two.

Leavitt path algebras for directed graphs were developed independently by two groups of mathematicians using different approaches. One group, which consists of Ara, Goodearl and Pardo, was motivated to give an algebraic framework of graph algebras. Meanwhile, the motivation of the other group, which consists of Abrams and Aranda Pino, is to generalise Leavitt's algebras, in which the name Leavitt comes from. Later, Abrams and now with Mesyan introduced the notion of Cohn path algebras for directed graphs. Interestingly, both Leavitt path algebras and Cohn path algebras for directed graphs can be viewed as algebraic analogues of C*-algebras of directed graphs.

In 2013, Aranda Pino, J. Clark, an Huef and Raeburn introduced a higher-rank version of Leavitt path algebras which we call Kumjian-Pask algebras. At their first appearance, Kumjian-Pask algebras were only defined for row-finite higher-rank graphs with no sources. Clark, Flynn and an Huef later extended the coverage by also considering locally convex row-finite higher-rank graphs. On the other hand, Cohn path algebras for higher rank graphs still remained a mystery.

This thesis has two main goals. The first aim is to introduce Kumjian-Pask algebras for a class of higher-rank graphs called finitely-aligned higher-rank graphs. This type of higher-rank graph covers both row-finite higher-rank graphs with no sources and locally convex row-finite higher-rank graphs. Therefore, we give a generalisation of the existing Kumjian-Pask algebras. We also establish the graded uniqueness theorem and the Cuntz-Krieger uniqueness theorem for Kumjian-Pask algebras of finitely-aligned higher-rank graphs.

The second aim is to introduce a higher-rank analogue of Cohn path algebras. We then study the relationship between Kumjian-Pask algebras and Cohn path algebras and use this to investigate properties of

Cohn path algebras. Finally, we establish a uniqueness theorem for Cohn path algebras.

Yunan Wang, University of Otago

Supervisors: Ting Wang

Date: 2017

Title: **Modelling Continuous Time Series With Many Zeros**

Earthquake activity is generally modelled using point processes as earthquake events usually occur at random times and locations. Recent studies have found it mathematically challenging and computationally complex to incorporate a point process model into a hidden Markov model to describe long-term seismicity. Given that earthquake data can be discretized in time to consider daily or hourly energy release, time series models could be a useful method for earthquake data analysis. Time series models can account for the autocorrelation of earthquakes. However, one issue that arises with the earthquake occurrence data is that there is a substantial proportion of time when no earthquake is recorded. This thesis proposes a class of two-part autoregressive (2PAR) models for continuous time series data with excess zeros. We employ a Bernoulli variable to model the excess zeros in the data, and use autoregressive processes to describe the serial correlation. Using this class of 2PAR models, we can model correlations that exist in either zeros or nonzeros in the data. We have proposed a class of residual analysis to check the goodness-of-fit of the proposed models. We also introduced a forecasting procedure using simulation to check the performance of the models.

We carried out a simulation study which shows that the estimators are unbiased and consistent, and the residual analysis and forecasting procedure for the proposed models are promising. We applied the proposed models to the energy indices obtained from the total stress release per hour from the 2010 Darfield earthquake sequence. The results reveal that the 2PAR models with serial correlation in both the presence probability and the earthquake energy indices captured the main features of the data. A retrospective forecasting experiment suggested that the proposed models provide higher information gain against a reference model.

Gordon Hiscott, University of Otago

Supervisors: David Bryant

Date: 2017

Title: **Inverse problems in evolutionary biology**

In this thesis, we explore three techniques which could be used to increase the efficiency of analyses in evolutionary genetics while still producing reasonably accurate results. The first of these methods improves the efficiency of analyses based on Markov chain Monte Carlo (MCMC) through the application of delayed acceptance sampling, an MCMC method with an additional proposal step in which an acceptance probability is computed from computationally less expensive approximate likelihoods. Rejection at the additional decision step should allow software like SNAPP ("SNP and AFLP Phylogenies") to avoid unnecessary computation of full likelihoods and, therefore, run more efficiently. The second method we discuss combines dynamic programming with classical numerical integration methods to compute likelihoods with respect to continuous trait models on trees. This method assumes explicitly known transition densities, but is efficient and has a relatively fast convergence rate. We apply the method to a threshold model which combines continuous traits with discrete observations. The third method we look at is another dynamic programming integration algorithm, except that this algorithm takes advantage of a basis function approximation of likelihood functions. This method allows for numerical solutions to PDEs to be applied directly and the use of Chebyshev polynomials as the basis functions make the method easy to implement. We apply this method to the computation of the likelihood given a genetic data set generated by diffusion processes.

Jörg Hennig

OBITUARIES

Maryam Mirzakhani, 3 May 1977 – 14 July 2017

This obituary is reproduced with the kind permission of Stanford University.

Professor Maryam Mirzakhani was the recipient of the 2014 Fields Medal, the top honor in mathematics. (Image credit: Courtesy Stanford News Service)

Stanford mathematics Professor Maryam Mirzakhani, the first and to-date only female winner of the Fields Medal since its inception in 1936, died Friday, July 14. She had been battling breast cancer since 2013; the disease spread to her liver and bones in 2016. Mirzakhani was 40 years old. She died at Stanford Hospital.

The quadrennial Fields Medal, which Mirzakhani won in 2014, is the most prestigious award in mathematics, often equated in stature with the Nobel Prize. Mirzakhani specialized in theoretical mathematics that read like a foreign language by those outside of mathematics: moduli spaces, Teichmller theory, hyperbolic geometry, Ergodic theory and symplectic geometry.

Mastering these approaches allowed Mirzakhani to pursue her fascination for describing the geometric and dynamic complexities of curved surfaces — spheres, doughnut shapes and even amoebas — in as great detail as possible. Her work was highly theoretical in nature, but it could have impacts concerning the theoretical physics of how the universe came to exist and, because it could inform quantum field theory, secondary applications to engineering and material science. Within mathematics, it has implications for the study of prime numbers and cryptography.

Mirzakhani joined the faculty of Stanford University in 2009, where she served as a professor of mathematics until her death.

“Maryam is gone far too soon, but her impact will live on for the thousands of women she inspired to pursue math and science,” said Stanford President Marc Tessier-Lavigne. “Maryam was a brilliant mathematical theorist, and also a humble person who accepted honors only with the hope that it might encourage others to follow her path. Her contributions as both a scholar and a role model are significant and enduring, and she will be dearly missed here at Stanford and around the world.”

Despite the breadth of applications of her work, Mirzakhani said she enjoyed pure mathematics because of the elegance and longevity of the questions she studied.

A self-professed "slow" mathematician, Mirzakhani's colleagues describe her as ambitious, resolute and fearless in the face of problems others would not, or could not, tackle. She denied herself the easy path, choosing instead to tackle thornier issues. Her preferred method of working on a problem was to doodle on large sheets of white paper, scribbling formulas on the periphery of her drawings. Her young daughter described her mother at work as "painting."

"You have to spend some energy and effort to see the beauty of math," she told one reporter.

In another interview, she said of her process: "I dont have any particular recipe [for developing new proofs]. . . . It is like being lost in a jungle and trying to use all the knowledge that you can gather to come up with some new tricks, and with some luck you might find a way out."

Mirzakhani was born in Tehran, Iran, and — by her own estimation — was fortunate to come of age after the Iran-Iraq war when the political, social and economic environment had stabilized enough that she could focus on her studies. She dreamed of becoming a writer, but mathematics eventually swept her away.

She attended an all-girls high school in Tehran, led by a principal unbowed by the fact that no girl had ever competed for Iran's International Mathematical Olympiad team. Mirzakhani first gained international recognition during the 1994 and 1995 competitions. In 1994, she earned a gold medal. In 1995, she notched a perfect score and another gold medal.

After graduating college at Sharif University in Tehran, she headed to graduate school at Harvard University, where she was guided by Curtis McMullen, a fellow Fields Medal winner. At Harvard, Mirzakhani was distinguished by her determination and relentless questioning, despite the language barrier. She peppered her professors with questions in English. She jotted her notes in Farsi.

McMullen described Mirzakhani as filled with "fearless ambition." Her 2004 dissertation was a masterpiece. In it, she solved two longstanding problems. Either solution would have been newsworthy in its own right, according to Benson Farb, a mathematician at the University of Chicago, but then Mirzakhani connected the two into a thesis described as "truly spectacular." It yielded papers in each of the top three mathematics journals.

"The majority of mathematicians will never produce something as good," Farb said at the time. "And that's what she did in her thesis."

Iranian President Hassan Rouhani said the "unprecedented brilliance of this creative scientist and modest human being, who made Iran's name resonate in the world's scientific forums, was a turning point in showing the great will of Iranian women and young people on the path towards reaching the peaks of glory . . . in various international arenas," according to Iranian state media.

"What's so special about Maryam, the thing that really separates her, is the originality in how she puts together these disparate pieces," said Steven Kerckhoff at the time of her Fields Medal award. Kerckhoff is a professor at Stanford who works in the same area of mathematics. "That was the case starting with her thesis work, which generated several papers in all the top journals. The novelty of her approach made it a real tour de force."

After earning her doctorate at Harvard, Mirzakhani accepted a position as assistant professor at Princeton University and as a research fellow at the Clay Mathematics Institute before joining the Stanford faculty.

"Maryam was a wonderful colleague," said Ralph L. Cohen, the Barbara Kimball Browning Professor of Mathematics at Stanford. "She not only was a brilliant and fearless researcher, but she was also a great teacher and terrific PhD adviser. Maryam embodied what being a mathematician or scientist is all about: the attempt to solve a problem that hadn't been solved before, or to understand something that hadn't been understood before. This is driven by a deep intellectual curiosity, and there is great joy and satisfaction with every bit of success. Maryam had one of the great intellects of our time, and she was a wonderful person. She will be tremendously missed."

In recent years, she collaborated with Alex Eskin at the University of Chicago to answer a mathematical challenge that physicists have struggled with for a century: the trajectory of a billiard ball around a polygonal table. That investigation into this seemingly simple action led to a 200-page paper which, when it was published in 2013, was hailed as "the beginning of a new era" in mathematics and "a titanic work."

"You're torturing yourself along the way," she would offer, "but life isn't supposed to be easy."

Mirzakhani is survived by her husband, Jan Vondrák, and a daughter, Anahita, as well as her parents, sister and two brothers.

Andrew Myers and Bjorn Carey

Alastair John Scott, 17 November 1939 – 25 May 2017

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Alastair Scott (photo credit: University of Auckland)

Alastair Scott, one of the finest statisticians New Zealand has produced, died in late May, aged 77, on the North Shore of Auckland. He is survived by his wife, Margaret, children Andrew and Julie, six grandchildren, and his sister Marilyn. There was standing room only at the University of Auckland's Maclaurin Chapel when he was farewelled on Wednesday May 31.

Alastair served the University of Auckland with distinction from 1972 until 2016. After his formal retirement in 2005 he held only fractional appointments, but continued working nearly full-time regardless. His research was characterised by deep insight and he made pioneering contributions across a wide range of statistical fields. He was acknowledged, in particular, as a world leader in survey sampling theory and in the development of methods to efficiently obtain and analyse data from medical studies. His methods are applied in a wide range of areas, notably in public health. Beyond research, he contributed prolifically to the statistical profession in academia, government, and society.

But Alastair wasn't just a world-leading statistician. He was also sociable, charming, mischievous, was always first with the news, loved a good gossip, but was always supportive of others. "Everybody who met Alastair became a lifelong friend," says colleague **Chris Triggs**. Adds colleague **Thomas Lumley**: "Alastair had a national and international reputation for being friendly and helpful."

Alastair grew up in Te Awamutu playing rugby and cricket, and had a lifelong love of the games. In his last year at Te Awamutu College, Alastair was Dux, and won the school's first university scholarship via a hothouse exam involving 10 papers, two in each of five subjects, sat over a period of less than three weeks. In 1958, he started studying maths at the University of Auckland. While living at student hall O'Rorke, he fell for fellow resident Margaret Hedley, a science student from Te Kuiti. Margaret would later teach high-school chemistry and biology.

Alastair gained his BSc in Mathematics in 1961 and his MSc in Mathematics in 1962. He then won a PhD scholarship in pure mathematics (algebra) to the University of Chicago. During the nine-month gap before going to

the United States, Alastair married Margaret (he later told a colleague that one of the chief pleasures of marriage was that he never had to go dancing ever again) and worked for the Applied Mathematics Division of the-then Department of Science and Industrial Research (DSIR) in Wellington. It was while at the DSIR that Alastair became fascinated by statistics and decided to switch his subject at Chicago from pure mathematics to statistics.

At Chicago, Alastair's doctoral supervisor was David Wallace, now an Emeritus Professor there. He gained his PhD in 1965, his thesis titled Allocation of Effort in the Design of Selection Procedures. When David moved to the London School of Economics (LSE), Alastair wrote him a letter asking if there were any jobs in its Department of Statistics. Indeed, there were — and Alastair ended up taking over the job vacated by fellow Auckland graduate George Seber! The LSE years were a time of hard work but also the foundation for lifelong friendships and collaboration.

Alastair made a conscious decision to make his career in New Zealand: he and Margaret wanted their children to grow up as New Zealanders. The Scott family returned to New Zealand in 1972, and Alastair joined what was then the Department of Mathematics and Statistics. Distance proved no barrier. Alastair held visiting positions at Bell Labs, the Universities of North Carolina, Wisconsin, and California Berkeley in the US, and at the University of Southampton in the UK. Throughout his career he was offered a stream of job offers from prestigious universities overseas, but turned them down.

In 1994, the University of Auckland's statistics staff, led by George Seber, had a very amicable divorce from the Department of Mathematics and Statistics. But due to George's ill-health at the time, it was Alastair who became the first head of the Department of Statistics. George, who retired in 2002, and Alastair were instrumental in building the Department of Statistics into the largest such department in Australasia.

In 2005, the year Alastair officially retired, a conference in Auckland in his honour attracted the largest concentration of first-rank international statisticians in New Zealand in one place at one time. In his "retirement" years — as we mentioned earlier, Alastair was still working — he remained a central figure in the Department.

From 2005 to 2008, Alastair was on New Zealand's first advisory committee on Official Statistics, the chief source of external advice for the Minister of Statistics about the health of the Official Statistics system. He also advised government statistics agencies in Australia, Canada, and the US.

Alastair was a Fellow of the Royal Society of New Zealand, the American Statistical Association, the Institute of Mathematical Statistics, and the Royal Statistical Society, and an honorary life member of the New Zealand Statistical Association (NZSA). In 2006, he received the prestigious Waksberg Award from the American Statistical Association and Statistical Society of Canada for outstanding contributions to survey methodology. That was followed in 2012 by the NZSA's premier prize, the Campbell Award, for sustained contribution to the promotion and development of statistics.

In November last year, in Christchurch, Alastair was awarded the Royal Society of New Zealand's Jones Medal, which recognised his lifetime contribution in the mathematical sciences. According to Thomas Lumley, "Statistics is mostly not about maths, so for a statistician to get a mathematics award requires significant theoretical contributions."

Alastair John Scott had a full life professionally and personally. He was a valued colleague and friend. We will miss him greatly and we extend our heartfelt condolences to Margaret, Andrew and Julie and his wider family and friends all over the world.

Ilze Ziedins, Chris Wild, Chris Triggs, Atakohu Middleton

REPORTS ON EVENTS

2016 New Zealand Mathematics Colloquium Report

The 2016 Colloquium was held at Victoria University of Wellington from 5–8 December, with three days of general mathematical activity and the final day being dedicated to mathematics and statistics education. This was the 50th anniversary of the first Colloquium, also held at Victoria in 1966. It was a pleasure on this auspicious occasion to welcome Graeme Wake and Mark Schroder who were also at that first meeting. Altogether, there were 98 registrants during the first three days of the Colloquium, of whom around 35 were postgraduates, while 77 people attended the Education day including 39 college teachers.

Following a welcome from Victoria's Vice Chancellor, Professor Grant Guilford, the conference got off to a rousing start with Professor Ben Burton's invited address titled "A Theory for Practical Computational Topology", delivered with great verve and featuring a flying laptop! Excellent invited addresses were also delivered by Dr Alexander Melnikov (Massey University), Professor Hinke Osinga (Univerity of Auckland) as NZMS Colloquium Lecturer, Professor Geoff Whittle (Victoria University) and Dr Rachael Tappenden (University of Canterbury) who was the second Butcher-Kalman Lecturer. This lectureship was established thanks to a generous donation from the Margaret and John Kalman Charitable Trust and New Zealand Mathematical Chronicle funds. Unfortunately, Professor John Butcher was not able to attend this year's colloquium (possibly the first he has missed since 1966) owing to a prior commitment but he sent his best wishes to the speaker.

One of the highlights of the meeting was the ANZIAM Lecture, delivered by Emeritus Professor Roy Kerr. His wonderful public talk, "Quasars, Black Holes and Gravitational Waves", recounted his remarkable discovery of an exact solution to Einstein's equations for a rotating black hole and its impact up to the present day, with the observation in 2016 by the Ligo project of gravitational waves.

The first three days of the conference featured close to 70 contributed talks. The Education day was blessed by two outstanding plenary lectures by Associate Professor Caroline Yoon and Professor Chris Wild (both University of Auckland). The first of these thoroughly engaged the audience, challenging us to think about "Mathematical freedom, constraints and border crossings". The second prompted us to gaze into the future of data and technology and their impact in education. The day was also enlivened by several contributed talks and a number of workshops exploring the role of technology in mathematics and statistics education.

The Women in Mathematics reception, financially supported by Te Pūnaha Matatini, was ably chaired by Dion O'Neale. He challenged those attending to think about the ways we carry out our roles and the importance of being an *ally*, so that those already in under-represented groups do not have to carry the whole burden of improving equity in the New Zealand mathematics communities.

Some 26 students entered for the Aitken Prize for best contributed paper. The winner was Naomi Gendler from the University of Auckland, for her talk "Pulse Dynamics of Fibre Lasers with Saturable Absorbers", while Emma Greenbank (VUW), Vee-Liem Saw (University of Otago) and Barak Shani (University of Auckland) received honourable mentions. Saeed Farjami (Auckland) was awarded the ANZIAM Poster Prize for his poster on the "Geometry of a Response". Thanks are owed to the excellent Aitken Prize committee for their efforts in attending all the talks and making the difficult decisions among so many excellent presentations. The Conference Dinner was held at the Wellesley Boutique Hotel where these prizes were awarded to their recipients, along with the NZMS Research Awards to David Bryant, Bernd Krauskopf and Alexander Melnikov (Early Career Award) and the inaugural Kalman Prize for the best paper published in the last 5 years to Gaven Martin.

The organising committee, David Balduzzi, Rod Downey, Kelsey Firmin, Mark McGuinness, Dimitrios Mitsotakis, Hung Le Pham and Ginny Whatarau more than ably ensured the success of this meeting and enabled me, as the convener, to have an easy life. Administrative staff and postgraduates from the School of Mathematics and Statistics ensured that the whole meeting ran smoothly and, I am sure, was enjoyed by all.

Peter Donelan (Victoria University of Wellington)

Mathematics in Industry New Zealand (MINZ)

Now in its third year and supported by long-time partner KiwiNet, Mathematics in Industry New Zealand's (MINZ, minz.org.nz) week-long event brings together a mixture of students and researchers with backgrounds in mathematics, statistics, engineering, and computer science, to solve real industry challenges. This included a mixture of

academics and students of all levels from across New Zealand, Australia, South Korea, Fiji, and from Italy. This year the challenges came from six leading businesses in New Zealand, including Fonterra, Zespri, Transpower, Fisher & Paykel appliances, Sanford Ltd and Horizons Regional Council.

University of Canterbury's Associate-Professor Mathieu Sellier in discussion with students.

The presentations were far from static equations on whiteboards. In particular, the modelling of the mechanical action of a Fisher & Paykel washing machine looked less like mathematics and more like art. Fonterra's challenge asked their team to predict the flavour profile of their milk powders with students applying both statistical approaches and modelling to analyse the chemicals involved in finding what chemicals caused different tastes.

Fonterra's Lisa Hall, a former participant come challenge setter that has seen the results of the work produced by MINZ. "The work done by last year's participants was being utilised within weeks of the event. Successes like this are why we keep coming back year after year with new problems."

The group's showed no shortage of mathematical firepower to tackle the issues, with Massey's Distinguished Professor Robert McLachlan on hand to assist the group tasked with optimising the monitoring of the fresh water network in the Horizons' Region and Zespri's group having the considerable experience of Emeritus Professor Graeme Wake.

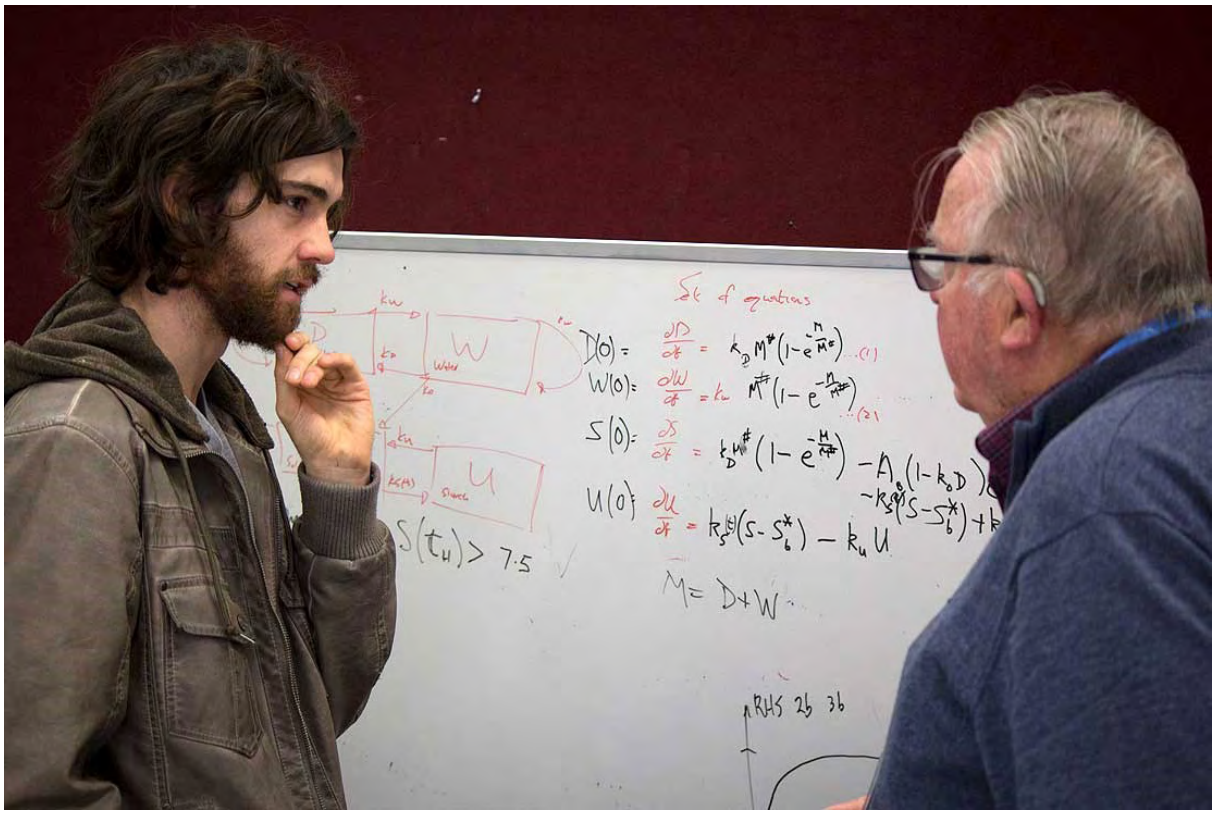
Event co-director Dr Luke Fullard, of Massey's Institute of Fundamental Sciences says both industry and participant walk away from the week with much more than they entered with.

"MINZ is unique because it allows a collaborative approach to industry problem solving, where mathematical scientists tackle real life problems shared by companies. Collaborative brain-storming is a great way of solving problems arising in industry and the environment.

"Mathematics is more relevant today as it has ever been. Educators looking for ways to inspire the youth of today in the importance of maths should look no further than the Mathematics in Industry NZ study week."

KiwiNet Chief Executive James Hutchinson spoke at the presentation day and said, "this week has been a fascinating and real insight into some excellent work. KiwiNet value our involvement with this event as our mantra is driving scientific discovery into new business for the benefit of New Zealand."

"A lot of people tried to crack the code as to how researchers can work with Industry — that's what is great about MINZ, theyve done it here."



Participant Marnus Stoltz (PhD student, University of Otago) and Emeritus Professor Graeme Wake.

Emeritus Professor Graeme Wake says "In fields such as Engineering and Biology it is easy to see their influence in civilisation through bridges or phones, medicines and food. Conversely, the field of mathematics is often invisible in real-world applications despite being, the backbone of practically everything we do."

"The study week concept has been going now for over half a century around the world. MINZ is an event which aims to promote the benefits and diverse applications of mathematics by linking mathematicians with industry problems."

Another highlight of the week came from invited guest, Dr Melanie Roberts from IBM Research Australia, who spoke to participants on Wednesday as a shining example of an academic who has made the transition into industry with outstanding success. Her talk explored two problems in weather impacted operations, focussing on the insurance industry and how companies can mitigate and respond to weather events.

From massey.ac.nz/massey/about-massey/news/article.cfm?mmarticle_uuid=AAD03B4F-151A-456A-A6B4-984B9278106E, communicated by Graeme Wake (Massey)

2017 SIAM Conference on Applications of Dynamical Systems

I would like to express my deep gratitude to the New Zealand Mathematics Society for their generous travel grant, which significantly assisted me to attend and participate in SIAM Conference on Applications of Dynamical Systems held in Utah, USA, in 21-25 May. This conference is the largest biennial conference in the area of applied dynamical systems and it attracts prominent researchers from all around the world.

At this conference, I presented a poster with the title "Saddle slow Manifolds and Canard Orbits in the Hodgkin-Huxley Model". This work introduces a new framework for computing two-dimensional saddle slow manifolds and illustrates a new mechanism for robust canard orbits in dynamical systems of higher dimensions. I discussed this work and exchange ideas with experts in the area of multiple-time-scale systems including Martin Wechselberger, Jonathan Rubin, Christian Kuehn and Mathieu Desroches.

Furthermore, my colleague Jose Mujica and I organised a mini-symposium at the conference with the title "Complex oscillations in multiple-time-scale problems". The aim of this mini-symposium was to bring together

speakers specialised in the area of multiple-time-scale systems, namely, John Guckenheimer, Krasimira Tsaneva-Atanasova, Theodore Vo and Yangyang Wang. The quality of the talks at the mini-symposium was very high and we were successful to attract as many as 45 attendants.

Cris Hasan (University of Auckland)

With the aid of the NZMS Student Travel Grant I attended the 2017 SIAM Conference on Applications of Dynamical Systems. This is a massive and important conference with over 900 participants held every two years at the Snowbird Ski and Summer Resort, in the middle of the mountains in Salt Lake City, USA.

At the conference, I co-organized with my fellow PhD student Cris Hasan a minisymposium about complex oscillations in multiple-time-scale problems, which is one of the topics of my research. The minisymposium was a great success: John Guckenheimer (Cornell University), Theodore Vo (Boston University), Yangyang Wang (Ohio University) and Krasimira Tsaneva-Atanasova (University of Exeter) gave enthusiastic and well received presentations to an interested audience of about 60. I also presented the poster "Global invariant manifolds and slow manifolds near a singular Hopf bifurcation", in which I described the role of these manifolds in the organization of recurrent dynamics in a normal form model, in the form of mixed-mode oscillations evolving onto a so-called Shilnikov homoclinic bifurcation. At the poster session, I had the chance to discuss my results with experts in the field, including John Guckenheimer and Jonathan Rubin, who gave me helpful feedback and suggestions for future research.

Overall, the conference was a great opportunity for networking and being in touch with the latest advances in theoretical and applied dynamical systems. With the discussions and ideas shared during the conference, I was able to get back to Auckland and submit my paper to the SIAM Journal on Applied Dynamical Systems.

Jose Mujica (University of Auckland)

PQCrypto 2017

The eighth iteration of the International Conference on Post-Quantum Cryptography (PQCrypto) was held in Utrecht, the Netherlands at the end of June in 2017. I was able to attend the conference and present my work with the help of NZMS. The paper I presented detailed an attack on cryptosystems based on supersingular isogenies and proposed countermeasures to thwart the attack. This cryptosystem is touted to be post-quantum secure, i.e. it will remain secure even with the arrival of quantum computers. The advent of quantum computers will herald the end of traditional public-key cryptosystems that have been based on the integer factorisation problem or the discrete logarithm problem, which explains the need for researchers to turn their attention to post-quantum systems.

I took the opportunity to speak to various participants in the conference and I hope to be able to collaborate with some of them in future. Due to the nature of the field, there are many fruitful research angles that one can take[2], hence speaking to people of different disciplines gave me some insights into the problem. A particularly interesting line of inquiry is the equivalence of categories between supersingular isogenies and the arithmetic of maximal orders of quaternion algebras. This led to many constructive discussions that I hope will be rewarding.

The conference was fruitful and productive for me and I wish to thank NZMS for making this possible!

Yan Bo Ti (University of Auckland)

3rd Karl Schwarzschild Meeting 2017

The 3rd Karl Schwarzschild Meeting on Gravitational Physics and the Gauge/Gravity Correspondence was held in Frankfurt am Main, Germany from the 24th to 28th of July 2017. This conference focussed on black holes in astrophysics, quantum gravity, and the gauge/gravity correspondence. A key element of this conference was to feature contributed talks by not only senior scientists, but also postdoctoral researchers and students. In this edition of the biennial conference, all contributed talks were plenary talks.

[2]Setting the elliptic curve over a finite field gives us an approach from number theory, the structure of the curve as an abelian variety allows us to view it geometrically, etc.

There were 123 registered participants, from all six major continents. Curiously, I have been the first and only participant from New Zealand/Australia in the Karl Schwarzschild Meeting, since its inception in 2013. This particular conference was quite intense, since there were no parallel sessions. It comprised 51 plenary talks, a poster session with 17 posters, as well as keynote talks delivered by invited scientists. The special conference talk, i.e. the "Schwarzschild Lecture" was given by Juan Maldecena, on the subject of "black holes and quantum mechanics".

Figure 2: Group photo for the 3rd Karl Schwarzschild Meeting (KSM) 2017, in Frankfurt, Germany. I am somewhat "blocked off" close to the back line, and on my left is Erik Verlinde. *(All photos are courtesy of Marco Knipfer, Michael Florian Wondrak, and the KSM Organisers.)*

This has been the best conference that I have attended, in terms of interacting with many people who share a common interest. I have really enjoyed talking about any general thing and general relativity with many people, over the full five days of the conference.

On top of that, I am happy to be named as the *Winner of the Karl Schwarzschild Prize 2017, for the best overall contributed talk*. In the announcement, it was mentioned that according to the plan, there were only the student and junior (postdoc) categories. However, during the judges meeting, they decided to invent a new "Best of the Best Winner" for the best overall talk. My talk was on the mass loss due to gravitational waves in the presence of a positive cosmological constant.

Well, there were many people who came to me after I gave my talk to personally say to me, "I like your talk!" — I really appreciate that these people came and explicitly let me know that!

I wish to express my gratitude to NZMS for awarding a Student Travel Grant, which provided the necessary additional support for my travel to Frankfurt for this conference. It was a really fruitful time for me with regards to my research in general relativity, disseminating my results to the relevant audience, as well as building vital networks with other researchers in the community.

Vee-Liem Saw (University of Otago)

Canterbury Biomaths Day joins the Te Pūnaha Matatini Biosphere theme

For the third time in recent years the Canterbury Biomaths Day joined forces with Te Pūnaha Matatini's Biosphere theme to bring together researchers from around the country. This year the event had over 25 participants including many students and early career researchers. The plenary talk, by Prof Dave Kelly (Biology, UC), explained how maths can give you answers to thistle problems when field work gets too hard.

Another highlight was Dr Dan Tompkins, (Landcare Research, Dunedin) explaining how the government's goal for a Predator Free NZ by 2050 isn't as unrealistic as it sounds. Overall the day was a great opportunity to find out what's going on around the country and the food was great! A big thank-you to Dr Audrey Lustig for organising it.

Figure 3: I am at the centre, *Winner of the Karl Schwarzschild Prize for the best overall contributed talk*. To my right is Viacheslav Emelyanov, winner for the postdoctoral category. To my left is Michael Florian Wondrak, winner for the student category. The rest are judges for the Karl Schwarzschild Prize.

Alex James (University of Canterbury)

GENERAL NOTICES

NZMS Education Group

The Education Group of NZMS is newly reorganised and working to establish an active role in NZ maths education. Our aim is to advocate for the enhancement of mathematics education in New Zealand through collaborative and constructive engagement with stake holders. The initial priorities of the group are to work at the nexus of secondary and tertiary education. As part of this, we are working to establish a NZ sub-group of First Year in Maths (FYiMaths), a network of mathematicians teaching in universities that was established in Australia more than five years ago. We will be holding the first meeting in NZ at the NZ Association of Maths Teachers conference held October 3–6 in Christchurch. If you are interested in joining the Education Group, please email us at nzmsed@gmail.com.

Cami Sawyer

Simon Marais Mathematics Competition

http://www.simonmarais.org/

Undergraduate Mathematics Competition
Australia/ NZ/ Asia-Pacific
7 October 2017

Eligibility: Undergraduate students at pre-registered universities located between New Zealand Standard Time and Indian Standard Time.

Entry: **Students** can enter **individually** or in **pairs**.
The best **universities** will be determined based on the scores of their 3 best individuals and 2 best pairs, subject to at least 3 of these 7 students being female and at least 3 being male. Please note: universities without 7 such entrants can still register to allow their students to compete for individual and pairs prizes.

Format: Two three-hour exams on **Saturday 7 October 2017**, at times TBC depending on the time-zone, to be held at pre-registered universities by local coordinators.

Problems: Challenging problems using core undergraduate mathematics. Possibly one open problem in PM exam.

Prizes: A$100,500 in total prize money, with additional corporate prizes and internships.

To register your university:

1. In consultation with your Head of Department/School, identify a local coordinator.
2. The Organising Committee will send an invitation to each Head in July, including the password for the university registration page.
3. For more information in the meantime, please contact:
   Anthony Henderson (The University of Sydney, director of SMMC Ltd)
   anthony.h@simonmarais.org
   Tony Guttmann (The University of Melbourne, chair of Organising Committee)
   tony.g@simonmarais.org

NZMS NOTICES

Minutes of the 42nd Annual General Meeting of the NZMS

Victoria University of Wellington, 5th December 2016.

Present: Astrid an Huef, Boris Baeumer, Anna Barry, Alona Ben-Tal, Mike Brettell, Jiling Cao, Petru Cioica-Licht, Lisa Orloff Clark, Shaun Cooper, Peter Donelan, Tom ter Elst, James Hannam, Jörg Hennig, Bernd Krauskopf, Carlo Laing, Stephen Marsland, Dillon Mayhew, Mark McGuinness, Robert McKibbin, Fabien Montiel, Graeme O'Brien, Lynette O'Brien, Dion O'Neale, Hinke Osinga, Iain Raeburn, Nicolette Rattenbury, Mick Roberts, Mark Schroder, David Simpson, Winston Sweatman, Rachel Tappenden, Steve Taylor, Chris Tuffley, Graeme Wake, Phil Wilson.

Apologies: John Butcher, Marston Conder, David Gauld, Rod Gover, Emily Harvey, Stephen Joe, Vivien Kirk, Robert McLachlan, Graham Weir.

The meeting opened at 5:05 pm.

1. Minutes of the 41st Annual General Meeting were accepted (Astrid an Huef/Graeme Wake, passed).
2. Matters Arising. None.
3. President's report. Astrid an Huef presented her report (as tabled). The President's report was accepted (Astrid an Huef/Mark McGuinness, passed).
4. Treasurer's report. Mark McGuinness spoke about the report (as tabled) on Bruce van Brunt's behalf. The accounts received an "unqualifed audit opinion". Subscriptions have not increased in 5 years, and may be increased at the next AGM. The Treasurer's report was accepted (Astrid an Huef/ Bernd Krauskopf, passed).
5. Appointment of auditors. The current auditor, Nirmala Nath from the School of Accountancy, Massey University, is to be re-appointed as Auditor. (Astrid an Huef/Mark McGuinness, passed).
6. Membership secretary's report. Was presented (as tabled) by Astrid an Huef. The meeting would like to thank John Shanks for his contribution and service (Astrid an Huef/Winston Sweatman, passed).
7. Election of 2018–2019 President
   (a) Departing Outgoing Vice-President: Winston Sweatman was thanked for his service.
   (b) Nominations for Incoming Vice-President: Vivien Kirk (Rua Murray/Astrid an Huef).
   (c) Vivien Kirk was elected.
8. Election of councillors to fill three spots:
   (a) Shaun Cooper and Emily Harvey have finished their first terms; the Society thanks them for their service.
   (b) There were three nominations for Council: Shaun Cooper (Winston Sweatman/ Mick Roberts), Emily Harvey (Astrid an Huef/Florian Beyer), Stephen Marsland (Winston Sweatman/Mark McGuinness).
   (c) Shaun Cooper, Emily Harvey and Stephen Marsland were elected.
9. Financial report from 2015 Colloquium and Report of 2016 Colloquium.
   (a) Shaun Cooper read a financial report, prepared by Rua Murray, from the 2015 Colloquium. The report outlined a small remaining (surplus) balance of $834.31 that has been applied towards internal costs (printing, room and security charges).
   (b) Mark McGuinness reported that the 2016 Colloquium was going well.
   (c) Astrid an Huef reminded everyone of the online colloquium survey that is open until the end of the week.
10. Forthcoming colloquia:

    2017 The 2017 Colloquium will be held at the University of Auckland 4–6 December, immediately following EMAC2017 conference 29 Nov–1 Dec.

2018 Otago will host in 2018 as the next Te Waipounamu (South Island) meeting.

2018 ACCMCC (combinatorics) conference will be in NZ in December 2018, organisers (Waikato) have asked for 2018 colloquium dates as soon as possible to arrange these not to clash.

2019 Chris Tuffley will ask the department at Massey University at Palmerston North if they are willing to host the 2019 Colloquium.

11. Report on NZ Journal of Mathematics from David Gauld presented as tabled by Shaun Cooper. Gaven Martin was thanked for 18 years of service as Editor. The Editorial Board has been revised; retiring, continuing and new members of the board are thanked for their support of the journal. Good manuscripts, including well-written survey articles, are being sought. Please encourage colleagues, collaborators, experts in your field, and especially NZ graduate students, to submit well-prepared manuscripts to the journal. Consider submitting your next good paper to the NZJM.

12. Report from the NZMS Education Group.

    (a) Dillon Mayhew talked about the two main groups that make up the NZMS Education Group. Anyone interested in participating should contact Dillon.

    (b) Graeme Wake mentioned that the Prime Minister's Science Teaching Prize now includes mathematics; mathematics teachers are encouraged to apply.

13. Update on Forder, Aitken, and Maclaurin lecturers. As in President's report.

14. Updating our constitution. Due to changes in the Incorporated Societies Act, the constitution needs to be revised by 2020. The main changes involve conflict resolution and winding up. Astrid an Huef, Emily Harvey and Rua Murray will work with ANZIAM (NZ branch) to prepare the required revisions.

15. General business.

    (a) Outgoing president Winston Sweatman was thanked for a total of 10 years of service to the NZMS Council. (Astrid an Huef/Shaun Cooper, passed).

    (b) Continuing council member Emily Harvey was thanked for ongoing service as secretary. (Bruce van Brunt[3]/Astrid an Huef, passed).

    (c) Continuing council member Bruce van Brunt was thanked for ongoing service as treasurer. (Astrid an Huef/Shaun Cooper, passed).

    (d) Mark McGuinness was thanked for standing in for the treasurer. (Bruce van Brunt[4]/Astrid an Huef, passed.)

    (e) The possible role of an honorary solicitor for the NZMS was raised.

    (f) The question of what to do with books, no longer wanted, of retired mathematicians was raised.

The meeting closed at 5:45 pm.

Shaun Cooper

New Zealand Mathematical Society Colloquium 5–7 December 2017: University of Auckland

The website for the 2017 NZMS Colloquium is now up. Please keep checking nzmathsoc.org.nz/colloquium2017 for the most up-to-date information on the speakers, program, accommodation, etc.

The registration and abstract submission portal will be open around mid-September. The accommodation booking service will also be online from mid-September.

The deadline for abstract submissions will be Friday 20 October 2017. We do not guarantee that every abstract will be accepted, but we hope to be able to accept most of them.

The deadline for conference registrations will be Monday 20 November 2017. After that date there will be a late fee.

The plenary speakers are:

[3] Nomination communicated by Mark McGuinness.
[4] Nomination communicated by Mark McGuinness.

- Ana Amador (ANZIAM lecturer), University of Buenos Aires, Argentina
- Bernd Krauskopf (2016 Research Award winner), University of Auckland, New Zealand
- Brendan Creutz (Butcher-Kalman lecturer), University of Canterbury, New Zealand
- David Bryant (2016 Research Award winner), University of Otago Dunedin, New Zealand
- Dorit Hochbaum, University of California Berkeley, USA
- Julie Clutterbuck, Monash University Melbourne, Australia
- Masina Po'e-Tofaeono, University of Auckland, New Zealand
- Nick Trefethen FRS, University of Oxford, UK.

As usual, there will be prizes for the best student talks and the best student posters. Students are strongly encouraged to attend the conference and to present a talk or poster.

Both the NZMS and the ANZIAM AGMs will take place during the Colloquium; see the notice about the NZMS AGM below.The ANZIAM AGM will occur 12.45–1.30pm on Wednesday 6 December.

Hinke Osinga and Tom ter Elst

Notice of 2017 Annual General Meeting of the NZMS

The Annual General Meeting of the New Zealand Mathematical Society will be held on Tuesday the 5th of December at 5pm, during the New Zealand Mathematics Colloquium, at the University of Auckland. Items for the Agenda should be forwarded by Monday the 20th of November to the NZMS Secretary.

Emily Harvey

NZMS Financial Assistance

The NZ Mathematical Society Council invites applications for financial assistance with the costs of mathematical research-related activity. Any research-related activity that furthers the objects of the Society will be considered. For example: hosting mathematical visitors; organising conferences, workshops, or outreach activities; and conference attendance, including costs associated with family responsibilities.

A relatively high priority will be given to applications involving contact between the mathematical communities of New Zealand and the islands of the South Pacific.

The remaining deadline for 2017 is 15 November. The funded activity must be at least one month after the application deadline. Retrospective applications are not considered.

Further information and the Application Form are available on our website nzmathsoc.org.nz/?assistance.

Emily Harvey

Call for nominations for NZMS Council positions

Nominations are called for three Councillor positions on the New Zealand Mathematical Society Council. The term of office of a Council member is three years. Council members may hold office for two (but no more than two) consecutive terms. I would invite members to consider the current makeup of the Council and to nominate candidates who would increase the diversity of the Council (e.g. career stages, areas of mathematics, geographic locations, genders, types of institutes) in order for us to best represent the NZ mathematics community. In particular, we would like to remind members that Student members are eligible to serve on the Council. The existing Council members, and their terms, can be found on the website: nzmathsoc.org.nz/?membership.

Nominations should be put forward by two proposers. The nominee and the two proposers should be current Ordinary members (including Student members) or Honorary members of the New Zealand Mathematical Society.

The nominations, including the nominees consent, should be forwarded by Friday 3rd of November 2017 to the NZMS Secretary, preferably by email. If nominations are sent by email, the two proposers and the nominee should each send separate email messages to the NZMS Secretary.

Emily Harvey

NZMS Student Travel Awards

One of the main activities of the NZMS is providing financial support to postgraduate students in mathematics in New Zealand. Towards this aim, the Society invites applications for Student Travel Awards from postgraduate students to support them presenting their research at conferences, attending workshops, and developing new collaborations. As of June 2017, the NZMS Student Travel Awards are supported by a grant of $5000 per annum from the Margaret and John Kalman Charitable Trust. This support has enabled us to increase the upper limit of funding from $1000 to $1500, and will be reviewed every three years by the Trustees, at which time a decision will be made either to continue, or discontinue, support of the Awards.

The NZMS Student Travel Awards will be awarded to students enrolled for a postgraduate degree in mathematical sciences at a New Zealand University who can demonstrate that they are involved in the NZ Mathematics community. Costs that can be covered include: flights, conference registration, accommodation, and travel-related costs associated with family responsibilities. Typical grants for travel within NZ and Australia are in the range $200–$600. For travel further overseas, larger grants up to $1500 may be considered.

The remaining deadline for 2017 is 15 November. The funded travel must be at least one month after the application deadline. Retrospective applications are not considered.

Further information about the NZMS Student Travel Awards and the updated Application Form are available on our website: http://nzmathsoc.org.nz/?assistance.

Emily Harvey

New & Notable Titles from siam®

Foundations of Applied Mathematics, *Volume 1: Mathematical Analysis*

Jeffery Humpherys, Tyler J. Jarvis, and Emily J. Evans

This book provides the foundations of both linear and nonlinear analysis necessary for understanding and working in twenty-first century applied and computational mathematics. In addition to the standard topics, this text includes several key concepts of modern applied mathematical analysis that should be, but are not typically, included in advanced undergraduate and beginning graduate mathematics curricula. When used in concert with the free supplemental lab materials, this text teaches students both the theory and the computational practice of modern mathematical analysis.

2017 • xx + 689 pages • Hardcover • 978-1-611974-89-8
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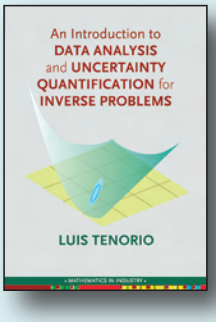

An Introduction to Data Analysis and Uncertainty Quantification for Inverse Problems

Luis Tenorio

Mathematics in Industry 03

Solutions to inverse problems are subject to many potential sources of error; thus it is important to include an assessment of the uncertainties as part of the solution. This book bridges applied mathematics and statistics by providing a basic introduction to probability and statistics for uncertainty quantification in the context of inverse problems as well as an introduction to statistical regularization of inverse problems.

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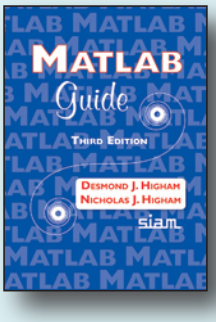

MATLAB Guide, *Third Edition*

Desmond J. Higham and Nicholas J. Higham

This third edition of *MATLAB Guide* completely revises and updates the best-selling second edition and is more than 25 percent longer.

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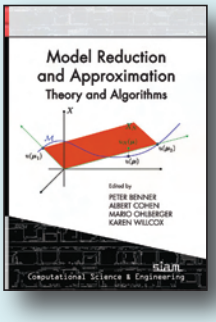

Model Reduction and Approximation: *Theory and Algorithms*

Edited by Peter Benner, Albert Cohen, Mario Ohlberger, and Karen Willcox

Computational Science and Engineering 15

This book presents a tutorial introduction to recent developments in mathematical methods for model reduction and approximation of complex systems. It covers sampling-based methods, approximation of high-dimensional problems by low-rank tensor techniques, system-theoretic methods, and a wide range of methods drawn from typically distinct communities (sampling based, tensor based, system-theoretic).

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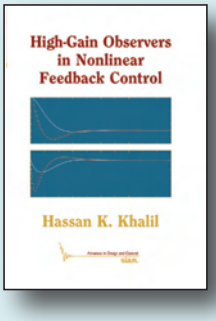

High-Gain Observers in Nonlinear Feedback Control

Hassan K. Khalil

Advances in Design and Control 31

High-gain observers are used extensively in the design of output feedback control of nonlinear systems. This book presents a clear, unified treatment of the theory of high-gain observers and their use in feedback control. It also discusses the separation principle for nonlinear systems; this differs from other separation results in the literature in that recovery of stability as well as performance of state feedback controllers is given.

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