Volume 42 Number 1 2015

The Australian Mathematical Society

Gazette

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The *Gazette* publishes items of the following types:

- Reviews of books, particularly by Australian authors, or books of wide interest
- Classroom notes on presenting mathematics in an elegant way
- Items relevant to mathematics education
- Letters on relevant topical issues
- Information on conferences, particularly those held in Australasia and the region
- Information on recent major mathematical achievements
- Reports on the business and activities of the Society
- Staff changes and visitors in mathematics departments
- News of members of the Australian Mathematical Society

Local correspondents submit news items and act as local Society representatives. Material for publication and editorial correspondence should be submitted to the editors. Any communications with the editors that are not intended for publication must be clearly identified as such.

Notes for contributors

Please send contributions to gazette@austms.org.au. Submissions should be fairly short, easy to read and of interest to a wide range of readers.

Please typeset technical articles using LaTeX or variants. In exceptional cases other editable electronic formats such as plain text or Word may be accepted. Please do not use definitions in your TeX files, as they may conflict with our style files. If you find such definitions convenient, please use a text editor to reinstate the standard commands before sending your submission.

Please supply diagrams as vector images (not bitmaps) where possible, as postscript (.ps) or encapsulated (.eps) files. Please supply photos at high-resolution (i.e. at least 400 pixels per inch (16 pixels per mm) at the final size of reproduction. For example, if the image is to be printed at 90 mm wide, it must be at least 1400 pixels wide. If JPEG format is used, images must be created with a high quality factor, i.e. artefacts such as halos of dots or jagged edges should not be obtrusive at high magnification. For more information, see *An Introduction to Computer Images* at delta-intkey.com/www/images.htm.

More information can be obtained from the *Gazette* website.

Deadlines for submissions to 42(2), 42(3) and 42(4) of the *Gazette* are 1 April, 1 June and 1 August 2015.

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Editorial

David and I welcome you to the first issue of the *Gazette* for 2015.

While we hear repeatedly that the number of high school students studying advanced mathematics subjects continues to drop, it is very pleasing that newspapers such as those published by Fairfax Press continue to take an interest in, and publicize, arguably the best mathematician in the world, Adelaide born Fields Medalist and recipient of a US$3 million 2015 Breakthrough Prize in Mathematics, Terrence Tao. It is nice to see him presented as a 'refreshingly normal' prodigy, family man and the Mozart of Mathematics. It is well worth watching the short video which accompanied the four-page article. (Terry Tao is to be a Plenary Speaker at the AustMS 2015 Meeting to be held 28th September to 1st October, 2015 at Flinders University.)

http://www.theage.com.au/good-weekend/-13fwcv.html

It is sad indeed that we entered 2015 with the fate of university funding and research funding still unclear. This reminds me of Nero playing the fiddle while Rome burnt. Higher education and research are too important to the future of Australia to be a political football. It is most likely that the result will be an Own Goal.

Congratulations to Professor John Sydney Croucher of Macquarie University who has been made a member (AM) in the Order of Australia 'for significant service to mathematical science in the field of statistics, as an academic, author, and mentor, and to professional organisations'.

The Australian Academy of Science has announced its 2015 Honorific medals for scientific excellence, and the 2014/15 AK Head Mathematical Scientists Travelling Scholarship. Details are given in an article in this issue. Congratulations to Professor Gustav I. Lehrer FAA of the University of Sydney, Professor Alan G.R. McIntosh FAA of the Australian National University, Professor Trevor J. McDougall FAA FRS of the University of New South Wales, Associate Professor Catherine Greenhill of the University of New South Wales, Dr Scott Morrison of the Australian National University, Associate Professor Yee Hwa Yang of the University of Sydney and Hien T. Nguyen of the University of Queensland.

Breaking News: Congratulations to Professor Cheryl Praeger AM FAA who was inducted into the Western Australia Women's Hall of Fame in recognition of 'her outstanding contribution to the education of girls and women in a field once considered the realm of the male gender'.

The relationship between the Australian Mathematical Society (AustMS) and Cambridge University Press dates back to the early 1980s when I negotiated the publishing of a new series of books by Cambridge University Press called the 'Australian Mathematical Society Lecture Series'. Today the three AustMS journals,

the BULLETIN, JOURNAL and the ANZIAM journal are published by Cambridge University Press. In the days of libraries throughout the world purchasing electronic 'bundles' of journals this relationship has proved enormously positive for authors in our journals and for the finances of the Society. This allows AustMS to support a large range of research activities.

In this issue we hear from the new President of AustMS, Professor Tim Marchant. Tim encourages you to vote in favour of Australian and New Zealand Association of Mathematical Physics (ANZAMP) becoming a division of AustMS — a position supported by the AustMS Council. ANZAMP is very active in promoting Mathematical Physics in Australia via workshops and conferences. Tim also reminds us that under the ERA assessment, the imperative has become 'Publish and be Cited, or Perish', and records easy steps you can take to improve your citation rate.

Professor Nalini Joshi, Chair of the National Committee of Mathematical Sciences, mentions that the Office of the Chief Scientist released a ground-breaking report called 'Benchmarking Australian Science, Technology, Engineering and Mathematics' and discusses its contents in this issue.

Professor Geoff Prince, Director of AMSI, brings to our attention 'AMSI's Research and Higher Education Committee has commissioned a review of the AMSI Workshop Program. Details of the current program and the relevant committees can be found at www.amsi.org.au. The review will not be concerned with the operational aspects of the current program, but with the purpose of the program, the range of events that we support and the way in which that support is specified. The mathematical sciences community is invited to make submission to the review.'

Amongst the many newsworthy items from around the country in our News section, we mention here that in 'November 2014, TTG Transportation Technology (a small Sydney-based company) won the National Export Award for the Environmental Solutions category. The award was for Energymiser — an on-board computer that advises train drivers of energy-efficient driving strategies. Energymiser was invented at UniSA by Professor Phil Howlett and Dr Peter Pudney using the mathematics of optimal control and has been developed over the past 15 years by TTGTT and UniSA. Details can be found at http://www.exportawards.gov.au/winners/2014/ttg-transportation-technology-nsw.'

This issue also contains a report on the 51st ANZIAM Conference held 1–5 February 2015 in Surfers Paradise and for which 229 people registered. There is also a report on the winners of the various ANZIAM Medals, Prizes and Scholarships.

There is a call for nominations for Prizes, Fellowships and Scholarships offered by the Australian Mathematical Society.

As usual, this issue also includes the entertaining and challenging Puzzle Corner, Book Reviews and Lift-Off Fellowship reports.

David and I hope you find this issue of the *Gazette* both interesting and informative.

Sid Morris, Adjunct Professor, La Trobe University;
Emeritus Professor, Federation University Australia.
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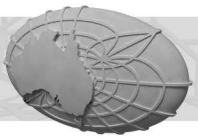
Sid Morris retired after 40 years as an academic. He received BSc (Hons) from UQ in 1969 and PhD from Flinders in 1970. He held positions of Professor, Department Head, Dean, Deputy Vice-Chancellor, CAO and CEO. He was employed by the universities: Adelaide, Ballarat, Flinders, Florida, La Trobe, UNE, UNSW, UQ, UniSA, Tel-Aviv, Tulane, Wales, and Wollongong. He was Editor of *Bull. AustMS* and *J. Research and Practice in IT*, and founding Editor-in-Chief of *AustMS Lecture Series*. He was on the Council of AustMS for 20 years and its Vice-President. He received the Lester R. Ford Award from the Math. Assoc. America. He has published 140 journal papers and 4 books for undergrads, postgrads and researchers, plus an online book, supplemented by YouTube and Youku videos, and translated into 6 languages. The third edition of the 900-page book *The Structure of Compact Groups* by Karl H. Hofmann and Sid was published in 2013 by Water De Gruyter GmbH, Berlin/Boston.



President's Column

Tim Marchant*

This is my first column after taking over as AustMS President from Peter Forrester during the 8th Australia-New Zealand Mathematics Convention, held in Melbourne, last December. I would like to thank Peter for his hard work and commitment to the Society, during his term as AustMS President. Peter remains part of the leadership team, as Immediate Past President, and I look forward to his continued contribution on the many issues facing the Society.

Council has approved a ballot of the membership to establish the Australian and New Zealand Association of Mathematical Physics (ANZAMP) as a Division of the Society. ANZAMP was formed in 2011 and is currently a special interest group of the Society. It has been very active in promoting Mathematical Physics in Australia via workshops and conferences and boasts a healthy membership. It is vital that the Society grows its membership base and supports all areas of mathematics. I believe that the ballot resolution, to establish ANZAMP as a Society Division, is worthy of your support.

I'm currently involved in the preparation of my University's ERA2015 submission and it's a constant reminder on just how critical journal citations have become, both for much of the ERA assessment and for the international University rankings. I think the phrase 'Publish or Perish' should now be updated to 'Publish and be Cited, or Perish'. All of these rankings include journal citations as collated by the Scopus and/or Web of Science databases. Also the H-index for individual researchers is increasingly important for grant success and career advancement.

There are a couple of simple actions Society members can take to improve their citation rates and H-Indices. Firstly, maintain a single Scopus and Web of Science profile, with a current employer affiliation. Many researchers have profiles that are split between name variants or multiple institutions which means that their H-index is artificially reduced. Secondly, place your publications in an online open source repository, to encourage its widest possible circulation. It has been shown that research papers placed in open access repositories are more widely cited, than those that appear in journal sites alone.

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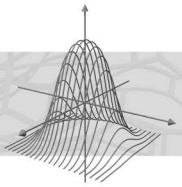
The Society formed a subcommittee to extend our membership base. The AustMS membership has been declining for some years now and I will report in detail on this critical issue in a future column. One piece of good news is that we now have a new online AustMS membership application form (thanks to Jerome Droniou for its development) which will make it much quicker and easier for new members to join the Society!

Tim Marchant received his Doctorate from Adelaide University in 1989. After graduation he joined Wollongong University where he is currently Dean of Research and Professor of Applied Mathematics. His research areas include nonlinear optics, nonlinear waves and combustion theory. Tim is a Fellow of the Australian Mathematical Society, a Member of the Endeavour Awards selection panel and on the editorial board of *Applied Mathematical Modelling*. His other interests include playing bridge and learning Mandarin.



Puzzle Corner

Ivan Guo*

Welcome to the Australian Mathematical Society *Gazette*'s Puzzle Corner number 41. Each puzzle corner includes a handful of fun, yet intriguing, puzzles for adventurous readers to try. They cover a range of difficulties, come from a variety of topics, and require a minimum of mathematical prerequisites for their solution. Should you happen to be ingenious enough to solve one of them, then you should send your solution to us.

For each puzzle corner, the reader with the best submission will receive a book voucher to the value of $50, not to mention fame, glory and unlimited bragging rights! Entries are judged on the following criteria, in decreasing order of importance: accuracy, elegance, difficulty, and the number of correct solutions submitted. Please note that the judge's decision — that is, my decision — is absolutely final. Please email solutions to ivanguo1986@gmail.com or send paper entries to: Gazette of the Australian Mathematical Society, Faculty of Science and Technology, Federation University Australia, PO Box 663, Ballarat, Victoria 3353, Australia.

The deadline for submission of solutions for Puzzle Corner 41 is 1 May 2015. The solutions to Puzzle Corner 41 will appear in Puzzle Corner 43 in the July 2015 issue of the *Gazette*.

Notice: If you have heard of, read, or created any interesting mathematical puzzles that you feel are worthy of being included in the Puzzle Corner, I would love to hear from you! They don't have to be difficult or sophisticated. Your submissions may very well be featured in a future Puzzle Corner, testing the wits of other avid readers.

Improbable product

Is it possible for the product of four consecutive positive integers to be equal to the product of two consecutive positive integers?

Many folds

Submitted by Andrew Kepert

(i) An A4 paper has the length to width ratio of $\sqrt{2} : 1$. How many folds are needed to locate a point on the longer edge that divides the edge into the ratio of $1 : 3$?

(ii) Start with a rectangular piece of paper, choose an edge and mark a point somewhere along it. Now there are two 'far' corners which do not belong

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to the chosen edge. Make a fold so that one of these far corners coincides with the marked point, then unfold. Make another fold so that the other far corner coincides with the marked point, then unfold again. Prove that the intersection point of the two creases has equal distance to two opposite edges of the paper.

Rabbit season

(i) Rachel and Fran are playing a game. Rachel controls three 'rabbit' pieces, while Fran controls a single 'fox' piece. Initially, all four pieces are placed somewhere along a straight line. They take turns making moves, with Rachel going first. Each move, a player is allowed to move one of her pieces a distance of at most one unit along the straight line. Fran wins if her fox piece can catch one of the rabbit pieces. Can Fran always win?

(ii) The same game is now played on a two-dimensional plane instead of a straight line. The rules are the same, except now Rachel has 20 'rabbit' pieces. Can Fran always win?

Lighthouse logic

There are 18 fixed lighthouses in the plane, each has the ability to illuminate an angle of 20°. Prove that, by carefully selecting the directions in which the lighthouses are operating, it is always possible to illuminate the whole plane.

Solutions to Puzzle Corner 39

Many thanks to everyone who submitted. The $50 book voucher for the best submission to Puzzle Corner 39 is awarded to Dave Johnson. Congratulations!

Integral means

Given n positive integers $a_1, a_2, \ldots, a_n$, their arithmetic, geometric and harmonic means are defined as follows:

$$\begin{aligned} \textit{arithmetic mean} &= \frac{a_1 + a_2 + \cdots + a_n}{n}, \\ \textit{geometric mean} &= \sqrt[n]{a_1 a_2 \cdots a_n}, \\ \textit{harmonic mean} &= \frac{n}{\frac{1}{a_1} + \frac{1}{a_2} + \cdots + \frac{1}{a_n}}. \end{aligned}$$

Can you find n distinct *positive integers such that their arithmetic, geometric and harmonic means are also positive integers?*

Solution by Joe Kupka: Yes it is possible for all three means to be positive integers. The key observation is that if we scale all of the numbers by a constant factor, all three means are also scaled by the same factor. Since the arithmetic and harmonic

means are automatically rational numbers, it suffices to begin with a set of number whose geometric mean is an integer and then scale accordingly.

An example would be $a_i = (n^{2n}-1)n^{2i}$ for $1 \le i \le n$. In this case the three means are given by:

$$\frac{a_1 + a_2 + \cdots + a_n}{n} = (n^{2n}-1)\frac{n^2 + n^4 + \cdots + n^{2n}}{n} = \frac{n(n^{2n}-1)^2}{n^2-1},$$
$$\sqrt[n]{a_1 a_2 \cdots a_n} = (n^{2n}-1)\sqrt[n]{n^{2+4+\cdots+2n}} = (n^{2n}-1)n^{n+1},$$
$$\frac{n}{\frac{1}{a_1} + \frac{1}{a_2} + \cdots + \frac{1}{a_n}} = \frac{n(n^{2n}-1)}{n^{-2} + n^{-4} + \cdots + n^{-2n}} = (n^2-1)n^{2n+1}.$$

They are indeed all positive integers.

Products of sums

We are given an $n \times n$ table where n is odd. An odd integer is written in each of its squares. Is it possible for the product of the column sums to be the negative of the product of the row sums?

Solution by Jensen Lai: The answer is no. Consider the problem in modulo 4. Each of the entries can be replaced by either 1 or -1. Since n is odd, the column sums, row sums and the corresponding products are all congruent to either 1 or -1 in modulo 4. We shall show that the product of the column sums is always congruent to the product of the row sums. This is certainly true if every entry is 1.

Let us study the effect of changing one entry from 1 to -1. One row sum will switch between 1 and -1. So the product of the row sums will also switch between 1 and -1. The same is true for one column sum as well as the product of the column sums. Now every possible table can be reached by changing some entries from 1 to -1, one at a time. Afterwards, both the product of the column sums and the product of the row sums will have switched the same number of times between 1 and -1. This implies that the two products are indeed always congruent in modulo 4.

However, if we add the product of the column sums with the product of the row sums, the result will always be congruent to 2 in modulo 4, which is certainly not 0. Therefore the two products cannot be negatives of each other.

Negative base

Given a positive integer $b > 1$, a base $-b$ representation *of a number n refers to the following form:*

$$n = a_0(-b)^0 + a_1(-b)^1 + \cdots + a_k(-b)^k$$

where $a_0, a_1, \ldots, a_k$ are non-negative integers less than b.

Prove that, for any positive integer $b > 1$, every integer (not just positive) has a unique base $-b$ representation.

Solution by Dave Johnson: We begin with an auxiliary result:

Fix a positive integer $b > 1$. If $-b < x_0, x_1, \ldots, x_k < b$, then the equation

$$0 = x_0(-b)^0 + x_1(-b)^1 + \cdots + x_k(-b)^k$$

is satisfied if and only if $x_0 = x_1 = \cdots = x_k = 0$.

By considering the equation in modulo b, we see that $x_0 = 0$. Now divide both sides by $-b$ and repeat the argument to obtain $x_1 = 0$ and so on. This proves the result. An immediate corollary is that any integer n can have *at most one* base $-b$ representation, because otherwise the difference between two representations will contradict the result above.

Back to the problem at hand. Consider all of the possible base $-b$ representations up to order k. In particular, we refer to

$$n = a_0(-b)^0 + a_1(-b)^1 + \cdots + a_k(-b)^k,$$

where $0 \leq a_0, a_1, \ldots, a_k < b$. It is clear that the terms with even powers are non-negative while the terms with odd powers are non-positive. This can be used to create upper and lower bounds for n, given by

$$(b-1)(-b)^1 + (b-1)(-b)^3 + \cdots \leq n \leq (b-1)(-b)^0 + (b-1)(-b)^2 + \cdots,$$

with the exponents bounded by k. The number of integers contained in this closed interval is given by

$$1 + (b-1)(b^0 + b^1 + \cdots + b^k) = b^{k+1}.$$

On the other hand, since each of $a_0, a_1, \ldots, a_k$ can take b possible values, there are exactly b^{k+1} possible base $-b$ representations up to order k. Recall that every integer has at most one base $-b$ representation, it follows that every number in this range has *exactly one* such base $-b$ representation. As k gets larger, it is clear that the upper and lower bounds grow indefinitely in both directions. Therefore every integer has a unique base $-b$ representation.

Ranking matches

(i) *Four table tennis enthusiasts are gathered to pit their skills against one another. There is a clear order in their table-tennis abilities and the better player always wins in a match. How many matches are needed to rank everyone according to their skill levels?*

(ii) *What if there were five table tennis enthusiasts to begin with?*

Solution: The answers to parts (i) and (ii) are 5 and 7, respectively. Out of n people, there are $n!$ possible ordering of skill levels. Since each match can have two possible outcomes, a minimum of $\lceil \log_2(n!) \rceil$ matches is required to determine a complete ordering.

For 4 people in part (i), at least $\lceil \log_2(4!) \rceil = 5$ matches are needed. This is achievable via a standard 'double elimination' format. Denote the players by A, B, C and D.

1. First, A plays against B, while C plays against D. Without loss of generality, suppose A and C are the winners.

2. Then, A plays against C in the winners' match, while B plays against D in the losers' match. Without loss of generality, suppose A wins and takes first place, while D loses and takes last place.
3. Finally, let B play against C to determine second and third places.

For 5 people in part (ii), at least $\lceil \log_2(5!) \rceil = 7$ matches are needed. This turns out to be possible as well, although the procedure is more complicated. Denote the players by A, B, C, D and E.

1. First, A plays against B, while C plays against D. Without loss of generality, suppose A and C are the winners.
2. Then, let A play C in the winners' match. Without loss of generality, suppose A wins. Up to this point, we have determined that $A > B$ and $A > C > D$.
3. Now, we determine the position of E within the $A > C > D$ chain. This can be achieved in two matches. First let E play against C. If E wins, then let him play against A. Otherwise let him play against D. After this, we have a complete ordering of A, C, D and E.
4. Finally we have to find the position of B using only two more matches. So far we only have $A > B$. There are two cases. If the previous step produced $E > A > C > D$. Then we can simply play B against C and D to complete the ordering. If $A > E$ occurs instead, then we may, without loss of generality, assume that $A > E > C > D$ since none of E, C or D have played against B. Now we can simply repeat the method used in the previous step to find the position of B amongst $E > C > D$, by first matching B against C, then E or D depending on the outcome.

In all cases, we have determined the complete ordering in 7 matches.

Note: As it turns out, the bound of $\lceil \log_2(n!) \rceil$ is not always achievable. The smallest counter-example occurs when $n = 12$, where $\lceil \log_2(12!) \rceil = 29$ but 30 matches are required. In general, determining the exact number of matches needed is computationally difficult and no simple formula is known.

Circular cuts

Submitted by Ross Atkins. The magician announces his next trick. "I have here, a piece of cardboard in the shape of a perfect circle. For my next act, I shall cut it into a number of pieces, so that all the pieces are absolutely identical to each other in shape and size..."

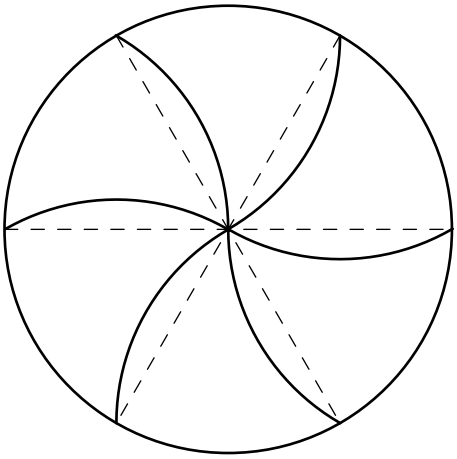
"So what", a restless audience member interjects, "anyone can do that, you've never seen a sliced pizza before?"

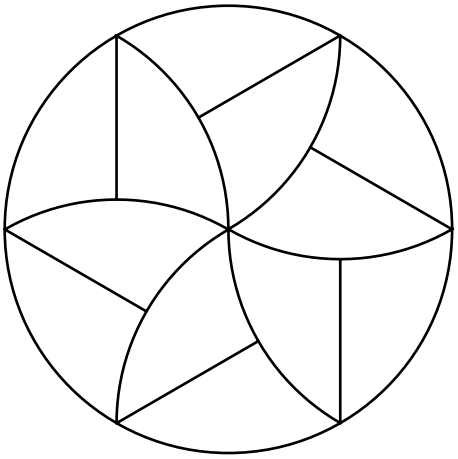
The magician keeps his composure. "Please let me finish. When I'm done cutting, at least one of the final pieces would not have touched the centre of the original circle to begin with."

Some started to scratch their heads. "Surely that's impossible!"

Will the magician be able to back up his words?

Solution by Jensen Lai: Yes, the amazing magician will be able to deliver. This is certainly one of those problems where pictures are worth more than words.





Ivan is a Postdoctoral Research Fellow in the School of Mathematics and Applied Statistics at The University of Wollongong. His current research involves financial modelling and stochastic games. Ivan spends much of his spare time pondering over puzzles of all flavours, as well as Olympiad Mathematics.

Order of Australia for John Croucher

In the Australia Day Honours, Professor John Sydney Croucher has been made a member (AM) in the Order of Australia 'for significant service to mathematical science in the field of statistics, as an academic, author, and mentor, and to professional organisations'.

John Croucher has been with Macquarie University since 1974, first in the Statistics Department, and then in the Macquarie Graduate School of Management.

He received his first PhD from the University of Minnesota in 1974 with a thesis titled *Game theoretic models with applications*, and a second PhD, in modern history, from Macquarie University, with a thesis titled *A science which cannot fail to elevate and purify the heart: the life and times of Janet Taylor and her role in the development of sea navigation.*

In 2011, he was awarded an honorary PhD from Divine Word University, in Madang, Papua New Guinea, where he had designed and taught the new MBA program, and served as a Council Member. The inscription read 'for services to humanity'.

In 2015 John was awarded a fourth PhD, this one from the University of Technology, Sydney, for a thesis on capital markets.

Throughout his teaching and writing, he has contributed to the practical application of quantitative methods to business and management. John is the winner of numerous national and international teaching awards, including Australia's prestigious Prime Minister's Award for Outstanding University Teacher of the Year in 2013.

An interesting part of his career was spent as a television presenter for seven years on rugby league telecasts on Channel 10 where he gave forecasts and statistical analysis of the matches. For 12 years he was the author of the popular Number Crunch column that appeared weekly in both the *Sydney Morning Herald* and *The Age* in Melbourne.

John is the author of over 130 research papers and 27 books, including his most recent ones:

- 2014 The Kid from Norfolk Island: Woodslane Press,
- 2012 Introductory mathematics and statistics (6th Edition): McGraw-Hill Australia,
- 2011 Love by Numbers: uncovering the secrets of sexual attraction: Woodslane Press,
- 2010 Quantitative analysis for management: McGraw-Hill Australia,
- 2010 The Secret Language: the real meaning behind what people say: Harper Collins Publishers.

Amongst his other achievements, John has been

- Benefactor, Parramatta High School, John S. Croucher Prize 'for Excellence in Mathematics', since 2003,
- Inaugural Chair, Responsible Gaming Committee of New South Wales, in 2001,
- A Visiting Professor at both the University of London and Divine Word University, PNG,
- Winner of the inaugural Distinguished Alumni Award at Macquarie University
- Fellow, Australian Mathematical Society, since 2001,
- Fellow, Royal Society for the encouragement of Arts, Manufactures and Commerce (RSA), since 2006,
- Elected Member, Australian Academy of Forensic Sciences, since 2005.

2015 Australian Academy of Science Awards

The Australian Academy of Science has announced its 2015 Honorific medals for scientific excellence, and the 2014/15 AK Head Mathematical Scientists Travelling Scholarship. The award winners include a number of mathematicians.

The medals for scientific excellence will be presented at an award ceremony on 27 May, 2015 at the Shine Dome, as part of the Academy's annual three-day event Science at the Shine Dome (https://www.science.org.au/events/science-shine-dome-2015) from 26 to 28 May. Medal winners will be invited to give short talks on their research after the presentation of medals.

2015 Hannan Medal for research in pure mathematics

The Hannan Medal honours the contribution to time series analysis of the late Professor E.J. Hannan FAA, and recognises research, in turn, in the fields of statistical science, pure mathematics, applied mathematics and computational mathematics. The 2015 winners are Professor Gustav I. Lehrer FAA (University of Sydney) and Professor Alan G.R. McIntosh FAA (Australian National University).

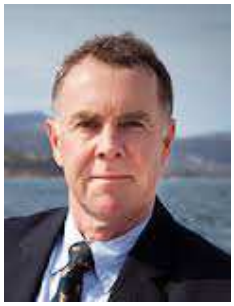
Professor Lehrer has made highly influential contributions to algebra and geometry. Among the highlights are his co-invention of the theory of cellular algebras in the decade's most highly cited Australian mathematical work, his development of 'Howlett–Lehrer theory' to solve decomposition problems in algebra and geometry, and his development of 'Springer–Lehrer theory', with geometric and algebraic applications. His recent joint solution of the second fundamental problem of invariant theory has resolved a question of 75 years standing.

Professor McIntosh works at the boundary between harmonic analysis and partial differential equations, two pillars of modern mathematics and physics. He is famous for having given with his collaborators the final answer to the Kato conjecture, a question raised in 1961 which puzzled specialists for 40 years. The techniques that he and his co-workers have developed have revolutionised the way we analyse the fundamental operators of physics.

2015 Jaeger Medal for research in Earth Sciences

The Jaeger Medal recognises the contribution of the late Professor John Conrad Jaeger, FAA, FRS, to Australian Earth science and is made to a scientist for

investigations of a high order into the solid Earth or its oceans carried out in Australia or having some connection with Australian Earth science. The 2015 winner is Professor Trevor J. McDougall FAA FRS (University of New South Wales).



Professor McDougall is internationally renowned for his ground-breaking work on ocean mixing processes and the thermodynamics of seawater. He has identified new mixing processes; defined neutral density surfaces along which mesoscale eddies mix; shown how lateral mixing processes should be included in ocean models; and redefined all the thermodynamic variables used in oceanography. His discoveries have improved ocean climate models and changed the way oceanographic data are analysed, increasing the accuracy of the science and confidence in models of the coupled atmosphere-ocean-ice climate system.

2015 Christopher Heyde Medal for research in Pure Mathematics

The Christopher Heyde Medal honours the contributions to mathematics by Professor Christopher Charles Heyde AM, DSc, Hon DSc, FAA, FASSA. Professor Heyde was the Foundation Dean of the School of Mathematical Sciences at the Australian National University, and Professor Emeritus of Statistics at Columbia University, New York. The 2015 winners are Associate Professor Catherine Greenhill (University of New South Wales) and Dr Scott Morrison (Australian National University).

Associate Professor Greenhill is internationally recognised as a leading expert in asymptotic, probablilistic and algorithmic combinatorics, undertaking research at the interface between combinatorics, probability and theoretical computer science. By studying fundamental combinatorial objects, such as graphs, she tackles problems of major significance to pure mathematics. Her highly cited research achievements include new formulae and algorithms that have found broad application in many areas, from statistics to computer science, physics and cryptography.

The interaction of quantum particles or quasi-particles in two dimensions involves a so-called 'fusion category' which describes the possible outcomes of collision between the quasi-particles. Diagrams describing the fusion category are analogous to the Feynmann diagrams well known in quantum field theory. Dr Morrison has made remarkable discoveries especially in this diagrammatic description of such low-dimensional processes. In particular he has classified the least complicated such theories that mathematics permits.

2015 Moran Medal for research in statistics

The Moran Medal recognises the contributions to science of the late P.A.P. Moran, FAA. The 2015 winner is Associate Professor Yee Hwa Yang (University of Sydney).

Associate Professor Yang is an applied statistician who has made significant contributions to the development of statistical methodology for analysing molecular data arising in contemporary biomedical research. Her work on removing extraneous variability for microarray data has been incorporated in major software packages used worldwide to identify gene expression patterns. She has also developed novel methods for integrating molecular and clinical data and has already made an impact on Melanoma research by identifying potential genes that help with predicting survival outcome.

AK Head Mathematical Scientists Travelling Scholarship 2014/15

The AK Head Mathematical Scientist Travelling Scholarship is named in honour of the late Dr Alan Kenneth Head AO FAA FRS (1925–2010) and is funded through the Gwenneth Nancy Head Foundation. Its purpose is to support mathematical science students/young researchers to further their studies and develop new international networks and collaborations whilst visiting facilities that they would not normally be able to access in Australia. It is awarded to one or more early career mathematical science students/research scientist to travel overseas for a period of time (between six weeks and three months) to further their studies and develop new international networks and collaborations to a maximum of $20,000 per year.

The Academy of Science has awarded AK Head Travelling Fellowships to Hien T. Nguyen of the University of Queensland and Yi Huang of the University of Melbourne.

Other awards and prizes

Besides membership of the Order of Australia, and Medals from the Australian Academy of Science, members of the Society have achieved significant recognition in several other ways.

Fellow of the American Mathematical Society

The American Mathematical Society has announced the 2015 Class of Fellows of the AMS, which includes Jonathan Michael Borwein (University of Newcastle), for contributions to nonsmooth analysis and classical analysis as well as experimental mathematics and visualization of mathematics.

The full list can be found at http://www.ams.org/profession/ams-fellows/new-fellows#sthash.WhdqY8nV.dpu.

Canadian Mathematical Society Robinson award

The Canadian Mathematical Society has announced that one of the two co-recipients of the 2014 G. de B. Robinson award are Jonathan M. Borwein (University of Newcastle), Armin Straub (University of Illinois at Urbana-Champaign), James Wan (University of Newcastle), and Wadim Zudilin (University of Newcastle) for their paper 'Densities of short uniform random walks' (with an appendix by Don Zagier), *Canadian Journal of Mathematics*, 64(5) (2012), 961–990.

The paper studies the densities of uniform random walks in the plane with a special focus on the case of short walks with three or four steps and less completely those with five steps. According to Robert McCann, Editor-in-Chief of the *Canadian Journal of Mathematics*, 'This is a wonderful article that is written in an engaging style and brings a heroic project to a triumphant conclusion'. For further information, see https://cms.math.ca/MediaReleases/2014/robinson-award.

Gavin Brown Prize

Professor Ben Andrews and Dr Julie Clutterbuck will jointly receive the Gavin Brown Best Paper Prize for their publication 'Proof of the fundamental gap conjecture', *J. Amer. Math. Soc.* 24 (2011), 899–916. Ben and Julie used novel methods to solve this long-standing conjecture. The Chair of the Gavin Brown Prize committee says: 'The result is clean and its formulation could be understood using second year undergraduate mathematics. The research is beneficial not only to mathematics, but also to physics — Ben and Julie's achievement has been acclaimed around the world'.

The Gavin Brown Prize was established in 2011 for 'an outstanding single article, monograph or book consisting of original research in Pure Mathematics'. It will be presented at the AustMS meeting at Flinders University in September.

ANZIAM Awards

Winner of the 2015 E.O. Tuck Medal

In honour of the late Ernest Oliver Tuck, FAustMS, FTSE and FAA, ANZIAM has instituted a mid-career award for outstanding research and distinguished service to the field of Applied Mathematics. At most one award will be made biennially, but only to a candidate of sufficient merit. This year, it was bestowed upon Associate Professor Troy Farrell, from Queensland University of Technology.

Citation for the 2015 E.O. Tuck Medal

Troy W. Farrell is an outstanding industrially focussed applied mathematician. He has been highly successful in addressing challenging and important problems that arise in industrial contexts. His work has simultaneously helped to develop the profession of applied mathematics and has achieved high impact for the industries his research has targetted, generating widespread economic benefits. In so doing, he has set an excellent example for the next generation of researchers. For these achievements, he is an ideal recipient of the E.O. Tuck Medal.

Since graduating with a PhD in 1999, Troy Farrell has produced more than 25 peer-reviewed journal articles and conference papers, a book chapter, 12 technical reports as well as many that are confidential and hence unpublished. He has been awarded nearly $1 million in grants and $400k in contracts, and has been involved with the supervision of 3 postdocs, 13 PhD and 16 Honours or Masters students. Troy is a highly regarded and award-winning university teacher and supervisor, and has also been recognised for his contributions to QUT's external engagement. He has been a visiting academic at the University of Southampton and at KTH in Stockholm.

Troy has used his in-depth knowledge of applied mathematics and physical chemistry to develop sophisticated models of chemical systems that are of great industrial significance. Some recent applications include batteries, dye-sensitised solar cells, drying of colloidal droplets, the oxidation of biomass stockpiles, and understanding the composition and recovery of coal seam gas being produced in Queensland. His work is mainly undertaken in collaboration with industrial partners, for whom his technical ability would not be applicable without supporting attributes including his work ethic, interpersonal skills, and willingness to undertake confidential research, some of which is suppressed from publication.

Troy is a recognised world expert on the electrochemistry of batteries. A specific highlight is his development of a comprehensive, multi-scale, computational model for primary alkaline battery discharge. The model includes realistic features such as charge transport in the electrolyte and at all physical interfaces in the cell, as well as simulation of the phases and structure of the micro-porous cathode. Troy has also successfully investigated many other features of batteries, including measurement of active material utilisation in primary alkaline battery cathodes, singular perturbation analysis for utilisation of active material in electrochemically active nanoporous particles, and the precipitation of ZnO in separator compartments of primary alkaline batteries.

His recent work on lithium ion batteries has gained international attention. The novelty and impact of this work has led to Troy being invited to give plenary lectures in the Oxford Centre for Collaborative and Applied Mathematics (OCCAM) at Oxford University, and in the Institute for Pure and Applied Mathematics (IPAM) at UCLA.

Dye-sensitised solar cells are another important area where his technical skills have been successfully applied. He has developed a model that accounts for charge transport in the semiconductor and electrolyte phases of the cell, as well as photo-electrochemical production of charge at the semiconductor/dye/electrolyte interface in the anode of the cell. Troy has also been the Principal Investigator in an ARC Linkage Grant on oxidation in biomass stockpiles. Another active research project was with the Australian Institute of Nuclear Science and Engineering on drying of colloidal nanoparticle sol droplets.

Troy's service to the Australian and New Zealand applied mathematics community is also noteworthy. He has done an excellent job as Director of the MISG over the last three years. He has a passion for communicating the relevance and effectiveness of mathematics to stakeholders in all parts of the community, as well as facilitating connections between early career researchers and industry.

Other roles of note include being Treasurer for QANZIAM since 2008, and Treasurer for ANZIAM 2009 in Caloundra. He has played a significant role with the QUT Node Leadership of the ATN Industry Doctoral Training Centre in Mathematics and Statistics, a federally funded national centre supported strongly by industry. He is also an important member of the QUT Mathematical Sciences School Executive, holding the position of Director of Industry and Engagement. He is an Associate Editor of ANZIAM J(E) and undertakes reviewing duties for many journals.

The selection panel unanimously recommends that Associate Professor Troy Farrell be awarded the ANZIAM E.O. Tuck Medal for 2015.

Winner of the 2015 John Henry Michell Medal

The John Henry Michell Medal, or simply the J.H. Michell Medal, is awarded annually by ANZIAM to at most one outstanding new researcher who has carried out

distinguished research in applied and/or industrial mathematics within Australia and New Zealand.

After careful consideration, the committee is unanimous in recommending that the 2015 J.H. Michell Medal be awarded to Dr Barry Cox from the University of Adelaide.

Citation for the 2015 J.H. Michell Medal

Barry obtained a Bachelor of Mathematics from the University of Wollongong in 1989, and then worked as a programmer for Illawarra Electricity and later for the NRMA. He commenced his PhD studies at the University of Wollongong in 2005, at which time he was in full-time employment as a programmer for BHP IT and Computer Sciences Corporation. He successfully completed his PhD in 2007 and initially worked as a Research Fellow in the Nanomechanics Group and then as a lecturer in the School of Mathematics and Applied Statistics at the University of Wollongong. In 2009 he received the prestigious ARC Australian Postdoctoral Fellowship for 4 years. Since 2010, Barry has been a Senior Lecturer in the School of Mathematical Sciences at the University of Adelaide.

Barry has made and continues to make 'ground breaking' contributions to the area of nanotechnology, starting with his PhD which examined nano-scaled structures, devices and materials. Barry has published almost 70 journal articles, with a significant number appearing in prestigious and high impact journals such as the *Proceedings of the Royal Society of London Series A*, *Journal of Mathematical Chemistry*, *Quarterly Journal of Mechanics* and *Applied Mathematics and Carbon*. Furthermore, Barry is the first author on the vast majority of his publications, which is a reflection of the importance of his contribution to many of the innovative ideas embodied in these papers.

A topic examined in several of Barry's papers, a new polyhedral model of carbon nanotubes, provides a good example of his research impact and innovation. Barry's work on the geometry of carbon nanotubes is highly original, and he was the first to propose such a solution in the twenty-odd years since the existence of carbon nanotubes was established. His new geometric model of carbon nanotubes properly incorporates the effect of curvature. From the numerical evidence, the model is unquestionably correct; it contains numerous implications relating to the fine structure of carbon nanotubes, and it is all accomplished with elementary geometry. Here we see in action Barry's elegant elucidation and precise identification of a complex structure using only basic mathematics. Barry's model is far simpler than anything previously proposed, yet it is able to produce carbon nanotube diameter predictions that are as accurate as the best *ab initio* calculations from quantum chemistry — the latter rely on supercomputers whereas Barry's predictions can be made using a simple calculator. Barry has now successfully extended his models for carbon nanotubes to other inorganic nanotube materials, which will prove to be very useful for nanotechnologists.

Barry has established strong links with prominent researchers in the field both nationally and internationally, and he has successfully supervised a number of research students to completion.

The committee regards Dr Barry Cox as a worthy recipient of the 2015 J.H. Michell Medal. Congratulations Barry!

TM Cherry Prize

A student prize was introduced in 1969 at Victor Harbor, and is awarded annually to the best student paper presented at the Conference. In May, 1976, ANZIAM (then the Division of Applied Mathematics) adopted the title TM Cherry Student Prize in honour of one of Australia's leading scientists, Professor Sir Thomas MacFarland Cherry, Kt, ScD, FAA, FRS. Mr Hayden Tronnolone (University of Adelaide) was awarded the TM Cherry Prize for the best student talk at the ANZIAM 2015 Conference for his talk 'Extruding Complicated Fluid Structures'.

The AF Pillow Applied Mathematics Top-up Scholarship

The AF Pillow Applied Mathematics Trust offers an annual 'top-up' scholarship to a student holding either an Australian Postgraduate Award (APA) or equivalent award for full-time research in Applied Mathematics leading to the award of a PhD. The aim of the AF Pillow Applied Mathematics Top-up Scholarship is to increase the quantity and quality of postgraduate students in the field of applied mathematics in Australia. Mr Pouya Baniasadi (Flinders University) was awarded the AF Pillow Applied Mathematics Top-up Scholarship for 2015.

ANZIAM 2015

Matthew J. Simpson[*] [**] **and Scott W. McCue**[*]

The 51st ANZIAM Conference was held on 1–5 February 2015 in the Outrigger Hotel, Surfers Paradise, Australia. A total of 229 people registered for the conference, with nine plenary presentations, 78 student presentations and 107 non-student presentations. Highlights of the conference included the plenary talks, presentations by the 2014 Michell and ANZIAM Medalists, the Women in Mathematics Lunch and the Conference Dinner and Awards Ceremony. The main conference was followed by a one-day workshop entitled 'Discrete mathematical models in the life sciences', held at Queensland University of Technology, Brisbane, on February 6, 2015.

The plenary talks comprised seven invited talks and two Medalist talks:

- Hugh Possingham (University of Queensland): 'Formulating and solving biodiversity conservation problems';
- Natalie Thamwattana (University of Wollongong; J.H. Michell Medalist): 'Mathematical modelling in nanotechnology';
- Tom Witelski (Duke University): 'Multiscale dynamics of dewetting fluid films';
- Leah Edelstein-Keshet (University of British Columbia): 'Models of cell polarization and motility';
- Ann Juel (University of Manchester): 'Interfacial instabilities on the pore scale';
- Mary Myerscough (University of Sydney): 'Modelling atherosclerotic plaque formation: Boundaries, balances and bifurcations';
- Michael Small (University of Western Australia): 'What is a random graph, and why should we care?';
- Kerry Landman (University of Melbourne; ANZIAM Medalist): 'Tracing genealogy within Fisher's travelling wave';
- Gary Froyland (University of New South Wales): 'Dynamics, Probability, and Predictability'.

Further details of the presentations are available at the conference website http://anziam2015.com. We owe our thanks to the invited speaker committee: Stan Miklavcic (Chair); Matthew Simpson; Scott McCue; Kate Smith-Miles; Georg Gottwald; Michael Plank; Nigel Bean; Yvonne Stokes and Antoinette Tordesillas.

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Plenary presentations at ANZIAM 2015. Left: Mary Myerscough's plenary presentation was chaired by Kerry Landman. Right: Michael Small's plenary presentation was chaired by Mick Roberts.

The Women in Mathematics Lunch, supported by Nalini Joshi's Georgina Sweet Australian Laureate Fellowship, celebrated the mathematical careers of the female plenary speakers at ANZIAM 2015. All conference delegates were invited to this special lunch that was hosted by Joanne Hall. The lunch involved a lively question–answer session which followed on from a more detailed question-answer document completed by all female plenary speakers, which can be found at http://www.austms.org.au/ANZIAM2015-QA.

The venue for the Conference Dinner and Awards Ceremony was SkyPoint, on level 77 of the Q1 Building. After taking in the views of the ocean, surrounding city and Gold Coast hinterland, delegates enjoyed their meal and the real highlight of the evening was the announcements of the awards of ANZIAM. The following awards were announced:

- The 2015 E.O. Tuck Medal: Associate Professor Troy Farrell (Queensland University of Technology). The E.O. Tuck Medal is a mid-career award for outstanding research and distinguished service;
- The 2015 J.H. Michell Medal: Doctor Barry Cox (University of Adelaide). The J.H. Michell Medal recognises outstanding new researchers;
- The 2015 T.M. Cherry Prize: Mr Hayden Tronnolone (University of Adelaide). This prize is for the best student talk at the ANZIAM conference;
- The 2015 A.F. Pillow Applied Mathematics Top-up Scholarship: Mr Pouya Baniasadi (Flinders University). This award is for a PhD student in applied mathematics.

After the close of the main conference, the School of Mathematical Sciences at Queensland University of Technology hosted a one-day workshop on 6 February entitled 'Discrete mathematical models in the life sciences'. The workshop was attended by approximately 60 delegates who heard plenary talks from Leah Edelstein-Keshet, Kerry Landman and Michael Small. The plenary talks by Leah and Michael focused on technical aspects of their research using discrete models while Kerry's plenary talk focused on how interactions with collaborators from the life sciences

2015 E.O. Tuck Medalist, Associate Professor Troy Farrell.
Left-to-right: Bob Anderssen, Troy Farrell, Larry Forbes and Kerry Landman.

had shaped her career. In addition to the plenary talks, the workshop hosted another eight regular presentations. The lunch break in Old Government House gave all delegates plenty of opportunity to meet and mingle with the plenary speakers and other delegates. At the close of the workshop many delegates continued lively discussions at Queensland University of Technology's Botanic Bar.

We would like to thank Bronwyn Hajek (chair) and the other members of the T.M. Cherry Prize committee. We also appreciate the CSIRO Student Support Scheme which assisted 48 students to attend the conference. The sponsors of ANZIAM 2015 also deserve special acknowledgment, these include the School of Mathematical Sciences at Queensland University of Technology, Hearn Software, Mathworks, QCIF and Pearson.

Special thanks also goes to the ANZIAM 2015 organizing committee: Matthew Simpson (Co-director), Scott McCue (Co-director), Peter van Heijster, Owen Jepps, Peter Johnston, Barbara Johnston, Zoltan Neufeld, Graeme Pettet and Tony Roberts (University of Queensland). We thank Raymond Johnson from Queensland University of Technology for his administrative support, and we also acknowledge the assistance of Natashia Boland and Steve Taylor, who passed on vital information and resources from ANZIAM 2013 and ANZIAM 2014, respectively. Finally, we thank Mark McGuinness for kindly offering to take photographs throughout the conference.

Technical Papers

Lift-Off Fellowship report Branching systems of ultragraphs, Perron–Frobenius operators

Hui Li*

I finished my PhD study at University of Wollongong under the supervision of Professor David Pask and Professor Aidan Sims, focusing on the area of C^*-algebras. In particular, I studied topological graph algebras (see [3]) and their twisted variation (see [5]).

During my PhD, I was also very interested in the (directed) graph algebra (see a detailed introduction in [6]). The graph algebra has been a very active area in the C^*-algebra for twenty years. It is important because it provides a lot of examples of C^*-algebras, certain types of them can be classified, and many properties of the graph algebra like the K-theory are closely related to the underlying graph. More importantly, it has many connections with other areas in mathematics such as dynamical systems.

A directed graph is a quadruple $E = (E^0, E^1, r, s)$ consisting of two countable sets E^0, E^1, and two maps $r, s\colon E^1 \to E^0$. To get a picture out of this abstract definition, just consider an arbitrary element $e \in E^1$ and visualize it as an arrow pointing from the source $s(e)$ to the range $r(e)$.

The graph algebra $C^*(E)$ is a C^*-algebra generated by a family of partial isometries $\{s_e\}_{e\in E^1}$ and a family of mutually orthogonal projections $\{p_v\}_{v\in E^0}$ satisfying very intuitive algebraic relations:

1. $s_e^* s_e = p_{r(e)}$, for all $e \in E^1$;
2. $p_v \geq \sum_{e\in F} s_e s_e^*$ for every $v \in E^0$ and finite $F \subset s^{-1}(v)$; and
3. $p_v = \sum\limits_{s(e)=v} s_e s_e^*$ whenever $0 < |s^{-1}(v)| < \infty$.

Recently, Kawamura [4], Gonçalves and Royer [1], [2] have built connections between the graph algebra and the Perron–Frobenius operator via an intermediate notion called the branching system. The definition of a branching system looks a bit technical, but the idea is really simple and it is just another way of realizing a

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Keywords and phrases: C^*-algebra; directed graph; ultragraph; branching system; Perron–Frobenius operator

graph algebra and representing it as a C^*-subalgebra of the bounded linear operator on the Hilbert space $\mathcal{L}^2(X, \mu)$ (more concretely, X can be $\mathbb{R}$). It was shown that it is possible to construct many branching systems and associated to each branching system is a Perron–Frobenius operator. The Perron–Frobenius operator from a branching system can be written down concretely in terms of the partial isometries of the graph algebra $C^*(E)$.

My Lift-off Fellowship supported me to travel to Universidade Federal de Santa Catarina, Florianópolis, Brazil, for three weeks and to collaborate with Professor Daniel Gonçalves and Professor Danilo Royer. During my visit in Brazil, we developed the notion of branching systems for a type of more general graphs called ultragraphs, and we constructed a relationship between a branching system of an ultragraph and the Perron–Frobenius operator of the branching system. The progress of the project went very well. Not only did we finish this generalization, also we solved some open problems left over from the early work in [1], [2], and we are writing our results into a paper to be submitted.

Finally I would like to thank Australian Mathematical Society for offering me a Lift-off Fellowship to go to Brazil and to communicate with people over there.

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Hui has recently completed a PhD at the University of Wollongong, under the supervision of David Pask and Aidan Sims. His thesis was titled 'Twisted Topological Graph Algebras', and was conducted in the area of Operator Algebras. Prior to this, he completed a Masters by research at the Australian National University under the supervision of Adam Rennie; his masters thesis was titled C*-Algebras and Quotients by Group Actions. He is currently employed as a Postdoctoral Fellow at the Research Center for Operator Algebras of East China Normal University in Shanghai.

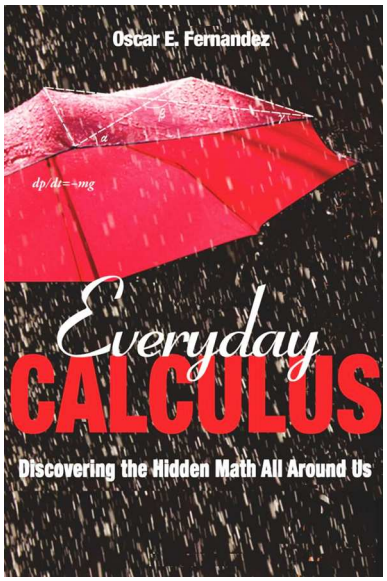
Book Reviews

Everyday Calculus

Oscar E. Fernandez
Princeton University Press, 2014, ISBN 978-0-691-15755-9

The target audience of this book is clearly stated right at the start, in the Preface. This book is for people who have asked 'When am I ever going to use [calculus]?' How many times do lecturers and teachers hear that question? And the book certainly promises much: The author's goal is that the reader 'should have a hard time figuring out what [calculus] *can't* be used for after reading this book.'

To achieve this goal, Fernandez takes the reader through a typical day and finds mathematics and calculus everywhere: while listening to the radio (Chapter 1), drinking his coffee (Chapter 2), using a GPS (Chapter 3), and selecting a seat at the movies (Chapter 7). This everyday journey also manages to discuss time travel (Chapter 3), why blood vessels branch at certain angles (Chapter 5) and the expanding universe (Chapter 7).



On the way, Fernandez manages to cover topics such as linear, polynomial, trigonometric, exponential and logarithmic functions (all in Chapter 1!), rates of changes, limits, derivatives, continuity (Chapter 2), second derivatives, linear approximations (Chapter 3), rules of differentiation, related rates (Chapter 4), differentials, optimisation, the mean value theorem (Chapter 5), Riemann sums, areas under curves, definite and indefinite integrals, the Fundamental Theorem of Calculus (Chapter 6), the average value of a function, and arc length (Chapter 7). All in 150 pages (and pages 119–150 are the appendices, end notes and index...). Compare that to the size of your favourite calculus textbook!

Clearly, to cover so many topics in 150 pages requires compromising on rigour and relegating much of the mathematical steps to appendices; Appendix A contains a refresher on graphs and functions, while Appendices 1–7 provide the intermediate steps and the calculations behind the mathematics that appears in each of the seven chapters.

The result is an interesting book, but perhaps not for the intended audience; those with less mathematical training would find the book frustrating I believe.

The book certainly includes plenty of complicated-looking formulae, such as

$$\theta(x) = \arccos\left(\frac{a^2 + b^2 - 576}{2ab}\right),$$

where

$$a^2 = (10 + x\cos\beta)^2 + (30 - x\sin\beta)^2$$
$$b^2 = (10 + x\cos\beta)^2 + (6 \quad - x\sin\beta)^2.$$

This formula appears while trying to select the best seat at a theatre (where the variables are defined on pages 101 and 102); a lay person would probably be amused to see such a complicated formula appear to help make such a mundane decision as selecting which row of seats in which to sit to watch a movie. Equations, admittedly not all as complicated as this (though some are!), appear regularly throughout the book, and surely would be too intimidating for someone without much mathematical training. And I suspect the pace at which the new topics emerge is too rapid for someone without mathematical training also. The book does, however, showcase many of the areas in which mathematics is applicable. In some ways the book reads as if it is preaching to the converted, and is providing evidence to the already-converted.

Many examples contain material that appears too involved for a lay reader, and unnecessarily so. For example, Newton's second law of motion is presented on p. 37 as

$$F_{\text{net}} = p'(t), \quad \text{where } p(t) = m(t)v(t) \text{ is the object's momentum,}$$

which I imagine is not how most of the intended reading audience would recall this Law. The more familiar $F = ma$ is given in a footnote.

Obviously, American units of measurement are used, so we see acceleration due to gravity given as 32 ft/s^2. There are some minor annoyances, such as the occasional loose use of language. On p. 54, for example, people are divided into two groups, I (those infected) and S (those susceptible to infection), and the next sentence talks about I and S as the *number* of people in those groups.

Some major quibbles do exist however, especially in the probability discussion of Chapter 6. For example, the picture of a normal distribution of the heights of American women on p. 94 (Figure 6.6) is certainly not normal in shape (surely producing a somewhat-accurate diagram would only have taken a few minutes of work?). Regrettably, only the mean of the distribution is labelled; no indication of the variation in the heights is provided at all.

The discussion about probability density functions in the same section is also found wanting. The peak of the normal distribution in Figure 6.6 occurs at the mean of 64 inches, and the vertical axis at this point has the value of 60; 60 what? The vertical axis is simply labelled as $f(x)$, which the text defines as the 'probability density function'. The text interprets this by stating that 'the graph shows that 60% of the sample has a height of 64 inches' which is clearly incorrect, and incredibly frustrating to read.

The very next sentence also makes me cringe: 'The fact that this is the *most frequent height* among adult women in the United States [i.e. the 64 inches just

discussed] makes this the average height for that population' (emphasis added), which is defining the average as the mode. Later on the same page, however, in a discussion of the time spent waiting for a train to arrive, Fernandez defines the average of an exponential distribution in a different way: halfway between the lower bound of a 0 min waiting time and the 10 min waiting time which is the longest waiting time that the author has experienced; this sounds more like the median. Turn a few pages, into the next chapter, and the average is defined on p. 99 as

$$f_{\text{avg}} = \frac{1}{n}\left[\sum_{i=1}^{n} f(x_i)\right],$$

which is an arithmetic mean. I sincerely hope that some of these errors are fixed in any subsequent editions.

There are some places where details are glossed over, understandably so in a short volume intended for a wide audience. However, some technical details are actually openly discussed, such as point discontinuities in continuous functions in Chapter 2.

Superscripts abound and can become tedious: superscripts in Roman numerals are for footnotes, superscripts in Arabic numerals are for endnotes, and superscripts in Arabic numerals that are preceded by an asterisk (for example, like this^{*1}) point the reader to an appendix containing more steps of the mathematical calculations. The results is that some pages contain large numbers of these superscripts and they soon become intrusive.

I have managed to find a number of things to criticise about this text, but this is unfortunate; the book is interesting, a little technical, and I enjoyed reading the book. But what of a lay reader, the intended audience? A reader with very little mathematics background is likely to find that the book moves too fast through complicated topics, is technical (despite much of this being placed in the appendices), and has too many intimidating formulae; however, they will probably be impressed to see how calculus does appear in so many situations even if they do not understand the details. And a reader who does have some mathematical background is likely to get frustrated by the lack of rigour and some inaccuracies in the text, but still be impressed by the applications discussed. Teachers and lecturers of calculus can probably find some useful applications to use and discuss in class, but these people are not really the target audience. In this context, note that the index contains mathematical topics but not the applications (so 'Chain Rule' is indexed, but not 'coffee'; 'Gaussian distribution' but not 'GPS').

So, despite some reservations, I recommend this book; I'm just not sure to what audience. Rather than being appreciated by the author's intended audience (those who ask 'When am I ever going to use calculus?'), perhaps the book would be most appreciated by those who teach the students who are likely to ask this very question.

Peter K. Dunn
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Topics in Random Matrix Theory

Terence Tao
Graduate Studies in Mathematics Vol. 132, American Mathematical Society, Providence, RI, 2012, ISBN-13: 978-0-8218-7430-1

There are already several reviews of this book; in particular, there is the MathSciNet review [7] by Steven Joel Miller, and the DMV review by Benjamin Schlein [8]. The advantage of this present review, if there is one, is that it is written by non-experts. We run a fortnightly evening reading group over dinner and drinks for staff, students, and ex-students. Each year we have a topic or book, and each evening one person volunteers to present material. In 2014, our 17th year, we chose Terry Tao's book on Random Matrix Theory.

To begin this review, we can do no better than quote Terry himself, from his review of another book on random matrices:

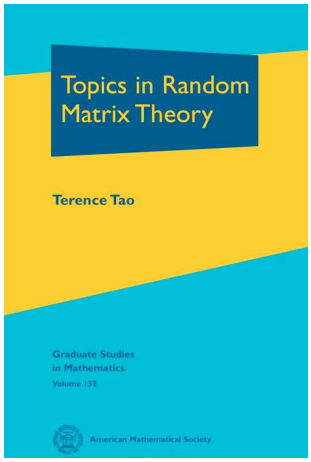
> The field of random matrices is a sprawling one, which originated in statistics and nuclear physics, but which nowadays has many deep and interesting connections with combinatorics, complex analysis, high-dimensional geometry, concentration of measure, integrable systems, Lie groups, and number theory. As such, it is nearly impossible to write a text on the subject that covers all aspects of random matrix theory, especially given that many parts of the subject are still evolving and not yet at a mature state of understanding. Tao [9]

From the preface of his own book, Terry writes: 'This text is *not* intended as a comprehensive introduction to random matrix theory, which is now a vast subject' [10, p. x]. Indeed, there is already a wealth of information available for the enthusiastic graduate student. In particular, we mention:

- the compilation of lectures delivered at the San Diego 2013 AMS Short Course on Random Matrices, containing a paper by Tao and Vu [11],
- the introduction to random matrices by Anderson, Guionnet, and Zeitouni [2], the MathSciNet review [9] of which being the one, by Tao, quoted from above,
- Peter Forrester's 791-page encyclopaedic work [4],
- the 919-page 'handbook' by Akemann, Baik and Di Francesco [1],
- the Courant Lecture Notes by Deift and Gioev [3],
- Mehta's book, now in its third edition [6],
- the oft cited book by Katz and Sarnak [5].

Terry's book of 282 pages comprises just three chapters. The first chapter (54 pages) is an entrée devoted to preliminary material: basic probability theory (34 pages), Stirling's formula (4 pages) and eigenvalues and sums of Hermitian matrices (16 pages). The notation adopted explicitly avoids set theoretic notation, and doesn't stipulate the underlying sample space. This natural notation is very flexible, but if you have grown up with your feet planted firmly in the sample space, you may find yourself tempted to regularly translate statements from the book into more conventional language. The second chapter (179 pages) is the main meal. A substantial

part of this chapter leads the reader to Wigner's semicircular law. This passage passes through the Chernoff inequality, the weak and strong law of large numbers, McDiarmid's inequality, the Talagrand concentration inequality, the central limit theorem (the treatment of which provides a natural introduction to the moment method proof of Wigner's semicircular law), the Berry–Esséen theorem, the Carleman continuity theorem, Lindelberg's swapping trick, Stein's method, the Bai–Yin theorems, etc. Chapter 2 then proceeds with a discussion of free probability (where Wigner's semicircular law is reproved using the free central limit theorem), Gaussian ensembles, the least singular value of a matrix, and the circular law. This latter topic, where Terry himself has contributed to the theory, involves significant new ideas beyond those used earlier and was beyond the scope of our reading group. The final chapter (36 pages) is a dessert of 'related articles' on Brownian and Dyson Brownian motion (16 pages), the Golden–Thompson inequality (7 pages) and the Dyson and Airy kernels of the Gaussian unitary ensemble via semiclassical analysis (13 pages). If the book is not a comprehensive introduction to random matrix theory, it is certainly a detailed presentation of many important aspects of the subject.



Overall, the impact of the book is quite awe inspiring. Terry gives an erudite and masterful presentation of the material. Each new page gives new historically important theorems, complete with comprehensive proofs, insightful comments and enlightening exercises. The unrelenting tempo of profound ideas is quite breathtaking. In reading this book, there can be no doubt that one is reading the words of one of the world's great mathematicians.

Our evening reading group using this book did function well, although a smaller than usual proportion of members volunteered to talk, perhaps because of the level of preparation required. The book is possibly too demanding a read for a group that meets over dinner and, particularly, over drinks. For self-study, or as a source for a day-time seminar group, it would be ideal.

Finally, we mention that this book continues the series of books derived from Terry's blog. A pdf version of the book is available at http://terrytao.files.wordpress.com/2011/08/matrix-book.pdf. Errata and comments can be found at http://terrytao.wordpress.com/books/topics-in-random-matrix-theory/.

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[10] Tao, T. (2012). *Topics in Random Matrix Theory* (Graduate Studies in Mathematics **132**). American Mathematical Society, Providence, RI.
[11] Vu, Van H. (ed.) (2014). *Modern Aspects of Random Matrix Theory* (Proceedings of Symposia in Applied Mathematics **72**). American Mathematical Society, Providence, RI.

The Q. Society
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Data-Driven Modeling & Scientific Computation: Methods for Complex Systems & Big Data

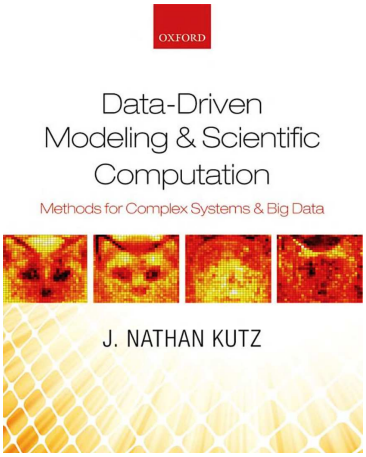
J. Nathan Kutz
Oxford University Press, 2013, ISBN 978-0-19-966033-9 (hardback)
Also available in eBook and paperback

The applied mathematician makes a three-stage attack on a problem: the creation of a model; analysis of the model by exact and approximate techniques; and simulation via scientific computation. Of the three, it is scientific computation that has spread the most into other disciplines and become an important tool for the researcher within them. Whether it is the engineer studying fluid flow over a complex geometry via finite elements, an ecologist solving a predator-prey ordinary differential equation (ODE) system with an adaptive Runge–Kutta scheme or the environmental scientist teasing out patterns from large data sets with time series analysis all increasingly require at least a passing acquaintance with the fruits of numerical analysis and some programming competence.

It is this requirement that prompts Professor Kutz's book *Data-Driven Modeling & Scientific Computation*. Kutz believes that the typical numerical analysis course, with its focus on rigour and establishing techniques, requires too much time to master and delivers material not clearly able to be implemented to solve real-world problems the broader research community wishes to solve. Kutz states that the goal of his book is to establish '... computing proficiency as the first and foremost priority above rigorous analysis'.

Computing requires a language in which to instruct the computer. The choice in *Data-Driven modeling* is MATLAB. On the whole this is a good choice. MATLAB is a commonly available software in universities and research institutions, is relatively friendly to the beginner (when compared to 3rd generation languages like FORTRAN), has a built-in development environment and visualisation, and comes with a large suite of code for all the common scientific computational tasks. The use of MATLAB is thus intended to allow one to reach coding and computation proficiency more quickly.

For individuals or poorer institutions the cost of MATLAB licences may be an issue. Kutz makes brief mention of one open source alternative (OCTAVE) and glibly claims that most MATLAB code is 'easily portable' to OCTAVE. Porting code presupposes a command of programming skills which may undercut the book's rationale somewhat.



Data-Driven modeling is organised into four parts. Chapter 1 of Kutz's 600+ page text is a MATLAB primer covering the basics of variable assignment, vectors, matrices, flow control, iteration, functions, data export and import, and plotting data. After the MATLAB primer in part 1 the reader is introduced to standard computational tasks: solving linear systems of equations, curve fitting, numerical differentiation and integration, optimization and more advanced visualisation. Each of these tasks has its own chapter where background information is given and theoretical results are stated but usually not derived. Snippets of MATLAB code and graphics are scattered throughout the text to illustrate how the problem is solved. Where there is a built-in MATLAB package for the task it is used and in general the MATLAB packages are treated 'to a large extent as blackbox operations'.

Part 2 deals with the solution of ODE, both initial (IVP) and boundary value problems (BVP), and partial differential equations (PDE). Standard IVP methods such as Runge–Kutta schemes are detailed. Shooting and relaxation methods are discussed for solving BVP. The section on ODE is rounded out with techniques for computing spectra. PDE are dealt with using finite differences, spectral methods and finite elements. Various time-stepping schemes are employed including the method of lines and the concept of operator splitting is demonstrated on the nonlinear Schrödinger equation.

There is nothing particularly novel about the material or its presentation in the first two parts. Other books cover similar material in a likewise pragmatic style e.g. *Numerical Methods in Engineering in MATLAB* by Kiusalaas, *Applied Numerical Methods Using MATLAB* by Yang *et al.* or *Applied Numerical Methods with MATLAB for Engineers and Scientists* by Chapra. What is novel is part 3, where

the reader is introduced to methods for data analysis. This substantial section of the book covers methods for large and complicated data sets i.e. the fashionable idea of 'big data'. Thus part 3 is timely and it is uncommon to see it combined with traditional topics such as curve fitting or the solution of BVP.

Data analysis methods start with some basics of probability, move on to time-frequency analysis including the use of wavelets, and then look at image processing. Some background linear algebra is then covered to enable the introduction of the key tool of singular value decomposition (SVD). The breadth of part 3 is impressive. Image recognition is used as a vehicle to present machine learning. Kalman filtering is introduced in the chapter on data assimilation. The SVD is then used for doing principal component analysis of a PDE so proper orthogonal modes may be found and the dimensionality of the PDE reduced in order to understand the dynamics. All this and more is presented and embellished with Kutz's own research.

The last section looks at 'real world' applications — i.e. real pieces of research not sterile problems. This part is mainly to inspire but also to say *look these methods really work*. Again there is quite a range of case studies here which could be made into research projects for advanced undergraduates.

Kutz envisions that his book could be used for both undergraduate and graduate courses in scientific computing, a graduate course in methods for data analysis or as a practitioner's reference book. In my opinion the book could be overwhelming in an undergraduate course (particularly so if students are also learning programming at the same time from this text) and as mentioned above there are a number of alternative texts teaching the traditional topics of scientific computation in a pragmatic manner. Further, the book is large and more than half of it would not be put to use in an undergraduate course. However, being able to direct your new PhD student to *Data-Driven Modeling & Scientific Computation* would be a big boon. So it is here as a reading course or reference manual for a researcher that I see Kutz's excellent text as being of greatest value.

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NCMS News

Nalini Joshi*

Benchmarking the Mathematical Sciences

On 1 December 2014, the Office of the Chief Scientist released a ground-breaking report called 'Benchmarking Australian Science, Technology, Engineering and Mathematics'.[1] There are key observations in this report about the mathematical sciences in Australia over the period 2002–2012, which I would like to draw to your attention. In reflecting on this data, please ask yourself the following questions (and let me know what you think!):

- Is the data consistent with developments in mathematical sciences in Australia over this period, e.g. declining numbers of researchers in mathematics and statistics departments, which occurred primarily in the late 1990s and early 2000s?
- Is the data accurate in reflecting the strength of each four-digit field-of-research (FoR) code for mathematical sciences in Australia?[2]

The data in the report is based on number, citation rates and authorship of research publications in the STEM[3] areas. The citation rates are weighted by field, that is, they are scaled by the average citations in that field, and therefore, these numbers are subject to how fields are defined. (These can vary with the databases used.)

First, the global picture: Australia produced 2.2% of total publications in STEM in this period. The total number of papers in mathematical sciences attributed to Australian authors in this period is 20,123 forming 2.15% of the world's share. Compared to other fields, this is the second-lowest proportion. Chemical sciences is lower at 1.98%, while environmental sciences is at the top with 7.49% of the world's publications in this area. (These figures can be found in Tables 2-1 and 2-2.)

Second, the measure of impact: Australia's field-weighted-citation rate over all the STEM fields is higher than the normalised world average, but slightly lower than that for a group of 15 European countries,[4] henceforth called EU15. Mathematical sciences is one of four fields for which the Australian field-weighted-citation rate is

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[1]The report can be downloaded at http://www.chiefscientist.gov.au/wp-content/uploads/BenchmarkingAustralianSTEM_Web_Nov2014.pdf.

[2]FoR codes for mathematical sciences: 0101 Pure Mathematics, 0102 Applied Mathematics, 0103 Numerical and Computational Mathematics, 0104 Statistics, 0105 Mathematical Physics and 0199 Other Mathematical Sciences.

[3]Science, Technology, Engineering and Mathematics

[4]Austria, Belgium, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Luxembourg, Netherlands, Portugal, Spain, Sweden and the United Kingdom.

higher than that of EU15. The other three such fields are earth sciences, physical sciences and the biomedical and clinical health sciences sub-group (see p. 10). This information is presented on a finer scale described by 4-digit FoR codes. There are two such FoR codes in mathematical sciences with relative citation rates lying above the corresponding rates for EU15 countries (see Figure 2-4). Table 2-3 shows that these are: 0104 Statistics and 0102 Applied Mathematics.

Australian Statistics is ranked higher than the USA and EU15 in relative citation rates. It is the *only* mathematical field ranked higher than both the USA and EU15, and it is positioned at 8th place out of 20 such STEM fields in Australia (see Table 2-3). Australian Statistics comprises 3.6% share of the field. Australian Applied Mathematics is ranked higher than EU15 but not the USA. In this band, it lies at 10th place and comprises 2.2% of the field.

Another measure of impact is provided in Chapter 3 of the report. Here Australia's contribution to the top 1% of citations in global publications in the natural sciences and engineering is analysed. Australia is ranked higher than 8 European countries, but is lower than Canada, France, China, Germany, UK and the USA (see p. 18). Australian mathematics is ranked 14th in its share of the top 1% out of 19 fields, with 3.1% of these publications. (Here, the field is defined by Scopus, rather than by FoR codes as described above.) Per million population, Australia has 2.9 top cited researchers, below that of Switzerland, the USA, UK, Denmark and Belgium. The top ranked country in this measure has more than 8 such researchers per million population.

There is a lot more in the benchmarking report than I have described here. The remaining chapters report on Patents, Research Funding, International Collaboration, the STEM Workforce, Higher Education and Schools, which are worth visiting in future columns.

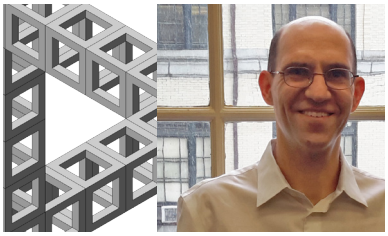
But for now, let me ask you to consider the questions at the beginning of this article. The above figures appear to describe a thriving research culture in mathematical sciences in Australia over the period 2002–2012, relative to other fields and to other countries. Yet, a conversation with an Australian mathematician of long standing may give the impression that we are in dire straits, with declining numbers of university departments in statistics and mathematics and declining numbers of continuing positions in these areas in universities. How can we reconcile these two opposing views? I look forward to hearing from you.

Nalini Joshi is an ARC Georgina Sweet Laureate Fellow and the Chair of Applied Mathematics at The University of Sydney. She was the President of the Australian Mathematical Society during 2008–2010, elected a Fellow of the Australian Academy of Science in 2008, became the Chair of the National Committee of Mathematical Sciences in 2011, and was elected to the Council of the Australian Academy of Science in 2012.

Research
Australian Mathematical Sciences Institute

2015 Lecture Tours

MAY



AMSI-CARMA Lecturer

Professor Jeremy Avigad

Carnegie Mellon University

Research: Mathematical logic and philosophy

JULY

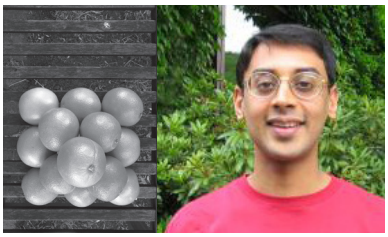
AMSI-ANZIAM Lecturer

Professor Michael Shelley

New York University

Research: Complex phenomena in active matter, biophysics, and complex fluids

SEPTEMBER



Mahler Lecturer

Professor Manjul Bhargava

Princeton University

Research: Number Theory

2014 Fields Medalist

AMSI Australian Mathematical Sciences Institute · Aust MS Australian Mathematical Society · ANZIAM · CARMA

More info: research.amsi.org.au

AMSI News

Geoff Prince*

Review of the AMSI Workshop Program

AMSI's Research and Higher Education Committee has commissioned a review of the AMSI Workshop Program. Details of the current program and the relevant committees can be found at www.amsi.org.au. The review will not be concerned with the operational aspects of the current program, but with the purpose of the program, the range of events that we support and the way in which that support is specified. The mathematical sciences community is invited to make submissions to the review. The opening date for submissions will be announced shortly through the usual channels.

The Workshop Program was one of AMSI's first initiatives and it has had a major impact on our research environment. Peter Hall was the inaugural chair of AMSI's Scientific Advisory Committee (SAC) which assesses applications for workshop sponsorship. Jon Borwein is the current chair of the SAC. While the program has sponsored hot topics workshops put together at short notice and theme programs lasting weeks and months, in recent years the program has settled in to sponsoring more or less conventional workshops across the entire spectrum of the mathematical sciences. These workshops number about 20 per year and run for between 2 and 5 days. AMSI funds each of these to a maximum of $10,000. At the moment we have a joint application process with the Society and ANZIAM for their own workshop programs and two rounds per year. These programs do not pool funds but the AMSI SAC advises the Society and ANZIAM on the quality of the applications. Of course many applications are directed to AMSI alone.

AMSI itself restricts its direct funding to the travel and accommodation support of a limited number of invited speakers, typically between one and four per workshop. These individuals are usually internationals with a significant track record of achievement. There are many other ways in which we could support workshops but we have chosen to do this because it delivers proven benefit and because this single focus is clear-cut for all parties. In addition, the AMSI Member Travel Funds introduced by Phil Broadbridge support workshop attendees from AMSI members without burdening the workshop organisers with the task of distributing travel support.

In thinking about your submission to the review, I suggest that you consider your international experiences as a source of innovation, whether we should be supporting attendees from developing countries, the possibility of longer events, joint

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workshops with other societies and institutes and so on. Please also give consideration to any inadvertent bias that might be present in the current (or future) program, for example against colleagues with families, against women or regional attendees. For instance, we know that women are under-represented at senior levels in academia so that too much focus on eminent scientists may produce an inherent male bias. Finally, but by no means exhaustively, there is national benefit. The program has always insisted on wide geographic participation so please give this some thought when you make your submission.

We look forward to hearing from you and, by the way, the next workshop application round closes on 5 June 2015.

I completed a BSc (Hons) and secondary Dip Ed at Monash University in the 1970s and moved to La Trobe where I undertook a PhD in 1981 in geometric mechanics and Lie groups. I did a postdoc at the Institute for Advanced Study in Dublin.

I've taught at RMIT, UNE and La Trobe University, where I was Head of Department a couple of times in the last decade. I worked at AMSI from 2004 through to 2006 in part as executive director to Garth Gaudry and I oversaw the introduction of the AMSI/ICE-EM Access Grid Room project. I became AMSI director in September 2009.

My research interests lie mainly in differential equations and differential geometry and I work with friends in Europe: Mike Crampin, Willy Sarlet, Olga Krupkova and Demeter Krupka.

My partner is a mathematician and we have two children with a refreshing lack of interest in mathematics. On the margins I brew beer and ride a bike.

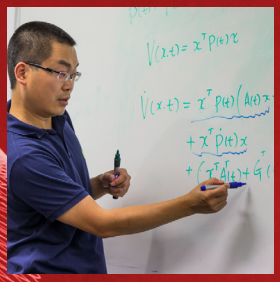
I'm a proud Fellow of the Society and am currently a Council member and a steering committee member.

Research

Australian Mathematical Sciences Institute

AMSI Sponsored Workshops

April 2015 – December 2015



Forthcoming events

Australian and New Zealand Applied Probability Workshop
7–10 April, Vine Inn Barossa

Symmetries and Spinors
13–17 April, The University of Adelaide

Workshop on Continuous Optimization: Theory, Methods and Applications
16–17 April, Federation University

AMSI Winter School on Algebra and Geometry in Physics
29 June –10 July, The University of Queensland

The Mathematics of Conformal Field Theory
13–17 July, Australian National University

Baxter 2015: Exactly Solved Models & Beyond
19–25 July, The University of Queensland

Workshop on Geometric Quantisation
27–31 July, The University of Adelaide

Number Theory Down Under
18–19 September, The University of Newcastle

International Workshops on Complex Systems and Networks
6–10 October, University of Western Australia

KOZWaves 2015: The Second International Australasian Conference on Wave Science
6-9 December, The University of Adelaide

BioInfoSummer 2015
7-11 December, The University of Sydney

Apply for Workshop & travel funding
Next round closes 5 June 2015

www.amsi.org.au/events

News

General News

Mathematics provides environmental solutions

Late November 2014, TTG Transportation Technology (a small Sydney-based company) won the National Export Award for the Environmental Solutions category. The award was for Energymiser — an on-board computer that advises train drivers of energy-efficient driving strategies. Energymiser was invented at UniSA by Emeritus Professor Phil Howlett and Dr Peter Pudney using the mathematics of optimal control and has been developed over the past 15 years by TTGTT and UniSA.

Details can be found at http://www.exportawards.gov.au/winners/2014/ttg-transportation-technology-nsw.

CMA proceedings now available through Project Euclid

The Mathematical Sciences Institute at the Australian National University are pleased to announce that the CMA proceedings have been made available on-line to the wider mathematical community on the Project Euclid website.

According to Professor Thierry Coulhon (Director), 'the Proceedings of the CMA are an essential part of the identity of the MSI at ANU. Several volumes are famous, and all of them are of interest. We are extremely happy and grateful that, thanks to Project Euclid, their content is made easily available to the wider mathematical community. I would also like to thank my predecessor Alan Carey who started this initiative.'

The proceedings can be accessed at https://projecteuclid.org/euclid.pcma.

Curtin University

Professor Song Wang began his term of Head of the Department of Mathematics and Statistics on 20 July 2014. Professor Lou Caccetta completed his term as Head. This was his fourth term as Head serving a total of 15 years.

Flinders University

Flinders mathematics has just moved into a new home in a brand new building at Tonsley, (along with engineering and computing departments). The new location is well separated from the main Flinders campus.

Macquarie University

People familiar with Macquarie University will be aware that the Department of Mathematics has always been centred in one of the oldest buildings on campus, Building E7A. In the last few years, the Department was moved and concentrated on Level 2 of Building E7A. In 2015, there will be major renovation of the whole

building E7A and the current proposal is that the occupants will be 'decanted' in April 2015, for a year, into 'The Hearing Hub'.

University of Melbourne

Following a restructure of the Faculty of Science, the Department of Mathematics and Statistics has been renamed the School of Mathematics and Statistics.

Mathematicians in the Media

The article 'Why mathematics matters' by James Franklin (UNSW) featured in Radio National's top 10 articles of 2014. Professor Franklin was interviewed on Radio National's The Philosopher's Zone in December to discuss his latest book, *An Aristotelian Realist Philosophy of Mathematics*. (A review copy of this book is available from the Gazette editors.)

Daniel Horsley (Monash) gave a public talk about Georg Cantor, at The Laborastory (http://thelaborastory.com/) on Wednesday 19 November. It is now available (audio) on their website: http://thelaborastory.com/stories/georg-cantor/. It is a beautiful and entertaining exposition of infinity and Cantor's discoveries about it, only 15 minutes long, aimed at the general public, and deserves a very wide audience.

Graham Farr (Monash) had an article on the film 'The Imitation Game', about Alan Turing, published in The Conversation in January 2015: http://theconversation.com/the-imitation-game-is-it-history-drama-or-myth-35849.

ANZAMP

ANZAMP has just become an associate member of the International Association of Mathematical Physics.

Call for Nominations for Academy of Science Awards

The Academy of Science has announced that nominations for the following awards are now open:

- Christopher Heyde Medal (mathematical sciences)
- John Booker Medal (engineering sciences)
- Moran Medal (statistical science)
- Nancy Millis Medal for Women in Science (any branch of the natural sciences)
- Hannan Medal (statistical science, pure mathematics, applied mathematics and computational mathematics)
- Thomas Ranken Lyle Medal (mathematics or physics).

Information on the awards (including eligibility criteria and nomination/application procedures and forms) is available on the website www.science.org.au/awards.

Call for Nominations for the 2015 Felix Klein and Hans Freudenthal Awards

The Executive Committee of the International Commission on Mathematical Instruction (ICMI) a number of years ago created two awards, each in the form of a medal and a certificate, to recognise outstanding accomplishments in mathematics education research:

- the Felix Klein Award, for lifelong achievement in mathematics education research,
- the Hans Freudenthal Award, for a major programme of research on mathematics education.

Nominations for the 2015 awards are now being invited. For details, see http://www.mathunion.org/icmi/activities/awards/call-for-awards-2015/.

Completed PhDs

ANU

- Dr Christopher Zoppou, *Numerical solution of the one-dimensional and cylindrical Serre equations for rapidly varying free surface flows*, supervisor: Stephen Roberts.

Curtin University

- Dr Yanli Zhou, *Computational methods for various stochastic differential equation models in finance*, supervisor: Y.H. Wu.
- Dr Tiffany Jones, *Mathematical modelling of cancer growth*, supervisor: L. Caccetta.
- Dr Yanqing Liu, *Controller design and disturbance rejection of constrained stochastic Markov jump systems*, supervisor: K.L. Teo.

Queensland University of Technology

- Dr Julian Back, *Stefan problems for melting nanoscaled particles*, supervisor: Scott McCue.
- Dr Rosmalina Hanafi, *Modelling and optimisation of railway crew scheduling*, supervisor: Erhan Kozan.
- Dr Kristen Harley, *Canards in advection-reaction-diffusion systems in one spatial dimension.* supervisor: Graeme Pettet.
- Dr Louise Manitzky, *Mathematical modelling of intramembranous bone formation during fracture healing*, supervisor: Graeme Pettet.
- Dr James Mckeone, *Statistical methods for electromyography data and associated problems*, supervisor: Anthony Pettitt.
- Dr Elizabeth Ryan, *Contributions to Bayesian experimental design*, supervisor: Anthony Pettitt.

Swinburne University

- Dr Elnaz Hajizadeh, *Molecular dynamics simulation of planar extensional and shear rheology of dendritic and blended dendrimer-linear polymer melts*, supervisors: Billy Todd and Peter Daivis (RMIT).
- Dr Elena Sanina, *Statistics of wave kinematics in random directional wavefields*, supervisors: Sergey Suslov, Dmitry Chalikov, Alessandro Toffoli and Prof. Alex Babanin.

University of Melbourne

- Dr TriThang Tran, *A configuration of homological stability results*, supervisors: Craig Westerland and Paul Norbury.
- Dr Han Gan, *Conditional distribution approximation and Stein's method*, supervisors: Aihua Xia and Kostya Borovkov.
- Dr Natalie Karavarsamis, *Methods for estimating occupancy*, supervisors: Andrew Robinson, Richard Huggins, Ray Watson and Graham Hepworth.
- Dr Ying Wan Yap, *Numerical solutions of the Boltzmann-BGK equation for oscillatory gas flows*, supervisor: John Sader.
- Dr Catherine Penington, *Collective motion of interacting random walkers*, supervisors: Kerry Landman and Barry Hughes.
- Dr Tharatorn Supasiti, *Flats and essential tori in spaces with polyhedral metrics*, supervisors: Lawrence Reeves and Hyam Rubinstein.
- Dr Sue Anne Chen, *Osmotic dimples and sliding bubbles: thin film flows where disjoining pressure counts*, supervisor: Steve Carnie.

University of Newcastle

- Dr Ian Searston, *Nonlinear analysis in geodesic metric spaces*, supervisors: Brailey Sims and George Willis.

University of New South Wales

- Dr Nick Fewster-Young, *A priori bounds and existence results for nonlinear systems of singular, second order boundary value problems*, supervisor: Chris Tisdell.
- Dr Kim Ngan Le, *Numerical methods for the Maxwell–Landau–Lifshitz–Gilbert equations*, supervisor: Thanh Tran.

UNSW Canberra

- Dr Hamizah Mohd Safuan, *Mathematical analysis of population growth subject to environmental change*, supervisors: Isaac Towers, Zlatko Jovanoski and Harvi Sidhu.
- Dr Edward Waters, *Modelling crowding affects in infectious disease transmission*, supervisors: Harvi Sidhu, Leesa Sidhu and Geoff Mercer.

University of Sydney

- Dr Theo Vo, *Geometric singular perturbation analysis of mixed-mode dynamics in pituitary cells*, supervisor: Martin Wechselberger.

- Dr Jonathan Kusilek, *On representations of affine Hecke algebras*, supervisor: Gus Lehrer.

University of Western Australia

- Dr Ibraham Almanjahie, *Statistical modelling and analysis of ion channel data*, supervisors: Robin Milne and Nazim Khan.
- Dr Paul Wright, *Dimensional characteristics of the non-wandering sets of open billiards*, supervisors: Luchezar Stoyanov and Lyle Noakes.
- Dr Guang Rao, *Self-complementary vertex-transitive graphs*, supervisors: Cai Heng Li and Michael Giudici.

University of Wollongong

- Dr Mohammed Aba Oud, *The dynamics of oil prices and valuation of oil derivatives*, supervisor:Joanna Goard.
- Dr Jean-Roch Nader, *Interaction of ocean waves with oscillating water column wave energy convertors*, supervisor: Song-Ping Zhu.
- Dr Enda Putri, *Stock loans valuation*, supervisor: Xiaoping Lu.

Awards and other achievements

Australian National University

The following staff members have been awarded grants in the latest round of ARC Discovery Project (DP15) and Discovery Early Career Researcher Award (DE15) grants:

- Jim Borger – DP15 – Pure mathematics
- Peter Bouwknegt (with Mathai Varghese) – DP15 – Mathematical physics
- Andrew Hassell – DP15 – Pure mathematics
- Qinian Jin and Markus Hegland – DP15 – Applied mathematics
- Amnon Neeman – DP15 – Pure mathematics
- Ben Andrews (with Glen Wheeler and James McCoy at UoW) – DP15 – Pure mathematics
- Jack Hall – DE15 – Pure mathematics

Curtin University

- Ryan Loxton received the Western Australian Early Career Scientist of the Year Award (2014) from the Premier's Office.

Macquarie University

- In the Australia Day Honours, Professor John Sydney Croucher, of the Macquarie Graduate School of Management, was made a member (AM) in the Order of Australia.

Monash University

- Ron Steinfeld has been awarded an ARC Discovery Grant, project title 'New efficient cryptographic tools for data privacy and software protection', jointly with Damien Stehle (ENS de Lyon).
- Darcy Best won the CMSA Student Prize for the best student talk at the 38th Australasian Conference on Combinatorial Mathematics and Combinatorial Computing (38ACCMCC), VUW, NZ, 1–5 December 2014.

Queensland University of Technology

Grants

- Dr Elliot Carr: Awarded an ARC DECRA Project 2015–2017
- Dr Qianqian Yang: Awarded an ARC DECRA Project 2015–2017
- Professor Kevin Burrage: Awarded two ARC Discovery Projects 2015–2017
- Dr Samuel Clifford: Awarded an ARC Discovery Project 2015–2017
- Professor Ian Turner: Awarded an ARC Discovery Project 2015–2017

University of Adelaide

- University of Adelaide Pure Mathematics Masters student Kelli Francis-Staite is the 2015 Rhodes Scholar for South Australia. Kelli is the University's 108th Rhodes Scholar and will use the Scholarship to start doctoral studies in mathematics at the University of Oxford.

University of Newcastle

- CARMA PhD student Matthew Tam has been awarded one of four student prizes for his talk 'Reflection Methods for Inverse Problems' at the biennial Computation Techniques and Applications Conference (CTAC) held at the ANU from 1–3 December. The prizes were sponsored by the Modelling and Simulation Society of Australia and New Zealand.

University of New South Wales

- Associate Professor Catherine Greenhill has been awarded the Australian Academy of Science's 2015 Christopher Heyde Medal.
- Scientia Professor Trevor McDougall has been awarded an Australian Academy of Science 2015 Jaeger Medal for Research in Earth Sciences.
- PhD student Boris Beranger has won the J.B. Douglas Award. The J.B. Douglas competition is held annually between selected PhD students from NSW universitities. The award commemorates the work of the late Jim Douglas, the first ever statistics appointment at UNSW.
- Former PhD student Stephen Maher has received an award for his thesis. The Aviation Applications Section of The Institute for Operations Research and the Management Sciences (INFORMS) confers a prize for the best dissertation in any area related to aviation operations research (air traffic management and airline OR). The award was announced on 9 November at the INFORMS Annual Meeting in San Francisco, with a prize of a plaque and an honorarium of $500.

- Associate Professor Chris Tisdell received a Teaching Excellence Award as part of the Australian Awards for University Teaching from the Office of Learning and Teaching.

University of Sydney

- Nalini Joshi has been awarded the Hardy Fellowship for 2015 by the London Mathematical Society and has been appointed to the Commonwealth Science Council.
- Peter McNamara and Oded Yacobi were awarded Discovery Early Career Researcher Awards for 2015–2017.
- Gus Lehrer, Andrew Mathas, Alex Molev and Ruibin Zhang were awarded ARC Discovery grants.
- Pengyi Yang was awarded a Sydney Postdoctoral Research Fellowship for 2015. His mentor is Jean Yang.
- Ian Melbourne has been awarded an International Research Collaboration Award by the University to work with Georg Gottwald.
- Jeroen Wouters will be joining the School in 2015 on a Marie Curie Fellowship. His advisor is Georg Gottwald.
- Gus Lehrer was jointly awarded the 2015 Hannan Medal for research in pure mathematics.
- Jean Yang has been awarded the 2015 Moran Medal for research in statistics.

University of Western Australia

- Cheryl Praeger has been awarded the George Szekeres Medal by the Australian Mathematical Society for an outstanding career in the mathematical sciences.

Appointments, departures and promotions

Australian National University

MSI staff departures

- Professor Coulhon Thierry, 1 February 2015, Academic Director
- Professor Eastwood Michael, 31 December 2014, Academic Adjunct Professor
- Dr Fang Yi, 31 January 2015, Academic
- Dr Lin Peijie, 30 December 2014
- Academic Professor Maller Ross, 1 January 2015, Academic
- Dr Rochon Frederic,1 January 2015, Academic
- Dr Seeliger Nora, 28 February 2015, Academic

MSI staff arrivals

- Dr Chen Xuzhong, arrived 20 January 2015
- Dr Dancso Zsuzsanna, 15 January 2015 to 14 January 2017

- Dr Hui Francis, 15 January 2015 to 14 January 2017
- Dr Onn Uri, 2 January 2015 to 24 December 2015

MSI promotions

- Jack Hall: Level A to Level B
- Jarod Alper: Level B to Level C
- Pierre Portal: Level B to Level C
- Timothy Trudgian: Level A to Level B

Emeritus

- Professor McIntosh Alan,1 January 2015 to 31 December 2050, Emeritus Professor

Curtin University

New staff

- Professor Song Wang from UWA
- Professor Jie Sun from National University of Singapore
- Professor Adrian Baddeley from UWA
- Associate Professor Benchawan Wiwatanapataphee from Mahidol University
- Associate Professor Kai Ki Jackie Li from Nanyang Technological University Singapore
- Dr Heather Lonsdale from Univ of Melboune (Lecturer)
- Dr Xinguang Zhang from Yantai University (Research Fellow)
- Dr Christina Kazantzidou from Aristotle University of Thessaloniki, Greece
- Dr Changjun Yu (Research Fellow)
- Dr Bin Li (Research Fellow)

Retirements/Resignations

- Dr Nirmala Achuthan retired
- Dr Kyle Chow resigned his position as Lecturer in June 2014

Promotions

- Ryan Loxton was promoted to Associate Professor

Federation University

- Musa Mammadov completed his position at the end of December, but remains an Honorary Research Associate.

Macquarie University

- The position of Head of Department of Mathematics was advertised externally and the selection process is underway.

Monash University

- Jonathan Keith has been promoted to Associate Professor

- Ron Steinfeld has been promoted to Senior Lecturer from 1 January 2015
- Amin Sakzad is starting a postdoctoral position in the Faculty of IT, working with Ron Steinfeld

University of Adelaide

- Finnur Larusson has been promoted to Level E
- Dr Guo Chuan Thiang (PhD Oxford) has joined Pure Mathematics as an ARC Research Associate
- Dr Wolfgang Globke starts a DECRA at Pure Mathematics

University of Melbourne

New staff

- Professor David Balding has commenced a joint appointment with the School of Biosciences
- Dr William Holmes, Dr James Osborne and Associate Professor James McCaw join the School of Mathematics and Statistics as applied mathematicians with interests in mathematical and computational biology
- Dr Darragh Walsh, Dr Michael Assis, Dr Lili Wang and Dr Naida Lacevic have commenced as research fellows
- Dr John Banks has commenced as Academic Manager of the Mathematics and Statistics Learning Centre

Departed staff

- Dr Steven Tobin
- Dr David Walker
- Dr Zajj Daugherty
- Dr Penny Wightwick
- Dr Woo-Sung Kim

Promotions

- Jan de Gier has been promoted to Professor, effective 1 January 2015
- Andrew Robinson has been promoted to Associate Professor and Reader effective 1 January, 2015

University of Newcastle

- Ljiljana Brankovic has been promoted to full professor
- Michael Coons has been promoted to Senior Lecturer
- Mike Meylan has been promoted to Associate Professor

University of New England

- Dr Maolin Zhou has joined UNE as a Postdoctoral Fellow, starting from November 2014. Research area: Nonlinear PDE

University of Southern Queensland

The following staff have been promoted as of 1 January 2015:

- Dr Nathan Downs has been promoted to Lecturer (Level B) from Associate Lecturer
- Dr Rachel King has been promoted to Senior Lecturer (Level C) from Lecturer
- Associate Professor Yury Stepanyants has been promoted to Professor (Level E) from Associate Professor

University of Sydney

- Samuel Mueller has been promoted to Associate Professor
- Holger Dullin and Martin Wechselberger have been promoted to Professor
- Sharon Stephen has been appointed to the position of Director of First Year Studies and Senior Lecturer
- Neville Weber has been awarded the title of Emeritus Professor

University of Western Australia

- Assoc Prof Alice Niemeyer left the School on 31 December 2014
- Michael Giudici was promoted from Level C to Level D
- Edward Cripps was promoted from Level B to Level C

University of Wollongong

- Dr Shuaian Wang has left the university
- Dr Valentina Wheeler has been appointed as Associate Lecturer for 12 months
- Glen Wheeler has been promoted to Level B
- Nathan Brownlowe and Thomas Seusse have been promoted to Level C
- Ngamta (Natalie) Thamwattana has been promoted to Level D
- Song-Ping Zhu has been promoted to Senior Professor

New Books

Monash University

Green, D.G., Liu, J. and Abbass, H. (2013). *Dual Phase Evolution*. Springer, New York.

Green, D.G. (2014). *Of Ants and Men: The Unexpected Side Effects of Complexity in Society*. Springer, Heidelberg.

University of Adelaide

Roberts, A.J. (2014). *Model Emergent Dynamics in Complex Systems*. SIAM, Philadelphia, PA. http://bookstore.siam.org/mm20/.

Conferences and Courses

Conferences and courses are listed in order of the first day.

Mathematics Bridge over the Pacific for Competitive Edge in Industry

Date: 12–13 March 2015
Venue: La Trobe University, Bundoora Campus, Melbourne
Contact: Phil Broadbridge (P.Broadbridge@latrobe.edu.au

Kickoff event for the Australian Branch of Kyushu University Institute of Mathematics for Industry.

5th Monash-Ritsumeikan Symposium on Probability and Related Fields

Date: 25–27 March 2015
Venue: Monash University, Clayton Campus

Australian and New Zealand Applied Probability Workshop

Dates: 7–10 April 2015
Venue: Vine Inn Barossa, South Australia
Web: http://maths.adelaide.edu.au/ANZAPW15/

The fourth Australia New Zealand Applied Probability Workshop will be hosted by the University of Adelaide, in the heart of Barossa, South Australia. Sponsored by AMSI, ANZIAM, ACEMS, and the School of Mathematical Sciences at UoA, the workshop aims to bring together researchers in Applied Probability from all regions to make new connections as well as present current work to their peers.

Keynote speakers:

- Ton Dieker (Georgia Tech/Columbia)
- Mariana Olvera-Cravioto (Columbia)
- Kavita Ramanan (Brown University)

For more information, please see the workshop website and/or email Giang Nguyen at giang.nguyen@adelaide.edu.au.

Symmetries and Spinors: Interactions Between Geometry and Physics

Date: 13–17 April 2015
Venue: University of Adelaide, Conference Room 7.15
Web: www.iga.adelaide.edu.au/workshops/April2015/

Plenary speakers José Figueroa-O'Farrill (University of Edinburgh) and Maxim Zabzine (Uppsala University) will deliver a series of lectures, supplemented by

research talks by other invited speakers. The IGA and the AustMS Women in Mathematics Special Interest Group will also host a Women in Mathematics gathering on one of the afternoons.

Everyone is welcome; please register at the website.

For more information, please see the website, or *Gazette* 41(4), p. 268.

Workshop on Continuous Optimization: Theory, Methods and Applications

Date: 16–17 April
Venue: Federation University, Ballarat Campus, T127

The Centre for Informatics and Applied Optimisation (CIAO) will be holding a two-day workshop on continuous optimisation in memory of Professor Alex Rubinov, the founding Director of CIAO, who would have been 75 this year. The workshop will be held on 16 and 17 April 2015 and will feature key researchers from across Australia who will come together to present their research in optimisation.

Students or staff interested in presenting a paper should contact A/Prof Adil Bagirov on 5327 6306 or email a.bagirov@federation.edu.au.

Operator algebras and mathematical physics

Date: 8–12 June 2015
Venue: University of Wollongong

Further details to be advised.

2015 AMSI Winter School on Algebra, Geometry & Physics

Date: 29 June to 10 July 2015
Venue: University of Queensland
Web: http://ws15.amsi.org.au

The school includes introductory and advanced courses in Geometric Representation Theory, Moonshine Conjectures and Vertex Operator Algebras, Moduli Spaces in Symplectic Geometry & K-Theory and its Applications. The 2015 School will be in collaboration with the ANU Special Theme Year. Registration is now open at the website, and closes on 21 June 2015.

The Mathematics of Conformal Field Theory

Date: 13–17 July
Venue: The Australian National University
Web: http://maths.anu.edu.au/events/mathematics-conformal-field-theory

This conference forms a part of the MSI's special year on Geometry and Physics and is a joint enterprise with the Pacific Institute for the Mathematical Sciences. The conference now officially has a website where all that wish to attend can register.

Industrial & Applied Mathematics Symposium 2015

Date: 16–17 July 2015
Venue: University of Wollongong
Web: http://eis.uow.edu.au/smas/anziam-symposium-2015/index.html

We are holding a two-day symposium on Industrial and Applied Mathematics to honour Jim Hill's 70th birthday, celebrating his long career achievements and his contribution to the Applied Mathematics discipline. All persons interested in participating are welcome and encouraged to attend. There is no registration fee; all you have to do is to fill the registration form at the website.

Various research topics will be presented at the symposium, including solid mechanics, fluid mechanics, financial mathematics, mathematical biology, nanomechanics and computational mathematics. Talks are by invitation, but if you would like to give a talk, please contact ngamta@uow.edu.au. The symposium will be held on the campus of the University of Wollongong where Jim spent the bulk of his career, with the symposium dinner being held on the Thursday night.

Baxter 2015: Exactly Solved Models & Beyond

Date: 19–25 July 2015
Venue: Palm Cove, Queensland
Web: http://baxter2015.anu.edu.au/

The ANU College of Physical and Mathematical Sciences is organising this international conference in honour of Rodney Baxter's 75th birthday. The conference will highlight Professor Baxter's pioneering contributions in exactly solved models in statistical mechanics which have inspired crucial developments in key areas of theoretical physics and mathematics.

Keynote speakers:

- George Andrews (Penn State)
- Ludwig Faddeev (St. Petersburg)
- Michio Jimbo (Tokyo)
- Barry McCoy (Stony Brook)
- Alexander Polyakov* (Princeton)
- Stanislav Smirnov* (Geneva)
- Alexander Zamolodchikov* (Rutgers)

* to be confirmed

IGA/AMSI International workshop on Geometric Quantisation

Date: 27–31 July 2015
Venue: The University of Adelaide
Web: http://www.iga.adelaide.edu.au/workshops/July2015/

Features keynote speakers including Jean-Michel Bismut, Nigel Higson, Eckhard Meinrenken and Michele Vergne. Registration is emphfree, so please register at the website.

ICIAM 2015, the Eighth International Congress in Industrial and Applied Mathematics

Date: 10–14 August 2015
Venue: Beijing, China
Web: http://www.iciam2015.cn/

Registration is now open. Importantly, *early-bird registration will finish at the end of April*. The website has plenty of content to choose from, with 27 invited talks and more than 3,000 minisymposium and contributed talks. (Some of you will remember well that the fifth ICIAM was held in Sydney in 2003.)

For more information, please see the website, or *Gazette* 41(3), p. 203.

Mathematics Education in a Connected World

Date: 16–21 September 2015
Venue: Catania, Italy

The 12th International Conference of the Mathematics Education for the Future Project in Montenegro, September 2014, was attended by 174 people from 29 countries. The next conference will be held near Catania, Sicily, at a beautiful hotel next to the sea. The conference title continues our search for innovative ways in which mathematics, science, computing and statistics education can succeed in our increasingly connected world. Our 12 previous conferences since 1999 were renowned for their friendly and productive atmosphere, and attracted many movers and shakers from around the world.

We now call for papers and workshops (which can be peer reviewed) with the possibility of future publication in a book or journal. Please email Alan Rogerson at alan@cdnalma.poznan.pl for all details and updates.

Number Theory Down Under

Date: 18–19 September 2015
Venue: The University of Newcastle
Web: http://carma.newcastle.edu.au/meetings/ntdu3/

The aim of this focussed conference is to bring together Australian number theorists to share ideas and to discuss current work. This conference will cover far-ranging areas of number theory and provide opportunities for both established and emerging Australian researchers to interact with top international experts in number theory. The focus of this conference is to explore the interactions between Diophantine geometry, Diophantine approximation, transcendence theory, and analytical computations.

59th Annual Meeting of the Australian Mathematical Society

Date: 28 September to 1 October 2015
Venue: Flinders University
Web: http://www.flinders.edu.au/science_engineering/csem/research/centres/fmsl/austms2015/austms2015_home.cfm

International Workshops on Complex Systems and Networks

Date: 6–10 October 2015
Venue: University of Western Australia

The IEEE International Workshops on Complex Systems and Networks are strongly interdisciplinary workshops intended to bring together electrical/electronic engineers, mathematicians, physicists, computer scientists, biologists, and social scientists, from their different disciplinary areas with the common interest in network science and engineering. The focus of IWCSN 2015 will be devoted to the significant impact of network topological complexity on the collective dynamics and emergent systems performance, from the viewpoints of science, techniques and engineering. In 2015 our workshop will have a special emphasis on the Mathematics of Complexity, Modelling and Engineering for Remote Operations.

Further details to be advised.

The 21st International Congress on Modelling and Simulation (MODSIM2015)

Date: Sunday 29 November to Friday 4 December 2015
Venue: Gold Coast Convention and Exhibition Centre, Broadbeach, Queensland
Web: http://www.mssanz.org.au/modsim2015/index.html

ASOR will be joining us again, for the 23rd National Conference of the Australian Society for Operations Research as will the DSTO led Defence Operations Research Symposium (DORS 2015).

The theme for this event will be Partnering with industry and the community for innovation and impact through modelling.

KOZWaves 2015

Date: 6–9 December 2015
Venue: The University of Adelaide
Web: http://www.maths.adelaide.edu.au/kozwaves2015/index.html

The second international Australasian conference on wave science, KOZWaves 2015, provides a forum for contemporary research on wave science to be disseminated between the different branches of wave theory and its applications. It promotes interdisciplinary collaborations between Australasian wave scientists, and with international researchers.

Confirmed invited speakers:

- Richard Blaikie (Uni Otago)
- Yuri Kivshar (Australian National Uni)
- Richard Manasseh (Swinburne Uni Tech)

39th Australasian Conference on Combinatorial Mathematics and Combinatorial Computing

Date: Monday 7 December to Friday 11 December 2015
Venue: University of Queensland
Web: http://39accmcc.smp.uq.edu.au/

Contributed talks will be sought from all areas of discrete and combinatorial mathematics and related areas of computer science. Invited speakers confirmed so far are Saad El-Zanati (Illinois State University), Catherine Greenhill (University of New South Wales), Penny Haxell (University of Waterloo), Jonathan Jedwab (Simon Fraser University), Charles Semple (University of Canterbury).

At this stage, the website contains only basic information. Further information will be added as it becomes available. Another announcement will be made when registration opens. Please email any questions to Darryn Bryant at db@maths.uq.edu.au. Hoping to see you in December in Brisbane.

BioInfoSummer 2015

Date: 7 December 2015 to 11 December 2015
Venue: The University of Sydney
Website: http://bis14.amsi.org.au/bis-15/

Conference on Geometric and categorical representation theory

Date: 14–18 December 2015
Venue: Mantra Hotel, Mooloolaba, Queensland
Web: https://sites.google.com/site/masoudkomi/mooloolaba

Mathematical Methods for Applications

Date: 11–14 November 2016
Venue: Hangzhou, China
Further information: P.Broadbridge@latrobe.edu.au

Joint meeting of ANZIAM and ZAPA (Zhejiang Applied Mathematics Association).

Vale

John Drummond

We inform members with regret of the death on 14 November 2014 of John Drummond, formerly of the Department of Mathematics at Macquarie University.

Visiting mathematicians

Visitors are listed in alphabetical order and details of each visitor are presented in the following format: name of visitor; home institution; dates of visit; principal field of interest; principal host institution; contact for enquiries.

Prof David Allen; Edith Cowan; 1 August 2014 to 31 July 2015; stats; USN; Shelton Peiris

Ian Anderson; Utah State University; 28 February to 20 March 2015; ANU; Dennis The

Dr Joel Andersson; Stockholm University; 1–31 October 2015; pure; USN; Leo Tzou

Severine Arnold; University of Lausanne, Switzerland; 11 March 2015 to 1 April 2015; MNU

Jeremy Avigad; Carnegie Mellon University; May and June 2015; philosophy and mathematical sciences; UNC

Paul Baird; Laboratoire de Mathematiques, De Bretagne Atlantique; September to December 2015; UWA; Lyle Noakes

Dr Lihui Cen; Zhongnan University; April 2014 to April 2015; industrial optimization; CUT; Ph: 92663534

Corina Constantinescu; University of Liverpoool; 7–28 March 2015; MNU

Thierry Coulhon; Paris Sciences et Lettres; 1 February to 31 December 2015; ANU; Peter Bouwknegt

Bart De Bruyn; Ghent University, Belgium; 4–28 April 2015; UWA; John Bamberg

Dr Yan Dolinsky; Hebrew University, Israel; 19 March to 2 April 15; Monash

Yinbin Deng; Central China Normal University; 1–31 March 2015; Nonlinear PDE; UNE; Shusen Yan

Wei Dong; Hebei University of Engineering, China; 1–31 March 2015; Nonlinear PDE; UNE; Yihong Du

Michael Eastwood; 1 January to 31 December 2015; ANU; Thierry Coulhon

Gyorgy Feher; University of Amsterdam; 25 January to 26 June 2015; UMB; Jan de Gier

Dr Ganes Ganesalingam; Massey University, NZ; 1 July 2014 to 30 June 2015; statistics; USN; Shelton Peiris

Humberto Godinez; University of Liverpoool; 9 March to 10 April 2015; Monash

Noor Hasnah; University of Malaya; 1 December 2014 to 31 March 2015; UMB; Owen Jones

Mario Heene; University of Stuttgart; 2 February to 30 April 2015; ANU; Markus Hegland

A/Prof Xian-Jiu Huang; Nanchang University, China; 1 October 2014 to 30 September 2015; ANU; Xu-Jia Wang

Ingrid Irmer; Florida State University; 1 December 2014 to 30 June 2015; UMB; Craig Hodgson

Peter Jagers; Chalmers University of Technology, Sweden; 22 February to 1 April 2015; MNU

Dr Zhong Jin; Shanghai Maritime University; August 2014 to August 2015; optimisation; FedUni; David Gao

Prof Naihuan Jing; North Carolina State University; 16 March to 14 April 2015 pure; USN; Alexander Molev

Valeriy Khakhutskyy; University of Munich; 3 February to 15 April 2015; ANU; Markus Hegland

Joachim Kock; Universitat Autònoma de Barcelona; 23 February to 27 March 2015; category theory, homotopy theory and algebraic geometry; MQU; Richard Garner

Prof Marie Kratz; ESSEC Business School, France; 11 March to 1 April 2015; MNU

Prof Shrawan Kumar; University of North Carolina; 16 July to 15 December 2015; pure; USN; Gus Lehrer

Zhe Liu; Zhejiang University; 1 April to 31 March 2015; UWA; Cai Heng Li

A/Prof Xuesong Ma; Capital Normal University, China; 2 February to 1 July 2015; UMB; Sanming Zhou

Michael Mandjes; University of Amsterdam, Korteweg-de Vries Institute for Mathematics; 27 February 27 March 2015; UMB; Peter Taylor

Johnathan Manton; University of Melbourne; 1 January to 31 December 2018; ANU; Alan Carey

David Mason; University of Witwatersrand; May to June 2015; UWA; Nev Fowkes

A/Prof Si Mei; Shanghai Jiaotong University, China; 9 August 2014 to 8 August 2015; pure; USN; Andrew Mathas

James McCoy; University of Wollongong; 1 January to 31 July 2015; ANU; Ben Andrews

Prof Ian Melbourne; University of Warwick; 29 January to 25 March 2015; applied; USN; Georg Gottwald

A/Prof Sylvie Monniaux; Université Aix-Marseille; 15 October 2014 to 15 July 2015; ANU; Pierre Portal

Samuel Mueller; University of Sydney; 1 January to 31 December 2016; ANU

Alfredo Parra; Technical University of Munchen; 2 February to 30 April 2015; ANU; Markus Hegland

Prof Adam Parusinski; Nice University; 1–30 April 2015; pure; USN; Laurentiu Paunescu

Dr Valter Pohjola; Univerisity of Helsinki; 7 March to 5 April 2015; pure; USN; Leo Tzou

Prof Frederic Robert; Universite de Lorraine; 11–26 April 2015; pure; USN; Florica Cirstea

Frederico Augusto Menezes Ribeiro; Universidade Federal de Minas Gerais; dates to be advised; UWA; Stephen Glasby

A/Prof Mei Si; Shanghai Jiaotong University; 28 August 2014 to 8 August 2015; pure; USN; Andrew Mathas

Paul Slevin; University of Glasgow; two or three months in the period April to June; category theory and homological algebra; MQU; Richard Garner

Anna Sulima; Jagiellonian University, Poland; 17 March to 6 April 2015; MNU

Jason Semeraro; University of Bristol; 7–28 April 2015; UWA; Cheryl Praeger

Mr Muhamad Shoaib; Higher Education Commission, Pakistan; 1 May to 30 November 2015; stats; USN; Shelton Peiris

Adam Sikora; Macquarie University; 1 January to 31 December 2015; ANU; Thierry Coulhon

Nozer Singpurwalla; City University of Hong Kong; 17–20 February 2015; UWA; Ed Cripps

Francisco Villarroya; University of Lund; 15 February to 25 April 2015; ANU; Pierre Portal

Fuyi Xu; Shandong University of Technology; June 2014 to June 2015; applied mathematical modelling and boundary value problems; CUT; Ph: 92663534

Lei Wang; Daliang University of Technology; March 2014 to March 2015; optimization and optimal control; CUT; Ph: 92663534

Dr Ben Webster; 16 May to 29 June 2015; pure; USN; Anthony Henderson

Dr Jeroen Wouters; 25 February 2015 to 24 February 2017; applied; USN; Georg Gottwald

A/Prof Dongsheng Wu; Michigan State University; 1 April to 10 June 2015; stats; USN; Qiying Wang

Dr Fan Yang; Jiangsu University of Science and Technology, China; 1 October 2014 to 30 September 2015; UMB; Sanming Zhou

Jianfu Yang; Jiangxi Normal University, China; 15 May to 15 June 2015; nonlinear PDE; UNE; Shusen Yan

Hui Zhou; Peking University, PRC; September 2015 to March 2017; UWA; Cheryl Praeger, Alice Devillers and Michael Giudici

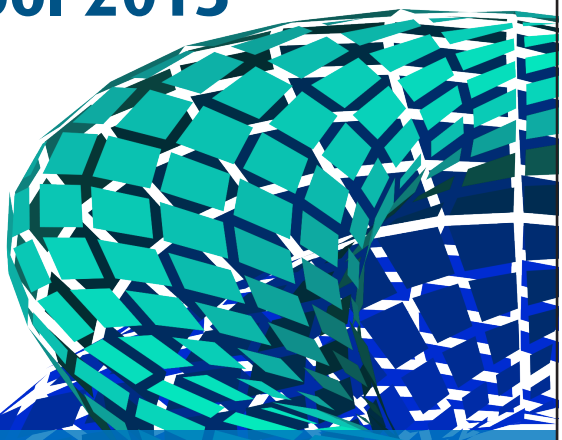
A/Prof Ke Zhu; Chinese Academy of Sciences; 6 April to 26 June 2015; stats; USN; Qiying Wang

Paul Zinn-Justin; Université Pierre et Marie Curie; 2 February to 15 April 2015; UMB; Jan de Gier

Higher Education
Australian Mathematical Sciences Institute

Winter School 2015

on Algebra, Geometry & Physics



29 June – 10 July 2015
The University of Queensland

Introductory and advanced courses in:

- K-Theory
- Geometric Representation Theory
- Vertex Operator Algebras
- Moduli Spaces

Who should attend?

Students and researchers working on the interface of geometry and mathematical physics.

Students! Apply for a full travel grant

In collaboration with the 2015 ANU Geometry and Physics Special Year

AMSI Australian Mathematical Sciences Institute
The University Of Queensland Australia
Australian National University
Australian Government Department of Education

www.amsi.org.au/WS

Nominations sought for the 2015 AustMS Medal

As announced in the November *Gazette*, the Medal Committee for the 2015 Australian Mathematical Society Medal is now seeking nominations and recommendations for possible candidates for this Medal, which will be awarded to a member of the Society, under the age of forty, for distinguished research in the Mathematical Sciences.

Nominations should be sent by email to the Chair of the AustMS Medal Committe. **Nominations should be received by 24th April 2015**.

The rules can be found at http://www.austms.org.au/The+Australian+Mathematical+Society+Medal+-+rules.

For further information, please email the Chair of the 2015 AustMS Medal Committee, Professor N.C. Wormald (nick.wormald@monash.edu), School of Mathematical Sciences, Monash University, PO Box 28M, Victoria 3800.

Nominations sought for the 2015 Gavin Brown Prize

As announced in the November *Gazette*, the 2015 Gavin Brown Prize Selection Committee is now seeking nominations and recommendations for possible candidates for this prize, to be awarded for an outstanding and innovative piece of research in the mathematical sciences published by a Member or Members of the Society. The award will be for a single article, monograph or book consisting of original research, and published in the nine calendar years preceding the year of the award.

Nominations should be sent by email to the Chair of the Gavin Brown Prize Committe. **Nominations should be received by 24th April 2015**.

Visit http://www.austms.org.au/Gavin+Brown+Best+Paper+Prize to view the rules.

For further information, please email the Chair of the 2015 Gavin Brown Prize Selection Committee, Professor J.M. Borwein (jon.borwein@gmail.com), School of Mathematical and Physical Sciences, The University of Newcastle, Callaghan, NSW 2308.

Alf van der Poorten Travelling Fellowship

As a result of a generous donation from the van der Poorten family, applications for the 2015 Alf van der Poorten Travelling Fellowship are now invited, subject

to the following rules. Prospective applicants should visit the Society's website at http://www.austms.org.au/Alf+van+der+Poorten+Travelling+Fellowship for an application template before submitting an application electronically to the selection committee at van.der.poorten@austms.org.au before 16 May 2015.

The members of the selection committee are: Associate Professor Lesley Ward (Chair), Dr Natalie Thamwattana and Associate Professor David Pask.

Rules for Alf van der Poorten Travelling Fellowship

1. The Alf van der Poorten Travelling Fellowship is offered to early-career researchers who have obtained their PhD in pure mathematics from an Australian university.
2. To be eligible to apply, a candidate must have qualified for their PhD within five years of the closing date, allowing for career interruptions, and they cannot have previously been awarded the Alf van der Poorten Fellowship. Applicants must have been members of the Society for at least twelve months at the time of application. (Back dating of membership to the previous year is not sufficient.) Preference may be given to applicants who are resident in Australia.
3. The Alf van der Poorten Fellowship will be awarded in odd-numbered years, unless no one of sufficient merit is found, in which case no Fellowship shall be awarded.
4. The Fellowship Committee of the Society will make recommendations to the President of the Society on the award of the Alf van der Poorten Fellowship.
5. Applications for the Alf van der Poorten Fellowship should include the completed application form, detailing a travel and research plan and budget (at most one page), a budget justification, letters of support from all institutions being visited, a full CV and a letter from the awarding institution confirming when the applicant qualified for the award of their PhD. Applications should be sent to van.der.poorten@austms.org.au by May 16 in the year of the Fellowship.
6. The applicant should arrange for two letters of support from experts in their field to be sent directly to the committee care of van.der.poorten@austms.org.au. These letters should comment on the track record of the applicant and on the merits of the Fellowship application. One of these letters can be one of the letters of support from a host institution.
7. The selection committee will recommend the amount to be granted, to a maximum of $10,000, to a successful applicant, taking account of the proposed research and travel activities, the need for support and the research track record of the applicant relative to opportunity.
8. The Selection Committee reserves the right to consult with appropriate assessors.

9. In applying for an Alf van der Poorten Fellowship applicants agree that if they are successful then their names, a citation and photograph can be published on the web pages and in the journals of the Society and they agree to submit a report on their Fellowship after its conclusion.
10. The Alf van der Poorten Fellowships will be awarded, in the first instance, every odd-numbered year from 2015 to 2029. The amount of the Fellowship may be changed in consultation with the family of Alf van der Poorten.

Special Interest Meetings

Applications are now considered twice a year, at the start of June and the start of December. The next closing date is 5 June 2015. Applications are required at least three months in advance of the meeting.

If funding is being sought from both AustMS and AMSI, a single application should be made at http://research.amsi.org.au/workshop-funding/.

If funding is not being sought from AMSI, please use the application form available at http://www.austms.org.au/Special+Interest+Meetings and send it to the secretary, Assoc. Prof. Peter Stacey, Department of Mathematics and Statistics, La Trobe University, Victoria 3086 (email: Secretary@austms.org.au).

News from the Annual General Meeting

The Society's 58th Annual Meeting was held recently at the University of Melbourne. The Director, Associate Professor Paul Norbury, his team of local organisers and the Program Committee, led by the Vice-President (Annual Conferences), were responsible for a very successful conference.

The following matters from the meeting are provided here for the information of those who could not attend.

(1) The George Szekeres Medal for 2014 was awarded to Professor Cheryl Praeger of the University of Western Australia.

(2) The Australian Mathematical Society Medal for 2014 was awarded to Associate Professor Josef Dick of the University of New South Wales.

(3) The Gavin Brown Prize for 2014 was awarded to Professor Ben Andrews and Dr Julie Clutterbuck for their paper 'Proof of the fundamental gap conjecture', *J. Amer. Math. Soc.* 24 (2011), 899–916.

(4) The 2013 B.H. Neumann Prize was awarded to Joshua Howie (University of Melbourne) for his talk 'A characterisation of alternating knots'.

Honourable mentions were given to Kamil Bulinski (University of Sydney), Inna Lukyanenko (University of Queensland), Calum Robertson (Monash University), Cameron Rogers (University of Newcastle) , Kyle Talbot (Monash University) and Elena Tartaglia (University of Melbourne).

(5) The Early Career Workshop, organised by Andrew Francis and Norman Do, was a great success. Next year there will be a short workshop on the afternoon of Sunday 27th September, before the Society's annual conference.

(6) It was confirmed that the fifty-ninth Annual Meeting of the Society will be held at Flinders University from Monday 28th September to Thursday 1st October 2015 with Associate Professor V. Ejov as Director.

It was provisionally determined that the sixtieth Annual Meeting of the Society will be held at the Australian National University from Monday 5th December to Thursday 8th December 2016 with Professor J. Urbas as Director.

(7) At a Special General Meeting the special resolution to change the Society's constitution was approved nem con.

(8) Council received a report from three early-career members who had been supported by AMSI and the Society to attend the 2014 International Congress of Mathematicians, with a view to exploring a future bid by Australia to host the Congress. It was decided to establish a working party, to be chaired by the President-elect, to further examine the issues and to decide if a compelling case to submit a bid can be made. It was agreed that a key task of the working party will be to investigate possible ways of Australia contributing to building mathematical science capacity in neighbouring developing countries.

(9) There was considerable discussion at both Council and the Annual General Meeting about the funding of Special Interest Groups and Divisions. In particular, there was strong support for the advocacy role of the Women in Mathematics Special Interest Group and agreement that this role was best served by a different funding model from that proposed for other Special Interest Groups. Following this discussion Council resolved as follows.

1. That, for the years 2014, 2015 and 2016, fifty percent of the surplus produced by the ANZIAM Journal be allocated in principle to ANZIAM, subject to annual approval by AMPAI.
2. That all Divisions be required to charge a membership fee to ordinary members of at least twenty percent of the ordinary membership fee of the Society.
3. That all Special Interest Groups, excepting the Women in Mathematics Special Interest Group, be required to charge a membership fee to ordinary members of at least ten percent of the ordinary membership fee of the Society.
4. That all Special Interest Groups, other than the Women in Mathematics Special Interest Group, receive a subvention of twenty-five percent of members' Society membership fees, subject to a minimum of $1,000 for the next three years.

5. That for each registrant at the Society's annual conference, twenty-five percent of the ordinary membership fee of the Society be levied as a capitation fee.

(10) Council decided to establish a subcommittee on membership. As a first step the committee will initiate a process for sending emails to Australian based researchers who are not Society members, outlining the benefits of joining the Society. In collaboration with the Accreditation Committee, it will also explore ways of increasing the attractiveness of the Society's accreditation scheme.

(11) Council has established a prize, named after the the inaugural editors of the three Australian Mathematical Society research journals, to be awarded annually for an article consisting of original research, published in one of the three journals in the six calendar years preceding the year of the award. The prize will cycle through the three journals over a three-year period and will include a monetary reward, to be $1,000 in 2015.

(12) Council has allocated $10,000 over 2015, 2016 and 2017, to share with AMSI in travel support for Australian mathematical sciences students and ECRs to attend the annual Heidelberg Laureate Forum. This is an event where young researchers can interact with winners of the Abel Prize, the Fields Medal, the Nevanlinna Prize and the ACM Turing Award. Each year 100 young mathematicians are selected worldwide to participate.

(13) When Council was discussing the issue of low attendance at undergraduate lectures, it was noted that this was one of a variety of issues where the Society would benefit from discussions within a Special Interest Group on Tertiary Mathematics Education. The possible establishment of such a group was therefore raised at the Society's Annual General Meeting.

(14) Following a suggestion from Mrs Joy van der Poorten, Council decided that the value of the Alf van der Poorten Fellowship should be doubled to $10,000 but be awarded every two years rather than annually. The eligibility period has been changed to require candidates to have qualified for their PhD within five years of the closing date, allowing for career interruptions.

(15) Following the decision that ordinary membership of a Special Interest Group should entail a membership fee of at least ten percent of the ordinary membership fee of the Society, Council decided to relax the threshold imposed last year, so it will now require a combined ordinary, sustaining and honorary membership of 60 as a threshold for consideration to become a Division.

(16) Council accepted a recommendation from the Gavin Brown Prize Committee that there should be at least a two-year difference between the publication year and the year of the prize. As nominations for the 2015 prize have already been called for, this change will apply from 2016.

AustMS Accreditation

Associate Professor C.M. Kellett of the University of Newcastle has been accredited as an Accredited Member (MAustMS).

Peter Stacey
AustMS Secretary
Email: P.Stacey@latrobe.edu.au

Peter Stacey joined La Trobe as a lecturer in 1975 and retired as an associate professor at the end of 2008. Retirement has enabled him to spend more time with his family while continuing with some research and some work on secondary school education. He took over as secretary of the Society at the start of 2010.

The Australian Mathematical Society

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Membership and Correspondence

Applications for membership, notices of change of address or title or position, members' subscriptions, correspondence related to accounts, correspondence about the distribution of the Society's publications, and orders for back numbers, should be sent to the Treasurer. All other correspondence should be sent to the Secretary. Membership rates and other details can be found at the Society web site: www.austms.org.au.

Local Correspondents

ANU:	K. Wicks	Southern Cross Univ.:	G. Woolcott
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ISSN: 0311-0729

Published by The Australian Mathematical Publishing Association Incorporated
Typeset in Australia by TechType, ACT
Printed in Australia by Union Offset Printers, ACT