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Gazette

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- 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

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Deadlines for the *Gazette* are 1 February for No. 1 (March), 1 April for No. 2 (May), 1 June for No. 3 (July), 1 August for No. 4 (September), and 1 October for No. 5 (November).

For more information, visit www.austms.org.au/gazette.

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Editorial

David and I welcome you to the July 2019 issue of the *Gazette*.

I should begin by admitting that it was remiss of me not to include some words in my March 2019 Editorial in the *Gazette* on the passing of Sir Michael Atiyah, who is described in the obituary written by Emeritus Professor Ian Stewart, as “probably the greatest British mathematician since Isaac Newton”.

Sir Michael Atiyah was born April 22, 1929 and died 11 January 2019. When he was elected a Fellow of the Australian Academy of Science in 1992 the citation read “Sir Michael Atiyah is one of the great mathematicians of this century. He received the Fields Medal in 1966 for his work on what is now known as the Atiyah–Singer index theorem. This is a very deep result relating the number of solutions of a partial differential equation to the topology of the underlying problem. Atiyah has a large number of Australian Ph.D. students and has collaborative links with Australian mathematicians”. He was born in London and educated in Khartoum, Cairo, Manchester Grammar School and Trinity College, Cambridge. He was elected in 1963 to the Savilian Chair at Oxford, where he remained until 1990. That year he moved to Cambridge as Master of Trinity College and the founding Director of the Isaac Newton Institute for Mathematical Sciences and served for 5 years as President of the Royal Society. In 2004 he shared with Isadore M. Singer the prestigious Abel Prize. His Royal Society biography includes the words: “He was best known for his co-development of topological K-theory and the Atiyah–Singer index theorem. As well as advancing pure mathematics, Sir Michael’s work has been fruitfully applied and extended to both pillars of theoretical physics — quantum theory and general relativity.” Ian Stewart in his obituary wrote “Atiyah was a keen advocate of public engagement, giving popular talks on the beauty of mathematics and his lifelong passion for the subject. . . . telling non-mathematicians why we do it, what it is for, and what it feels like.” I can do no better than draw your attention to a talk in the year 2000 of Michael Atiyah on four of the Millennium Problems: <https://youtu.be/jQEdHOZscw4>.

In her President’s Column, Jacqui Ramage begins by announcing that Council has approved the appointment of Deborah Jackson as Secretary of AustMS for when Peter Stacey steps down, and of Jon Berrick as Editor of the Journal of AustMS as a replacement for George Willis. She also mentions that there has been a significant increase in the number of sustaining members of AustMS. She says also that “We are working hard implementing a strategy to secure the Society’s long-term financial viability. At the moment we are highly dependent on the income from publications and the move towards open access means that this source of income will steadily decrease over time and we will need to compensate for that loss. This is not just a financial concern, it is also an existential concern for our journals as more academics move towards open access journals as they seek to meet the open access requirements of funding agencies in various countries.” She also mentions an exciting piece of news that the 15th International Congress of Mathematics Education (ICME15) will be held in Sydney in 2024. She also discusses a change in the process of assessment of competitive grant applications by the Australian Research Council.

We are pleased to include in this issue the names and citations of the six Australian mathematical scientists elected by the Australian Academy of Science as Fellows on 27 May. Our congratulations to all of them. We are also pleased to include the citation for Alison Grant Harcourt AO who has been made an officer of the Order of Australia in the Queen's Birthday Honours List. Alison is also Victorian Senior Australian of the Year for 2019.

In her column as Vice-President (learning and teaching), Diane Donovan reports that "In May Professor Chris Tisdell visited UQ and presented the first of the AustMS Standing Committee on Education's 'Workshops on Transitioning Teaching Innovation into Research Publications'. This workshop was supported by Professor Karen Benson, Institute for Teaching and Learning Innovation (ITaLI) UQ and by Professor Joe Grotowski, the School of Mathematics and Physics, UQ. I would like to thank both Chris, Karen and Joe for their support for this highly beneficial event."

Tim Brown, Director of AMSI, reports "AMSI has had a very busy period developing a refreshed Strategy Statement. The strategy statement is now available on the web. AMSI has also expanded its Board with the appointment of five new independent members, who come from a wide diversity of backgrounds. Amongst other items he reports that AMSI has had record media coverage in 2019 with over 863 media articles and a potential reach well over 81 million, continuing its strong impact and presence.

In the regular Talking Teaching section, Diane Donovan begins by saying "I was intrigued to read Carolyn (Caz) Sandison's article, "A Case of Disappearing Students" in the March *Gazette*. I found myself being challenged by the statement "Students in my service subjects are not coming to lectures. However, the pass rate was on par with previous years, students appear to still be learning...". In her article Carolyn discusses her analysis of this situation and how she has responded to changes in student expectations. She also comments on the effects of such changes, or lack thereof, on student results. Some changes Carolyn instituted were the creation of videos, pointers to good quality material on the web and flipped classrooms making better use of class time. The discussions by Carolyn and others provide pointers which we may analyse and follow."

Peter Forrester writes for the last time as NCMS Chair before the new Chair, Alan Welsh, takes over. Peter says "regulations in the UK relating to universities and international students, requiring in particular as a visa requirement evidence of student attendance and engagement. Checking this with a UK based colleague, it is indeed the case that attendance data is collected by the old fashioned way of keeping of a roll, but now done electronically. Should attendance and engagement be a visa requirement here in Australia?" *Editorial comment: would it be strange or perhaps even discriminatory to insist on attendance for international students but not local students?*

We regard it as an important service to the mathematical community that the *Gazette* includes obituaries. In this issue we have the obituary of Roly Mortlock.

In the news from AustMS, Peter Stacey records that the 2019 Alf van der Poorten Travelling Fellowship has been awarded to Dr Scott Lindstrom, currently at the

Hong Kong Polytechnic University. He also reminds members of the Lift-off Fellowships which provide short-term support, including living expenses and travel grants, for students who have recently submitted for examination a PhD thesis in the mathematical sciences.

In the regular item on the Mathematical Research Institute (MATRIX) David Wood reports on its many activities. Similarly, Anthony Henderson reports on the activities of The Sydney Mathematical Research Institute.

Michael J. Plank and Mark McGuinness provide the report of the ANZIAM 2019 Conference. They begin with some statistics: “The 55th ANZIAM 2019 Annual Conference was held 3–7 February 2019 at the Rutherford Hotel in Nelson, New Zealand. There was an excellent turnout from the applied maths community of 225 full registrations plus 5 single-day registrations. The conference programme featured 214 talks altogether, made up of 9 invited plenary talks and 205 contributed talks, of which 75 were from students.”

Peter Higgins presents Puzzle Corner 58 of the *Gazette* of the Australian Mathematical Society. The new problems are called “Ships in the Night”.

We include a review by Nadezda Sukhorukova of Swinburne University of Technology, of the book *Nonlinear Optimization* authored by Francisco J. Aragón, Miguel A. Goberna, Marco A. López and Margarita M.L. Rodríguez. This book is recommended for upper-level undergraduate degree courses in the area of mathematics, statistics and industrial engineering as well as graduate degree courses for a large variety of non-mathematics fields: finance, management, computer science, artificial intelligence and many others.

Finally, I mention the News section which has a wealth of information about comings and goings, completed PhDs, awards and other achievements, and forthcoming workshops, conferences and visitors.

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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 of *AustMS Lecture Series* and *J. Group Theory*. He has been on the Council of AustMS for 25 years and its Vice-President. He received the Lester R. Ford Award from the MAA. He has published 160 journal papers and 4 books for undergrads, postgrads and researchers, plus an online book, translated into 8 languages and supplemented by YouTube videos and a Facebook group of 7,000 members. In 2016 he was ordained as a Rabbi and in 2019 he edited the book: *Topological Groups: Advances, Surveys and Open Questions*. He enjoys spending time with his two grandchildren.



President's Column

Jacqui Ramagge*

Another exciting quarter has flown by. I am delighted to report that Council has approved the appointment of Deborah Jackson as Secretary for when Peter Stacey steps down, and of Jon Berrick as Editor of the Journal as a replacement for George Willis. I would like to thank all for their past and future contributions to these significant roles. We are also in the process of appointing a replacement for our seemingly irreplaceable Treasurer, Algy Howe.

In exciting news, our encouragement of members to opt for sustaining membership rather than ordinary membership has resulted in a significant increase in the number of sustaining members. Recall that sustaining members pay twice the membership fee in order to help the Society; it can be thought of as a self-imposed tax whereby members at more senior levels of appointment and who can afford to do so pay higher membership fees than our more junior colleagues. We maintain membership fees deliberately low in order to make membership accessible to all, and I encourage those of you who can afford to do so to become sustaining members. Remember that membership is tax-deductible if it is employment-related (which it is for all academics) and that universities typically allow a certain number of Society memberships to be paid from some funds such as consultancy accounts.

We are working hard implementing a strategy to secure the Society's long-term financial viability. At the moment we are highly dependent on the income from publications and the move towards open access means that this source of income will steadily decrease over time and we will need to compensate for that loss. This is not just a financial concern, it is also an existential concern for our journals as more academics move towards open access journals as they seek to meet the open access requirements of funding agencies in various countries. For example, the Research Excellence Framework in the UK stipulates that any item accepted for publication from 1 April 2016 must be open access to be eligible for submission as part of the exercise. At this point in time such a requirement can be met by paying for individual items to be open access, but we are mindful of what the future may bring. This is one of the reasons that we are encouraging members to choose the option of sustaining membership.

A recent highlight was the inclusion of Alison Harcourt in the Queen's birthday honours list. The only disappointment was that she was the only mathematical scientist honoured this year. I encourage members to nominate colleagues they think are worthy of honours as every recipient helps to raise the profile of the discipline.

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Another excellent piece of news was the announcement by the International Committee for Mathematical Instruction that the 15th International Congress of Mathematics Education (ICME15) will be held in Sydney in 2024. This will present major logistical challenges and I do not envy the organisers! However, the event is expected to bring over a thousand people to our shores and Mathematics Education in Australia will be all the richer and more visible for it. I look forward to seeing everybody there.

On the research front, the Australian Research Council undertook a public consultation into a review of the Australian and New Zealand Standard Research Classification. More information about the review can be found at <https://www.arc.gov.au/anzsrc-review>. The Australian Mathematical Sciences Institute coordinated a response across the mathematical sciences that took input from the AMSI/AustMS research committees and from the Statistical Society of Australia. The changes recommended were mostly at the six-digit level as the four-digit research codes were deemed to be appropriate if appropriately used.

The Australian Research Council has introduced a new step in the assessment of competitive grant applications whereby an applicant has three days from receipt of assessments to report any *ad hominem* attacks. In the past some such assessments were removed from consideration and the ranking score for the application was calculated on the remaining assessments. Unfortunately by that time the rejoinder had already been submitted and the applicant had addressed some of the comments in their rejoinder. Presumably the aim of this step is to remove any offensive assessments before the rejoinder is written, so that the panel members need not even know there was an offensive assessment by simply waiting a week before reading them. I have yet to see the outcome of such reports, but I strongly support the spirit of the initiative as I have seen some highly inappropriate comments in my time.

Last, but not least, I met with Kylie Walker, CEO of Science and Technology Australia (STA), the umbrella body for science and technology societies around the country. We discussed a number of things. The annual event *Science meets Business* has been discontinued and replaced by a *Future Industries Round Table*. The hugely successful *Science meets Parliament* continues and we hope to send two delegates this year.

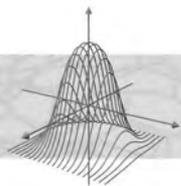
We also discussed the Ally Network. This is a visible network of staff and students across universities who support a commitment to providing an inclusive and respectful university environment for people who identify as being lesbian, gay, bisexual, transgender, intersex, or queer. The Ally Network regularly provides training and trained Allies receive stickers they can place on their doors declaring their Ally status. Such stickers are typically branded, making them hard to reuse if you change institutions, and training is variable across institutions. If STA provided training and support they would provide a valuable service and trained Allies could use STA-branded signs in any institution.

Finally, a reminder to everyone to nominate themselves or a colleague for one of our prizes or awards. Nominations for our Teaching Excellence awards close on 31 July 2019. A full list of the Awards and Prizes of the Society can be found at <https://www.austms.org.au/Awards>. I encourage everyone to make the best use possible of the opportunities the Society provides.



Jacqui Ramagge is a Fellow of the Australian Mathematical Society with research interests across algebra, analysis, and geometry. She is currently Head of the School of Mathematics and Statistics at the University of Sydney.

Jacqui has won awards for: teaching from the University of Newcastle; research environment from the University of Wollongong; and contributions to mathematics enrichment from the Australian Mathematics Trust. She has served on various Australian Research Council panels for eight of the last ten years including as Chair of the Australian Laureates Selection Advisory Committee. Jacqui is Chair of the Advisory Board for the University of Sydney Mathematical Research Institute and serves on the MATRIX Advisory Board.



Puzzle Corner

Peter M. Higgins*

Welcome to Puzzle Corner 58 of the *Gazette* of the Australian Mathematical Society. In this first section I will introduce two new problems: “Ships in the Night”. After that I will give a solution to Puzzle Corner 57 on “The naming of Popes and the Fibonacci series”.

I would be happy to receive your solutions to Puzzle Corner 58 not later than 15 August 2019. The email address for solutions is austmspuzzles@gmail.com. Any particularly interesting solutions will be mentioned in the next Puzzle Corner.

Combinatorial and network problems are often the staple of puzzle pages like this one but today I've gone for a change of tack and offer a couple of problems on relative motion, each with a nautical bent. Indeed I have set these problems for my first year students. The first question they normally manage, although it may look as if there is not enough information to solve the problem. The lesson to learn is that sometimes you may have to introduce a symbol not given in the question and see where the mathematics leads. If the problem is well-posed, the answer will be independent of that quantity. In the following setting we are not told how far the vessels are apart, and so it is not possible to calculate the *time* of their rendezvous. That however was not asked for in the question and the problem is solvable nevertheless.

Problem 1. A patrol boat spots the lights of a trawler, *The Goblin*, to the North-east, steaming North at a speed of 10 knots. Suspecting *The Goblin* of smuggling contraband, the patrol boat sets off on a straight line interception course at a speed of 25 knots. Find the bearing of the patrol boat, to the nearest degree, East of North.

The second one is again an application of the Sine rule but is nonetheless quite tricky!

Problem 2. As his ship is sailing due East at 10 knots, the Captain spots the mast flag pointing Southeast. When the boat is turned so that she sails due South, at the same speed, the flag now points directly East. What is the wind speed and direction?

Solutions to “The naming of Popes and the Fibonacci series”

Problem 1. P_m ends in JP for all $m \geq 1$ so J^2 can never occur in the word P_n . Next observe that P_n begins with PJ or with JP according as n is even or odd (immediate by induction). Hence, no P_n begins nor ends in P^2 , a fact that ensures that P^3 never appears in the papal sequence.

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Problem 2. The $n = 2$ case is simply our second re-writing rule. Writing $B_{i+1} = Q(B_i)$ we obtain using induction that for $n \geq 3$:

$$\begin{aligned} B_n &= Q(B_{n-1}) = Q(B_{n-2}^2 B_{n-3} \cdots B_1 2) \\ &= Q(B_{n-2})Q(B_{n-2})Q(B_{n-3}) \cdots Q(B_1)Q(2) \\ &= B_{n-1}^2 B_{n-2} \cdots B_2 B_1 2, \text{ as required.} \end{aligned}$$

Problem 3. For $n = 1$ we have $B_1 = 12 = \overline{P}_3$ (as in extended form $\overline{P}_3 = PJP^2J$) and $B_1 2 = \overline{P}_2 \cdot \overline{P}_3$ as $B_1 2 = 122$ while $\overline{P}_2 \cdot \overline{P}_3 = 11 \cdot 12 = 122$, and so both identities hold for $n = 1$.

Our inductive hypothesis is two-fold:

$$B_m = \overline{P}_{2m+1}, B_m B_{m-1} \cdots B_1 2 = \overline{P}_{2m} \cdot \overline{P}_{2m+1} \text{ for all } m < n, n \geq 2.$$

Tackling the second identity first, we see that by the result of Problem 2 we have:

$$\begin{aligned} B_n B_{n-1} \cdots B_1 2 &= B_{n-1}^2 B_{n-2} \cdots B_2 B_1 2 B_{n-1} B_{n-2} \cdots B_1 2 \\ &= \overline{P}_{2n-1} \cdot (\overline{P}_{2n-2} \cdot \overline{P}_{2n-1}) \cdot (\overline{P}_{2n-2} \cdot \overline{P}_{2n-1}) \\ &= (\overline{P}_{2n-1} \cdot \overline{P}_{2n-2}) \cdot (\overline{P}_{2n-1} \cdot \overline{P}_{2n-2}) \cdot \overline{P}_{2n-1} \\ &= \overline{P}_{2n} \cdot (\overline{P}_{2n} \cdot \overline{P}_{2n-1}) = \overline{P}_{2n} \cdot \overline{P}_{2n+1}. \end{aligned}$$

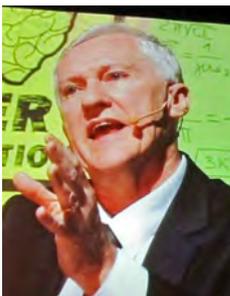
By Problem 2 we complete the induction as follows:

$$\begin{aligned} B_n &= B_{n-1}(B_{n-1} B_{n-2} \cdots B_1 2) \\ &= \overline{P}_{2n-1} \cdot (\overline{P}_{2n-2} \cdot \overline{P}_{2n-1}) = (\overline{P}_{2n-1} \cdot \overline{P}_{2n-2}) \cdot \overline{P}_{2n-1} \\ &= \overline{P}_{2n} \cdot \overline{P}_{2n-1} = \overline{P}_{2n+1}. \end{aligned}$$

Problem 4. For P_7 we need B_3 . We act the Q morphism three times, reverse the result, and then insert the 0 separator to obtain:

$$\begin{aligned} B_3 &= Q^3(1) = Q^2(12) = Q(12122) = 1212212122122; \\ \overline{B}_3 &= 2212212122121 \mapsto 02020102020102010202010201 \\ \therefore P_7 &= JP^2JP^2JPJP^2JP^2JPJP^2JPJP^2JP^2JPJP^2JP. \end{aligned}$$

Taken from my paper “The Naming of Popes and a Fibonacci Sequence in Two Noncommuting Indeterminates”, *The Fibonacci Quarterly*, **25**, No. 1, February 1987, 57–61.



Peter Higgins is a Professor of Mathematics at the University of Essex. He is the inventor of Circular Sudoku, a puzzle type that has featured in many newspapers, magazines, books, and computer games all over the world. He has written extensively on the subject of mathematics and won the 2013 Premio Peano Prize in Turin for the best book published about mathematics in Italian in 2012. Originally from Australia, Peter has lived in Colchester, England with his wife and four children since 1990.



Talking Teaching

Edited by Diane Donovan*, Birgit Loch and Sid Morris*****

The opinions expressed here are those of the author and not necessarily of the Editors of this column or the Editors of the Gazette or the Australian Mathematical Society.

I was intrigued to read Carolyn (Caz) Sandison's article, "A Case of Disappearing Students" in the March *Gazette*. I found myself being challenged by the statement

Students in my service subjects are not coming to lectures. However, the pass rate was on par with previous years, students appear to still be learning . . .

In her article Carolyn discusses her analysis of this situation and how she has responded to changes in student expectations. She also comments on the effects of such changes, or lack thereof, on student results. Some changes Carolyn instituted were the creation of videos, pointers to good quality material on the web and flipped classrooms making better use of class time. The discussions by Carolyn and others provide pointers which we may analyse and follow.

In my own teaching I would agree, that I am not seeing a great deal of change in the first year pass or fail rates, but yes I have seen a considerable drop in attendance even at the very first lecture. The challenge I find is coming to grips with

exactly how are the students learning, and since I am not the primary driver for this knowledge gain, what are they learning?

Well-developed podcasts and videos, tailored to the course in question, are outstanding resources. But is this what the students are using and what is it about these resources that engages them? Is it just convenience?

I believe you learn mathematics by doing mathematics, something a flipped classroom can certainly facilitate. However, my limited experience of a flipped classroom was that many students did not really engage, merely chatted and waited, to copy a solution provided by another student. Did I not structure the exercises properly? What could I have done to engage more students, to set a better pace and to instigate active learning? Were my questions just all wrong?

Carolyn and others have provided some answers to these questions through their discussions and articles. But why did these students not engage? Was it boredom?

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Maybe they didn't know where to start or how to structure their thoughts to go forward. Here my experience is that pen screen technology and projection of student's work to the front captivates them and provides them with an anonymous environment in which to participate. It also provides a platform to allow me to see the "blockers" in their thought processes. So for instance they may not have accessed a key definition which provides a framework on which to make a mathematical argument.

So my thesis for the current article is:

In the modern learning environment what are the students learning and how are they learning it? Further how can we ascertain this information so that we may capitalise on it?

In the article "The transition from traditional face-to-face teaching to blended learning – implications and challenges from a mathematics discipline perspective", the authors, Loch and Borland,¹ list 7 research questions that they suggest need "urgent attention". Précised they are

1. *How do we ensure students engage?*
2. *How do we encourage students to self-regulate mathematics learning?*
3. *What can we do to build in redundancies to aid learning?*
4. *What is the role of technology? Does it exist and how do we use it?*
5. *What about deep learning and student engagement?*
6. *What support do staff need to promote these approaches?*
7. *How do we assess the impact of these approaches?*

I am particularly interested in point 5. My anecdotal evidence is that students are doing okay at first year but by third year I am seeing a change, with significant changes in their ability to reason. But I have seen no evidence that it is associated with lack of attendance at lectures or what could be causing a problem. I do know that I feel more removed from the students and I am finding it harder to transfer and find opportunities to transfer my personal knowledge to my students.

I would appreciate hearing from the readers if they are aware of studies that have reported some answers to the above questions. Personally I believe that there is a strong need for these questions to be addressed, providing a robust road map for future teaching and learning approaches.

As a community of mathematicians, we could approach this by individual studies contributing to a body of literature, each recording their own findings. However, we could also work together to develop a far reaching comprehensive approach developing a research study across Australian institutions, leading to longitudinal

¹Loch, B. and Borland, R. (2014). The transition from traditional face-to-face teaching to blended learning—implications and challenges from a mathematics discipline perspective. In *Rhetoric and Reality: Critical Perspectives on Educational Technology*. Proceedings, Ascilite 2014, Dunedin, NZ.

results with far reaching impact. I see this second approach as being more robust and having far more impact. So I would like to begin by promoting such discussions at teaching focussed conferences and through chat groups and emails. If you would like to participate in such a study please register and we will see what we can get achieve.



Diane is AustMS Vice President, Learning and Teaching, a Fellow of the Australian Mathematical Society, a Foundation Fellow of the Institute of Combinatorics and its Applications and a Life Member of the Combinatorial Mathematical Society of Australasia. She has broad experience teaching mathematics across the secondary and tertiary sectors, as well as being an active researcher publishing widely on educational matters, combinatorial mathematics and applications of mathematics. She has been a Chief Investigator on research grants including an Australian Learning and Teaching Council Grant to develop a Professional Development Program for the Mathematical Sciences.



Learning and Teaching

Diane Donovan*

In May Professor Chris Tisdell visited UQ and presented the first of the AustMS Standing Committee on Education's 'Workshops on Transitioning Teaching Innovation into Research Publications'. This workshop was supported by Professor Karen Benson, Institute for Teaching and Learning Innovation (ITaLI) UQ and by Professor Joe Grotowski, the School of Mathematics and Physics, UQ. I would like to thank both Chris, Karen and Joe for their support for this highly beneficial event.

The workshop attracted attendees from UQ, Central Queensland University, QUT, Queensland Academy of Sciences, Mathematics and Technology and the University of New England, with further interest from Griffith University, University of Newcastle, Notre Dame University and University of Sothern Queensland.

Chris provided much food for thought, taking us through the planning and execution of a number of his own research studies, then opening the floor to general discussion. One theme of discussion was centred on how to plan and structure a case study, from the development of research questions to different research methodologies and approaches leading to rigorously justified results and key findings. In the later part of the workshop Chris broadened the discussions to include other research approaches including Case Studies, Intervention Research, Quasi Experimental Research and Action Research, and touched on Ethics-related approvals. Throughout, Chris provided many opportunities for hands on activities that promoted sharing of ideas, where participants could learn from each other's experiences.

For me Chris' work was inspiring and motivated me to plan future teaching and learning projects with the idea to transition them into scholarly studies. But more than that, in past projects I have focussed on implementing or trialing new programs and only considering the development of a report or publication after the teaching period was completed. Ideas from this workshop have motivated me to develop a more comprehensive research plan which I hope will keep pace with the implementation of ideas, thus delivering a more holistic and better structured research program.

So thanks Chris. I really enjoyed the afternoon as I am sure the other attendees did too.

*School of Mathematics and Physics, The University of Queensland.

Chris has kindly offered to repeat the workshop at other venues around Australia, with a workshop planned for Melbourne in the first week of September 2019. So if you would like to host a similar workshop at your university please feel free to email me (dmd@maths.uq.edu.au) and we can discuss logistics and I can put you in touch with Chris.



Diane is AustMS Vice President, Learning and Teaching, a Fellow of the Australian Mathematical Society, a Foundation Fellow of the Institute of Combinatorics and its Applications and a Life Member of the Combinatorial Mathematical Society of Australasia. She has broad experience teaching mathematics across the secondary and tertiary sectors, as well as being an active researcher publishing widely on educational matters, combinatorial mathematics and applications of mathematics. She has been a Chief Investigator on research grants including an Australian Learning and Teaching Council Grant to develop a Professional Development Program for the Mathematical Sciences.



Communications

2019 Australian Academy of Science Fellows

The Australian Academy of Science elected six Australian mathematical scientists as Fellows on 27 May. Our congratulations to all of them. We reproduce their official citations here.

Professor David Balding (University of Melbourne)

David Balding is co-developer of the Balding–Nichols match probability formulae, which allow for population genetic effects in the evaluation of DNA profile evidence. He is also author of the likeLTD software for profiles obtained from low DNA template and/or degraded samples. He is co-proposer of the Balding–Nichols model for simulation of genetic data from structured populations and for likelihood-based inferences from structured population data. He is a pioneer of computational methods for inferring demographic history and detecting the effects of selection, and has made important contributions to methods for genetic association analyses.

Debra Bernhardt (University of Queensland)

Debra Bernhardt (nee Searles) is a world leader in nonequilibrium statistical mechanics. She is widely known for the first rigorous derivation of a fluctuation relation, known as the Evans–Searles Fluctuation Theorem, showing the second law of thermodynamics can be derived mathematically rather than just postulated as a law of nature. The theorem has broad implications for the behaviour of small systems where fluctuations become pronounced. Debra has also made significant contributions to theoretical computational chemistry, including combining quantum chemistry and molecular simulation, as well as the calculation of transport properties of materials.

Peter Corke (Queensland University of Technology)

Peter Corke has made significant contributions to the field of robotic vision. In particular, he has developed a solid foundation for the theory and practice of visual servoing, on which he is the world authority. He is the founding director of the ARC Centre of Excellence for Robotic Vision. His research has defined and advanced the field through significant and highly-cited scientific papers, and made it widely accessible through popular textbooks, online courses and open-source software. In addition, he has pioneered the practical use of this theory in aerial, marine and land robotic systems for applications as diverse as mining and environmental monitoring.

David Karoly (Earth Systems and Climate Change Hub, CSIRO)

David Karoly is internationally recognised as a world leader in climate dynamics and climate change science. In his early research, he carried out pioneering studies that provided the theoretical basis for understanding observed linkages between

climate anomalies at large distances across the globe. He identified, for the first time, the links between El Niño–Southern Oscillation events and variations of the Southern Hemisphere circulation. His research has led the development of methods for the detection and attribution of climate change, most recently for extreme climate events. David is also an international leader in the public communication of climate science.

Kerry Landman (University of Melbourne)

Kerry Landman stands at the vanguard of internationally recognised applied mathematics devoted to cross-disciplinary research and real-world problems. She has made crucial contributions to a range of fields, from colloidal fluid mechanics to developmental biology. The distinguishing feature of Kerry’s achievements is the development of a broad spectrum of inventive models, which provide a fundamental understanding of how complex processes interact to produce experimentally observed behaviour. In recognition of her career contribution to industrial and applied mathematics, in 2014 she was awarded the ANZIAM medal, the premier medal of the Australia and New Zealand Industrial and Applied Mathematics Society.

Alexander Molev (University of Sydney)

Alexander Molev is a pure mathematician who has made substantial research contributions to algebra, representation theory, algebraic combinatorics and mathematical physics. He is a world-leading expert on ‘Yangians’, a particular class of quantum groups that he has used to solve longstanding open problems. Alexander’s book *Yangians and Classical Lie Algebras* is widely viewed as the definitive monograph in the field. In 2001, he was awarded the prestigious AustMS Medal of the Australian Mathematical Society for his work in representation theory.

Queen's Birthday Honours

Alison Grant Harcourt AO

Alison Harcourt of the University of Melbourne was made an Officer of the Order of Australia in the Queen's Birthday Honours List, the only mathematician to be so recognised this year. The award was for 'distinguished service to mathematics and computer science through pioneering research and development of integer linear programming'.

Together with Ailsa Land, she introduced the branch and bound algorithm, in the pioneering paper

Land, A.H. and Doig, A.G. (1960). An automatic method of solving discrete programming problems. *Econometrica* **28**, 497–520.

It introduced an effective method for solving linear programming problems, in which some of the variables are constrained to take integer values. Drastically reducing the number of permutations which needed to be considered, it made such problems practical to solve. The algorithm is an essential tool in contemporary optimization with wide ranging applications in logistics, scheduling, etc.

The paper was written while both authors were at the London School of Economics. They deliberately submitted it using only their initials, concerned that identifying themselves as women would prejudice assessment of their paper.

Alison spent many years at the University of Melbourne as a Senior Lecturer in Statistics. Her statistical work had a number of practical applications. A survey with social scientist Ronald Henderson and economist R.J. Harper included the first measures to quantify poverty in Australia, eventually informing the 1972 Henderson Royal Commission. With fellow statistician Malcolm Clark, she introduced a double randomisation method for allocating positions of political candidates on ballot papers. This eliminated the option parties had to benefit from the donkey vote (by choosing candidates who were alphabetically advantaged) and was incorporated into the Commonwealth Electoral Act in 1984.

Well past retirement age, she still undertakes sessional tutoring at the University of Melbourne, which last year granted her its highest honour: the degree of Doctor of Science (honoris causa).

She is also Victorian Senior Australian of the Year for 2019.

55th ANZIAM 2019 Annual Conference

Rutherford Hotel, Nelson, New Zealand

3–7 February 2019

Michael J. Plank* and Mark McGuinness*

The 55th ANZIAM 2019 Annual Conference was held 3–7 February 2019 at the Rutherford Hotel in Nelson, New Zealand. There was an excellent turnout from the applied maths community of 225 full registrations plus 5 single-day registrations. The conference programme featured 214 talks altogether, made up of 9 invited plenary talks and 205 contributed talks, of which 75 were from students. The contributed talks were run in five parallel sessions. Student participation continues to be a strong theme of the ANZIAM conference, in large part thanks to the ANZIAM Student Support Scheme which this year contributed towards the conference expenses of 35 students. Building on the recent efforts to promote engagement with the Japanese Society for Industrial and Applied Mathematics (JSIAM), we were delighted to welcome 14 delegates from Japan. We also welcomed delegates from the US, UK, Germany, Russia, Canada and India, amongst others.

The invited speakers committee for the conference was chaired by Vivien Kirk (University of Auckland) and consisted of Snezhana Abarzhi (University of Western Australia), Nigel Bean (University of Adelaide), Jari Kaipio (University of Auckland), Frances Kuo (University of New South Wales), Terry O’Kane (CSIRO, Hobart), Michael Plank (University of Canterbury), Hans de Sterck (Monash University) and Cecilia González Tokman (University of Queensland). The committee came up with a great selection of six speakers and the addition of the 2018 medalists brought the total to nine invited plenary talks:

- Ruth Baker (University of Oxford)
- Judith Berner (NCAR, Boulder)
- Phil Howlett — 2018 ANZIAM Medallist (University of South Australia)
- Claire Postlethwaite — 2018 Michell Medallist (University of Auckland)
- Raúl Rojas (Freie Universität Berlin) — supported by financial assistance from Australian Research Council Centre of Excellence for Mathematical and Statistical Frontiers (ACEMS)
- Anja Slim (Monash University)
- Ian Sloan (University of New South Wales)
- Yvonne Stokes — 2018 Tuck Medallist (University of Adelaide)
- Martin Wechselberger (University of Sydney)

Thank you to all the invited speakers for travelling to Nelson and for giving an excellent selection of plenary talks.

*Conference Directors



Invited speakers and previous medal winners Claire Postlethwaite (2018 Michell medallist), Phil Howlett (2018 ANZIAM medallist) and Yvonne Stokes (2018 Tuck medallist).

This was the first ANZIAM Annual Conference to have a Code of Conduct. All delegates including invited speakers were required to agree to this Code of Conduct as a condition of registration. The Code of Conduct was printed in the conference booklet and displayed prominently on the conference website. We also reminded session chairs to keep the Code of Conduct in mind during their sessions. The website included a list of representatives who could be contacted in the event of a participant experiencing harassment or other behaviour in breach of the Code of Conduct. These representatives included a postgraduate student, an early-career researcher as well as mid-career and senior academics.

The Women in Mathematical Sciences Lunch was held on Tuesday 5 February under the umbrella of the Women in Mathematics Special Interest Group (WIM-SIG) of the Australian Mathematical Society. The lunch was open to all conference delegates and 98 people registered. The event was generously supported by Professor Kate Smith-Miles' Georgina Sweet Australian Laureate Fellowship and by Te Pūnaha Matatini (a New Zealand Centre of Research Excellence). The purpose of the lunch is to support women, and particularly early career researchers, to enter and establish careers in mathematics. The programme for the lunch was organised by the WIMSG Chair Yvonne Stokes (University of Adelaide) in conjunction with Hinke Osinga (University of Auckland), who chaired the session. This featured a panel discussion with the five female invited plenary speakers. Thank you to Yvonne, Hinke and all the panellists for an excellent and stimulating event.

We were honoured to have as a delegate Alex McNabb DSc, FRSNZ one of New Zealand's leading real-world mathematicians. The conference featured a half-day Special Session in honour of Alex. This session was chaired by Emeritus Professor Graeme Wake and featured eight contributed talks from some of Alex's former collaborators. We are grateful to Graeme for organising this session and for hosting Alex at the conference dinner.

The Conference Dinner was held on Wednesday 6 February at the Rutherford Hotel. The NZ Branch of ANZIAM was delighted to welcome benefactors and



Some of the prize and medal presentations at the conference dinner. Top: Michael Small jointly presenting Elle Musoke (left) and Conway Li (right) with the TM Cherry Prize. Bottom left: Shaun Hendy presenting Scott McCue with the EO Tuck Medal. Bottom right: Phil Howlett presenting Peter Taylor with the ANZIAM Medal.

Nelson locals Simon Crase and Esmee Emerson to the dinner as its guests. The usual range of awards and prizes were presented at the dinner. The TM Cherry Prize for the best student presentation was awarded jointly to Elle Musoke (University of Auckland) and Conway Li (University of Western Australia). The TM Cherry Prize committee was chaired by Michael Small (University of Western Australia) — a big thank you to Michael and the committee for all their hard work in evaluating the many excellent student presentations. The Mahony–Neumann–Room Prize for the best paper published in the ANZIAM Journal was jointly awarded to Larry Forbes and to F Aragón Artacho, Jon Borwein and Matthew Tam. The AF Pillow Top-up Scholarship was awarded to Jesse Sharp (Queensland University of Technology). The JH Michell Medal was awarded to Ryan Loxton (Curtin University); unfortunately Ryan was unable to attend the conference and Michael Small collected the medal on his behalf. The EO Tuck Medal was awarded to Scott McCue (QUT) and the ANZIAM medal was awarded to Peter Taylor (University of Melbourne). Congratulations to all the prize winners and medallists on your well-deserved achievements.

As has become traditional, there was a student function on the Monday evening, organised by the ANZIAM Student Representative Philip Brown (University of Adelaide). This year the function was financially supported by Te Pūnaha Matatini. Phillip also announced the hotly contested Cherry Ripe prize for best non-student talk at the conference closing. This was awarded to Raúl Rojas (Freie Universität

Berlin), with honourable mentions for Melanie Roberts, David Khoury and Chris Lustri.

Building on a recent initiative at the 2018 meeting in Hobart, the conference featured an informal LGBTI+ morning tea open to all. This allowed participants to discuss issues affecting LGBTI+ delegates, as well as broader issues of diversity at the conference. One thing we received positive feedback about was the inclusion of a space on the conference name badges for delegates to write their pronouns should they wish. It would be great to see the LGBTI+ meeting continued and perhaps promoted more broadly at future ANZIAM conferences.

The following sponsors provided generous financial support to the conference: Professor Kate Smith-Miles' Georgina Sweet Australian Laureate Fellowship; the ARC Centre of Excellence for Mathematical and Statistical Frontiers (ACEMS); Technic Pty Ltd - COMSOL Multiphysics® Sales and Support in Australia and New Zealand; Te Pūnaha Matatini, a New Zealand Centre of Research Excellence; PDE Solutions Inc; Lone Star Restaurant and Bar. We are also grateful to the ANZIAM Student Support Scheme, which contributed financial support towards the travel expenses of 35 students. A big thank you to all the sponsors, kia ora.



Left: Bernd Kraushopf presenting invited speaker Judith Berner with a small gift on behalf of the conference organisers. Right: one of the highlights of the conference was a live demo of a Hele Shaw cell by invited speaker Anja Slim.

The Mathematical Biology Special Interest Group held a one-day meeting on Friday 8 February at the Nelson-Marlborough Institute of Technology's Nelson Campus. 62 people registered for this meeting and the theme was 'Emergent Phenomena Across Scales'. The meeting programme was organised by Alys Clark (University of Auckland) and included a presentation by the inaugural winner of the MBSIG Best Student Paper Prize, Alexander Browning. Unfortunately the meeting was forced to finish an hour early due to a bush fire near the venue, which closed the campus! (This was a separate fire to the large Pigeon Valley fire which was burning during most of the week.) We apologise to those speakers who were unable to give their presentations for this reason. Nevertheless, the talks that were given were all very interesting; thank you to Alys for organising the programme for this event.

A number of people have remarked on the increasing expense of attending ANZIAM in recent years and there is a concern that this is preventing a significant number

of members from attending the conference. This is an important issue for the society to consider. To help facilitate conversations about the best way to run future ANZIAM conferences, Figure 1 shows an approximate breakdown of how the income from registration fees was spent.

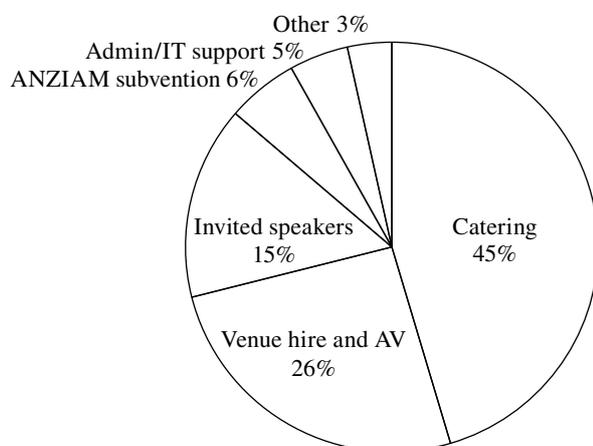


Figure 1. Approximate breakdown of expenditure (excludes conference dinner which was ticketed separately).

We would like to acknowledge the mahi of our excellent organising committee: Amie Albrecht (University of South Australia), Rachelle Binny (Manaaki Whenua), Emma Greenbank (Victoria University of Wellington), Dimitrios Mitsotakis (Victoria University of Wellington), Julie Mugford (University of Canterbury) and Phil Wilson (University of Canterbury). Thanks also to Chanelle du Rand for coordinating the event from the venue's side, to Ginny Whatarau, Caroline Nebel and Christo Muller (Victoria University of Wellington) for administrative and technical support, and to Giorgia Vattiato and Fareeda Begum (University of Canterbury) for helping out with multiple tasks during the conference. Thank you to Bruce van Brunt for taking photos throughout the conference.

Finally, a big thank you to everyone who travelled to Nelson to make the ANZIAM 2019 conference such a great event.

Ngā mihi nui, ka kite anō au i a koutou, greetings and see you all again next year.



Obituaries

Roly Mortlock



Friends and former colleagues were sorry to hear the sad news that Associate Professor Roly Mortlock passed away recently, following a short illness.

While Roly retired some years ago, those of us who were around in mathematics education some years ago, and especially those of us in Western Australia, would have known him well, and will remember him with great fondness.

Born and bred in Western Australia, where he began his teaching career as a secondary school mathematics teacher, Roly went to the USA, firstly completing a masters degree in Mathematics before undertaking his PhD studies at the University of Michigan in what was then the fledgling new profession of mathematics education. Following his graduation, Roly and his family worked at the University of Alberta for a time before he was lured back to Western Australia by Professor Larry Blakers, one of the founding fathers of the AAMT and for a long time the Head of the Mathematics Department at the University of Western Australia. Larry had been involved in the New Maths movement via SMSG (the School Mathematics Study Group) at Stanford University, and was keen to provide a substantial link between mathematics and education. His creation of a joint position in the Department of Mathematics and the Department of Education at UWA in the early 1970s was a seminal moment in the history of mathematics education in Western Australia, and the appointment of Roly to the position was an inspired decision.

Roly's impact on mathematics education and on those of us engaged in it at that time was enormous. Many senior mathematics teachers, as well as many less senior mathematics teachers, were profoundly influenced by Roly's command of the discipline of mathematics education, by his personal expertise as a teacher and a scholar and by the unflinching educational support he generously gave to

students and others in the local community during his appointment. (In fact, I do not think it is too much of an exaggeration to suggest that many people at the time did not even know that there was a profession of mathematics education.) I count myself as one of the many privileged people to study and work with him, and know that essentially all of the important matters in mathematics education in Western Australia were positively affected by his work and his influence over the lifetime of his UWA appointment. The breadth of his understanding of mathematics teaching and the rigour of his attention to detail were defining features of our engagement with him as a scholar and a teacher. Roly's joint appointment allowed him to have a positive influence on a number of colleagues in the Mathematics Department, engaging them in work with teachers, and included his teaching new courses in mathematics designed to support the work of teachers, such as a unit in Transformation Geometry and a Master of Science Education degree for postgraduate coursework study by advanced mathematics teachers. Many of Roly's students went on to successful and senior careers in mathematics education in many different quarters around Australia and elsewhere. Although working in a research university, his deep respect for the work of mathematics teachers in schools and his understanding of the work of schools was never diminished, and he always felt like a colleague and a friend.

Roly's influence extended well beyond his work at the University, and included two periods as President of the Mathematical Association of WA, and a succession of other seminal roles within MAWA and the wider community. Some of this work intersected, such as his work with senior teachers studying at UWA to produce a book on mathematical problem solving (that was translated into Japanese and sold in Japan as well as Australia for many years), and another book on mathematical investigation (launched at the ICME-5 congress in Adelaide in 1984) that is still available from MAWA. He was an important influence on mathematics curriculum developments in Western Australia, and those shaping them in the 1970s and 1980s. He was also an early collaborator on *The Australian Mathematics Teacher*, taking responsibility for research in mathematics education, and was an important member of the group responsible for the first AAMT conference in Perth in 1976, and attended the inaugural MERGA conference in 1977, as well as being involved in subsequent conferences.

Roly retired relatively early to Denmark, on WA's south coast, to pursue his other passions of family, fishing and gardening. Although he didn't publish many papers during his time at UWA, and so may not be well known to the many people who began their careers as mathematics teachers from 1990 onwards, his influence over the emerging profession of mathematics education in WA remains unmatched.

Sic Transit Gloria Mundi.

Emeritus Associate Professor Barry Kissane, School of Education, Murdoch University, Murdoch WA 6150. Email: b.kissane@murdoch.edu.au



Book Reviews

Nonlinear Optimization

Francisco J. Aragón, Miguel A. Goberna, Marco A. López and
Margarita M.L. Rodríguez
Springer, Cham, 2019, ISBN 978-3-030-11183-0

General notes

This book is recommended for upper-level undergraduate degree courses in the area of mathematics, statistics and industrial engineering as well as graduate degree courses for a large variety of non-mathematics fields: finance, management, computer science, artificial intelligence and many others. The assumed knowledge is a standard course of Linear Algebra and Calculus. The authors carefully revise the essential topics of the assumed knowledge and this enables non-mathematics students to follow the book. The book contains many examples with illustrations. This makes the presentation clear and easy to follow. On the top of this, the book contains many practical problems from different areas, including science, engineering, management, finance, data science, resource allocation and many others.

In this book, the authors approach each practical problem from several directions. In particular, the authors demonstrate how each practical situation can be modelled and validated, that is, how each problem can be formally written as a mathematical problem. This preliminary study is very important and, in some cases, even harder than the actual solving stage.

There are three parts in this book: Preliminaries and two main parts (Part I and Part II). Part I (Chapters 2–4) targets analytical studies, while Part II (Chapters 5 and 6) deals with the computational side of the problem. These two main parts can be studied independently after Preliminaries.

Preliminaries

There are two main purposes for this part. Firstly, the authors provide a very convincing motivation on why it is beneficial to use optimisation for modelling. There are several essential topics in this part that should not be skipped. In particular, model formulation, reformulation and validation. These topics are not included in general Linear Algebra and Calculus courses. However, these are very important skills to learn. In particular, the authors dedicate several sections to monotone transformations of objectives and constraints, elimination of absolute values in the objective function, continuous formulation of integer and mixed integer problems and other important issues. Secondly, the authors revise the most important topics from Calculus and Linear Algebra that will be used as a working tool throughout the book. This is especially important for non-mathematics students, since their mathematical knowledge may be limited.

After studying Preliminaries, the reader can proceed to Part I (analytical studies) or skip it and go directly to Part II (numerical methods).

Part I

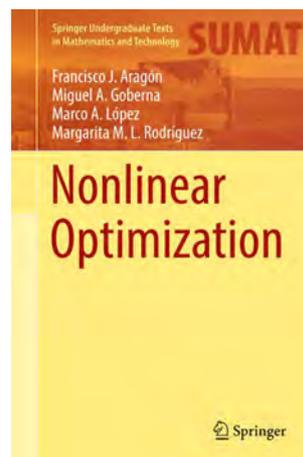
In this part, the authors concentrate on convex optimisation. This area covers a very broad range of topics. In particular, linear programming is a special field within convex optimisation. Linear programming is not a pre-requisite or assumed knowledge for this book, but since it is commonly used in practical applications, it is beneficial for the reader to get a good grasp of this topic. This book provides a wide range of references to excellent textbooks on linear programming.

The authors start with the definition of convex sets and convex functions. Then they move to a more detailed description of convex functions. In particular, they consider special cases of convex functions: strictly and strongly convex functions. The properties of these functions are essential for the development of efficient computational methods (Part II of this book).

Then the authors move to unconstrained optimisation: quadratic optimisation and least squares. Least squares regression (linear or polynomial) has many potential applications in science, engineering, finance and data science. Another important application is the least squares solutions to overdetermined linear systems.

The authors also provide detailed guidelines on how to deal with the problems when the derivatives do not exist or are very expensive to evaluate. This area is very important, since there are many practical applications where the objective functions (or some of the constraints) are nonsmooth. The authors use Jensen's inequalities (first and second) and the geometric-arithmetic mean inequality.

In the last chapter of Part I, the authors start with the analysis of some practical problems: the Fermat–Steiner problem, surface tension, potential energy minimisation and statistical parameter estimation (statistical inference). Then the authors move to a systematic study of constrained optimisation problems. The main study point here is the celebrated Karush–Kuhn–Tucker (KKT) theorem. This theorem provides a first-order optimality condition for a convex linearly constrained convex optimisation problem in terms of nonnegativity conditions (NC), stationarity conditions (SC) and complementarity conditions (CC). There is also the so-called Frank–Wolfe theorem on the existence of optimal solutions in convex linearly constrained problems. In the same chapter, the authors dedicate a considerable amount of time to the linear separation of convex sets. One of the main reasons for this is a broad range of practical applications, in particular, data classification using the Support Vector Machines (SVMs). This book also provided



a detailed description of sensitivity analysis, Lagrange and Wolfe duality. Finally, the authors provide a short introduction to conic optimisation.

Part II

This part contains two chapters: unconstrained and constrained optimisation algorithms. In Chapter 5 (unconstrained algorithms) the authors start with line search methods: stepsize, direct and indirect line search. These methods are applied when the search direction is chosen. There is also a detailed discussion on how to balance two main objectives when choosing the stepsize, since one would like to reduce the value of the function as much as possible without spending too much time on computations. This balance can be achieved by imposing certain conditions on the stepsize. In this book, the authors discuss Wolfe and Goldstein conditions. The authors also study the convergence of line search methods and the convergence rate.

The next several sections are dedicated to search direction methods: Newton's method, its modifications and application to least squares problems and solving systems of linear equations, conjugate direction methods and, finally, derivative-free optimisation methods. The authors discuss the applicability of the methods and also, where possible, their relationships.

In the last chapter (constrained optimisation), the authors demonstrate how constrained optimisation problems can be reduced to unconstrained ones. This can be done through penalty and barrier methods. These methods have several variations. In particular, there are some specific features for applying these methods to equality and inequality constrained problems. There is also a discussion on constraint qualification and second order optimality conditions. The remaining part of this chapter introduces sequential quadratic programming methods. These methods are based on the application of Newton's method to KKT.

Concluding notes

This book contains many carefully designed pictures for visual demonstration. There are many examples of the application to practical problems. Many exercises are equipped with detailed solutions, rather than just short answers.

Nadezda Sukhorukova

Swinburne University of Technology, Australia and Centre for Informatics and Applied Optimization (CIAO), Federation University Australia. Email address: nsukhorukova@swin.edu.au



AMSI News

Tim Brown*

AMSI has had a very busy period developing a refreshed Strategy Statement. Initial input came from meetings by the Director at many members and a survey of staff in member institutions and AMSI staff. This initial input was followed by a Strategy Day involving the Joint Venture Partners, the Board and the Executive. The final stage was wide circulation of drafts through members and a decision by the Board. The strategy statement is now available on the web.

AMSI has also expanded its Board with the appointment of five new independent members, who come from a wide diversity of backgrounds. Bringing a rich mix of broader expertise and mathematical experience, the new appointees are:

- Anne Baly, Director of Phillips KPA
- Sue Barrell, former Bureau of Meteorology Chief Scientist and Corporate Executive, Science and Innovation,
- Robyn Owens, Deputy Vice-Chancellor (Research), University of Western Australia,
- Joe Forbes, Co-Founder of Biarri
- Andrew Peele, Director of the Australian Synchrotron, ANSTO.

The institute has had record media coverage in 2019 with over 863 media articles and a potential reach well over 81 million, continuing its strong impact and presence. AMSI released data on Year 12 participation in advanced maths, showing a disappointing continuing decline in the participation of girls (and boys). With more than 326 national TV, print and radio stories and a reach well over 25 million, this report stimulated a robust national discussion. Following up on that success, a joint report with CSIRO Data 61, *Advancing Australia's Knowledge Economy – Who are the top PhD Employers?*, generated significant attention both in government and the broader community. The launch in the election campaign of AMSI's second Occasional Paper, *Australian Secondary Mathematics Teachers Shortfalls: A Deepening Crisis*, generated enormous media interest. Discussions with government are occurring on these matters.

The Research and Higher Education team have been hard at work presenting the annual Winter events, AMSI Optimise and Winter School. This year, AMSI Optimise was held in Perth in partnership with Curtin University and focused on mathematical innovation in the mining, oil and gas, agriculture and water sectors. The five-day program included strong industry and female participation and was well received by attendees. A particular highlight was the Business Breakfast sponsored by BHP which involved a panel discussion on how to attract and retain the best STEM talent to the natural resources sector. The 2019 AMSI Winter School on computational modelling of heterogeneous media is currently underway (July)

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at Queensland University of Technology. The residential school involves an exciting program full of lectures, special talks and activities centred around this fascinating field. This year we welcome two international lecturers — QUT alumnus Professor Jen Pestana from University of Strathclyde (Glasgow) and Professor Daniel Peterseim, University of Augsburg (Germany). Special thanks to our AMSI Event Directors, Professor Lou Caccetta (Optimise) and Professor Ian Turner (Winter School) and their local staff for working alongside AMSI staff to bring these events to the Australian mathematical sciences community and associated industries.

It is an exciting time for AMSI with the APR.Intern program's 'Open Up Your World' campaign rolling out nationally. Planning is underway for the 2019 STEM-fest, celebrating the Women Changing Australia which will be held at KPMG. The event will showcase the achievements of inspirational women in the STEM sector with a focus on four key areas: Space, Data Science, Advanced Manufacturing and Cyber Security. The Business Development team are working hard to rollout the block internships across our 20 university partners. AMSI welcomes the opportunity to partner with the Western Australia's Defence Science Centre to provide students with the opportunity to develop industry skills while helping drive real-world defence innovation.

CHOOSEMATHS Days have continued to be run in schools and universities across the country and have all been a great success, with each event involving activities and inspiring speakers who talked about their journey with mathematics. With term two coming to a close, the CHOOSEMATHS Outreach team are looking forward to a well-deserved break. It is pleasing to hear lots of stories from teachers, parents and students that continue to highlight the great work AMSI is doing. Teachers can be nominated, and student teams can be registered at www.choosemathsawards.org.au. The 2019 CHOOSEMATHS careers awareness campaign has just been launched. Keep an eye out for CHOOSEMATHS billboards and bus shelter ads and an ear out for radio spots across the country. Careers packs will be sent to schools in the new school term.



Tim Brown has been Director of the Australian Mathematical Sciences Institute (AMSI) since January 2019. Tim was Deputy Vice-Chancellor (Research) at La Trobe as well as Dean of the College of Science at ANU. Tim has been President of the Australian Council of Deans of Science and President of the Statistical Society of Australia. He was previously Head of Mathematics and Statistics, and Foundation Director of the Statistical Consulting Centre, at the University of Melbourne, Professor at the University of Western Australia and also worked at Monash University and the University of Bath. Tim's research interests have been in probability, especially probability approximations and stochastic processes, applied statistics and educational measurement (with applications to Year 12 moderation, scaling and interstate-transfer).



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2019 SCIENTIFIC EVENTS

6 - 8
S E P | **DYNAMICAL SYSTEMS**
APPLICATIONS TO PHYSIOLOGY | DEAKIN UNI

9 - 13
S E P | **CHALLENGES IN HPC** | ANU

30 SEP
- 4 OCT | **ANALYSIS ON**
MANIFOLDS | ADELAIDE UNI

7 - 11
O C T | **APPLIED MULTIVARIATE**
STATISTICS METHODS WORKSHOP | UON

11 OCT | **OPTIMISATION METHODS**
IN WILDFIRE EMERGENCY MANAGEMENT | RMIT

20 OCT | **STOCHASTIC & ALGEBRAIC**
MODELS FOR GENOME EVOLUTION | UTAS

25-29
O C T | **UNCERTAINTY**
QUANTIFICATION WORKSHOP | ANU

2 - 6
D E C | **AMSIBIOINFOSUMMER 19**
A SYMPOSIUM IN BIOINFORMATICS | USYD

8 - 12
D E C | **DATA SCIENCE**
DOWN UNDER WORKSHOP | UON

16-17
D E C | **FINITE GEOMETRY: A WORKSHOP**
IN HONOUR OF **TIM PENTTILA** | ADELAIDE UNI

[AMSI.ORG.AU/SCIENTIFIC](https://amsi.org.au/scientific)



2019-20 SUMMER FLAGSHIP EVENTS



AMSI
BIOINFO SUMMER 19
A SYMPOSIUM IN BIOINFORMATICS
THE UNIVERSITY OF SYDNEY 2-6 DECEMBER
SAVE THE DATE
B I S . A M S I . O R G . A U



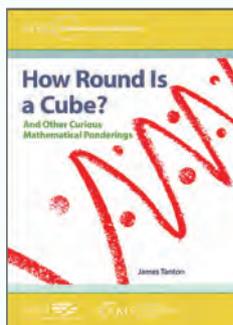
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SCHOLARSHIPS 2019-20**
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HOW ROUND IS A CUBE? And Other Curious Mathematical Ponderings

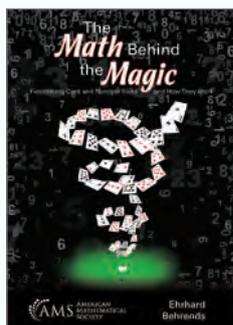
James Tanton, Mathematical Association of America

A collection of 34 curiosities, each a quirky and delightful gem of mathematics and each a shining example of the joy and surprise that mathematics can bring. Intended for the general math enthusiast, each essay begins with an intriguing puzzle, which either springboards into or unravels to become a wondrous piece of thinking. The essays are self-contained and rely only on tools from high-school mathematics (with only a few pieces that ever-so-briefly brush up against high-school calculus).

MSRI Mathematical Circles Library, Vol. 23

A co-publication of the AMS and the Mathematical Sciences Research Institute

Aug 2019 262pp 9781470451158 Paperback A\$39.60



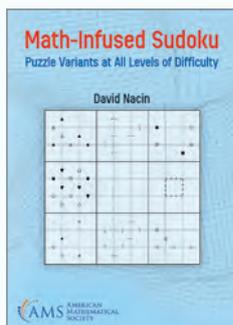
THE MATH BEHIND THE MAGIC Fascinating Card and Number Tricks and How They Work

Ehrhard Behrends, Freie Universität

Translated by David Kramer

Magic tricks can be easy to perform and have an interesting mathematical foundation. In this rich, colourfully illustrated volume, Ehrhard Behrends presents around 30 card tricks and number games that are easy to learn, with no prior knowledge required. This is maths as you've never experienced it before: entertaining and fun!

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MATH-INFUSED SUDOKU Puzzle Variants at All Levels of Difficulty

David Nacin, William Paterson University

Presents nine variations on a classic and beloved puzzle type. Building upon the rules of Sudoku, the puzzles in this volume introduce new challenges by adding clues involving sums, differences, means, divisibility, and more. Each of the first eight chapters presents a rule system followed by a series of puzzles that progress in difficulty from easy to hard, allowing readers to develop and hone skills in logical problem solving, pattern discernment, and strategy building. In the final chapter, the eight puzzle variants are combined into a single complex puzzle type that puts all of the reader's new skills into play.

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MATRIX News

Mathematical Research Institute MATRIX

David Wood*

MATRIX is Australia's international residential mathematical research institute. We have recently hosted research programs in PDEs, Functional Data Analysis, Representation Theory, Topology, Differential Geometry, Number Theory, Models of Infectious Diseases, Ergodic Theory, and Spatial Statistics. MATRIX will run a mix of programs from across the mathematical sciences in the coming six months.

Upcoming programs

- **Mathematics of Physiological Rhythms**
9–13 September 2019
Organisers: Maia Angelova (Deakin), James Sneyd (Auckland), Aneta Stefanovska (Lancaster), Plamen Ivanov (Boston and Harvard)
- **Conservation Laws, Interfaces and Mixing**
4–8 November 2019
Organisers: Snezhana I. Abarzhi (Western Australia), Neville Fowkes (Western Australia), Alik Nepomnyashchy (Technion, Israel Institute of Technology), Anthony Roberts (Adelaide), Yvonne Stokes (Adelaide)
- **Structural Graph Theory Downunder**
25 November – 1 December 2019
Organisers: David Wood (Monash), Anita Liebenau (UNSW), Alex Scott (Oxford)
- **Tropical Geometry and Mirror Symmetry**
9–20 December 2019
Organisers: Nick Sheridan (Edinburgh), Brett Parker (Monash), Paul Norbury (Melbourne), Jian He (Monash), Kristin Shaw (Oslo)
- **Early Career Researchers Workshop on Geometric Analysis and PDEs**
13–24 January 2020
Organisers: Paul Bryan (Macquarie), Jiakun Liu (Wollongong), Mariel Sáez (Pontificia Universidad Católica de Chile), Haotian Wu (Sydney)
- **Harmonic Analysis and Dispersive PDEs: Problems and Progress**
3–7 February 2020
Organisers: Zihua Guo (Monash), Ji Li (Macquarie), Kenji Nakanishi (Kyoto), Wenhui Shi (Monash)
- **The Skeleton of Turbulent Shear Flows**
14 September – 2 October 2020
Organisers: Philip Hall (Monash), Ivan Marusic (Melbourne), Beverley McKeon (Caltech), Laurette Tuckerman (EPSCI, Paris)

*MATRIX, Creswick, <http://www.matrix-inst.org.au/>

- **Hyperbolic Differential Equations in Geometry And Physics**

9–20 December 2020

Organisers: Jesse Gell-Redman (Melbourne), Andrew Hassell (ANU), Todd Oliynyk (Monash), Volker Schlue (Melbourne)

More programs will be announced soon.

Outreach

In November 2019, as part of our outreach program, MATRIX and ACEMS will host a workshop to equip school teachers to lead MathsCraft events. Back in schools, the MathsCraft leader poses problems, provokes participants, and organises the sharing of students' ideas. Problems are designed to give an authentic experience of doing mathematical research in a supportive and collaborative environment.

MATRIX Annals

The **2017 MATRIX Annals**, the second volume in the **MATRIX Book Series**, has been published on 25 March 2019 with almost 700 pages. This series documents scientific activities at MATRIX. The Editors are David Wood (Editor-in-chief), Jan de Gier, Cheryl Praeger, and Terence Tao. Articles can be peer-reviewed, containing original results or reviews on a topic related to the program, or non-peer-reviewed expository articles based on talks or activities at MATRIX.

Submission

Anyone can apply to organise a MATRIX program. Every program should have ample unstructured time to encourage collaborative research. Longer programs can have an embedded conference or lecture series. Short workshops focussing on a special theme are also welcome. The MATRIX Family Fund provides additional support to participants with families.

The MATRIX Scientific Committee selects programs on scientific excellence as well as on the participation rate of high profile international participants and/or business and industry partners, among other criteria.

The next deadline for program proposals in 2020–2022 is

8 November 2019

Expressions of interest may be submitted at any time. Guidelines can be found at <https://www.matrix-inst.org.au/guidelines>.

Organisers are encouraged to supplement their funding from MATRIX through other schemes including: the International Visitor Program of the University of Sydney Mathematical Research Institute; the AMSI and AustMS/ANZIAM workshop funding scheme; and AustMS travel grants.

MATRIX Minors

MATRIX Minor programs are self-funded visits to MATRIX to make use of the available office space and facilities at the Creswick Campus outside program times,

for example to work intensively in a small group. Such visits are subject to the approval of MATRIX but can be arranged by sending an email request that briefly outlines the proposed research and timings.

Questions

Comments, suggestions and requests are always welcome. Please send these, as appropriate to:

Directors	Jan de Gier (jdg@matrix-inst.org.au) David Wood (davidw@matrix-inst.org.au)
Executive Officer	Sally Zanic (sallyz@matrix-inst.org.au)
Chair of the Advisory Board	Tony Guttmann (guttmann@unimelb.edu.au)

MATRIX is a partnership between Monash University and The University of Melbourne, with the ARC Centre of Excellence for Mathematical and Statistical Frontiers (ACEMS) as an associate member.



Professor Wood's research interests lie in discrete mathematics, especially structural graph theory, extremal graph theory, graph colouring, and combinatorial geometry. He is an Editor-in-Chief of *The Electronic Journal of Combinatorics*, and is an editor of *Journal of Computational Geometry*, *Journal of Graph Theory*, and *SIAM Journal on Discrete Mathematics*. He is a former President of the Combinatorial Mathematics Society of Australasia.



NCMS News

Peter Forrester*

A face-to-face meeting of the National Committee for the Mathematical Sciences was held at the Academy of Science in Canberra on 13 June. A couple of months earlier I attended the annual National Committee Chairs meeting. One of the themes on that occasion was the international profile of the particular disciplines represented by the various National Committees, as measured by representation on governing bodies, and the hosting of international congresses. The great success enjoyed by Australia and Australian mathematicians at the ICM in Rio featured prominently, as did our high profile delegates and office holders for the IMU. It was not long after the Chairs meeting that the result of the bid made by the Consortium for Mathematics Education, led by Kim Beswick as Convenor, to host the International Congress on Mathematical Education, ICME-15, in Sydney in 2024, was to be announced. The projected number of delegates for this event is close to 3000. To the Australian Mathematical Sciences community's great joy and pride, the bid was announced as successful. In reporting to the NCMS, Kim highlighted the inclusive nature of the bid, with the Consortium begin a partnership between MERGA, AAMT, AustMS, SSA and AMSI, and engagement with the Asia-Pacific region, with the latter most significant in relation to ICMI's legacy objectives.

The meeting on 13 June was addressed by Claudette Bateup, the Director of Education at the Academy, and two writers for the reSolve: Maths by Inquiry program. In the relatively short time window from mid-2015 to mid-2018, when the program was fully funded, the program created a suite of web based resources for Foundation to Year 10 classroom use and professional learning, using inquiry based methodology. An extension of funding was obtained through the Federal Governments National Innovation and Science Agenda, to allow for the resources to be expanded and refined, and to build on the gains made in forming a network of over 250 Champions of reSolve.

I placed as an agenda item 'Issues relating to overseas students'. It was early in May when three members of the Mathematical Sciences community featured prominently in the Four Corners program relating to (in my perception of the presentation) the reliance of our universities on full fee paying students, the profit driven international student agent industry, the preparedness of the students and their welfare in multiple senses, and the stress the latter places on the staff. Some people I've spoken to on this regret the matter was made public, and would have preferred the use of other channels. I personally thought our colleagues showed great courage, and very much have held the higher ground throughout, with student welfare and academic integrity remaining core. In a timely development, it was announced on 30 May in *The Sydney Morning Herald* that the Education

*Chair, National Committee for Mathematical Sciences, Department of Mathematics and Statistics, The University of Melbourne, Parkville 3010, VIC.
Email: p.forrester@ms.unimelb.edu.au

Minister Dan Tehan ‘has directed his department to work on a series of proposals to ensure standards aren’t suffering and that students are being properly cared for’.

On other aspects of this agenda item, I drew attention to the regulations in the UK relating to universities and international students, requiring in particular as a visa requirement evidence of student attendance and engagement. Checking this with a UK based colleague, it is indeed the case that attendance data is collected by the old fashioned way of keeping of a roll, but now done electronically. Should attendance and engagement be a visa requirement here in Australia?

The meeting marked the end of my term as the NCMS chair. Alan Welsh, from the ANU, will take over from mid-year. Alan, as a statistician, is well placed to ensure that policy makers see the fundamental role played by the Mathematical Sciences in the rise of Data Science, and to provide guidance relating to initiatives for Data Science to become part of the school curriculum, which are contemporary issues of national importance.



Peter Forrester received his Doctorate from the Australian National University in 1985, and held a postdoctoral position at Stony Brook before joining La Trobe University as a lecturer in 1987. In 1994 he was awarded a senior research fellowship by the ARC, which he took up at The University of Melbourne. Peter’s research interests are broadly in the area of mathematical physics, and more particularly in random matrix theory and related topics in statistical mechanics. This research and its applications motivated the writing of a large monograph *Log-gases and Random Matrices* (PUP, Princeton) which took place over a fifteen-year period. His research has been recognised by the award of the Medal of the Australian Mathematical Society in 1993, and election to the Australian Academy of Science in 2004, in addition to several ARC personal fellowships. He was AustMS President from 2012 to 2014.



The Sydney Mathematical Research Institute

Anthony Henderson*

It has been an exciting few months for SMRI as we have finally, after more than a year of planning, started our core function of hosting visiting researchers. On 1 May 2019, the honour of being the first SMRI visitor went to Matthias Lesch of the University of Bonn, who was selected in our International Visitor Program for a three-month research visit spent mainly at the University of Wollongong.



L–R: Stephan Tillmann (USyd), Jonathan Spreer (USyd), Hyam Rubinstein (UMelb)

This program requires visitors to spend at least two weeks at SMRI even if their primary location is another university, a restriction which was vindicated immediately by Matthias' experience: not only did the members of our School of Mathematics and Statistics benefit greatly from the two seminar talks he gave in Sydney, but he was able to begin his trip with some valuable thinking time in our comfortable and quiet offices in the University of Sydney's Main Quadrangle.



Yusra Naqvi (USyd)

We have welcomed 33 visiting researchers in our first three months, a rate which will surely prove higher than our long-run average, having been boosted by the

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Email: anthony.henderson@sydney.edu.au



Alex Casella (Florida State University)

Northern Hemisphere summer among other factors. In addition to the successful applicants to SMRI's International Visitor Program, we host researchers visiting for generally shorter terms to collaborate with members of the School or to participate in workshops and conferences. As Executive Director, I have the enjoyable task of trying to assign all these visitors to shared offices in such a way as to maximize the chance of seeding new collaborations. A complete list can be found on the SMRI website¹ along with profiles of selected visitors written by our Senior Science Communicator, Stephen Morgan. To quote Gwyn Bellamy of the University of Glasgow, the subject of one of these profiles: "Mathematics is like playing. It's great to be here at SMRI, to get a chance to play all day."

SMRI Director Geordie Williamson, who was recently awarded the Christopher Heyde Medal of the Australian Academy of Science, will give a public lecture on mathematics and music at 12.30 pm on 7 August as part of the "This Sounds Like Science" series held at Sydney's City Recital Hall. Informing the public about mathematical research is an important part of SMRI's mission, and my next report will include several further events planned for the latter months of 2019.



Anthony Henderson is currently the Executive Director of the University of Sydney Mathematical Research Institute, which he helped to establish in 2018. After obtaining his PhD from the Massachusetts Institute of Technology in 2001, he returned to the University of Sydney as a postdoctoral researcher and has worked there ever since. For his publications in geometric and combinatorial aspects of representation theory, Anthony was awarded the Christopher Heyde Medal in 2011 and the Australian Mathematical Society Medal in 2012. He also received a Faculty of Science Citation for Excellence in Teaching in 2009, and his Honours-level lecture notes on Lie algebras were published by Cambridge University Press in 2012. He is a founding Director of the Simon Marais Mathematics Competition for undergraduates in the Asia-Pacific region.

¹<https://sydney.edu.au/research/centres/mathematical-research-institute.html>



News

General News

Mathematics in the Media

Dr Savin Chand from Federation University was one of three scientists featured in an ABC interview “how might climate change affect cyclones?” Climate scientists from around the world converged at a major meteorological and oceanography conference in Darwin from 11–14 June, organised as part of the Australian Meteorological and Oceanographic Society Annual Meeting and the International Conference on Tropical Meteorology and Oceanography. Dr Chand presented his latest research on how human-induced climate change is impacting the frequency and intensity of tropical cyclones in Australia, and around the world. He was later interviewed by the ABC on his ground-breaking work. The recorded interview is available at <https://www.abc.net.au/radio/programs/pm/how-might-climate-change-affect-cyclones/11211520>.

Completed PhDs

Queensland University of Technology

- Dr Guvenc Dik, *A mathematical approach to synchronise and optimise emergency department operations*, supervisors: Erhan Kozan, Paul Corry and Glen Tian.
- Dr Libo Feng, *Numerical investigation and application of fractional dynamical systems*, supervisors: Fawang Liu, Ian Turner and Qianqian Yang.
- Dr Aiden Price, *Improved constructions of low-density parity-check codes*, supervisors: Harry Bartlett, Ed Dawson and Joanne Hall
- Dr Matthew W. Sutton, *Variable selection and dimension reduction for structured large datasets*, supervisors: Kerrie Mengersen, Chris Drovandi and Benoit Liqueur.
- Dr Eloise C. Tredenick, *Mathematical modelling of ionic agrochemical diffusion in plant cuticles: a mechanistic approach*, supervisors: Troy Farrell, Scott McCue and Whilhelmina Forster-Schou.

University of Adelaide

- Dr Peter Mathews, *Characterising the social media temporal response to external events*, supervisors: Nigel Bean, Lewis Mitchell, Giang Nguyen.

University of Melbourne

- Dr Wei Huang, *Spline techniques for incomplete and complex data*, supervisors: Aurore Delaigle and Felix Camirand Lemyre.

- Dr Michael Lydeamore, *Mechanistic and statistical models of skin disease transmission*, supervisors: James McCaw, Jodie McVernon and Patricia Campbell (Peter Doherty Institute).
- Dr David Kirszenblat, *Topics in optimisation*, supervisor: Hyam Rubinstein.
- Dr Patrick Andersen, *Degree bounded geometric spanning trees with a bottleneck objective function*, supervisors: Charl Ras and Sanming Zhou.
- Dr Tianyu Yang, *A combinatorial curvature flow for ideal triangulations*, supervisors: Craig Hodgson and Hyam Rubinstein.
- Dr Ana Dow, *CAT(O) structures on link exteriors: variations on a theme*, supervisor: Hyam Rubinstein.

University of Western Australia

- Dr Jack Murdoch Moore, *Improvements to local projective noise reduction through higher order and multiscale refinements*, supervisors: Michael Small and Ali Karrech.

Awards and other achievements

Australian National University

The new Hanna Neumann Building secured three awards at the latest ACT Architecture Awards ceremony, held on the 15th June 2019:

- The Enrico Taglietti Award for Educational Architecture
- The W. Hayward Morris Award for Interior Architecture
- The Pamille Berg Award for Art in Architecture.

La Trobe University

- Professor Reinout Quispel has been awarded a Simons Fellowship from 3 July to 19 December 2019.

University of Adelaide

- Johnny Lim (supervisors Mathai Varghese and Guo Thiang) received the Elsevier Young Scientist Award for the best student talk at the Tianjin conference in June 2019 (see <http://www.math.nus.edu.sg/mathanf/Meeting-2019.06/IndexDual.html>). It was a unanimous decision by a panel of four judges.

University of Melbourne

- Professors David Balding and Kerry Landman have been elected as Fellows of the Australian Academy of Science.

University of Southern Queensland

- Professor Yury Stepanyants has recently been awarded an international grant with Indian colleagues. He is now involved in the team of researchers from Australian side working on the Scheme for Promotion of Academic and Research Collaboration (SPARC) — a new collaborative research initiative from the Ministry of Human Resource and Development (MHRD), Government of India. This program offers long-time research funding, student exchange, and international faculty visits. The Principal Co-investigators are Professor Trilochan Sahoo and Dr Santu Das from the Indian Institute of Information Technology of Bhagalpur, Bhagalpur, Bihar, India.

University of Sydney

- Samuel Mueller has been selected as a Fellow of the American Statistical Association.
- Sally Cripps has been awarded \$800,000 over two years by the Ramsay Foundation for a project on Bayesian modelling of childhood obesity.
- Samuel Mueller, John Ormerod, and Jean Yang have received a special commendation from the Australian Council of Graduate Research for the 2019 ACGR Award for Excellence in Graduate Research Supervision.
- Alexander Molev was elected as a Fellow of the Australian Academy of Sciences.

University of Western Australia

- Professor Enrico Valdinoci (2002), Professor Cheryl Praeger (1973) and Professor Michael Giudici (2002) appear on the MathSciNet database as the most cited mathematicians in their graduating year.
 - Professor Inge Koch has accepted an invitation to be one of the Australian ‘Women in Mathematics’ and to feature in their exhibition. Professor Cheryl Praeger who is also featured in the exhibition.
 - Alex Bors received a 2018 Kirkman Medal from the Institute of Combinatorics and its Applications. Kirkman Medals recognise excellent research by Fellows or Associate Fellows of the ICA early in their research career, as evidenced by an excellent body of published research. According to the citation he “has made outstanding contributions to the understanding of combinatorial and quantitative problems on finite groups. He addresses fundamental theoretical questions, some of which are motivated by practical applications. He seeks characterizations that support efficient algorithmic decidability”.
-

Appointments, departures and promotions

Deakin University

- Professor Lynn Margaret Batten has been appointed Professor Emeritus effective 1 July 2019. Her Deakin email address will continue in use.

Monash University

New staff:

- Professor Santiago Badia joins Monash from CIMNE (Barcelona). He works in Applied and Computational Mathematics, specifically on the numerical approximation of partial differential equations (PDEs), e.g. using finite element methods, for modelling fluid and solid mechanics, electromagnetics, and multiphysics problems. He is particularly interested in large-scale scientific computing and numerical linear algebra.

New Research Fellows:

- Dr Davide Ravotti
- Dr Minh Nguyen
- Tony Huynh will commence as a post-doctoral research fellow in the Monash Discrete Mathematics Researchgroup in September 2019. Tony works in structural graph theory, matroids, and combinatorial optimisation.

Queensland University of Technology

Arrivals:

- Dr Vivien Challis has joined the School of Mathematical Sciences at QUT as Lecturer in Applied Mathematics
- Dr Chris Baker has joined the School of Mathematical Sciences at QUT as Lecturer in Applied Mathematics

Swinburne University

- Dr Carlo Galuzzi joined the Department of Maths, coming from Maastricht University in the Netherlands. Fields of interest: Mathematics Applied to Neuroscience, HW/SW Codesign, Reconfigurable Computing.

University of Melbourne

New appointments:

- Dr David Squire (Research Fellow)
- Professor Geoffrey Grimmett (Professor in Applied Probability)
- Dr Wei Huang (Lecturer)
- Dr Mario Kieburg (Lecturer)

University of Technology Sydney

New appointments, effective July 2017:

- Matias Quiroz (formerly UNSW) has been appointed as Lecturer from June 2019
- Joanna Wang (currently NSW Bureau of Crime Statistics and Research) has been appointed as Lecturer from December 2019
- Mary Coupland has been promoted to Associate Professor (effective January 2019)

University of Western Australia

- Dr Luke Morgan left UWA for an Assistant Professor position at the University of Primorska

Conferences and Courses

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

*For information about MATRIX programs,
see the report by David Wood in this issue.*

Flags, Galleries and Reflection Groups

Dates: 5–9 August 2019

Venue: University of Sydney

Web: <https://www.maths.usyd.edu.au/u/yusra/FGRConf/>

Speakers:

- Barbara Baumeister (Universität Bielefeld, Germany)
- Charlotte Chan (Princeton University, USA)
- Matthew Dyer (University of Notre Dame, USA)
- Ulrich Görtz (Universität Duisburg-Essen, Germany)
- Christophe Hohlweg (Université du Québec à Montréal, Canada)
- Allen Knutson (Cornell University, USA)
- Shrawan Kumar (University NC Chapel Hill, USA)
- Thomas Lam (University of Michigan, USA)
- Martina Lanini (Università degli Studi di Roma Tor Vergata, Italy)
- Jon McCammond (University of California Santa Barbara, USA)
- James Parkinson (University of Sydney)
- Arun Ram (University of Melbourne)
- Anne Schilling (University of California Davis, USA)
- Monica Vazirani (University of California Davis, USA)
- Geordie Williamson (University of Sydney)

Workshop on Monge-Ampere equations: in celebration of Professor John Urbas's 60th birthday

Dates: 19–23 August 2019

Venue: The Pavilion, Kendall on the Beach Holiday Park, Kiama, NSW

Web: <https://maths.anu.edu.au/news-events/events/workshop-monge-ampere-equations-celebration-professor-john-urbas's-60th-birthday>

The aim of this workshop is to bring together international leading mathematicians and provide participants an opportunity to exchange ideas and foster/enhance collaborations. It will focus on new advances and strengthen connections between Monge-Ampere equations and their applications, in particular in optimal transportation.

For further details, please contact Admin.research.msi@anu.edu.au.

International Workshop on Stochastic Partial Differential Equations

Dates: 26–28 August 2019

Venue: University of Sydney (Camperdown Campus)

Web: <https://www.eventbrite.com.au/e/workshop-on-stochastic-partial-differential-equations-tickets-59029362412>

Speakers at this event include:

- Zdzislaw Brzezniak (York University, to be confirmed)
- Jerome Droniou (Monash)
- Quoc Le Gia (UNSW)
- Benjamin Goldys (Sydney)
- Ngan Le (Monash)
- Debopriya Mukherjee (UNSW)
- Akash Ashirbad Panda (Indian Institute of Science Education and Research, to be confirmed)
- Pierre Portal (ANU)
- Andreas Prohl (Tuebingen University)
- Nimit Rana (York University)
- Thanh Tran (UNSW)
- Rongchan Zhu (Beijing Institute of Technology)

Organizers are:

- Ben Goldys (The University of Sydney)
- Daniel Hauer (The University of Sydney)
- Ngan Le (Monash University)
- Thanh Tran (UNSW)

Interested participants can contact Ben Goldys (benjamin.goldys@sydney.edu.au). We are looking forward to meeting you, enjoying the talks, and discussing maths with you.

Challenges in High Performance Computing

Dates: 2–6 September 2019

Venue: Australian National University, Hanna Neumann Building (145)

Web: <https://maths.anu.edu.au/news-events/events/challenges-high-performance-computing>

Contact: admin.research.msi@anu.edu.au

The focus of this interdisciplinary workshop is on bringing together techniques that are at the forefront of mathematics and computer science for solving large scale problems motivated by applications on high performance computers. The main aim is to foster cooperation and communication between the fields of Algorithms, Resilience, Middleware, Software and Applications.

Student participation is highly encouraged.

Invited speakers:

- Algorithms: David Keyes, King Abdullah University of Science and Technology
- Resilience: Ulrich Ruede, Friedrich-Alexander-University of Erlangen-Nuremberg
- Software: Lois Curfman McInnes, Argonne National Laboratory
- Applications: Raquel Salmeron, Airservices Australia
- Middleware: George Boscila, University of Tennessee

Part of the Special Year 2019: Computational Mathematics <https://maths.anu.edu.au/news-events/event-series/special-year-2019-computational-mathematics>.

Dynamical Systems Applications to Physiology

Dates: 6–8 September 2019

Venue: Deakin University

Web: <https://www.matrix-inst.org.au/events/mathematics-of-physiological-rhythms/>

The aim of the research program is to unite and combine current trends in dynamical systems and time series analysis for solving problems in physiology which are governed by repeating processes. Examples are circadian rhythms, cardio-dynamics, sleep processes, glucose-insulin regulation and many others. The importance of the circadian clock to human health was recognised by the 2017 Nobel prize in medicine. The invited participants are experts in mathematics, physics and computer sciences working in applications of dynamical systems and time series in physiology, biology and medicine. The program will explore the state-of-the-art mathematics underlying periodic and periodic-like processes in human physiology.

Challenges in HPC

Dates: 9–13 September 2019

Venue: The Australian National University

Scientific computing is often termed as the ‘third way to do science’, alongside theory and experiments. The focus of the workshop is to investigate the current

challenges of solving large scale problems on high performance computers. The workshop is part of the Special Year on Computational Mathematics to be celebrated in 2019 by the Australian National University's Mathematical Sciences Institute.

Number Theory Down Under 7

Dates: 30 September to 3 October 2019

Venue: University of New South Wales

Web: <https://web.maths.unsw.edu.au/~igorshparlinski/NTDU-7/NTDU-7.html>

12th Southern Hemisphere Delta Conference

Dates: Sunday 24 November to Friday 29 November 2019

Venue: Esplanade Hotel, Fremantle, Western Australia

Web: swandelta.org

This conference, on the teaching and learning of undergraduate mathematics and statistics, has the theme 'Reflections of Change'. It will incorporate a Special Teachers Day on Thursday 28 November, which allows for teachers and university educators to collaborate and share issues.

Please note the following important deadlines.

- 21 August 2019: Final date for submission of full papers for the Conference Proceedings.
- 28 August 2019: Final date for submission of abstract-only presentations.
- 28 August 2019: Final date for submission of abstracts for posters.

For further information about the conference and registration, see our website, or email the committee: swandelta2019@gmail.com.

Uncertainty quantification workshop

Dates: 25–29 November 2019

Venue: The Australian National University

Web: <https://maths.anu.edu.au/news-events/events/uncertainty-quantification-workshop>

Quantifying modelling uncertainty is essential for credible simulation-aided knowledge discovery, prediction and design. This workshop brings together a diverse set of researchers to identify challenges and novel research directions in the field of uncertainty quantification (UQ). Talks will focus on both algorithm development and applications of UQ in areas ranging from aerospace, material and electrical engineering to the environment. The focus will particular focus on various issues surrounding high-dimensional parameter spaces, multi-fidelity modelling, parameter inference, optimal experimental design, and design under uncertainty.

The 14th Engineering Mathematics and Applications Conference

Dates: 26–29 November 2019

Venue: UNSW Canberra at the Australian Defence Force Academy

Web: <https://unsw.adfa.edu.au/conferences/EMAC-2019>

The Engineering Mathematics and Applications Conference (EMAC) is the biennial meeting of the Engineering Mathematics Group (EMG), a special interest group of the Australian and New Zealand Industrial and Applied Mathematics (ANZIAM) division.

This meeting provides a forum for researchers interested in the development and use of mathematical methods in engineering and applied mathematics. It aims to foster interactions between mathematicians and engineers, from both academia and industry.

Broad themes

Conference topics range broadly over:

- Applied and industrial mathematics
- Engineering mathematics
- Computational mathematics
- Mathematics education
- Applied statistics & OR.

A long-running feature of EMAC is the inclusion of special sessions on engineering/mathematics education focusing on the needs of both engineering and applied mathematics undergraduates.

Important dates:

- Early-bird registration closes: 22 October 2019
- Abstract submission closes: 5 November 2019.

Sixty-third annual meeting of the Australian Mathematical Society

Dates: Tuesday 3 to Friday 6 December 2019

Venue: Monash University

Contact: Professor I.M. Wanless (ian.wanless@monash.edu.au)

Fourth Workshop on Metric Bounds and Transversality

Dates: 8–10 December 2019

Venue: Swinburne University, Melbourne

Web: <https://www.wombat.rmitopt.org/>

This workshop focuses on current trends and new techniques in variational and nonsmooth analysis and their diverse applications in applied mathematics. In past events topics of the workshop have included error bounds, metric (sub) regularity, Aubin property and calmness, transversality of collections of sets, subdifferential characterisations, monotone operator theory, fixed-point methods and applications of these techniques/properties to optimality conditions and the convergence of fundamental optimisation algorithms.

Keynote speakers:

- Prof Alexander Ioffe (Technion, Israel)
- Prof Marco López-Cerdá (Univ. Alicante, Spain)
- Dr Nir Sharon (Tel Aviv Univ., Israel)
- Prof Michel Théra (Univ. Limoges, France)

Registration is now open at the website.

42nd Australasian Conference on Combinatorial Mathematics and Combinatorial Computing

Dates: 9–13 December 2019

Venue: University of New South Wales, Sydney

Web: <https://conferences.maths.unsw.edu.au/e/42accmcc>

ACCMCC is the annual conference of the Combinatorial Mathematics Society of Australasia. The conference covers all areas of combinatorics in mathematics and computer science. Invited speakers include:

- Michael Albert, University of Otago
- Joachim Gudmundsson, University of Sydney
- Daniel Horsley, Monash University
- Ken-ichi Kawarabayashi, National Institute of Informatics, Japan
- Cheryl Praeger, University of Western Australia
- Wojciech Samotij, Tel Aviv University
- Maya Stein, Universidad de Chile
- Stephan Thomassé, École Normale Supérieure de Lyon

For more information about 42ACCMCC or to be added to a mailing list for future announcements, please contact the organisers at accmcc2019@unsw.edu.au.

Finite Geometry: A Workshop in Honour of Tim Penttila

Dates: 16–17 December 2019

Venue: The University of Adelaide

Web: <https://penttilafest.wordpress.com/>

Tim Penttila will soon be turning 60, so it seems fitting to celebrate and honour his career with a two-day workshop devoted to finite geometry. The host of this event is the University of Adelaide, where Tim obtained his Bachelor degree. There will be invited talks from some of Tim's collaborators, plus a selection of contributed talks. Supported by the Australian Mathematical Sciences Institute and the Institute for Geometry and its Applications.

Featured speakers:

- Nicholas Hamilton, The University of Queensland
- Alice Man Wa Hui, BNU-HKBU United International College
- Christine O'Keefe, CSIRO
- Valentina Pepe, La Sapienza, The University of Rome
- Cheryl Praeger, The University of Western Australia
- Geertrui Van de Voorde, University of Canterbury, NZ.

Aboriginal and Torres Strait Islander Mathematics Alliance 2020 conference

Dates: 27–30 July 2020

Venue: Yirrkala, Northeast Arnhem Land

Web: <https://atsimanational.ning.com/atsima-2020-yirrkala>

ATSIMA is excited to announce that ATSIMA 2020 will be held in Yirrkala an Indigenous Community in Arnhem Land, in the Northern Territory, 18 km South-East from the large mining town of Nhulunbuy. ATSIMA together with Yirrkala Bilingual School will work in collaboration.

This opportunity to attend a conference right in the middle of where culture and mathematics is being taught is not to be missed.

If you would like to work in collaboration with ATSIMA and Yirrkala School please contact Melinda Pearson (melindapearson@atsima.org).

64th Annual Meeting of the Australian Mathematical Society (AustMS 2020)

Dates: Tuesday 8 December 2020 to Friday 11 December 2020

Venue: University of New England, Armidale, NSW

Contact: Gerd Schmalz: schmalz@une.edu.au.

Vale

Associate Professor Roly Mortlock, retired from Murdoch University, passed away recently, following a short illness. An obituary appears in this issue.

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.

Information in this section is complemented by Anthony Henderson's report from the Sydney Mathematical Research Institute.

Prof Antoine Ayache; Lille University, France; 1–30 August 2019; LTU; Andriy Olenko

Prof Barbara Brandolini; University of Naples; 15 July to 20 September 2019; non-linear anisotropic equations and Pincare–Wirtinger inequalities; USN; Florica Cirstea

A/Prof. Jian Chen; Foshan University, China; applied and computational mathematics; 1 March 2019 to 1 March 2020; QUT; Fawang Liu

- A/Prof. Yongsheng Cheng; University of Science and Technology of China; 25 August 2019 to 28 February 2020; Lie theory closely related affine Kac–Moody algebras; USN; Ruibin Zhang
- Prof Daryl Cooper; University of Santa Barbara USA; 1 September to 15 December 2019; USN; Stephan Tillmann
- Dr Andrew Craig; University of Johannesburg; 2–13 August 2019; LTU; Brian A. Davey
- Ms Giulia Dal Verme; University of Milan; 17 October 2018 to 20 June 2019; boundary quotients of semigroup C^* -algebras; USN; Nathan Brownlowe
- Eleonora Deiana; Universite de Namur; 1 April to 28 June; applied probability; University of Adelaide; Giang Nguyen
- Mr Saibo Gang; Université Paris Sud; 17 June to 2 August 2019; ANU; Matthew Hole
- Prof Petr Gurka; University of Life Sciences Prague; 6–16 August 2019; nonlinear elliptic PDEs involving the p-Laplace operator and new functional analytical methods; USN; Daniel Haue
- Prof Miroslav Haviar; M Bel University, Slovakia; 1–15 August 2019; LTU; Brian A. Davey
- Prof Alexandru Hening; Tufts University Boston; 15 June to 1 October 2019; stochastic harvesting in population dynamics; USN; Anthony Henderson
- Prof Yehui Huang; North China Electric Power University; 1 September 2018 to 31 August 2019; ANU; Bryan Wang
- Mr Mair Khan; Quaid-I-Azam University Islamabad; 15 March to 14 August 2019; numerical analysis, partial differential equations, computational fluid dynamics, shooting methods; USN; Sharon Stephen
- Prof Henning Krause; Universitat Bielefeld; 26 June to 27 July 2019; representation theory, homological algebra; USN; Anthony Henderson
- Prof Guy Latouche; Universite Libre de Bruxelles; 15–28 June 2019; University of Adelaide; Giang Nguyen
- Mr Steve Laubie; Ensta Paris Tech; 18 March to 16 August 2019; computer programming skills Python and C++, Matlab; USN; Peter Sehoon Kim
- Mr Julien Lenhardt; Ensta Paris Tech; 18 March to 18 August 2019; grand challenges in nanoscience and nanotechnologies; USN; Lamiae Aziz
- Mr Minhua Liu; Chinese Academy of Sciences; 1 September 2018 to 31 August 2019; geometric representation theory; USN; Geordie Williamson
- Dr Benjian Lyu; Beijing Normal University; 1 November 2018 to 31 October 2019; UOM; Sanming Zhou
- A/Prof Joseph Maher; CUNY; 8 July to 25 August 2019; geometric topology and trisections of 4-manifolds; USN; Anthony Henderson
- Ms Sayantika Mondal (FRT scholar); 28 May to 31 March 2020; ANU; Joan Licata
- Dr Vidit Nanda; Oxford Univerisity; 18 September 2018 to 30 June 2021; applied algebraic topology; USN; Jacqui Ramagge
- Prof Alice Niemeyer; RWTH Aachen, Germany; July to December 2019; CMSC
- Dr Syarifah Zyurina Nordin; 1 July to 20 December 2019; task scheduling in parallel processors; USN; Anthony Henderson

- Prof Jan Obloj; 12 August to 20 December 2019; quantification of the value of information in the robust approach to pricing and hedging problems; USN; Anna Aksamit
- Prof Adam Parusinski; Universite de Nice; 1 July to 31 August 2019; equisingularity and applications; USN; Anthony Henderson
- Prof Franz Pedit; University of Massachusetts Amherst; 1 June to 2 August 2019; algebro-geometric aspects of integrable surface theory; USN; Anthony Henderson
- Mr Nimit Rana; University of York UK; 15 July to 30 August 2019; stochastic partial differential equations; USN; Ben Goldys
- Dr Diego Santiago Pazo Bueno; University of Cantabria; 13 July to 31 August 2019; collective mode reductions for firing-rate models and macroscopic chaos; USN; Anthony Henderson
- Dr Nir Sharon; Tel-Aviv University; November to December 2019; approximation; SUT; Nadezda Sukhorukova
- Ms Juhua Shi; Nanjing University of Science and Technology; 18 September 2018 to 17 September 2019; ANU; Xu-Jia Wang
- Dr Siti Ainor Mohd Yatim; Universiti Sains Malaysia; 7 February 2019 to 6 February 2020; numerical simulation and numerical analysis of ordinary and partial differential equations; USN; Peter Sehoon Kim
- Prof Alexey Slunyaev; 1 July to 31 August 2019; mathematical methods of soliton description in water with uneven bottom; USN; Anthony Henderson
- Dr Claude Viallet; 21 July to 24 August 2019; discrete integrable systems and algebraic entropy; USN; Anthony Henderson
- Dr Xianfeng Wang; Nankai University; 1 September 2018 to 31 August 2019; ANU; Ben Andrews
- Dr Xun Xie; Beijing Institute of Technology; 6 September 2018 to 31 August 2019; Kazhdan–Lusztig combinatorics; USN; Geordie Williamson
- Prof Tu Yundong; Guanghua School of Management; 18 July to 18 August 2019; functional coefficient regressions with nonstationary time series; USN; Qiyang Wang
- Dr Jingkui Zhang; Qingdao University of Technology; 30 March 2019 to 29 March 2020; ANU; Matthew Hole
-



The 2019 Alf van der Poorten Travelling Fellowship

The 2019 Alf van der Poorten Travelling Fellowship has been awarded to Dr Scott Lindstrom, currently at the Hong Kong Polytechnic University.

Lift-off Fellowships

Members are reminded of the Society's Lift-off Fellowships which provide short-term support, including living expenses and travel grants, for students who have recently submitted for examination a PhD thesis in the mathematical sciences.

The fellowship rules, application form and details of past fellowship holders can be found at <http://www.austms.org.au/Lift-Off+Fellowship+information>.

If you will soon complete a PhD, or have a student who will soon complete a PhD, please keep the scheme in mind.

AustMS Accreditation

The following members have been accredited as Fellows (FAustMS):

- Associate Professor Lesley Ward of the University of South Australia,
- Professor Christopher M. Kellett of the University of Newcastle.

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 his interest in mathematics. 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.

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Publications

The Journal of the Australian Mathematical Society

Editor: Professor George Willis
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The ANZIAM Journal

Editor: Professor Andrew Bassom
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Editor: Professor John Loxton
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The *Bulletin of the Australian Mathematical Society* aims at quick publication of original research in all branches of mathematics. Two volumes of three numbers are published annually.

The Australian Mathematical Society Lecture Series

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The lecture series is a series of books, published by Cambridge University Press, containing both research monographs and textbooks suitable for graduate and undergraduate students.

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