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NEWSLETTER

OF THE

NEW ZEALAND MATHEMATICAL SOCIETY

Contents

PUBLISHER'S NOTICE

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

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

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EDITORIAL

This issue marks the end of our first year as editors. Citing Mark Wilson's wise words in his final editorial "I doubt they fully realise yet what they have taken on, and hope that they receive plenty of assistance from the community", we realise now how demanding the job can be and we have had our ups and downs. The best part of the job is the support we are privileged to have from our vibrant community. We thank you all for this support. Please remember that we welcome any contributions and comments.

This year the Newsletter went into a full electronic format. We have not received any negative comments about this and one good outcome, among many, that we can mention is that the page limit for the contributions is more flexible now. So please, keep on sending us your ideas!

We want to highlight a couple of news items about our members. Hinke Osinga from the Department of Mathematics at the University of Auckland was made a Fellow of the Royal Society of New Zealand, the first female mathematician to receive this honour. Alastair Scott from the Department of Statistics at the University of Auckland received the Jones medal from the RSNZ. The Jones Medal is awarded biennially, for lifetime achievement in pure or applied mathematics or statistics by a person with substantial connections to New Zealand.

The Colloquium this year was held at Victoria University of Wellington. The Colloquium, our annual gathering of mathematicians of all stripes, was well-attended and a great success. The organising committee with Peter Donelan as convener are to be congratulated on a warm and friendly event with fascinating plenary talks. There was also a very high standard of contributed talks by new and more established researchers alike. Please see Astrid's PRESIDENT'S COLUMN for details of prizes awarded; we also include some photos of the event taken by Mark McGuinness and Chris Tuffley on page 27.

We look forward to improving the Newsletter next year and we want to wish all of you the best for 2017.

Miguel Moyers and Phil Wilson

PRESIDENT'S COLUMN

The column for this issue will be the President's Report for 2016.

President's Report, 2016
New Zealand Mathematical Society

This is an updated version of my report tabled at the Annual General Meeting in December 2016. It now includes grants awarded in the December Council meeting, Councillors elected at the AGM, and recipients of NZMS awards and Fellowships which were announced at the conference dinner.

This year's New Zealand Mathematics Colloquium was at the Victoria University of Wellington; the first Colloquium, 50 years ago in 1966, was also at VUW. It was a very successful conference, and I would like to thank the organisers at VUW for all the work involved with this.

I would like to congratulate David Gauld (University of Auckland) and Hinke Osinga (University of Auckland). David was named an officer of the New Zealand Order of Merit, for services to mathematics, in the 2016 New Year Honours List. Hinke was elected a Fellow of the Royal Society of New Zealand in 2016.

Membership

The current membership is 253, up from last year's 227. We have 64 student members. We welcome several new members this year.

Please encourage new colleagues and students to join our Society. The first year of membership is free. I thank John Shanks (University of Otago) for his long and continuing service as Membership Secretary.

Lecture tours

The Forder and Aitken lecture tours are reciprocal two-yearly exchanges between the London Mathematical Society and the NZMS, which usually occur in alternating years. Earlier this year, Julia Gog (University of Cambridge) toured as the Forder Lecturer. I am grateful to Mick Roberts (Massey University) who coordinated Julia's tour. Hinke Osinga has been selected to be the next Aitken Lecturer; her tour will take place in 2017.

The Maclaurin lecture tours are reciprocal two-yearly exchanges between the American Mathematical Society and the NZMS. Gaven Martin (Massey University) toured the US this October and November. Gaven spoke at the University of Texas at Austin, the University of Illinois at Urbana-Champaign, University of Wisconsin at Madison, Indiana University and Princeton University. He also gave an invited address at the AMS Fall Southeastern Sectional Meeting in Raleigh.

Ken Ono (Emory University) has been selected to be the 2017 Maclaurin Lecturer. His tour is planned for November of 2017. I am grateful to Shaun Cooper (Massey University) who will coordinate Ken's tour.

NZMS Council

Winston Sweatman (Massey University) stood down from Council. Vivien Kirk (University of Auckland) was elected Incoming President. Shaun Cooper and Emily Harvey (Market Economics) were re-elected to Council. Steven Marsland (Massey University) was elected to his first term on Council.

New Prize

The inaugural Kalman Prize for Best Paper was awarded at the Colloquium conference dinner (see below). The Prize was instituted this year to recognise excellence in research carried out by New Zealand mathematicians. The Prize will normally be awarded annually for an outstanding and innovative piece of research in the mathematical sciences published by a member or members of the NZMS. The Prize is for a single publication of original research, which may be an article, monograph or book, having appeared within the last 5 calendar years. The

value of the Prize is $5000. The Prize is generously funded by the Margaret and John Kalman Charitable Trust, and recognises the significant contributions to mathematics in New Zealand made by Professor John Kalman.

I thank Eamonn O'Brien (University of Auckland), Gaven Martin and Bernd Krauskopf (University of Auckland) for developing the proposal for this new prize and for negotiating it with the Margaret and John Kalman Charitable Trust.

NZMS Awards

Aitken Prize

The Aitken Prize is for the best contributed talk by a student at the Colloquium. The Prize was awarded to Naomi Gendler of the University of Auckland for the talk "Pulse Dynamics of Fibre Lasers with Saturable Absorbers".

Emma Greenbank (VUW), Barak Shani (University of Auckland) and Vee-Liem Saw (University of Otago) received honourable mentions.

Early-Career Award

The Early-Career Award was awarded to Alexander Melnikov (Massey University) for "highly original contributions to the theory of computability in algebra and topology".

Research Award

This was awarded jointly this year to:

- David Bryant (University of Otago) for "work developing mathematical, statistical and computational tools for evolutionary biology, and work drawing on evolutionary biology to develop new theories in mathematics".
- Bernd Krauskopf (University of Auckland) for "outstanding contributions to dynamical systems, especially bifurcation theory and its application to diverse physical phenomena".

NZMS Fellowships

Fellowships were awarded to Alona Ben-Tal (Massey University), Alex James (University of Canterbury), Vivien Kirk, Bernd Krauskopf, Carlo Laing (Massey University), Mark McGuinness (VUW) and Hinke Osinga.

Kalman Prize for Best Paper

The inaugural Kalman Prize for Best Paper was awarded to Gaven Martin (Massey University) for the journal article

- T. H. Marshall and G. J. Martin. Minimal co-volume hyperbolic lattices, II: Simple torsion in a Kleinian group. *Annals of Mathematics* **176** (2012), 261–301.

NZ Journal of Mathematics

The Journal is published by a joint committee of the New Zealand Mathematical Society and the Department of Mathematics of the University of Auckland. Gaven Martin stepped down as editor of the NZJM this year, and I thank him for his 18 years of service with the journal. Shaun Cooper has taken up the Editorship. The NZMS representatives on the managing committee of the journal are Winston Sweatman and Rob Goldblatt (VUW).

Funding

In 2016 we awarded student-travel grants to Seyedvahid Amirinezhad, Saeed Farjami, Michael Hackney, Yosafat Pangalela, Nemanja Poznanovic, Ilija Tolich, Danie van Wyk, Jurij Volcic, Cris Hasan, Valerie Chopovda (Gloria Olive Award) and Anggha Nugraha.

We provided a grant to Mathematics-in-Industry NZ (MINZ) towards student travel and accommodation costs. MINZ 2016 was held in July at VUW. Graeme Wake and Mark McGuiness (VUW) were the co-directors. Graeme Wake reported on this very successful event in the August Newsletter. MINZ 2017 will be held at Massey University (Palmerston North) 26-30 June, 2017.

We supported a Maths Craft Festival organised by Jeanette McLeod (University of Canterbury), Phil Wilson (University of Canterbury) and Julia Collins (University of Edinburgh). The Festival was held at the Auckland Museum, and featured eight craft creation stations and seven public lectures over a weekend in September. Nearly 2000 people attended. Julia Collins reported on the event in the August Newsletter.

We made a commitment to fund the accommodation costs for up to 5 students attending the Computability and Complexity Symposium. The Symposium will take place in early January of 2017 in Raumati.

We supported the New Zealand Maths and Stats Postgraduate Conference which took place in Queenstown 12–23 November in 2016.

From 2017 on we will contribute towards the cost of a speaker (or another approved activity) at the biannual conference of the New Zealand Association of Mathematics Teachers.

Newsletter

The Newsletter continues in its electronic form. I thank the new editors Miguel Moyers Gonzalez (University of Canterbury) and Phil Wilson (University of Canterbury).

Website

I thank Boris Baeumer (University of Otago) for his continuing service as webmaster for our website. Council has decided to no longer charge for job or PhD-position listings on our website, provided the request comes from a source appropriately affiliated with our community. The listings will be on our site under "Opportunities", and will be linked to from the homepage.

Acknowledgements

There are many people who contribute to the running of the NZMS, and I am grateful to them all. I thank the members of the Council for their efforts, especially Emily Harvey as Secretary, Bruce van Brunt (Massey University) as Treasurer and Winston Sweatman as Outgoing President. Winston steps down again from Council this year, and I thank him for his total of 10 years on Council so far.

Astrid an Huef

MATHEMATICAL MINIATURE

MM41: Wukacodes

I never actually met Timothy Swan but I knew him to be a reclusive eccentric who lived just along the road from me. Mrs Swan came to see me when Timothy died at the age of 53, because she had the idea that I had something to do with mathematics. Timothy had not been a good student and had left High School without any qualifications. All he liked doing was playing with numbers and equations which had nothing to do with what he should have been studying. He sometimes asked his teachers questions but the questions didn't really make sense. After he left school, he couldn't hold down any sort of job. He received a disability benefit and never left his mother's care until he died. His life became one of introspection and loneliness.

He left behind hundreds of notebooks and Mrs Swan wanted my advice as to what should be done with them. Did I want them? I accepted them, of course, but, after a cursory glance, I left them untouched for 30 years until I came back to them recently, This is an account of some items I have tried to understand from the notebooks.

First of all, from what I read, it seemed that Timothy had tried to re-educate himself and had started attending lectures at the University in a random sort of way. Then there had been a clampdown on unregistered students and he tried to lie low. But his face had already become known in the eclectic collection of departments that he had infiltrated. A Philosophy professor took pity on him and encouraged him all he could. Timothy, still quite young, asked the professor what the distributive law was and was rewarded with the address of a former Polish friend now working at University College, Dublin. This friend was supposed to know everything there was to know, not only about logic, but also about mathematics. The letter was wrongly addressed to Wukashevich, the closest Timothy could get to the sound of the name he had been given; but it must have arrived safely because he eventually received a reply. This was a single sheet of paper containing the line:

$$= \times x + y\,z + \times x\,y \times x\,z\,.$$

This was a challenge to me, as it must have been to Timothy, because there were many pages in the notebooks devoted to attempts to decode this line. But it may have been related to "Wukacodes", which featured in other notebooks. Wukacodes seem to be finite sequences of non-negative integers which can be combined by concatenation and which have a specific grammatical meaning. The length of a code is the number of members of the sequence and the weight of a code is the total of the integers which comprise it. If the weight, minus the length, is negative the code is said to be "forestial" and if it is forestial but no proper subcode is also forestial, it is "treeish". A code which is not forestial, is said to be "stumpy".

Some examples were given for treeish codes:

$$0, 10, 200, 110, 3000, 2010, 2100, 1200, 1110\,,$$

and I worked out for myself that there are 14 treeish codes with length 5.

In another notebook it is shown how the set of codes of a specific length can be reduced if some assumptions are made about adjacent treeish subcodes. Specifically $xy = yx$ if x and y are each treeish. In the examples of codes of length 4, 2010 and 2100 would then be the same code written a different way. Thus there are only 4 reduced codes of length 4.

There are some easy theorems such as "the product of two stumpy codes is also stumpy" but the notebooks generally are weak on formal results with carefully crafted proofs. This seems to be a characteristic of untrained, but gifted, amateur mathematicians.

At some time, Timothy Swan must have taken an interest in formal languages, such as those which can be characterised using Backus-Naur Form (or Backus Normal Form). Here is a fragment taken from one of the notebooks:

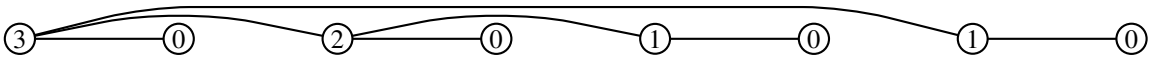
$$\texttt{<forest>}:= \quad \mid \texttt{<forest><tree>}$$

There must have been more but I couldn't find it. He seems to have attempted to use BNF to characterize treeish, forestial and stumpy Wukacodes but he must have realized that this was impossible and a more complicated grammar would be required.

Overleaf I pose some questions.

Questions

1. My story about Timothy Swan is partly fictional; but could there be some truth somewhere in it?
2. What is the real name of Wukashevich?
3. What was the meaning of the letter Timothy received?
4. What are the 14 treeish codes of length 5?
5. How many do these reduce to?
6. If the definition of <forest> were changed so that the number of <tree> is not allowed to be a multiple of 3, then how can this be expressed as a BNF grammar?
7. What sort of grammar would be required to identify treeish Wukacodes?
8. I have been trying to understand where words like treeish came from and the following diagram is the best I could do. Can anyone help me further?



J.C. Butcher

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CYBERMATH

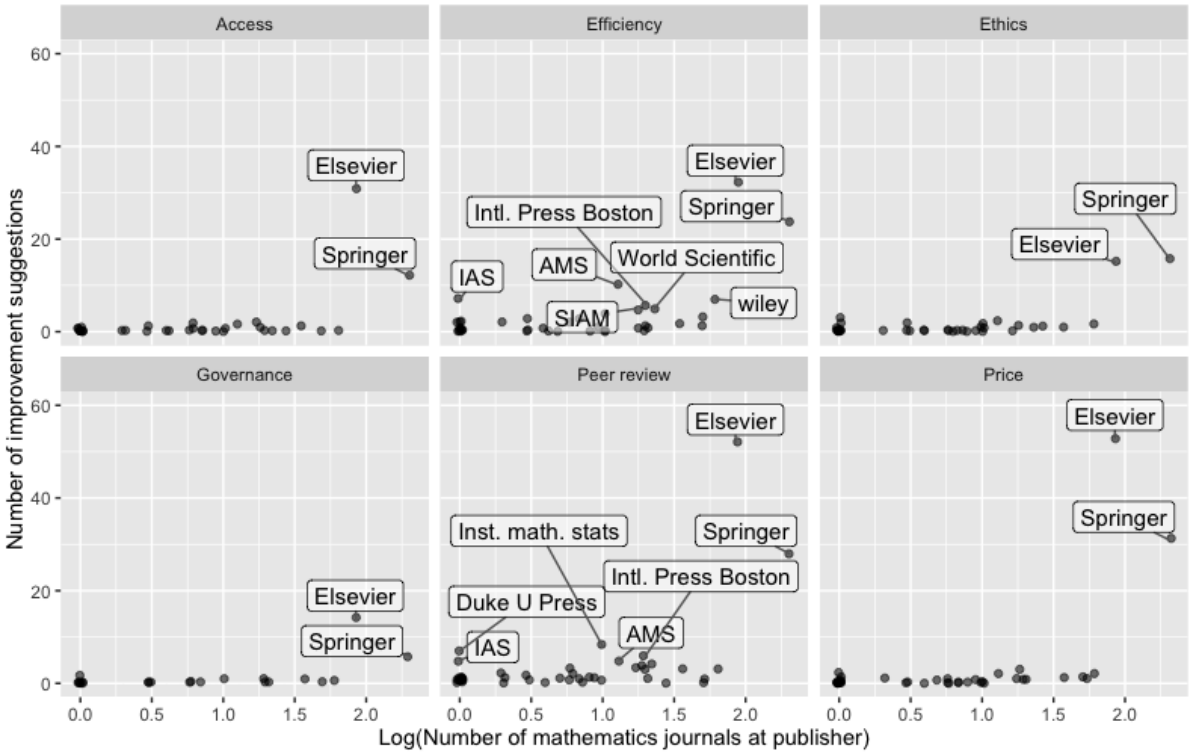


Figure 1: Number of suggestions per publisher, by category and portfolio size (small horizontal jitter added for clarity).

In the last issue I described preliminary results of an international online survey of mathematical opinion about journals. Here is a summary of the final results, obtained by reducing longer articles coauthored with Australians Cameron Neylon and David Roberts, which will appear soon in the European Mathematical Society Newsletter and Notices of the American Mathematical Society. Overall we interpret these results as showing that respondents are strongly in favour of change in the publishing system, but pessimistic about the support the efforts for such change would get from their colleagues. There is strong support for high(er) ethical standards and high quality peer review, and substantial support for rather radical changes to the way journals operate. These issues are also the subject of serious concerns raised in free-text answers. Editors and publishers should take note of these concerns, alongside the demand for greater transparency in editor selection and editorial processes. On several of these issues, editors' views diverge from that of the community, and this should be a subject of some concern. However, there is substantial agreement between editors and non-editors on many issues.

The survey cannot be taken as representing the general opinion of mathematicians, because we have no information about who responded — full anonymity was promised to participants. However we are confident that we reached a broad cross-section of the community. Of respondents, in the last three years 33% have acted as an editor for a mathematics journal, 93% have authored a paper and 86% have acted as referee. All data including a copy of the survey itself and raw and processed responses, and the code used for processing, is available at figshare.com/projects/Survey_of_mathematical_publishing/16944.

We closed the survey when it reached exactly 1000 responses, on 28 August 2016. Respondents self reported as PhD student (10.5%), postdoc (15.5%), tenure-track (7%), tenured (57%) and other (emeritus, librarian, etc) (10%). Geographical representation was dominated by Europe (54%) and North America (25%). Other respondents selected Oceania (11%), Asia (6%) and South America (4%) and Africa (0.5%) as locations.

On a five point scale from 1 being "the status-quo is completely acceptable" to 5 being "almost all [journals] need serious work", 78% of respondents selected 3, 4 or 5. Amongst respondents there is a strong desire for change. Free text answers describing the major perceived problems revealed serious concerns which suggest systemic issues: almost 200 journals from 57 publishers were mentioned by name as needing serious improvement. These ranged from journals at large commercial publishers and university presses to small Open Access journals that do not charge an Article Processing Charge (APC), over the whole spectrum of prestige. Of particular concern

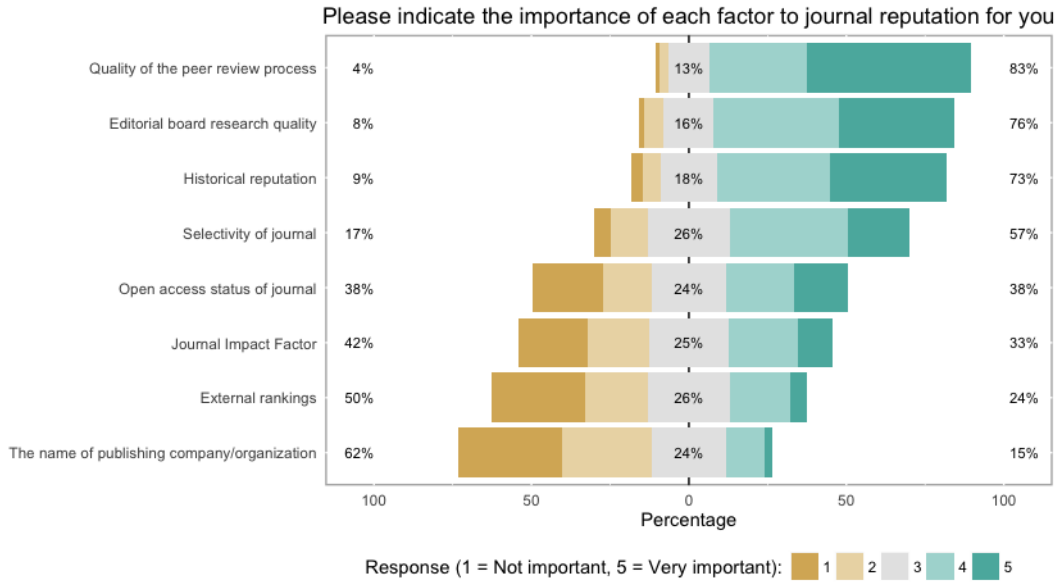


Figure 2: Stacked diverging bar chart of Likert scale responses.

is the number of respondents who had concerns with the quality of peer review. For example, 126 journals or publishers were named as being unsatisfactory in the time taken for refereeing or from acceptance to publication.

On this question those who had acted as editors did not differ substantially from those who had not. To protect anonymity, the survey did not ask which journals editors worked for, but with over 330 editors this sample must include many associated with traditionally run journals.

Figure 1 plots the suggestions for each publisher in each category, by the size of the mathematics journal portfolio (or rather, $\log_{10}$ of the number of mathematics journals, to account for the range of two orders of magnitude: 1–202 journals). Any publisher having at least five suggested journals is labelled. One would expect publishers with larger mathematics portfolios to garner more criticism, but there is essentially little trend among publishers excluding Elsevier and Springer. Even though Elsevier publishes less than half as many mathematics journals as Springer, its journals get more suggestions for improvements in all categories but one.

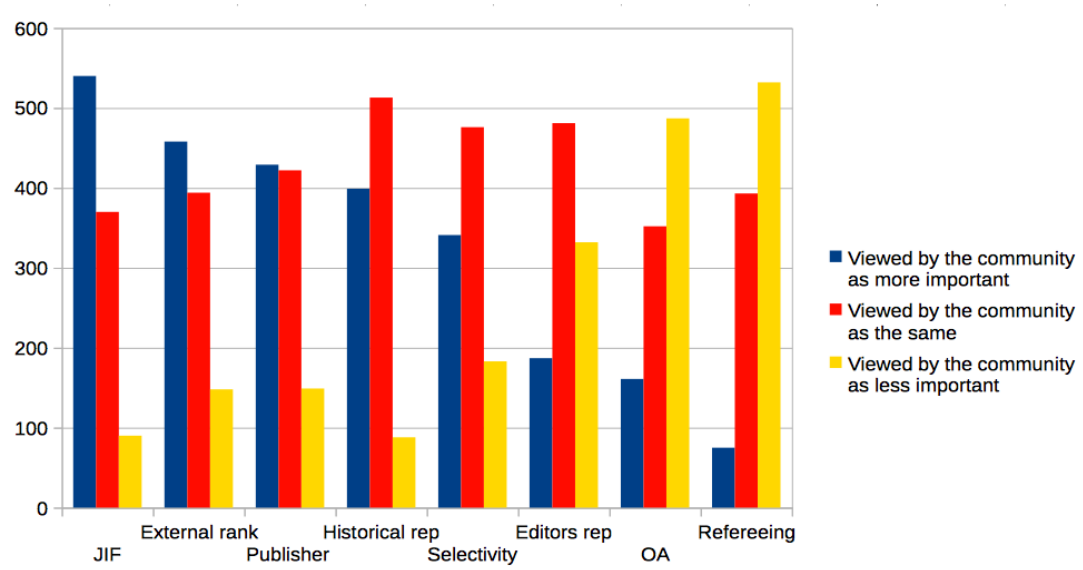


Figure 3: Respondents' beliefs about community opinion on issues.

In two sets of questions we asked respondents how important they thought specific aspects were for journal reputation, and how important they thought those same aspects were for the community's view of reputation.

Results are summarized in Figure 2. The most important factor for respondents was the quality of peer review (median rank 5). This was followed by the reputation of editors and historical reputation, and selectivity (median 4), then Journal Impact Factor (JIF), Open Access status and external rankings (median 3). The publisher had the lowest median ranking (2) with a mode of 1.

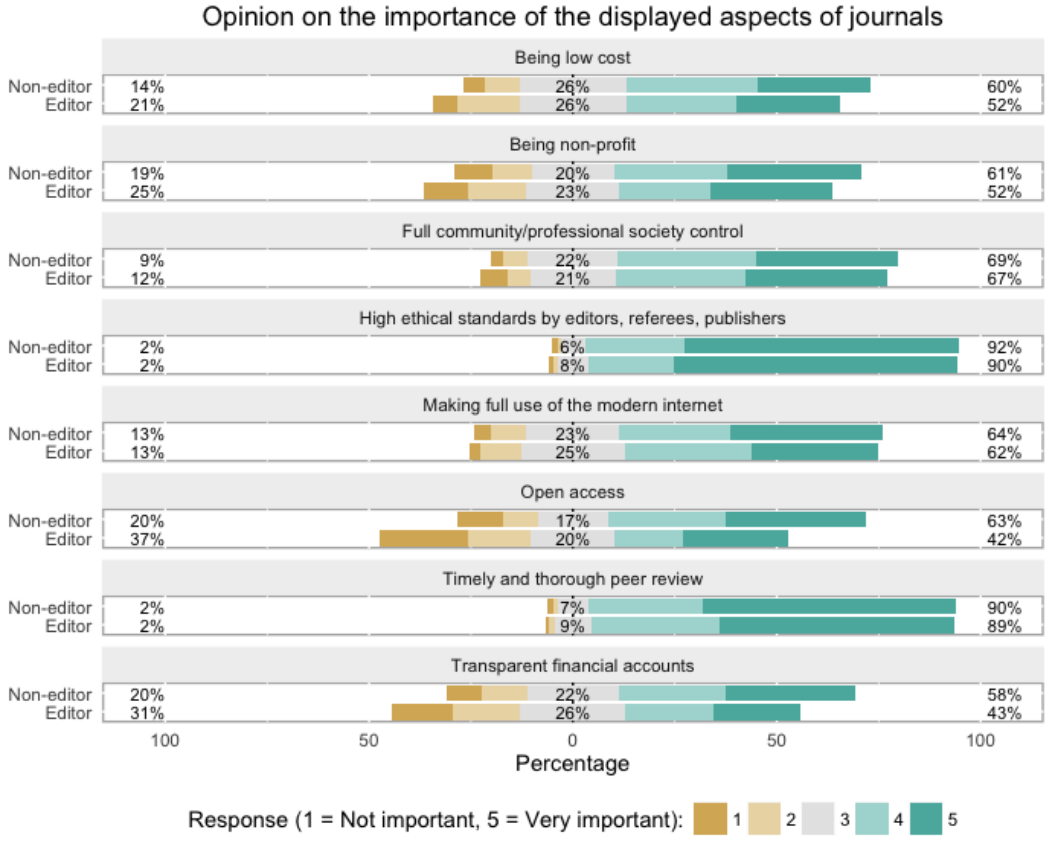


Figure 4: Importance of journal aspects: editors and non-editors

When we asked the respondents' assessment of the importance of these factors for the community's view, a striking pattern emerged, shown in Figure 3. For factors that might be considered as traditional markers of prestige (publisher, external rankings, JIF) respondents believe they matter more to the community than they do to themselves. That is, respondents tend to believe themselves less influenced by such "external" factors than the community. For other "traditional" markers (editors' reputation, historical reputation, degree of selectivity) this was less pronounced but the tendency is in the same direction.

When asked about Open Access, respondents implied strongly that it was more important to them than the community. Combined together this shows that our respondents believe their colleagues to be more influenced by traditional markers and less interested in OA than themselves. These differences matter. Change is risky. If mathematicians are pessimistic about their colleagues' desire for change, then working for change is much less appealing. It's one thing for the status quo to be supported by peer pressure, but it appears it may be supported by the *perception* of peer pressure.

Finally, the difference between personal and community views on the importance of the peer review process was both striking and disturbing. By a strong margin, most respondents view the quality of peer review as more important to themselves than they believe it is to the community. If this is true beyond our sample, it is concerning because it suggests that individuals do not see the community as a whole as driven by high standards. While this is potentially a result of sample bias, further investigation of this finding should be carried out.

In terms of new practices, almost a quarter of respondents supported open peer review as a default (with opt-out) and half supported post publication review with moderated comments and commenter identities revealed. Nearly half supported the publication of anonymous referee reports, suitably presented, to help readers. Free-form responses were also allowed, and of the 53 constructive suggestions made, 11 mentioned double-blind refereeing.

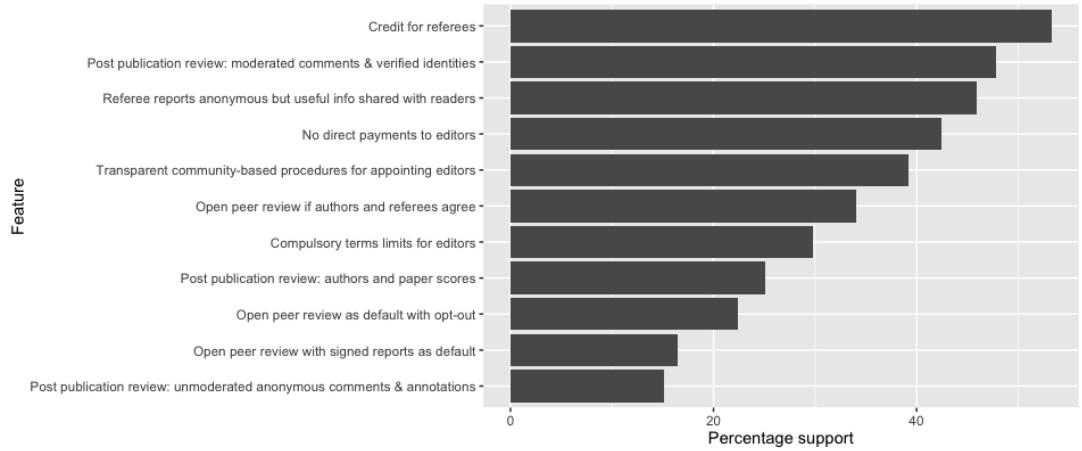


Figure 5: Support for new practices

Editors were clearly less favourable towards open review (26% vs 38%) and community election of editors (31% vs 43%) than non-editors. Interestingly, editors were slightly more supportive of banning monetary payments to editors (45% vs 41%) and of editor term limits (31% vs 29%).

When asked what should happen if efforts by editors to reform a journal are blocked by the publisher, over half of respondents favoured resigning to join a better journal (29%) or to create a new one (32%). Only a very small proportion (4.5%) favoured settling for the status quo. For this set of respondents at least, the appetite for change is there, and community support for bold moves by editors on behalf of the community is strong.

Mark C. Wilson

ORATION BY VAUGHAN JONES

Vaughan Jones was made an Honorary Doctor of the University of Rome Tor Vergata, on 30 June 2016. At the ceremony he delivered an oration on **Mathematics as slave and as master**, speaking in Italian for the introduction, but speaking in English for the rest of the oration.

Matematica, come serva e padrona

Sir Vaughan F. R. Jones, F.R.S.

Gentili Signore e Signori, illustre Rettore,

Vorrei dirvi quanto sia onorato nel ricevere questa laurea dall'Università di Roma Tor Vergata. Ho avuto una lunga connessione con questa università a causa della sua tradizione incredibilmente forte nella teoria algebrica dei campi quantistici, una disciplina che ho imparato a conoscere ed apprezzare sempre di più. È giusto dire che Tor Vergata è il centro mondiale di questo settore, non poco a causa della brillante scienza e della devozione al lavoro di Roberto Longo. Questo dipartimento è un tributo alla tradizione secolare nella matematica e nella fisica in Italia. È un enorme piacere essere qui con tutti voi in questa giornata e vorrei condividere con voi alcune mie riflessioni meno scientifiche sulla matematica. Per conservare l'integrità mentale di noi tutti, continuerò in inglese.

One of the most perplexing moments for the professional mathematician is when a lay person innocently asks a question like "What exactly is it that you do in your work". It would be downright rude, and certainly counter-productive for the image of the profession, to reply "Oh, you wouldn't understand." This is particularly acute on an airplane, where one may have this person as company for several hours. I am fortunate, or unfortunate (I'm not sure which) to have the option of answering the question with some basic ideas about knots in 3-dimensional space, and how my own work has impacted the mathematical theory. The fundamental question of when two knots are "the same" is quite intuitive, and not hard to communicate with a little handwaving or even a piece of string. But I have to say that after a long explanation of this, my interlocutor probably thinks I am a bit of a nutcase, albeit one who must be really good at tying his shoelaces .... Let's face it, when it comes to mathematics, the average, and even the way-above-average, person has learned at school to solve the quadratic equation, possibly even to sum a geometric series, but has certainly forgotten how to do either within a few years of his or her mathematical education. The concepts necessary to explain what most mathematical research is about — the Hilbert spaces, differential equations or smooth compact manifolds, are simply beyond comprehension without many many hours, even years, of study. Without this rigorous preparation, a person, obliged to think in terms that he or she understands, will inevitably think that mathematicians just do more and more complicated sums — adding and multiplying bigger and bigger numbers.

There is not much we mathematicians can do about that. In this talk I will try to communicate some of the infectious enthusiasm and obsessive thought patterns induced by mathematics, just by talking about more and more complicated sums. The title of the talk is "Mathematics as slave and as master" and we will see two instances of mathematics being put to very practical and repeated use — mathematics as slave — and in the same stroke how a little curiosity leads one to intensive reflection induced by the topic. So intensive that one is caught up in a web of obsessive thought from which there is no release until the problem is solved — mathematics as master.

Imagine you are an engineer in Egypt some five thousand years ago charged with constructing a pyramid on a square base. The corners must be extremely accurate right angles or the whole construction will be unsound. How do you obtain such accuracy? The edges of your square base might be 200 metres long, so it is not acceptable to try to extrapolate the precision of a right angle formed say by eye, but on a scale of a metre or so. The errors would be unacceptable. And of course you don't have any lasers or theodolites because you're living five thousand years ago. But a piece of abstract mathematics comes to the rescue. For it is known — Heaven knows how — that a triangle whose edges have lengths in the ratio 3:4:5 has a right angle. You may not have lasers but you certainly have rope, units of which can easily be measured to be of equal length. An engineer's dream. For the error in the right angle will be governed by the error in the equality of the units of rope length, which will only be as big as the errors in cutting or folding the rope. So the bigger the job the smaller the error! Perfect. So go ahead, make your 3:4:5 triangle out of rope and you have as perfect a right angle as you could ask for. Repeat the process on all corners and for all subsequent pyramids. Mathematics is the best of slaves.

But the inquisitive cannot help thinking "are there any other combinations of numbers which will do the job as 3:4:5 did?". We know that the key is the Pythagoras theorem that in a right-angled triangle the square on the

hypotenuse is the sum of the squares on the other two sides. Thus if we can find other triples of integers with the square of the third being the sum of the squares of the other two, we are in business. Any candidates? Consider 5,12 and 13: $5^2 + 12^2 = 25 + 144 = 169 = 13^2$. Works like a charm. But it is unlikely to be of any interest for pyramid-building: it is trumped in every way by 3:4:5. Less rope units, less error, less time to make. But it's intriguing, isnt it? Are there any more triples? Are there infinitely many triples? Is there a formula that gives all triples?

With five thousand years of hindsight it is easy to be smug about these questions and think of them as rather easy, but back then the simple manipulation of numbers was more clumsy, there was no algebra, the concept of a general solution would probably have been akin to magic. Each one of these Pythagorean triples would have been considered mystical, and possibly sects might have been formed devoted to the finding of more and more of them. Try 8, 15 and 17. Works! But you might not like the idea that 15 and 17 differ by 2 and not by 1, as in the other examples. Are there more examples without this property? The questions pile one on top of another and demand solution. And solution can be very very difficult. All of this without any practical application, since our original 3:4:5 remains the best. But we cannot help but ask the questions, mathematics has become the master; so completely that we may be unable to escape its grasp. A solution to one question just suggests another and so on, literally ad infinitum. Indeed mathematics has been a formidable slave-driver in this particular problem. Our modern mathematics has relegated the general solution of the Pythagorean triple to what we disparagingly call a "triviality", but this has not released us from servitude. For in the seventeenth century Fermat asked if there are any triples like 3,4,5 such that the sum of the *cubes* of the first two is the cube of the third: $a^3 + b^3 = c^3$. He rapidly, though extremely cleverly, appeased the maths gods by solving this one and showing that there are no such triples. But then how could he not ask if Pythagorean triples are the only game in town — perhaps for no other p is there a triple with $a^p + b^p = c^p$? Mathematics is in complete control here, for these higher powers are neither areas nor volumes, and so the question is utterly unrelated to pyramid-building or engineering. But irresistible to those of us of a mathematical bent. And now the slave-driver is pushing his slaves to the limit. It will be over three centuries of deep, deep thought before the maths gods are again appeased and Andrew Wiles proves "Fermat's last theorem", using the most advanced and abstract mathematical tools around.

Mathematics can also be kind to its slaves. The development of all that number theory to solve the likes of Fermat's last theorem gave us considerable control of many machinations of arithmetic. This control has yielded one major practical tool in communications and financial transactions: public-key cryptography. This was a whole new concept in the code/decode game. When you send a public-key message you broadcast to everyone exactly what procedure you used to encode that message (though not the message itself, of course). The idea is that this information is of no use to anyone trying to decode the message, unless they have some extra information. There are several methods that could be used for doing this, but the best-known is the RSA method which relies for its security on the hope that it is difficult to factor an integer into primes. Recall that a prime number is an integer that has no factors other than 1 and itself, and that any integer can be factored into a product of prime numbers in a unique way. In the RSA system a number is made public and used to encrypt messages. This number is a product of two rather large primes, call them p and q, each one being say 100 digits long. The product pq is then applied by RSA magic to the message (realised as a number) to produce another number, which is broadcast to the recipient, and anyone else who cares to listen. The trick is that decoding the message is easy (for a computer...), if one knows the individual numbers p and q, but not directly from pq. The only way to hack this is to factorize pq into its two primes. But this factor problem is thought to be very time-consuming: known methods would take an unreasonably long amount of time. But if the recipient knows p and q, then his computer will quickly decode the message. This is mathematics as slave. Some such method is of broad use in commercial transactions such as credit cards. Imagine how hard and how often the slave is working here, day in, day out all over the world. Much more than it was for our Egyptian engineer with his 3:4:5 triangle. You might say that we are getting our money's worth. But as in the Pythagorean triples case, mathematics wins in the end. For one cannot help but ask: "is it really true that factoring a number is an inherently hard problem?". And this problem is *really* hard! Unlike the Pythagorean triples and Fermat's last theorem, it remains unsolved in spite of huge effort of the obsessive kind. Mathematics has become master again! And it becomes more so with the advent of the quantum computer, a device which, *if* it can be built, will take advantage of some inherent multitasking in quantum mechanics to do some calculations much faster than a conventional computer. The quantum computer demands a new kind of mathematics. Remarkably, Peter Shor has shown that a quantum computer would be able to factorize a number so quickly that the RSA method would be hackable! The quantum computer used in this way would turn mathematics back into slave, but practical necessity and human curiosity would soon give rise to difficult questions whose answers would require yet again the slavish obsessive devotion, which will surely lead to another use of mathematics as slave. The slave-master cycle will continue as long as humans are around to think and need.

PROFILE

Felipe Voloch

José Felipe Voloch is a high-flying number theorist who grew up in Rio de Janeiros famed beach suburb, Copacabana. He has over 100 publications in refereed journals including the Annals of Mathematics and Inventiones Mathematicae documenting fundamental contributions to Arithmetic Algebraic Geometry as well as applications to Cryptography and Coding Theory. He has held continuing (tenured) positions in three countries, and all of this despite the fact that he is a university dropout.

It was while studying for university entrance exams that Felipe first developed a taste for mathematics, which until then had come easily to him but never stimulated much interest. He studied undergraduate mathematics at PUC (Pontifícia Universidade Católica) and, concurrently, began working towards a Masters degree at IMPA (The Instituto Nacional de Matemática Pura e Aplicada). He was awarded the Masters, but without ever completing his undergraduate degree. He went on to Cambridge, where he completed a certificate of advanced studies (Part III) and a PhD under J.W.S. Cassels.

His doctoral work concerned the number of solutions to polynomial equations over finite fields. The results, published jointly with Stöhr in the Proceedings of the London Mathematical Society, led to a new proof of the Riemann hypothesis for curves over finite fields and yield several improvements on it. It remains his most cited paper to date, still attracting several citations each year. The thesis itself was defended in 1985, outdoors on a sunny afternoon in Londons Hyde Park. Felipe and the examiners, Charles Matthews and Bryan Birch, had been attending a conference to honour Roth on the occasion of his 60th birthday, and Birch had insisted it was too nice a day to pass up the opportunity to be outside.

Following his PhD Felipe returned to Brazil, accepting a tenure track position at IMPA where he worked from 1985 1992. He was awarded tenure but due to the declining economic situation in Brazil, decided to explore his options. He spent most of 1991 on sabbatical at Berkeley, where he collaborated with Coleman to prove a conjecture of J-P. Serre concerning Galois representations associated to modular forms. In 1992, he joined the vibrant number theory group headed by John Tate at the University of Texas at Austin, where he was promoted to full Professor in 2000.

Since its inception Felipe has been an active participant in the MathOverflow community, which he says is addictive and takes up too much of his time. Nonetheless he is supportive of anything that expands the mathematical community and facilitates collaboration. (Ironically, one of Felipes most celebrated answers on MO is about the least collaborative mathematician Lucien Godeaux who has published 600+ papers with 0 coauthors.)

In February 2016 Felipe was appointed Professor of Mathematics at the University of Canterbury. While newly arrived as an immigrant, he has had an enduring relationship with NZ for decades through his wife Jane who is a kiwi. The two met while Felipe was at Cambridge and she was working for a publishing company in London. They were married in Christchurch in 1988 and they were here on 22 February 2011 when the earthquake struck. Together they have a daughter, Sofia, who has recently moved to Rio de Janeiro. While we may owe our good fortune of having Felipe in the NZ mathematical community to Jane, Felipe jokes that Texas open carry laws and the declining political situation in the US also contributed to his move. Apart from inexplicably wearing an Argentine Pumas jersey from time to time, he is happily adapting to the easy living in NZ.

Felipe describes a mathematical proof as merely a way of convincing your friends that something is true. This description evidences his collaborative spirit and belies the depth of his work. The New Zealand mathematical community will surely be enriched by his presence and it is a pleasure to welcome him as a colleague, a collaborator, and a friend.

Brendan Creutz

LOCAL NEWS

ANZIAM

Boris Baeumer who has been the Chair of the New Zealand Branch of ANZIAM for a term of three years stepped down from his role during the New Zealand Mathematical Society Colloquium. The Branch rules do not allow the Chair to serve consecutive terms. We would like to take this opportunity to thank Boris for his service.

The 53rd annual ANZIAM Conference will be held in Adelaide, South Australia, 5–9 February, 2017. Talks from all areas of applied mathematics are welcome. Early-bird registration closes on 16 December 2016 and abstract submission closes on 12 January 2017. For more details see: www.maths.adelaide.edu.au/anziam2017/.

More information on ANZIAM and the NZ branch can be found at www.anziam.org.au.

Alona Ben-Tal

AUCKLAND UNIVERSITY OF TECHNOLOGY

SCHOOL OF ENGINEERING, COMPUTER AND MATHEMATICAL SCIENCES

Events

The Joint NZSA+ORSNZ Conference was held at AUT between 27–30th November. The conference, which was chaired by Dr Sarah Marshall (Department of Mathematical Sciences) and Dr Priya Parmar (Department of Biostatistics and Epidemiology), welcomed over 200 delegates, primarily from NZ universities. The Sir Paul Reeves Building provided an excellent venue for the conference.

Highlights of the conference included the keynote sessions by Professor Di Cook (Monash University), Dr Michael O'Sullivan (University of Auckland), Dr Kevin Ross (Orion Health), Professor Rhema Vaithianathan (AUT), and Professor David Morton (Northwestern University), and a data journalism discussion panel featuring Harkanwal Singh (NZ Herald), Keith Ng (On Point), Lillian Grace (Figure NZ), Allan Lee (AUT lecturer in journalism), Di Cook (Monash University) and Professor Thomas Lumley (University of Auckland).

There were 115 contributed talks by academics, practitioners and students from New Zealand and abroad. On 1st December two post-conference workshops were held at AUT's city campus. Prof Di Cook ran a computer-based workshop and shared her expertise in the area of R and data visualisation with 18 participants. A Health Analytics Workshop, sponsored by Te Punaha Matatini and Precision Driven Health, was attended by approximately 50 delegates and provided an excellent networking opportunity for academics and practitioners, including several members of AUT's Data Science Research Group who participated in this workshop.

Group photo of participants of the NZSA+ORSNZ Conference.

On 1–2 December, the Mathematical Science Research Group (MSRG) is organizing the 2016 AUT Mathematical Sciences Symposium. This is a joint effort of Professors Jiling Cao and Jeffrey Hunter, with the assistance of Drs Kate Lee, Sarah Marshall and Wenjun Zhang. The Symposium focuses mainly on some areas in Applied Mathematics and Analytics/Statistics. This main purpose of this event is to develop and promote opportunities for AUT academic staff working on these areas to collaborate with colleagues from other universities.

Travel and Conference Participation

In August Dr Murray Black was invited by Deakin University to give an oral presentation at their NZ Winter School held at the Spencer on Byron Hotel in Takapuna. He shared his research on using Inquiry-Based designs in order to teach and assess mathematics. In September Dr Murray Black was invited to a Postgraduate study camp for ethnic AUT students held at Vaughan Park, Long Bay. He spent this time advising students on designing research projects coupled with probable mathematical and statistical analysis in their projects across a variety of contexts.

Professor Jeffrey Hunter attended the Royal Statistical Society 2016 International Conference held at the University of Manchester over the period 5-8 September. He participated in a Methods and Theory Session devoted to Markov chains and spoke on "The computation of Mean First Passage Times for Markov Chains".

In November Dr Hyuck Chung visited the School of Mechanical and Manufacturing Engineering at the University of New South Wales to continue collaboration

with Associate Professor Nicole Kessissoglou. Dr Fabien Montiel of Otago University also joined to work on research article on acoustical scattering and active cloaking of an array of obstacles. This research is a continuation of their previous paper on acoustical scattering by an array of resonant cylinders that create stopband in sound wave transmission. This collaboration brings an engineering expertise of Nicole and mathematical technique by Fabien and Hyuck together to find an efficient and accurate computation method to analyse sound field in and around an array of obstacles. During the visit, some preliminary work on active cloaking of cylinder and resonant cylinder were completed. For now two journal papers are planned from this research collaboration.

Wenjun Zhang

UNIVERSITY OF AUCKLAND

DEPARTMENT OF ENGINEERING SCIENCE

Awards

A/Prof Iain Anderson has been awarded the Pickering Medal by the Royal Society of New Zealand, which recognises excellence and innovation in the practical application of technology leading to significant recognition and influence both in NZ and overseas. Iain leads the Biomimetics Laboratory, and his research has lead to important developments with regards the ability to combine electric charge with soft polymer materials, to mimic muscle action that includes force, movement and sensing of stretch. In 2012, Iain together with graduate students Todd Gisby and Ben OBrien launched StretchSense, a company that has received much acclaim both nationally and internationally for its advancements in wearable technology. The citation reads: "To Iain Alexander Anderson for the development and commercialisation of applications for electroactive polymer technology". This recognition comes after his award of the Uniservices Commercialisation Medal last year. More details can be found at www.auckland.ac.nz/en/about/news-events-and-notices/news/news-2016/11/pickering-medal--new-technology-that-mimics-nature.html.

Dr Andrea Raith received Marsden funding in the latest round to support her research into integration of problem decomposition to address issues of complexity in Multiobjective Optimisation Problems. Andrea is well known for her work in this area, and its application to problems ranging from transport modelling to more effective strategies for radiotherapy treatment. More details can be found at www.auckland.ac.nz/en/about/news-events-and-notices/news/news-2016/11/university-of-auckland-engineering-marsden-funding-1-point-7-million.html.

Other News

Dr Andreas W. Kempa-Liehr has been appointed as Senior Lecturer in computational analytics/operations research. Andreas graduated 2004 from the Institute of Applied Physics at the University of Münster with his thesis on Dissipative Solitons in Reaction Diffusion Systems, which has been published in the Springer Series of Synergetics. After graduation he joined the work group of Prof Honerkamp at the University of Freiburg and started heading the service group Scientific Information Processing at the Freiburg Material Research Center. In 2009, Andreas switched to industry as a professional analyst with Energie Baden-Württemberg AG and senior data scientist with the predictive analytics company Blue Yonder GmbH.

Dr Colin Simpson also joins the Department from 1st December in the role of Professional Teaching Fellow, to continue the excellent work undertaken by Dr Jon Pearce who leaves the Department for pastures new at the end of November after 7 years with us.

New graduate student Kazem Abbaszadeh has recently begun his PhD with Dr Golbon Zakeri. His research will be looking at the analytics of agile and resilient manufacturing through large demand response. The aim is to use diagnostic and descriptive analytics to model and build software that could be used to respond optimally to volatilities in the input and output processes in New Zealand (large) manufacturing. He will start by building models for intensive users of electricity in the manufacturing sector to respond to electricity scarcity through demand response; this sector consumes about 35% of electricity in New Zealand.

Richard Clarke

DEPARTMENT OF MATHEMATICS

John Butcher was an Invited Speaker at the International Conference on Numerical Analysis and Applied Mathematics, which was held (in his honour) at Rhodes in September. After the conference he visited Zürich and gave a colloquium lecture to the Seminar für Angewandte Mathematik at the ETHZ. In August, the third edition of John's renowned book **Numerical Methods For Ordinary Differential Equations** was published by Wiley. He has a contract with Springer to write a book on B-Series: Algebraic Analysis of Numerical Methods.

Marston Conder has been on study and research leave for the second semester of 2016, and has travelled extensively, to work with colleagues and to give lectures, including invited lectures at the European

Congress of Mathematicians in Berlin (July), the "Escola de Algebra" in Brazil (August), and the International Workshop on Combinatorial & Computational Aspects of Optimization, Topology and Algebra in Mexico (December). In May he solved a 54 year-old problem when he answered a 1962 question of Zappa, by showing (somewhat surprisingly) that a non-trivial coset of a Sylow p-subgroup of a finite group can contain only elements whose orders are powers of p. Also while in Brazil, he answered a 1982 question of Sidki about the finiteness of groups in an infinite class related to Carmichael's 1923 presentation for the alternating groups. Marston will hold a workshop on Symmetries of Surfaces, Maps and Dessins, at the Banff International Research Station (BIRS), Canada, in September 2017; and he will hold a workshop on Symmetries of Graphs and Networks, at the Tsinghua Sanya International Mathematics Forum, Sanya, Hainan, China, in January 2018.

Pedram Hekmati (from IMPA, Rio de Janeiro) has been appointed as a Senior Lecturer.

Steven Galbraith delivered his Inaugural Lecture on "Pythagoras to Turing to Snowden", and he was interviewed about that on the Radio NZ show "Nine to Noon".

Vaughan Jones was made an Honorary Doctor of the University of Rome Tor Vergata on June 30. He delivered an Oration on **Mathematics as slave and as master**, which is printed on page 13 of this *Newsletter*.

Bernd Krauskopf and Hinke Osinga were invited to attend and speak at the Annual Meeting of the Japan Society for Industrial and Applied Mathematics. Their visit is part of an initiative to deepen the links between JSIAM and ANZIAM.

Hinke Osinga has become the first woman mathematician to be elected as a Fellow of the Royal Society of New Zealand. That honour is richly-deserved. She was interviewed on Radio NZ National on November 17, and that interview is now available through a permanent on-line link, at www.radionz.co.nz/national/programmes/ninetonoon/audio/201824228/royal-society-fellow-hinke-osinga-on-maths-and-crochet.

Kathy Luedge from TU Berlin will be in our Department for the period from October 2016 to August 2017 as a senior Humboldt Fellow, to work with Bernd Krauskopf and Neil Broderick (Physics Department) on nonlinear laser dynamics.

Tobias Rossmann (from Bielefeld University) is now a post-Doctoral Research Fellow.

Our recent colleague Dimitri Leemans will hold a workshop on Symmetries of Discrete Structures in Geometry, at the Banff International Research Station (BIRS) in Oaxaca, Mexico, in August 2017.

Members of this Department gained four standard Marsden research grants, as follows.

Marston Conder, Jianbei An & Eamonn O'Brien: Symmetry, group structure, algorithms and representations, awarded $500,000.

Rod Gover: Geometric structures critical for analysis and physical theories, awarded $525,000.

Steven Galbraith & Giovanni Russello (Computer Science): Advanced mathematical and cryptographical tools for software protection, awarded $590,000.

Hinke Osinga & Bernd Krauskopf: Invariant manifolds and their interactions: understanding the geometry of dynamics, awarded $590,000.

Two colleagues were awarded Faculty Research Development Fund grants, as follows.

Sione Ma'u: Pluripotential theory, algebraic geometry and probability, awarded $26,000.

Shayne Waldon: Useful redundancies — the construction of SICs, awarded $28,000.

And a University of Auckland Learning Enhancement Grant was awarded to Paddy Bartlett, Julia Novak & Igor' Kontorovich for their project on Supporting Extramural Communities in Mathematics, in support of our MAX programme.

Recent visitors include: Nina Bindel (TU Darmstadt), Craig Costello (Microsoft Research), Dr Mathieu Desroches (INRIA), Dr Martin Doležal (Czech Academy of Sciences), Valentina Grazian (U21 Scholar, University of Birmingham), Dr Andy Hammerlindl (Kalman Visiting Fellow, Monash University), Prof. Edward Huang, National Cheng Kung University (Taiwan), Prof. Tim Lenton (University of Exeter), Dr Teemu Luostari (University of Eastern Finland), Jeroen Pijnenburg (Eindhoven), Dr Julia Traverso (Technische Universität Darmstadt), Dr Fre Vercauteren (KU Leuven, Belgium), Prof. Andrew Waldron (UC-Davis), Dr Carsten Wolters (Universität Münster) and Prof. Valentin Zagrebnov (Université d'Aix–Marseille).

Garry J. Tee

DEPARTMENT OF STATISTICS

Celebrating George Seber

On October 19, staff got together to celebrate 50 years since *George Seber* published a paper in Biometrika that is now widely regarded as one of the founding papers of capture-recapture methodology. Capture-recapture has grown into a major research discipline, and has been the focus of over 8,500 articles, as indexed by Web of Science, since George's groundbreaking paper. A special issue of Statistical Science (2016) commemorates the 50th anniversary, including an interview with George Seber which outlines his life

and work — and what makes the famous Seber brain tick ("I need counselling for my compulsive writing"). See bit.ly/2dWCBhu.

New postdocs

Dr Irene Zeng, who did her PhD in experimental design and analysis for proteomics with the department, has just started in a post-doctoral role with Prof Thomas Lumley, who was her PhD supervisor. As Thomas puts it, "I've been working in genomics for years, but only with DNA data. I thought it would be useful and interesting to learn more about all the other sorts of high-dimensional biological measurements that are available now, and think about how to analyse the data. I applied for a grant for us to work together on how to analyse the effects of other measurements on the intermediate steps of gene expression and protein abundance, and through to more familiar biological characteristics. As part of the project, we plan to produce software and to work with other Auckland researchers to plan future experiments." The role is funded by a Faculty Research Development Funding grant.

Dr Binyamin Oz from Israel started a three-year position as a Postdoctoral Research Fellow, working with Prof Ilze Ziedins, in July. He gained his PhD, the topic strategic behaviour in queues, from the Department of Statistics and the Federmann Center for the Study of Rationality at the Hebrew University of Jerusalem.

Student successes

Chanadta Somchit and *Yu (Jackie) Liu* have successfully defended their PhD theses. *Daisy Shepherd* was awarded second prize in the UoA Faculty of Science Postgraduate Poster Competition in September. This is the second year in a row that a Statistics PhD student has landed a prize in the competition. *Alex Stuteley* presented at the Australasian Vital Statistics Interest Group Workshop on November 22, just days after presenting his honours dissertation. He and supervisor, Andrew Sporle, have created a tool, currently in live beta format, that can be used by anybody to calculate, compare and graph age-standardised rates using existing microdata or count data.

Statistics Teachers' Day

The theme for this year's Statistics Teachers' Day, held on November 25 at the Epsom campus, was "Data, data, everywhere." More than 300 teachers attended to be inspired and find how out about their peers' tips and tricks to engage students in statistical thinking.

The plenary speaker was *Di Cook*, Professor of Business Analytics in the Department of Econometrics and Business Statistics at Monash University, Australia. Prof Cook talked about the role of open data, open source software and data visualisation in developing "quantitative citizenship". As she says, "In this technological age we are drowning in data. Good data visualisation helps us to swim, digest the data, and learn about our world."

Statistics graduates return for Alumni Showcase

What did statistics have to do with this year's spectacular discovery of gravitational waves? How does statistics help us eradicate pests like possums, rats and stoats? And how can you wrangle a representative sample out of social networks?

These were just three of the questions posed — and answered — by Department of Statistics academics who presented their research at the first joint Alumni Showcase, a collaboration by the Statistics, Mathematics and Computer Science departments. It took place on Saturday 15 October in the new Science building at the University's City Campus. The day aimed to strengthen links with graduates by presenting seven short talks on current research, information stands, guided tours of the computer history museum, and a lunch over which graduates had the opportunity to renew relationships with their former lecturers and forge new connections.

Read full story here www.stat.auckland.ac.nz/en/about/news-and-events-5/news/news-2016/2016/10/graduates-return-for-alumni-showcase-2016.html, and enjoy photos from the day on the Department of Statistics' Facebook page at www.facebook.com/statsak/photos/?tab=album&album_id=1217394211653284.

Documenting the impact of hunting in the Amazon

Just how much damage did hunting for hides do to wild animal populations in the Brazilian Amazon in the 20th century? Conservation expert *Associate Professor Rachel Fewster* is one of a team that has used previously unpublished shipping records about wild animal hide exports from the region to estimate how hunting affected animal population survival rates.

The team's research was published in mid-October in the open-access journal Science Advances (advances.sciencemag.org/content/2/10/e1600936), and concludes that water-dwellers like giant river otters, black caiman and manatees suffered population collapse and local extinction. In contrast, land animals including collared peccaries, deer and even jaguars lived in areas less accessible to hunters. This helped their populations remain resilient, even when the international fashion trade was demanding hides in the 1930s and 1940s and again in the 1960s.

Read the full story here: www.stat.auckland.ac.nz/en/about/news-and-events-5/news/news-2016/2016/10/documenting-the-impact-of-hunting.html.

Protecting indigenous data

Senior research fellow *Andrew Sporle* was among Māori academics who represented New Zealand at the first international meeting to focus on indigenous control of data about native peoples.

Mr Sporle (Rangitāne, Ngāti Apa, Te Rārawa) joined three other Māori researchers at the Indigenous Open Data Summit on October 5 in Madrid, Spain. The summit provided a forum to discuss what action was being taken to protect the use of data about indigenous peoples. It preceded the 4th Annual International Open Data Conference (IODC) in the city on October 6 and 7.

Mr Sporle says that indigenous data sovereignty is the right of a native people to govern the collection, ownership and application of its own data, and derives from tribes' inherent right to govern their people, lands and resources.

In a world of open data, he adds, indigenous peoples are becoming increasingly concerned about who owns and represents statistics about indigenous people, who has access to the data, its cultural integrity, and how people's privacy and autonomy is protected. Read the full story at www.stat.auckland.ac.nz/en/about/news-and-events-5/news/news-2016/2016/10/protecting-indigenous-data.html.

Rapid eradication assessment tool developed

Researchers from the University of Auckland Department of Statistics and School of Biological Sciences have developed a new online tool for rapidly confirming when pests have been successfully eradicated from an area, in association with Landcare Research and Mexican partners GECI (Grupo de Ecologa y Conservacin de Islas). Users input basic population dynamic parameters for the pest species, such as how far individuals can move, how likely they are to be detected, and what level of effort will be put in to monitoring. The software calculates how likely it is pests have been eradicated from the area if none are detected.

Study collaborator *Dr James Russell* says, "With new bold visions to eradicate introduced predators from the entirety of New Zealand by 2050, and all of its offshore islands along the way, managers need cutting-edge scientific tools to enable them to confirm eradication as quickly as possible so they can move on to the next project".

Read the full story at www.sbs.auckland.ac.nz/en/about/news-and-events/news/news-2016/08/rapid-eradication-assessment-tool-developed.html.

R — the ultimate virus

R will be no stranger to anyone reading this — but did you know that its creators thought, way back in the beginning, that it would never be used outside the University of Auckland? There's an entertaining story about R's very modest beginnings here: www.ingenio-magazine.com/r-the-ultimate-virus/.

Visitors

Barbara McKnight, Professor of Biostatistics at the University of Washington, Seattle is visiting. Her research interests include statistical methods in animal carcinogenicity testing, epidemiology, and genetic epidemiology, and she has collaborated on studies of diabetes, cancer, traumatic injury and cardiovascular disease.

Sander Greenland, Professor of Epidemiology and Statistics at the University of California, Los Angeles, visited in September, thanks to a Distinguished Visitor Award obtained by Andrew Sporle and Thomas Lumley.

Steffen Klaere & Julie Middleton

UNIVERSITY OF WAIKATO

DEPARTMENT OF MATHEMATICS AND STATISTICS

Yuri Litvinenko promoted

We have been very happy to learn Yuri has been promoted to associate professor. He has a PhD in Physics from the University of New Hampshire (USA) where he worked before joining the academic staff at the University of Waikato in 2008. Yuri's research interests lie in the fields of solar activity, cosmic-ray acceleration and transport, and plasma astrophysics. He has worked closely with Ian Craig, who retired recently - see the August 2016 *Newsletter*.

Associate Professor Yuri Litvinenko.

Yoonsuh Jung

Yoonsuh Jung, a Senior Lecturer in Statistics, will be leaving us next February. He has been a staff member here since about mid-year of 2013. He will be taking up a position at Korea University in Seoul, the city where he grew up. We thank him for his contributions to the Department and University and wish him well in his new position.

Machine Learning conference

The CMS faculty hosted a very successful 8th Asian Conference on Machine Learning at Waikato in November. Bob Durant was program chair. There were 93 attendees with some from as far afield as the US, Europe and Scandinavia as well as the Pacific Rim, and feedback from attendees on both the program and organization has been very positive. An ACML record of 141 papers were submitted with 34 accepted for publication in the proceedings/journal special issue and for presentation at the conference. The proceedings are published at jmlr.org/proceedings/papers/v63. There was a lively program of workshops, tutorials and invited talks — the latter from John Shawe-Taylor (University College London) and Vincent Tseng (National Chiao Tung University); Tie-Yan Liu (Microsoft Research Asia, Beijing), Albert Bifet (Telecom ParisTech) and Aish Fenton (Netflix, California).

Bob Durant wearing the conference T-shirt.

New masters degree

The University has received CUAP approval to offer a new degree called the Master of Security and Crime Science. The degree includes a compulsory statistics paper as well as elective papers in statistics and cryptography, taught by Mathematics. Staff will be located on the second floor of G-building, one floor below Mathematics and Statistics — the dark side is moving closer!

Comings and goings

Among movements of quite a few members of the Maths and Stats Department, Tim Stokes is off to the Aust. Math. Soc. Annual Conference at ANU in early December and will give a contributed talk "Constellations: rethinking composition of functions", a development of his earlier paper "Constellations: Arrows Without Targets." given at la Trobe earlier this year. Cecilia Flori has returned from Nelson with a great desire to go back to the South Island. Nick Cavenagh is off to Rome to spend three weeks learning Italian, with not a scrabble board in sight!

Kevin Broughan

INSTITUTE OF NATURAL AND MATHEMATICAL SCIENCES

Congratulations to Frederick Lam who was the overall winner of the "Lecturer of the Year" awarded by the Albany Students' Association. Frederick has been teaching at Albany since 2004 and is a Senior Tutor in Mathematics. Other mathematics staff that were nominated for the award this year are Alona Ben-Tal, Annalisa Conversano, Robert McKibbin, Shaun Cooper, Winston Sweatman and Victor Yeh.

Carlo Laing has been promoted to Professor and Sasha Melnikov has been promoted to Senior Lecturer.

In November, Alona Ben-Tal, Robert McKibbin, Mick Roberts and Graeme Wake attended the Asia Pacific Consortium of Mathematics for Industry Forum "Math-for-Industry" 2016 at QUT in Brisbane. The Massey invited talks delivered were Alona Ben-Tal: Modelling the physiological effects of Nasal High Flow. Mick Roberts: Biodiversity and the ecology of emerging infectious diseases.

Alona Ben-Tal was a plenary speaker at the first joint meeting ANZIAM-ZAPA (Australian and New Zealand Industrial and Applied Mathematics - Zhejiang Applied Mathematics Association), Hangzhou, China, 11–14 November, where she presented a talk entitled: Mathematical modelling of the cardio-respiratory system: challenges and opportunities.

Dr Maja Elstad, from the University of Oslo, Norway, is currently visiting our institute. Maja holds a PhD in cardiovascular physiology, a medical degree and two-years of mathematical studies. She will visit us for three months to collaborate with Alona Ben-Tal on a mathematical model of blood flow and respiratory sinus arrhythmia (a change in heart rate at the frequency of breathing).

Shaun Cooper

VICTORIA UNIVERSITY OF WELLINGTON

SCHOOL OF MATHEMATICS AND STATISTICS

It has been a busy and successful year for the School. After hosting the NZ Mathematics in Industry Study Group mid-year we are now (as your correspondent writes) gearing up for the NZ Mathematics Colloquium. The committee has been working hard to juggle timetable demands, prepare the book of abstracts and make sure everything is geared up for a successful meeting. It would not have been possible without the energy and experience of our school manager Ginny Whatarau (and if anything goes wrong it definitely won't be her fault). The very first colloquium was also held at Victoria 50 years ago. Graeme Wake and John Butcher both attended — perhaps others among us?

Research funding is a perennial issue. The Marsden Fund provides large amounts of funding for universities and the lucky few researchers who receive a grant. Colleagues in the School were successful on three grants, two of them in statistics (Ivy Liu and Richard Arnold for a project on 'Dimension reduction for mixed type multivariate data', Estate Khmaladze for 'Theory of distribution-free tests for statistical hypothesis and unitary operators in functional space') while Rod Downey picked up his seventh Marsden as PI for 'The mathematics of computation'. Soon after this announcement we also heard that Pete Smith in the Statistics group was awarded a James Cook Fellowship (this School's fourth) for research on millimetre wave communication systems.

The downside is that there are so many outstanding projects that simply dont get funded under the present Marsden structure. I think the mathematics community needs to continue to remind the powers that be that the returns from offering, say, five $100k grants as opposed to one $500k grant would be significantly greater, at least in the mathematical sciences. It is worth remembering that the James Cook Fellowships only provide around $100k per year, yet free up an academic to undertake full-time research for the period of tenure.

Members of the mathematical logic group have also been recipients of significant awards. Recently arrived post-doctoral fellow, Rutger Kuyper, has been awarded the Stieltjes Prize for 2015, which recognises the best PhD in Mathematics in the Netherlands. Rutger was awarded the prize for his thesis entitled Computability, Probability and Logic, which examines the interplay between these three subfields of mathematics. His thesis consists of three parts: computability and logic, algorithmic randomness and how logical reasoning can be combined with intuitive probabilistic reasoning. He completed his PhD at the Radboud University Nijmegen under the supervision of Dr Sebastiaan Terwijn. Dr Kuypers thesis committee included Victoria's Professor Rod Downey with whom he is now working.

Meanwhile, Rod himself is the recipient of a Research Award of the Alexander von Humboldt Foundation in Germany. This is in recognition of his research accomplishments in computability, complexity and randomness. The Award is valued at 60,000 Euro. Rod will be visiting Germany for some time during 2017 to continue collaborations he has there under the terms of the award. A number of these awards are given each year across a range of disciplines. Past awardees in mathematics include four Fields Medallists and illustrious names such as Anosov, Kobayashi, Langlands, Mandelbrot and Milnor. The list also includes Victoria alumnus and benefactor Shayle Searle who was Professor of Biological Statistics at Cornell University from 1965–1996.

Adam Day, Hung Pham and Nokuthaba Sibanda have all been promoted to Senior Lecturer. Adam's research on randomness and computability has led to solutions and new approaches to fundamental problems, especially relating to the real numbers and their constructible hierarchy that forms the core of his current Marsden Fast Start project with Andrew Marks at UCLA. His research was recognised by the NZMS Early Career Award in 2015. Hung's research concerns a wide range of problems in Banach algebras and associated structures, and which regularly appears in leading journals. He has discovered solutions to long-standing open problems and his work has been recognised by a number of invitations to speak at international conferences in analysis. Nokuthaba researches across a range of applications of statistics, extending methodology in areas such as health, epidemiology, language diversity and the environment. Currently she is pursuing new research directions in fisheries statistics and leads a NIWA-funded research project.

Rob Goldblatt reports on his recent travels: "In August I was an invited plenary speaker at Logic Colloquium 2016, the annual summer meeting of the Association for Symbolic Logic, held in Leeds. Later I gave a talk at University College London, and then presented a paper at the conference Advances in Modal Logic in Budapest. In October I spent three weeks in Taiwan as the Wendy Huang Visiting Fellow at the National Taiwan University in Taipei. I gave a series of lectures to the Philosophy Department, and was also a keynote speaker at a joint conference of the Asian Workshop on Philosophical Logic and the Taiwan Philosophical Logic Colloquium. In addition I gave a talk at the National Chung Cheng University in the city of Chiayi."

Mark McGuinness has been asked to address U3A, the University of the Third Age, on what applied mathematics means to him. They heard about Mark's work from somebody who was at his talk to a Zonta meet-

ing in Parliament earlier this year. Mark went to the ANZIAM-ZPAMS joint meeting in Hangzhou in November, and spoke about modelling steaming Surtseyan ejecta. Prof Zongben Xu, a member of the Chinese Academy of Sciences, spoke about Big Data and drew a big audience. As well as being busy with preparations for the colloquium, Mark is a plenary speaker at the AUT Mathematical Sciences Symposium early in December.

The School's involvement in Victoria's actuarial science programme continues to be successful. Interim Programme Director, John Haywood, attended the NZ Society of Actuaries conference in Tauranga where alumna and Advisory Board member Andrea Gluyas was appointed the Society's President, the first woman to hold that position. Programmes such as this provide a clearer avenue to a career though it remains the case that students who excel in mathematics readily find their way into rewarding careers, including as actuaries, without the specialist vocational training. À chacun ses goûts.

Visitors and seminars

Former students Emily Mason and Kylie Maxwell gave an interesting insight into a relatively new world of work, one that will increasingly attract mathematics and statistics graduates, in their talk 'Changing the world with numbers — being part of a social investment analytics team'. Professor Nathalie Deruelle visited Matt Visser and gave a fascinating and intriguingly titled seminar 'Thermodynamics of hairy black holes'. Dr Zacharias Anastassi from Qatar University visited Dimitrios Mitsotakis and gave a seminar 'Fitted Linear Multistep Methods for the Solution of Periodic Differential Equations'. It was also a pleasure to host Dr Lisa Clark from Otago who gave a seminar entitled 'Two abstract supermodels: groupoids and Steinberg algebras'. The School's research colloquium series, featuring our own as speakers, has recently included talks by Dimitrios Mitsotakis, George Barmpalias, Peter Smith and David Balduzzi.

Peter Donelan

UNIVERSITY OF CANTERBURY

SCHOOL OF MATHEMATICS AND STATISTICS

Congratulations to *Clemency Montelle* on her promotion to Associate Professor and to *Rick Beatson* on his promotion to Professor.

Congratulations to *Hannes Diener* on two counts. First, Hannes has been successful on a large international grant. The project CID (computing with infinite data) is under the EU scheme H2020-MSCA-RISE-2016. The application Hannes was involved in is currently in the formal negotiation phase. The grant money is to be spent on visits of researchers from 12 EU institutions to eight non-EU institutions, one of which is our School. The project will hopefully attract RSNZ counter-funding for research visits from our side to EU partners.

Second, Hannes received a 2016 College of Engineering Teaching Development Grant. The project the award is for is to further develop a system of web-based lecture notes. These notes don't just look clean and modern they can also, automatically, transform into slides. The main advantage for the lecturer is that this ensures that both notes and slides are updated at the same time. Writing the source is no harder than writing LaTeX files. Being web-based, one can easily include interactive elements. There are still many rough edges to be smoothed, and many features that should be implemented during the project (the possibility to take notes, interactive plots, improved printing, live polling/feedback, etc.).

In November the University of Canterbury conferred the rare honour of the title Canterbury Distinguished Professor to Emeritus Professor and world renowned mathematician *Roy Kerr*, (former Head of Department). Canterbury Distinguished Professor is the highest academic title that can be awarded by the University Council and has been conferred only twice before in the University's 143-year history. Title recipients are Nobel Prize winners or equivalent, such as the Crafoord Prize, which Roy received in May this year. The new appointment makes Roy the only Canterbury Distinguished Professor in New Zealand.

In September *Raaz Sainudiin* resigned after more than nine years in the School. Raaz has taken up a position as Data Science Consultant at webintrinsics.

In October *Brendan Creutz*, who had been on fixed-term contract, was appointed to a continuing position in the School. Brendan had a busy few weeks. He and *Felipe Voloch* organised the Second NZ Number Theory Workshop, which has held at the University of Canterbury on October 27th 2016. It follows the First NZ Number Theory Workshop held at the University of Auckland in April this year. The four speakers were David Harvey (UNSW), Byoung Du Kim (VUW), Barak Shani (UofA), Yan Bo Ti (UofA); see www.math.canterbury.ac.nz/~f.voloch/meeting.html for abstracts. The workshop concluded with a problem session.

In November Brendan and his wife Nika welcomed their first son, Ian Mindaugas, to the world. Well done Brendan.

The Optimization and Statistics in Data Science Workshop was held at the University of Canterbury on Tuesday 22 November. Six fantastic speakers presented their work and explained the research challenges arising in this new data science era. The speakers

were Thomas Lumley (Statistics, University of Auckland), Golbon Zakeri (Engineering Sciences, University of Auckland), Tim Robinson (Statistics, University of Wyoming), Miriam Hodge (Statistics, Lincoln University), Blair Robertson (Mathematics and Statistics, University of Canterbury) and Kourosh Neshatian (Computer Science, University of Canterbury); see www.math.canterbury.ac.nz/~r.tappenden/Workshop/ for abstracts. The workshop brought together nearly 50 participants from a wide range of backgrounds, including mathematics and statistics, biological sciences, forestry, electrical engineering, computer science and ecology. *Rachael Tappenden, Blair Robertson* and *Marco Reale*, organized the workshop, and they gratefully acknowledge enthusiasm and financial support from the School of Mathematics and Statistics and the College of Engineering at the University of Canterbury.

Abstracts of PhD theses

Paul Joseph Cordue, University of Canterbury

Supervisors: Charles Semple, Mike Steel, Simone Linz (University of Auckland)

Date: October 2016

Title: **Phylogenetic Networks that Display a Tree Twice**

In the study of phylogenetics, which is the study of how forms of life evolve and relate to each other, there is great scope for mathematics to get involved. One such study of phylogenetics that currently employs mathematics is the study of phylogenetic networks and phylogenetic trees. Phylogenetic networks and trees can be used to represent how life evolved with the former having the ability to represent biological processes such as hybridization, horizontal gene transfer, and gene recombination. In terms of mathematics, one sees phylogenetic networks and trees as directed graphs. A phylogenetic network N displays a rooted phylogenetic tree T if all of the ancestral history inferred by T is also inferred by N. The main result of this thesis is a quartic-time, in terms of the number of leaves in the network, algorithm that decides whether or not a given phylogenetic network displays a tree twice. As a consequence of the work leading to the main result, a class of phylogenetic networks is discovered such that there is a quadratic-time, in terms of the number of leaves in the network, algorithm for counting the number of distinct trees displayed by a given network in the class. These results are interesting because it has been shown that in general counting the number of trees displayed by a given phylogenetic network is #P-complete. Thus the main result of this thesis opens the door to insights regarding a computationally hard problem.

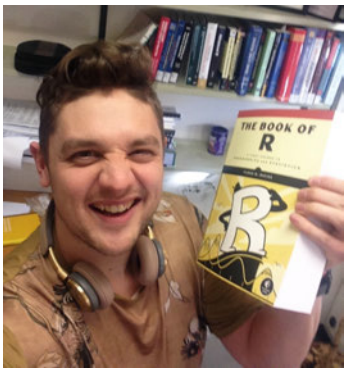
Günter Steinke

UNIVERSITY OF OTAGO

DEPARTMENT OF MATHEMATICS AND STATISTICS

Congratulations to *Richard Barker* for two major achievements. Firstly, he was recognised as an emerging talent in governance with the 2016 Emerging Director Award from the Institute of Directors (IoD) Otago Southland Branch. Richard chairs the boards of the Hopkins Farming Group Ltd and Dinsdale Ltd, and he is a director of Oritain Global Ltd. Secondly, after Richard was the Mathematics & Statistics Head of Department from 2008 to early 2016, he has now been appointed as the new Sciences Pro Vice Chancellor, and from 2017 he will lead the Division.

Tilman Davies has published "The book of R — A first course in programming and statistics". The review by the digital magazine Computerworld says: "Extremely well written with excellent explanations and examples, this book fully accomplishes the goal of providing the reader with both the programming and statistical skills required to become proficient with this language. I am nothing short of amazed at the consistent quality and clarity of the text and the utility of the exercises." Very well done, Tilman.



T and R.

Our Administrative Assistant *Marguerite Hunter* has received one of the 2016 Disability Information and Support's Appreciation Awards, "for providing exceptional support and guidance to staff and students". Congratulations, Marguerite, on the well-deserved recognition of your excellent work.

Visitors

David Robertson (University of Newcastle, Australia) visited for two weeks in November. He was working on topological full groups together with *Lisa Orloff Clark*.

Abstracts of PhD theses

Monika Balvočiūtė, University of Otago

Supervisors: David Bryant and Andreas Spillner

Date: 2016

Title: **Flat embeddings of genetic and distance data**

The idea of displaying data in the plane is very attractive in many different fields of research. This thesis will focus on distance-based phylogenetics and multidimensional scaling (MDS). Both types of method can be viewed as a high-dimensional data reduction to pairwise distances and visualization of the data based on these distances. The difference between phylogenetics and multidimensional scaling is that the first one aims at finding a network or a tree structure that fits the distances, whereas MDS does not fix any structure and objects are simply placed in a low-dimensional space so that distances in the solution fit distances in the input as good as possible.

Chapter 1 provides an introduction to the phylogenetics and multidimensional scaling. Chapter 2 focuses on the theoretical background of flat split systems (planar split networks). We prove equivalences between flat split systems, planar split networks and loop-free acyclic oriented matroids of rank three. The latter is a convenient mathematical structure that we used to design the algorithm for computing planar split networks that is described in Chapter 3. We base our approach on the well established agglomerative algorithms Neighbor-Joining and Neighbor-Net. In Chapter 4 we introduce multidimensional scaling and propose a new method for computing MDS plots that is based on the agglomerative approach and spring embeddings. Chapter 5 presents several case studies that we use to compare both of our methods and some classical agglomerative approaches in the distance-based phylogenetics.

Peter Green, University of Otago

Supervisor: David Fletcher

Date: 2016

Title: **Towards a fast Bayesian climate reconstruction**

To understand global climate prior to the availability of widespread instrumental data, we need to reconstruct temperatures using natural proxies such as tree rings. For reconstructions of a temperature field with multiple proxies, the currently preferred method is RegEM (Schneider, 2001). However,this method has problems with speed, convergence, and interpretation. In this thesis we show how one variant of RegEM can be replaced by the monotone EM algorithm (Liu, 1999). This method is much faster, especially in suitably designed pseudoproxy simulation experiments. Multi-proxy reconstructions can be large, with thousands of variables and millions of parameters. We describe how monotone EM can be implemented efficiently for problems on this scale.

RegEM has been interpreted in a Bayesian context as a multivariate normal model with an inverse Wishart prior. We extend this interpretation, noting the empirical Bayesian aspects, the implications of the prior for the variance loss problem, and using posterior predictive checks for model criticism. The Bayesian interpretation leads us to suggest a novel prior. Simulated reconstructions with this prior show promising performance against the usual prior, particularly in terms of low sensitivity to the tuning parameter.

Christopher Zane Stevens, University of Otago

Supervisor: Jörg Frauendiener

Date: 2016

Title: **The numerical initial boundary value problem for the generalised conformal field equations in general relativity**

The purpose of this work is to develop for the first time a general framework for the Initial Boundary Value Problem (IBVP) of the Generalised Conformal Field Equations (GCFE). At present the only investigation toward obtaining such a framework was given in the mid 90's by Friedrich at an analytical level and is only valid for Anti-de Sitter space-time. There have so far been no numerical explorations into the validity of building such a framework.

The GCFE system is derived in the space-spinor formalism and Newman and Penrose's eth-calculus is imposed to obtain proper spin-weighted equations. These are then rigorously tested both analytically and numerically to confirm their correctness. The global structure of the Schwarzschild, Schwarzschild-de Sitter and Schwarzschild-Anti-de Sitter space-times are numerically reproduced from an IVP and for the first time, numerical simulations that incorporate both the singularity and the conformal boundary are presented.

A framework for the IBVP is then given, where the boundaries are chosen as arbitrary time-like conformal geodesics and where the constraints propagate on (at least) the numerical level. The full generality of the framework is verified numerically for gravitational perturbations of Minkowski and Schwarzschild space-times. A spin-frame adapted to the geometry of future null infinity is developed and the expressions for the Bondi-mass and the Bondi-time given by Penrose and Rindler are generalised. The Bondi-mass is found to equate to the Schwarzschild-mass for the standard Schwarzschild space-time and the famous Bondi-Sachs mass loss is reproduced for the gravitationally perturbed case.

Jörg Hennig


NZ Mathematical Society
51st Colloquium 2016
The School of Mathematics & Statistics
Te Kura Mātai Tatauranga
Victoria
Freedom
Constraints
and border

REPORTS ON EVENTS

7th Conference on Non-Classical Logic: Theory and Applications

I wish to thank the New Zealand Mathematical Society for their financial support of my attendance at the 7th conference on Non-Classical Logic: Theory and Applications in Poland in September 2015. The conference was organised by Department of Logic at Nicolaus Copernicus University, Toruń, Poland.

Speaking about Toruń, it is a small city in Poland, and even, they do not have a public airport (they do have military airport though). Also, as you already might know, there are only few people in there who can speak English. It would be helpful if I could speak Polish, Germany, or even Russian. In spite of those facts, Toruń is a very beautiful city to visit. It is one of the oldest city in Poland, surrounded by Vistula River and also some old castles. It is also the birthplace of Polish astronomer Mikołaj Kopernik (it is Nicolaus Copernicus if you cannot guess!) and also very famous for its gingerbread (I went to the underground "museum" to learn how to make it, but sorry I cannot share the ingredient here as we had to take an oath not to share it!).

For the conference itself, it is a very good one and filled by some strong and famous logicians (Poland has a worldwide reputation for its strength in logic). The conference brought together around forty participants. Less than a quarter of our number came from countries outside of Europe, and I was the only participant from New Zealand. The small number of participants made the conference more focused and enable us to have more intense discussion. In there, I talked about my research on paraconsistent mathematics (i.e. contradictions in mathematics and my proposed solution for it). The fact that it was only me who talked about this subject made some people got interested in it and asked some insightful questions. We had a further discussion during the dinner and I met this two people (Ben Martin from UCL in UK and Roberto Ciuni from Padua, Italy) who were interested in reading more of my writings, and even we are still in contact until now. I also learnt some new things from other participants' talks and they deepened my knowledge in logic itself.

To sum it up, I am really grateful for the support I got from the Society. It made me able to attend that conference and benefited very much from it (not just for my current research, but also for my future career).

Anggha Nugraha (University of Canterbury)

2016 Summer School in Discrete Mathematics

Earlier this year, I attended the UP Famnit PhD Summer School in Discrete Mathematics located in Rogla, Slovenia, from June 26 to July 2. The summer school was held at Hotel Planja, Rogla which is situated at around 1500m above sea level.

This year the summer school consisted of two minicourses. The first was on 'Regular Polytopes and Almost Simple Groups' and was given by Dimitri Leemans (University of Auckland, New Zealand), and the second was on 'The Structure of Vertex-Stabilizers in Vertex Transitive Graphs' and was given by Pablo Spiga (University of Milano-Bicocca, Italy). Both courses were very interesting and were well presented. There were also daily tutorials which gave students the opportunity to engage with the material presented, by working on some problems.

Students were also invited to present talks at the summer school and there were some great talks covering various areas of discrete mathematics. I gave a talk on 'The Arc-Types of Calyey Graphs' in which I discussed the main results of my MSc thesis (submitted about a week prior to my arriving in Slovenia). Most of the speakers were affiliated with European universities, however there were also people like myself who had travelled across the world to be there. I was the only student from New Zealand to attend.

The conference organisers did a great job of organising and encouraging social events. There were planned sporting activities most nights as well as daily meals which were provided by the hotel. There was also a wide variety of things to do around the mountain and the conference location showed off the beautiful Slovenian countryside. I went on a number of walks and was happy to enjoy the nice summer weather. The conference dinner was extremely festive and included a live band which played into the small hours of the morning. I had the pleasure of meeting many good people from all over the world during my stay at Rogla.

I also had the opportunity to talk to a number of people about my Masters thesis and my research. I am still in contact with several people about potential PhD study at various universities.

Overall, attending the summer school was a great opportunity for me as it gave me the chance to present my work and meet many great people. I also took a lot away from the two minicourses and had a great time in

Slovenia. I would like to thank my MSc supervisor Marston Conder, as well as Jianbei An and Eamonn O'Brien for the generous financial support I received for my travel. I would also like to thank the NZMS for further financial support. I hope I have the opportunity to attend another summer school at Rolga in the future.

Nemanja Poznanovic

Canadian Operator Symposium

In June of 2016 I attended the Canadian Operator Symposium in Montreal with the aid of an NZMS travel grant. I greatly enjoyed my time at this conference and the opportunity to meet other mathematicians working in Operator algebras and functional analysis.

I presented work from my PHD thesis on the 'C*-algebras generated by semigroups of partial isometries'. This work is a generalisation of Nica's work on semigroups of isometries. This talk was well received and during the questions I received several helpful suggestions and comments about potential new avenues to continue my project.

The conference imposed a 10 minute limit on invited talks in order to squeeze everyone in. While it was good to see every talk, I feel that the conference would have benefited from having multiple streams of speakers and thus allowing each presenter more time. I enjoyed the challenge of presenting in the 10 minute time slot. This was the first time I had had to condense my research down to such a short speaking slot and I found it was a very useful exercise to distil the talk down to its essentials.

Two new research connections I made were with Nadia Larsen and with Charles Starling, both of these researchers presented on work that relates to my own. Larsen presented on C*-algebras generated by LCM semigroups which is another generalisation of Nica's work. This introduction to an alternate generalisation has led me to a new area of research, trying to apply my own results in the context of LCM semigroups which I will pursue after my thesis and current projects are complete.

The second, Charles Starling presented on C*-algebras generated by inverse semigroups of which C*-algebras generated by partial isometries are a special case. I had several useful conversations with him over the course of the conference and hope to be able to communicate with him further over the coming months. While I am not yet sure of the applications to my own work, these conversations gave me a new lens with which to view my work.

All in all I found this was an excellent opportunity to meet with fellow researchers in my field and to see a broad overview of all the work that is going on in Operator algebras.

Ilija Tolich (University of Otago)

DIMACS Workshop on Cryptography and its Interactions

With the help of the New Zealand Mathematical Society I was able to attend DIMACS Workshop on Cryptography and its Interactions: Learning Theory, Coding Theory, and Data Structures which took place in Rutgers University on July 11–13, 2016. The subjects of the workshop are in the heart of my research, and therefore it was important for me to attend. The workshop was very fruitful, and besides of being exposed to new areas of research and how my work interacts with other areas, I was also able to meet well-known researchers in my field.

I gave a talk on the first day of the workshop about a recent paper our group in the University of Auckland wrote. The talk's title is "Applications and Limitations of the SFT Algorithm", and as the title suggests we addressed some applications, as well as limitations, of the Sparse Fourier Transform (SFT), focused on cryptography. The latter is a very strong tool that allows to recover the "strong" frequencies of a function in polynomial time. This tool comes from Learning Theory, and has been shown to be applicable in Cryptography and to Coding Theory.

I received a good feedback on my talk, and had a few discussions on my work with some researchers during the workshop. The SFT algorithm in its modern state, along with its interaction to cryptography, is the main topic of a recent PhD thesis of a scholar who attended my talk. I was very happy to present our analysis and results to her. We had a fruitful conversation after my talk. Moreover, I made some good connections with a few researchers in USA, and they suggested me to keep in touch for a potential post-doctoral position. I thank the New Zealand Mathematical Society for giving me this opportunity.

Barak Shani (University of Auckland)

The perfume of kinematics in Grasse

"Such a nice place is France." I do apologise since the starting sentence does not sound academic at all, but I really like France!

Although the conference was about kinematics of robotic mechanisms and it might be seen a bit irrelevant to mathematics at the first glance, but it was deeply connected to mathematical ideas and approaches. It is not unfair if I say that the fundamental of kinematics, which can be interpreted as geometry of motion, has been always being established on mathematics and some mathematical theories like algebraic geometry, Lie groups and Lie algebra, and Singularity theory.

In that conference, I presented my initial research that I had done in about first nine months of my PhD studies. It was about kinematic singularities of geared mechanisms. Presenting this research at the high-level conference like Advances in robot Kinematics (ARK) where almost all leading researchers in the field of kinematics gather biennially, helped me as a PhD student to achieve two successes.

Although it is always kind of concern when you are going to give a talk, it was much worse for me before going to this conference. I remember, for example, the first academic talk that I gave when I was doing my Master's degree was absolutely a terrible emotional condition. I was full of stress for nearly a week just because I was going to give a talk for 15 minutes! However, after giving a talk at the ARK, I achieved a high level of self-confident by which I can now give a talk really fluently and smoothly without any deadly stress.

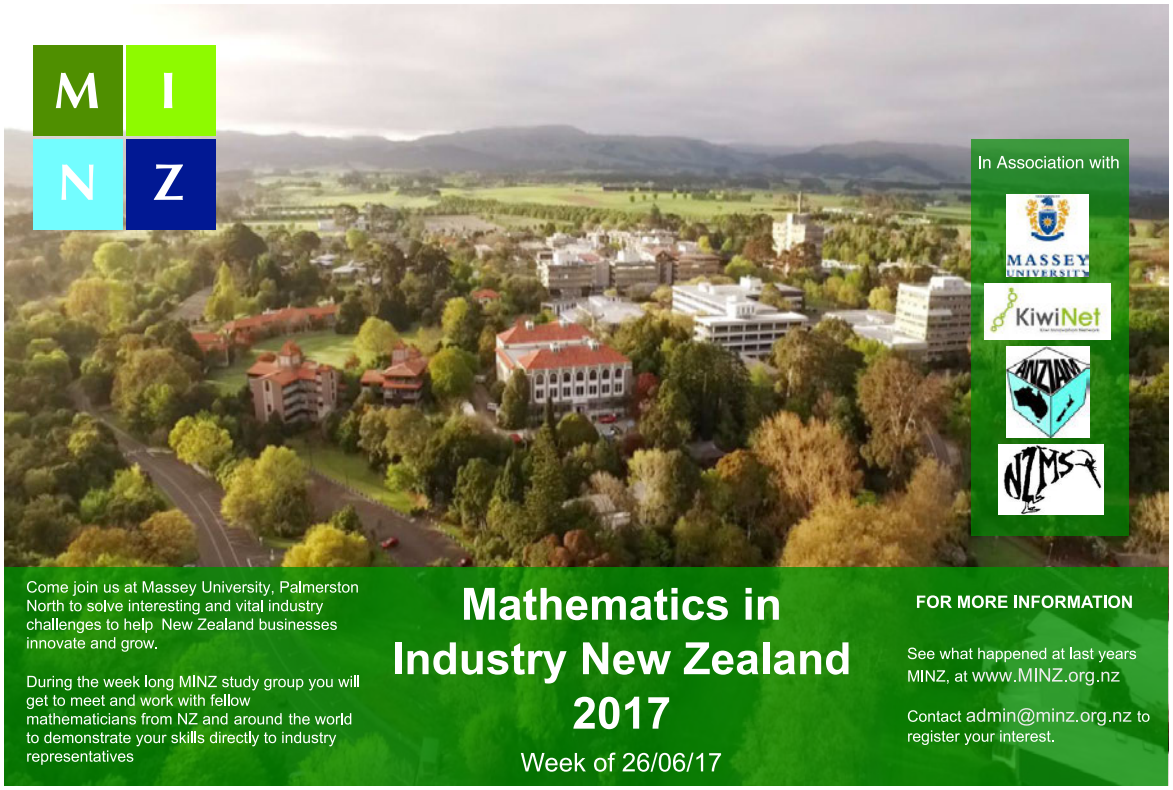
I made some strong connections with some well-known researchers and a great friendship network with some other PhD students attending the ARK from around the globe. I should mention Andreas Müller, who is one of the pioneering researchers in the field of mechanism kinematics, as an example among others. We had a couple of conversations for hours during the program. He gave me a lot of invaluable hints and ideas which really helped me to look for the research pathway in more efficient way.

Furthermore, after coming back to New Zealand and consulting with Peter Donelan, who is my current primary supervisor, we asked Andreas to help and advise me regarding any relevant questions or difficulties and fortunately he accepted it. Thus, I am nowadays in contact with him in a regular basis. So, about each month we have a Skype meeting in which I present my research progress to him and he provide me with some useful comments and feedbacks.

S.Vahid (Hamed) Amirinezhad (Victoria University of Wellington)

GENERAL NOTICES

Mathematics in Industry New Zealand (MINZ) 2017



Graeme Wake

The Prime Minister's Science Teacher Prize

I am involved with this prestigious annual award. There was an impressive field across all the sciences and in 2016 mathematical sciences was added. But sadly, there were no candidates from mathematics and statistics. Please publicise the award and encourage nominations of relevant people.

About the prize.

- This prize will be awarded to a permanently appointed registered teacher who is teaching science[1] to school-age children (in a primary, intermediate or a secondary New Zealand registered school) and who has been in the same role for at least 12 months prior to their nomination.
- The Prime Minister's Science Teacher Prize is worth $150,000. The recipient will receive $50,000 with no expectations and the recipient's school will receive $100,000 to use for the development of science.
- Nominations close in September 2017.

Graeme Wake

[1]Taken to include teaching relevant to any of the science, technology, mathematics, pūtaiao, hangarau or pāngarau learning areas of the New Zealand curriculum.

New & Notable Titles from SIAM

MATLAB Guide, *Third Edition*

Desmond J. Higham and Nicholas J. Higham

This third edition of *MATLAB Guide* completely revises and updates the best-selling second edition and is more than 30 percent longer. The book remains a lively, concise introduction to the most popular and important features of MATLAB® and the Symbolic Math Toolbox. Key features include a tutorial in Chapter 1 that gives a hands-on overview of MATLAB, a thorough treatment of MATLAB mathematics, and a web page that provides example program files, updates, and links to MATLAB resources.

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SIAM Member $43.40 • Order Code OT150

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"For years, my only system for training students to LaTeX has been to hand them a copy of Learning LaTeX *and to tell them to start writing. This has worked without fail for dozens of students. I never would have thought it possible, but the new edition is a substantial improvement with the additional coverage of BiBTeX, Beamer, and posters.* Learning LaTeX *should be handed to new graduate students in mathematical sciences along with their office key and ID card."*

— Don Estep, Colorado State University

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SIAM Member $20.30 • OT148

Data Assimilation: *Methods, Algorithms, and Applications*

Mark Asch, Marc Bocquet, Maëlle Nodet

Fundamentals of Algorithms 11

This book places data assimilation into the broader context of inverse problems and the theory, methods, and algorithms that are used for their solution. Readers will find a comprehensive guide that is accessible to nonexperts and the latest methods for advanced data assimilation, combining variational and statistical approaches.

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978-1-611974-53-9 • List $84.00
SIAM Member $58.80 • FA11

Dynamic Mode Decomposition: *Data-Driven Modeling of Complex Systems*

J. Nathan Kutz, Steven L. Brunton, Bingni W. Brunton, Joshua L. Proctor

The recently developed dynamic mode decomposition (DMD) is an innovative tool for integrating data with dynamical systems theory. It has deep connections with traditional dynamical systems theory and many recent innovations in compressed sensing and machine learning. This is the first book to address the DMD algorithm and it presents a pedagogical and comprehensive approach to all aspects of DMD currently developed or under development.

2016 • xvi + 234 pages • Softcover
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