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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 Marie Graff and Chris Stevens. 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 marie.graff@auckland.ac.nz and/or to chris.stevens@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

Kia ora koutou

This is the end of 2022 and we survived once again another challenging year. Congratulations to everyone! We also think of our colleagues at AUT facing redundancy and we wish that the situation will be resolved with a positive outcome in the next year.

This issue of the Newsletter is featuring the NZMS incoming President[1], Melissa Tacy. Have a look to know more about Melissa in the profile section. Our immediate past President, David Bryant, also provides an energetic column about university governence and the consequences that some members of our society are facing.

You may have noticed that the last issue did not include the Mathematical Miseponymy, nor will this current issue. Unfortunately, this section has run out of contributors for the last two issues despite our efforts to find nice mathematical anecdotes. However, we really hope that this is just a short-term situation and that the next issue (and the following ones) will be honoured by such contributions. For now, we would like to call for volunteers to ensure the survival of the section. Please contact us, at marie.graff@auckland.ac.nz or chris.stevens@canterbury.ac.nz, to let us know if you have a mathematical story to share and for which issue of 2023 it can be ready.

At the occasion of the first in-person NZMS colloquium since 2020, many prizes have been awarded (details in the President's column). Congratulations to all! We also thank the organisers of this edition of the colloquium. It was nice and rejuvenating to see each other again after so many restrictions and lockdowns, even though some of us had to cancel due to Covid (still around!).

For now, we wish you all a well-deserved Summer break.

☼ Meri Kirihimete ☼

Marie Graff and Chris Stevens

[1] also known as the incoming past Vice-President, according to the latest AGM

PRESIDENT'S COLUMN

These are troubled days for NZ universities. In the past few weeks there has been industrial action at all of the major universities. Officially, the main reason for protest is that academic and general staff are sick of pay raises well below the level of inflation. Unofficially, I feel that much of the protest is about the way tertiary management have been treating all of their employees. Then the terrible news from AUT: at least 250 staff facing voluntary or forced redundancy, including at least seven mathematicians (yet to be confirmed). Given all that has happened at AUT, Massey, and across the academic sector, I can't help wondering if NZ is organising its tertiary institutions in the right way. If the administration has to sack a huge proportion of staff that administration have failed at their job.

It is clearly terrible to be made redundant and the NZMS will try and help those who lose their positions. Even just being assessed and threatened by redundancy causes damage. Your multi-faceted, creative, educational, scholarly contributions are projected onto a single, usually orthogonal, axis. The university stops being your academic home and starts being just the institution you earn your pay-checks.

I've seen and heard much discussion on the over-emphasis on competition in the NZ tertiary sector. Universities compete, departments compete. Waste and lost potential abound. The government is not unaware of this. The Auditor General reported significant inefficiencies in the sector because universities didn't work or plan together[2]. Similar sentiments were voiced by the Productivity commission[3]. Presumably, they meant cooperation in more than just management tactics.

There is some cause for optimism. We are finally seeing the unions act in a (mostly) coordinated fashion across all universities. It would be hard to deny the need for more of a counter-weight to management. We need ways to push back against stupid or unjust university governence which go beyond leaving and quitting. I, for one, wish the TEU all success in its court case against AUT.

All of this highlights the fact that societies and organisations like the NZMS act as an antithesis of inter-university competition. The society exists primarily to support and strengthen the people working in mathematics. NZMS initiatives act between and across universities, they encourage sharing of resources and strategies, and they undermine fake competition between departments. And it does this on a shoestring.

We are only one of the many organisations in NZ devoted to Mathematics and Mathematics education. As well as the NZMS there is NZMRI, ANZIAM, AMSI, MERGA, NZAMT, PMA and of course the NMA, AMA, WMA, MMTA, WMA, NMMA, CMA, and OMA (I'll let you look up the acronyms). The NZMS works so well building networks between universities. We really now have to work harder to strengthen connections with rest of the mathematics community. This is not just a job for the education committee.

This is my last newsletter column as President. Melissa Tacy will be taking over next week, and the NZMS will definitely be in safe hands. There are several projects I will work on as vice-president which I couldn't complete as president: I'm keen to see the redesign of our webpage through to completion; I want to have a serious attempt at getting an internship program set up next year; and we have the 50th Jubilee to plan for 2024.

I thank those who have been working with me and with the NZMS this year. Thanks to Melissa (president-elect), Dimitrios (secretary) and Stephen (treasurer). Thanks to the NZMS council with their patience (I'm still a bit rough on meeting protocol). Thanks to Marie and Chris for editing the newsletter, and a special (anonymous) thanks to the nomination committee, prize committees and accreditation committee for their time-consuming and difficult work.

Again, my thoughts and support for those facing redundancy, and for those trying to function in any department gutted by redundancies. We will be working as the NZMS to find practical ways to help.

David Bryant

[2] https://oag.parliament.nz/2017/tei-assets

[3] https://www.productivity.govt.nz/inquiries/new-models-of-tertiary-education/

New fellows of the NZMS

- Tanya Evans (Auckland)
- Nicolette Rattenbury (Auckland)

Prizes of the NZMS

Aitken Prize

The Society offers a prize for the best contributed talk by a student at the annual New Zealand Mathematics Colloquium. This prize is known as the Aitken Prize, in honour of the New Zealand born mathematician Alexander Craig Aitken. The Prize was first offered at the 1995 Colloquium held in conjunction with the Aitken Centenary Conference at the University of Otago. Candidates for the Prize give a talk on a topic in any branch of the mathematical sciences.

The Aitken Prize for 2022 was awarded jointly to:

- **Emma Hogan (University of Canterbury)** for the talk
  The intersection of bicircular and lattice path matroids
- **Pedro Rossetto (University of Otago)** for the talk
  Magnetically confined mountains on neutron stars

Gillian Thornley Award for outstanding contribution to the cause or profession of mathematics

This annual award was established in 2020 to recognize outstanding contributions to the cause or profession of mathematics in New Zealand. The award will be made to a person or group that has made an outstanding contribution to mathematics within NZ.

The Gillian Thornley Award for 2022 goes jointly to **Jeanette McLeod and Philip Wilson (Canterbury)**, for their outstanding contributions to mathematics and science communication. Jeanette and Phil are the brains and hands behind the highly successful Maths Craft initiative, which has reached thousands of people of all ages at its public events and workshops since 2016 and through the Maths Craft in a Box project in 2021 and 2022. Jeanette and Phil's dedication and brilliant communication of mathematics to the general public have had demonstrable effects in promoting mathematics and in making the wider public aware of its beauty and usefulness for everyone.

Kalman prize for best paper

The Kalman Prize for Best Paper was instituted in 2016 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: 2016-2020. 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.

This year's Kalman prize is awarded to **Claire Postlethwaite (University of Auckland)**, as co-author of the paper *Stability of cycling behaviour near a heteroclinic network model of Rock-Paper-Scissors-Lizard-Spock*.

C.M. Postlethwaite and A.M. Rucklidge. "Stability of cycling behaviour near a heteroclinic network model of Rock-Paper-Scissors-Lizard-Spock", Nonlinearity, 35, 1702, 2022.

The nomination for this paper describes it as one of the two or three most significant research achievements a New Zealand based mathematician has ever been involved with.

NZMS Early Career Research Award

This award was instituted in 2006 to foster mathematical research in New Zealand and to recognise excellent research carried out by early-career New Zealand mathematicians. Candidates will be judged on their best three published research outputs and a brief CV. Research outputs could include publications in books, journals, other peer-reviewed venues, or other types of high quality mathematical research.

The 2022 NZMS early career award goes to **Priya Subramanian (University of Auckland)** for her insightful contributions to the analysis of pattern-forming systems via the development of models, theory and numerical methods for the characterisation and classification of emerging complex spatiotemporal patterns, including in thermoacoustics and soft matter crystallisation.

NZMS Research Award

This annual Award was instituted in 1990 to foster mathematical research in New Zealand and to recognise excellence in research carried out by mathematicians in New Zealand. This Award is based on mathematical research published in the last five calendar years (2016-2020).

The 2021 NZMS award goes to **Noam Greenberg (Victoria University of Wellington)** for contributions and significant advances in computability theory, proof theory, set theory, computable structure theory and algorithmic information theory.

EDUCATION

The government's new Maths and Literacy strategy was mentioned in the August column of this newsletter. Shortly after that, in mid-August, the Ministry of Education (MoE) released the *Literacy & Communication and Maths Action Plans* document, see https://www.education.govt.nz/our-work/changes-in-education/curriculum-and-assessment-changes/literacy-and-communication-and-maths-strategy/. The maths specific part of the document starts on page 24. Pages 26–28 focus on teaching and learning. It is good to see some recommendations of the Royal Society report being addressed, such as:

- Maths teaching and learning time to be safeguarded. (A recommended minimum time spent per week in school will be specified.)
- More finely detailed learning progressions. More examples and resources including a detailed step-by-step learning sequence for Years 0–10.

Mathematical content will be weaved throughout other Learning Areas[4] as appropriate. Also, the relationship between maths, history and culture will be explored, with a special focus on te ao Māori.

Supports and resources, professional learning and development, and teacher education programmes will be informed by a Common Practice Model (CPM) whose purpose is to ensure quality teaching and assessment across all schools and across all levels of the curriculum.

In September 2022 a number of organisations were invited to nominate contributors to the CPM for Mathematics, including the NZMS. There were 12 positions available, and two of our Education Group members were selected—Julia Crawford and Kerri Spooner. Julia was nominated by Cognition Education and supported by the NZMS, and Kerri was nominated by the NZMS. Congratulations Julia and Kerri!

And now for something completely different. This past semester I taught part of a general education course (Maths 190G) at the University of Auckland, a course aimed at non-maths students. One assignment question asked them to write an essay about *Infinity*. Some of the essays were very enjoyable to read, so to fill the rest of the column, I thought it would be good to share one of them. It is reproduced below with permission. Enjoy!

Sione Ma'u

Infinity

by Scarlett Parkes

Infinity is a transformative concept that has far-reaching implications for mathematics and art. The following short essay will explain some basic history of mathematical understandings of infinity and link the concept of infinity to my own life through *The Fault in Our Stars*, a cheesy teen romance book that was extremely popular in 2014, relating these back to our understanding of infinity from class. I hope to make the point that both the long history of infinity in a mathematical sense, and its use in art like novels to express moving themes, are intrinsically interlinked aspects of the concept.

Infinity, like maths itself, has a long history. Of particular interest to me are early mathematicians' attempts to tease out the concept. Allen (2000) describes how Aristotle explored the concept of potential infinity, questioning the physical and temporal limitations to hypothetical infinities. He argued that in theory one can continue adding to the set of integers infinitely, but in reality the amount of physical space within which to do this is finite. However, time is outwardly infinite, and both space and time are able to be infinitely divided into smaller and smaller increments, so in this way the potential physical limitations to some infinities does not necessarily stand. Related to the concept of dividing space or time into smaller increments is the method of exhaustion in which one removes a half or more from an object continually, creating something infinitely small (Allen, 2000).

[4]Subjects are grouped into *Learning Areas* by the MoE and NZ Qualifications Authority (NZQA). E.g. Maths and Stats are in the same learning area.

Later, European mathematicians discovered the concept of one-to-one correspondence. They noticed that despite a larger circle seeming to have more points on it than a smaller one, the points on the larger circle could be associated one-to-one with those in a smaller circle (Allen, 2000). This concept of one-to-one correspondence was transformative for comparing infinities, and is one that we in Maths 190G are particularly familiar with as we use it to explore the cardinality of different infinities.

This concept of comparing infinities is also familiar to me in other contexts. When I was in high school, like a lot of teen girls at the time, I read a lot of John Green books. His most famous work, *The Fault in Our Stars*, makes reference to infinity in terms of the love story between Augustus and Hazel, two teenagers who are dying of cancer.

"There are infinite numbers between 0 and 1. There's .1 and .12 and .112 and an infinite collection of others. Of course, there is a bigger infinite set of numbers between 0 and 2, or between 0 and a million. Some infinities are bigger than other infinities... I cannot tell you how grateful I am for our little infinity." (Green, 2012, p. 256).

In the book, the concept of smaller infinities is used to express the significance of Augustus and Hazel's love, within the short period of time that they were both alive. It is a way that the two come to terms with the finiteness of their relationship, by finding the infinities in the minutiæ. While the quote is not technically correct, as the infinity of numbers between 0 and 1 has the same cardinality as those between 0 and 2, the point remains that not all infinities have the same cardinality, but that does not mean they are not also infinite. And thus, the point remains that not all love stories have the same length, but that does not mean they are not important.

Despite the inaccurate approximation of the concept of infinity, *The Fault in Our Stars* remains an example of the way in which artists use mathematics to express emotive concepts that would otherwise be difficult to grasp. The history of infinity is also useful in marking how our current understandings came to be. Certainly infinity is a powerful concept with significant implications.

References

Allen, G. D. (2000). *The history of infinity.* Lecture notes, Texas A & M University.
https://www.math.tamu.edu/~dallen/history/infinity.PDF

Green, J. (2012). *The Fault in Our Stars.* Dutton Books.

PROFILE

Melissa Tacy

Dr Melissa Tacy is a Lecturer[5] in Mathematics at the University of Auckland, and is the incoming NZMS president (2022-2024).

Melissa grew up in Canberra, Australia. She has always had a strong interest in mathematics, and after completing an undergraduate degree in mathematics at the Australian National University (ANU) in 2005, she began her PhD studies under the supervision of Prof. Andrew Hassell again at the ANU. Melissa was a highly successful PhD student, and was awarded a Fulbright scholarship to spend a year of her PhD at the University of California, Berkeley. Some of her fondest memories of her PhD occurred as she traveled home to Canberra via Europe involving a healthy mix of conferences, summer schools, and holidays (incidently I happened to visit Canberra as a summer research student at this time, also under the supervision of Andrew Hassell, but just missed meeting Melissa).

Melissa completed her PhD entitled '*Semiclassical L^p estimates for quasimodes on submanifolds*' in 2010, after which she spent a year as a postdoc at the Institute for Advanced Study at Princeton University, and then three years at Northwestern University. In 2014 Melissa returned to Australia to take up a lecturing position at the University of Adelaide, and then a short term research position at the ANU. At this point Melissa tells me that due to lack of long term academic position on the horizon, she was considering leaving academia. Thankfully she persevered, and the University of Otago was lucky enough to have her join the Department of Mathematics and Statistics as a lecturer in 2017. In 2020 Melissa moved to her current position at the University of Auckland.

Melissa's research interests lie in the intersection of semiclassical, microlocal, and harmonic analysis. One could also list partial differential equations here, as much of her work is closely connected to estimates for solutions to differential equations. The typical setting of Melissa's research involves a high frequency parameter, a Riemannian manifold, and a differential operator. Given these objects, one can construct eigenfunctions and then ask questions like "how do these eigenfunctions grow as the frequency becomes larger?" and "can eigenfunctions

[5]Editorial note: Melissa has been promoted Senior Lecturer from February 2023.

concentrate their energy in small sets?". This latter question is also known as *scarring*, and can be thought of as an echo of the classical system (i.e. the dynamics of a billiard ball bouncing around the domain) inside the quantum system (as represented by the eigenfunctions of the differential operator under consideration).

One of Melissa's recent results includes considering the difficult case of products of eigenfunctions. In certain situations Melissa shows that it is possible to significantly improve the L^p bounds that one would naively expect from the case of one eigenfunction. The paper where Melissa proves this fact is highly regarded; in fact it was awarded the Kalman prize for best paper by the NZMS in 2020! Recently Melissa has also worked on random waves, and their small scale structure. These results have a slightly different flavour, and involve proving that certain random variables are equidistributed. The random variables are typically an average of the wave over a small region (such as a ball with a shrinking radius).

Melissa is also active in promoting mathematics. In the past this has included giving a talk on quantum chaos to a crowded pub, publishing articles on infinity for a general audience, and explaining mathematics to school students. While she was based at Otago, she also organised a well attended weekly 'shut up and write' session. This involved herding a group of mathematicians into a quiet room, and getting us to finish writing up projects for a few hours with the promise of a visit to the pub once we were done.

Looking ahead Melissa has a number of projects working on proving L^p estimates by combining Fourier integral operator theory together with harmonic analysis ideas from wavelet/Fourier analysis. Outside of research, she is taking over as the President of NZMS and is looking forward to her two years in the role. One of her goals is to get New Zealand universities collaborating in sharing honours offerings (like what is done in Australia). The NZMS also has its 50 year anniversary on her watch in 2024. As part of the celebrations, the NZMS is running a joint meeting with the Australian Mathematical Society, and the American Mathematical Society (hopefully by the time the newsletter comes out there will be something more to announce about this). That should keep her pretty busy over the next few years!

Timothy Candy

LOCAL NEWS

AUCKLAND UNIVERSITY OF TECHNOLOGY

SCHOOL OF ENGINEERING, COMPUTER AND MATHEMATICAL SCIENCES

Obituary

It is with great sadness I share the news of the passing of Dr Murray Black.

Murray has been a well respected Senior Lecturer in the Department of Mathematical Sciences and has worked with AUT since its early days as AIT. In 1995 he became Head of the School of Mathematical Sciences and when Mathematical Sciences was merged with Computing to form the School of Computing and Mathematical Sciences, Murray became an Associate Head of School. Continuing as a Senior Lecturer over many years, he was a dedicated teacher who loved to share his passion for mathematics with his students. The School has benefited greatly from his many years of dedicated service in various capacities.

Events

On Thursday 17th November, Department of Mathematical Sciences and the Mathematical Modelling and Analytics Research Centre hosted the AUT Analytics Mix and Mingle. The event brought together around 50 academics, alumni, students and industry partners for the afternoon. There was an interesting plenary talk by Mike Parsons (Air New Zealand) and thought-provoking panel discussion with panellists Geoff Leyland, Stasha Rmandic, Amantay Abdurakhmanov and Mike Parsons. Prizes were awarded to top Master of Analytics students: Yianni Manolakakis (Best STAT995 presentation semester 1), Helen Wu (Best STAT995 presentation semester 2), Surbhi Gupta, Candice Lao and Kai Zhou (Best STAT804 group presentation).

Members of the AUT Department of Mathematical Sciences were out in the community to share the love of STEM with students of all ages at the MOTAT STEM Fair in Auckland. The event gave youngsters some hands-on activities and puzzles to inspire and enthuse them.

Travel and Conference Participation

Dr Hyuck Chong's work with Grant Emms (Marshall-Day Acoustics) was presented at The ACOUSTICS 2022 THE ACOUSTICAL SOCIETY OF NEW ZEALAND CONFERENCE, THE NATURE OF ACOUSTICS 31 OCT – 2 NOV 2022, TE PAPA, WELLINGTON, NEW ZEALAND. The paper is titled 'Accuracy of a prediction method for sound transmission loss of glazing.' The results from this collaboration has been incorporated into a sound transmission prediction software Insul.

Wenjun Zhang

UNIVERSITY OF AUCKLAND

DEPARTMENT OF MATHEMATICS

In October we had a party to celebrate Shixiao Wang's retirement from his career in Auckland. Below is a photo of Stepen Taylor giving a speech about Shixiao's contributions.

Shixiao and Stephen Taylor.

Bernd Krauskopf will serve as Head of Department in 2023 and then Steven Galbraith will return for a second term as Head of Department in 2024. Jeroen Schillewaert is taking over from Warren Moors as deputy Head of Department starting January 2023.

Florian Lehner and Ofer Marmur have arrived (finally!) in Auckland. Both were interviewed for their positions way back in 2019. While Florian and Ofer are pleased to have been able to enter NZ, a large number of staff have been very excited to travel internationally to visit relatives and research collaborators.

Kyoung Hyun Lee is a new research fellow in the department, working with Hinke and Bernd.

Farewell to Melissa Lee and Tomasz Popiel. Melissa is starting an academic position at Monash in 2023. Melissa was also awarded a Discovery Early Career Researcher Award (DECRA) by the Australian Research Council.

Mathematics staff had tremendous success in this year's Marsden round. The successful Standard Proposals are:

* Associate Professor Graham Donovan "Spatial tipping points, early warning signals and lung physiology: when can we predict catastrophic change?", with AI Professor Merryn Tawhai, Auckland Bioengineering Institute (ABI)

* Professor Hinke Osinga "'Fingerprints' of wild chaos: from theory to practical relevance", with AIs Professor Bernd Krauskopf, Dr Andy Hammerlindl (Monash), Associate Professor Katsutoshi Shinohara (Hitotsubashi University)

* Dr Melissa Tacy "Improved control for synthesis of the Fourier transform under symmetry or dynamical constraints"

The successful Fast Start Proposals are:

* Dr Matthew Conder "Algorithms for linear groups", with AI Dr Jeroen Schillewaert

* Dr Marie Graff "Adaptive Eigenspace Inversion: Applicable analysis and extensions", with AI Dr Bamdad Hosseini (University of Washington)

A 3-day zoom conference called the "Northeastern University and University of Auckland International Symposium on Mathematics" took place in September. We are developing a joint-teaching arrangement between Northeastern University and the Mathematics and Engineering Science departments at Auckland. The symposium included two plenary invited talks by researchers from Peking University: Yi Liu "3-Manifold Groups and Finite Quotients", Bin Liu "Lagrange and Liapunoff Stability for Nonlinear Oscillations".

We held an event for undergraduates to meet Benjamin Preston, who is an inspiring alumni of the Mathematics department at the University of Auckland. Benjamin is co-founder of Ockham Residential, which has been described as Auckland's most thoughtful developer. Many of the Ockham Residential buildings are named after Mathematicians or Mathematical concepts, such as Hypatia, The Turing, The Isaac, Set, and Bernoulli Gardens. Benjamin's career has also included working in financial services and energy trading with Macquarie Bank and Goldman Sachs, High school Mathematics teaching in Texas (USA), and owning a guitar store.

Sina Greenwood organised the Faculty of Science Pacific Research Symposium in November, which featured talks by Sione Ma'u on "Transfinite diameter" and Malia Puloka on "Pacific students' reasoning with categorical data: Beliefs and challenges".

Other staff news

In addition to his Marsden fast-start grant, Matthew Conder has been awarded a Rutherford Foundation 2-year Postdoctoral Fellowship.

Congratulations to Igor' Kontorovich for his University of Auckland Early Career Research Excellence Award.

Warren Moors inaugural lecture "Applications of Topology to Analysis" took place on Thursday October 6th.

Congratulations to Hinke Osgina for being invited as a STEAM speaker for WOMAD NZ 2023. Currently she is one of only two STEAM speakers announced. https://www.womad.co.nz/artists/hinke-osinga/

Jeroen Schillewaert has been awarded his habilitation by the Institut des Hautes Etudes Scientifiques (Université Paris-Saclay).

Arkadii Slinko has returned from a successful sabbatical. In July he visited Karlsruhe to work with Prof Clemens Puppe. In September he was in Krakow working with the team of Prof Piotr Faliszewski. In September-October he visited the Murat Sertel International Center for Economic Design in Istanbul, hosted by Prof Remzi Sanver.

Congratulations to Kevin Stitely (supervised by Bernd and Scott Parkins (Physics)) for having his PhD thesis listed on the September Deans List. Kevin is now a post-doctoral research fellow in the department, funded by the Dodds-Walls CORE.

Josephina Tamatoa co-developed the South Auckland Mathematics Challenge (SAMC), which has been successfully running for a number of years. It was profiled by the University and on Radio NZ. See here: https://www.auckland.ac.nz/en/news/2022/08/24/south-auckland-maths-challenge.html Josephina also continues to coach Hockey at a high level and has been awarded a Faculty Teaching and Learning Development Grant.

Steven Galbraith

DEPARTMENT OF ENGINEERING SCIENCE

On 20 October, the Department of Engineering Science celebrated the achievements of 102 students, who presented their research during the two days Part IV conference at the Epsom Auditorium. The conference had eight sessions and saw 54 presentations. Taiji Endo, Nicholas Wright, Alex Chen, Tanishq Sharma, Sooyong Kim, and Hyunbin Ko received Best Presentation awards for Engineering Science. Sophie Byrne, Natasha Humphries, Kristi Fechney, Ben Sharp, Nicky Dachs, and Leah Slack received Best Presentation awards for Biomedical Engineering.

The Operations Research and Analytics group organised the 54th conference of the Operations Research Society New Zealand (ORSNZ) on 28 and 29 November. At this conference, Associate Professor Andrew Mason was awarded the Hans Daellenbach Price of ORSNZ. The price honours the considerable contributions of Emeritus Professor Hans Daellenbach to Operations Research / Management Science (OR/MS) in New Zealand. The ORSNZ established the ORSNZ Hans Daellenbach Prize in 2001. Professor Daellenbach's contributions reflect his belief that the best work in OR/MS combines strong innovative methodology with practical impact. The Daellenbach Prize is awarded for such a body of work that has made a significant contribution and received international recognition.

Also, at this conference, ORSNZ's Young Practitioner Prizes (YPP) prizes were awarded in two categories: paper and presentation. There were two awards for each. Christina Lin (Department of Engineering Science) was awarded the 1st place paper award for her work on *Modelling housing feature impacts on sale price in newly developed suburbs relative to a standard house*. Dominic Keehan (Department of Engineering Science) was awarded the 2nd place paper award for his work on *Certainty equivalent model predictive control and distributionally robust stochastic dynamic programming*. Karl Zhu (Department of Engineering Science) was awarded the 1st place presentation award for his talk on *Finding the missing with integer programming*. Uwe Langmayr (Institute for Industrial Production, Karlsruhe Institute of Technology) was awarded the 2nd place presentation award for his talk on *Calculation of synthetic energy carrier production costs with high temporal and geographical resolution*.

Andreas Kempa-Liehr

UNIVERSITY OF WAIKATO

DEPARTMENT OF MATHEMATICS AND STATISTICS

Daniel Delbourgo is on leave in Tasmania. He has come to the end of a 3 year term as chair, but the issue of who will lead the department from 2023 has yet to be completely resolved. The same is true for the external review on mathematics which took place over the past few months. We understand the external reviewer has made a preliminary report which is now in process between the Head of School and the reviewer.

Even though in June we said goodbye to Chaitanya Joshi with a dinner, he has been with us quite often during the remainder of 2022. We wish him well at the University of Auckland. Ian Hawthorn will be moving to Tauranga where he will be the sole mathematician in residence. As well as mathematics and mathematics education, that city will be getting an very fine singer. David Chan will continue to be with us for 2023. Nick Cavenagh and Yuri Litvinenko have been both away on study leave, and things being as they are will be welcomed back with open arms!

Jacob Heerikhuisen and Han Gan are continu- ing to develop their Covid-19 model for the central north island DHB's, as the next wave builds and the variants multiply.

Paul Brown has joined a research project of the NZ Police which includes two research teams and has the title "Understanding Policing Delivery". This project is focused on identifying whether, where, and to what extent, any bias exists at a system level in the Police's operating environment. He continues in his position as a Research Fellow in the Department of Mathematics and Statistics at Waikato. He has been working with the Police on a range of projects including statistical modelling of crime and crime patterns in Hamilton.

Three of our postgraduate students in Mathematics - Kaden Hughes (MSc), Raiza Corpuz, and Zac Isaac (both Ph.D.) - recently attended the four-day New Zealand Mathematics and Statistics Postgraduate conference in Wānaka. Each attendee delivered talks on their research and peer votes resulted in Raiza's presentation being highly commended in Pure Mathematics and Zac's being awarded the runner-up prize for Applied Mathematics.

Raiza Corpuz obtained both her bachelor's and master's degrees in mathematics from the University of the Philippines Diliman. Her field of interest is number theory, with a specialization on elliptic curves, which is

the subject of both her bachelor's and master's theses. After graduating, she undertook a 2-year teaching position at the same university where she had taught calculus courses. She moved to New Zealand to diversify her area of research and to develop a good work ethic as a researcher. She is undertaking research towards a PhD in mathematics under the supervision of Daniel Delbourgo at the University of Waikato. Their ongoing research is about devising a way to induce the Iwasawa main conjecture from a family where it is known to be true, to another family where the conjecture is not known to hold. They have already made good progress towards this goal.

It's the first time since G Block was opened in 1989 that all the carpet in the corridors has been replaced and the walls painted. Each floor on G Block was colour-themed. So the third floor of G Block (where most of the Maths and Stats staff are) had 'Bladerunner' (a shade of green) as its theme colour. Sadly, this maintenance work was carried out just for the corridors. So any worn carpet some of us have in our offices is still there!

Kevin Broughan

MASSEY UNIVERSITY

SCHOOL OF MATHEMATICAL AND COMPUTATIONAL SCIENCES

David Simpson has been awarded a Marsden grant for a project entitled "Minimal mathematical models for dynamical systems with abrupt events". The AI on the project is Professor Paul Glendinning from the University of Manchester.

Shaun Cooper gave the R.P. Agarwal Memorial Lecture at the 21st Annual Meeting of the Society of Special Functions and their Applications organised by the Department of Studies in Mathematics, University of Mysore, India.

Carlo Laing and Indranil Ghosh attended the Dynamical Systems in NZ meeting held at the beautiful Castaways Resort at Karioitahi, 14-18 November.

Carlo Laing spent the midsemester break on a research visit to Potsdam University and the Weierstrass Institute in Berlin.

Carlo Laing

VICTORIA UNIVERSITY OF WELLINGTON

SCHOOL OF MATHEMATICS AND STATISTICS

We have some good news from Te Herenga Waka in Wellington: We celebrate Professor Rod Downey, Dr David Cox, Mr Malcolm Jones:

The internationally recognized Professor Rod Downey won the 2022 " NZ Association of Humboldt Fellows Research Award". Meanwhile Rod and A/Prof Alexander Melnikov are hosting Dr Lu Liu with whom they have been working on algorithmic randomness and model theory. Dr. Liu is known as China's youngest full university Professor https://en.wikipedia.org/wiki/Liu_Lu.

Dr David Cox won the 2022 Tertiary Teaching Excellence Award in the Innovation in Learning, Teaching, and Curriculum category. David excels at the teaching job he loves. Teaching one of the largest first year courses at the University, Cox is challenged with balancing learners who excelled in Year 13 Statistics, and those who hate maths and lack faith in themselves to succeed. Through a range of student-centred innovations and a passionate concern for at-risk learners, Cox has transformed his course, evidenced by increasing pass rates, better results for Māori and Pasifika learners, and the testimonies of his learners, their whānau, and his peers.

The school of mathematics PHD candidate Malcolm Jones won one of the two PGSA Research Excellence awards. Malcolm studied constructions of groupoids from inverse semigroups. The fields of algebra and analysis have been entangled on the subject of these constructions since the 1980s. However, their research demonstrated in detail that the groupoid of filters and the groupoid of germs are actually the same (topologically isomorphic).

Dimitrios Mitsotakis

UNIVERSITY OF CANTERBURY

SCHOOL OF MATHEMATICS AND STATISTICS

Congratulations to *Rua Murray* on his promotion to the rank of Professor, to *Daniel Gerhard* and *Blair Robertson* on their promotions to the rank of Associate Professor, and to *Varvara Vetrova* on her promotion to the rank of Senior Lecturer Above the Bar.

Congratulations to *Mike Plank* and *Taylor Winter* who both were successful with Covid-19 related proposals. Mike won the tender for the Covid-19 modelling contract with the Department of the Prime Minister and Cabinet. Mike is the National Director of the project, and along with Dion O'Neale from the University of Auckland will co-lead the programme. Taylor's application with the Children and Families Research fund from Te Manatū Whakahiato Ora | Ministry of Social Development was successful. The project title is "Wellbeing and COVID-19: Risk and resilience during lockdown and a potential to foster cultural transmission".

Congratulations to *Brendan Creutz* and *Felipe Voloch* who have been awarded a Marsden Grant as PIs for a project titled "Rational points and anabelian geometry". This project will develop techniques to decide whether certain polynomial equations can be solved, not with rational numbers, but with rational functions. While analogous to the classical problem in many ways, the study of solutions in function fields is more closely related to applications. Moreover, some questions become more tractable in this framework as one is able to employ geometric methods that are otherwise unavailable. Specifically, Brendan and Felipe will explore how the existence of solutions can be influenced by the fundamental group, an object which encodes arithmetic and geometric properties of the algebraic variety defined by the equation. Ultimately, a deeper understanding of the function field case will also shed light on the classical question of rational solutions.

Kudos to *Lena Collienne* who was awarded the prestigious RSNZ Hatherton Award for her work on identifying a biologically meaningful way to calculate distances between evolutionary histories. Lena is a postdoc in *Alex Gavryushkin*'s Biological Data Science lab at the University of Otago, but based in our School since the beginning of the year. The Hatherton Award is an annual award for the best scientific paper by a student registered for the degree of PhD at any New Zealand University, published or accepted for publication either during their studies or within two years of the completion of the PhD in Physical Sciences, Earth Sciences or Mathematical and Information Sciences. Lena has been lecturing for us this year. She will shortly be joining the Fred Hutchinson Cancer Research Centre in Seattle, WA.

In mid-August, *Jeanette McLeod*, *Phil Wilson*, the Maths Craft team and the School successfully launched the first edition of Maths Craft in a Box, a free, self-contained box dedicated to exploring the fascinating world of fractals in the classroom. They were delighted to "sell out" of their first batch of 200 boxes within 36 hours! The Box provides enough craft materials to build a large fractal sculpture, packs of student Zines (workbooks) providing a beautifully illustrated introduction to the mathematics of fractals, and custom-made online instructional videos. For more about the Box, see https://www.mathscraftnz.org/box. The School had a busy six weeks of packing and shipping boxes, with all orders fulfilled by the end of September.

The Box was created and developed by Jeanette and Phil, who are Director and Deputy Director of Maths Craft New Zealand, Aotearoa's largest maths outreach initiative. They are thrilled to see that the Box has gone to schools all over Aotearoa. From tiny rural primary schools like Stirling School (with a roll of 33 students) to giant urban high schools like Westlake Boys and Westlake Girls (each with a roll of over 2,200 students). It is estimated that this round of Boxes reached over 10,000 students. Future Boxes exploring more Maths Craft topics are in the works, with the second edition of the Box planned for release in 2023. Thanks to the support of the University of Canterbury, and other generous sponsors, Maths Craft have so far been able to offer the Box for free and they hope to be able to continue doing so in the future. Jeanette also gave a fantastic live interview with Jesse Mulligan on RNZ. Listen to "Maths Craft in a box designed to help a love of mathematics" https://www.rnz.co.nz/national/programmes/afternoons/audio/2018853954/maths-craft-in-a-box-designed-to-help-a-love-of-mathematics.

In mid-October the School welcomed *Philipp Wacker* as a senior lecturer in statistics. Philipp obtained his PhD from the University of Augsburg, Germany, in 2016. Since then he held postdoctorial positions at the University of Erlangen-Nürnberg and the Free University of Berlin. His research interests are in (infinite-dimensional) Bayesian inverse problems, uncertainty quantification, particle-based optimization and sampling methods, ensemble Kalman inversion, Laplace approximation, nested sampling, data assimilation. Philipp was offered this position in 2019, but the pandemic and the complexities of Immigration NZ caused significant delays. Since his arrival Philipp is wasting no time: his three children started school or preschool within a week, and he set up a reading group in the School on kernel methods in statistics and applied mathematics.

In late October *Philip Davies* joined the School as Lecturer (Teaching and Administration only) in Statistics. Phil had been in the School since 2018 in various roles. He has substantial connections with industry and is currently pursuing a PhD in Statistics.

Weighty congratulations to *Jennifer Brown* for winning Gold in her class in the Oceania Masters Weightlifting

Philipp Wacker

competition in Melbourne in September. Jennifer was a member of the NZ team that competed in the event.

In her role as National Party spokesperson for Research, Science, Innovation and Technology, Hon. Judith Collins, briefly visited the School on the 31st of October 2022, to meet *Alex Gavryushkin* and *Clemency Montelle* who stressed the importance of maths in bio tech and how a deeper integration between academia and industry can benefit the country. Targeted drug treatments, such as drugs that only kill cancerous cells, are "a fine maths problem", says Alex, who is currently working on many globally cooperative projects.

Günter Steinke

UNIVERSITY OF OTAGO

DEPARTMENT OF MATHEMATICS AND STATISTICS

Congratulations to *Ting Wang* for securing a Smart Ideas grant from the MBIE Endeavour Fund, together with Mark Stirling from Otago's Department of Geology. Their project is entitled "Forecasting future megaquakes on New Zealand's biggest fault: The Hikurangi subduction zone", and it will receive $1M funding over a period of three years. The project will build the first probabilistic forecasting tool for great earthquakes along the Hikurangi subduction zone, incorporating a first systematic analysis of the influence of slow slip events on the earthquake occurrence rate.

Even more congratulations to *Ting Wang* are in order, as she is the 2022 recipient of the NZSA Littlejohn research award. This is the premier research award of the NZSA, which is named in commemoration of Roger Littlejohn, who worked as a biometrician with AgResearch, based at the Invermay Research Centre, Dunedin. The award recognises excellence in research, based on publications during the five calendar years preceding the date of the award. Well done, Ting!

Florian Beyer has been appointed as the new Associate Dean International at the Division of Sciences. In this role, Florian provides support and advice on matters related to internationalisation and coordinates engagement between the Division and the International Office. Florian's former role as the Director of Studies for Postgraduate Maths (Honours and Diplomas) has been taken over by *Fabien Montiel*. All the best for your new responsibilities, Florian and Fabien!

Jörg Hennig

PhD SUCCESS

Emil Mendoza (University of Canterbury. 2022)

Title: Nonparametric estimation of the random coefficients model through regularized maximum likelihood.
Supervisors: Fabian Dunker and Marco Reale (both University of Canterbury)

Abstract: Nonparametric Estimation of the Random Coefficients Model through Regularized Maximum Likelihood (RMLE) is explored. Chapter 1 establishes the underlying theory of the method and convergence rates. Simulation results are presented comparing the RMLE method with a kernel-based estimator. An application to real data is also presented. The conclusion reached is that the RMLE method is more robust with respect to tail behaviour of the design density. Chapter 2 builds on the method by expanding it to a threedimensional application. An open-source software package is also produced through Python. Chapter 3 discusses a case study of the housing market in Christchurch, New Zealand. The hedonic house price model is used to examine the changes in consumer preferences across three different time periods. The RMLE method is applied to model unobserved heterogeneity in the aforementioned consumer preferences through the inclusion of random coefficients in the hedonic model.

Sarah Jayne Mark (University of Canterbury. 2022)

Title: The intersection of longest path in a graph.
Supervisors: Jeanette McLeod (University of Canterbury), Brendan McKay (ANU), and Phillip Wilson (University of Canterbury)

Abstract: In this thesis we examine the famous conjecture that every three longest paths in a graph intersect, and add to the classes of graphs for which it is known that this conjecture holds. This conjecture arose from a question asked by Gallai in 1966, the question of whether all of the longest paths in a graph intersect (Gallai's question). In 1969, Walther found a graph in which the longest paths do not all intersect, answering Gallai's question. Since then, many other graphs in which the longest paths do not all intersect have been found. However there are also many classes of graphs for which the longest paths all intersect, such as series-parallel graphs and dually chordal graphs. Finding such classes of graphs is an active area of research and in this thesis we add to these classes of graphs.

We begin by investigating Gallai's question for a specific class of graphs. A *theta graph* is a graph consisting of three paths with a pair of common endpoints and no other common vertices. A *generalised theta graph* is a graph with at least one block that consists of at least three paths with a pair of common endpoints and no other common vertices. We show that for a subclass of generalised theta graphs, all of the longest paths intersect.

Next, we consider the conjecture that every three longest paths of a graph intersect. We prove that, for every graph with n vertices and at most $n+5$ edges, every three longest paths intersect.

Finally, we use computational methods to investigate whether all longest paths intersect, or every three longest paths intersect, for several classes of graphs. Two graphs are *homeomorphic* if each can be obtained from the same graph H by a series of subdivisions. We show that, for every simple connected graph G that is homeomorphic to a simple connected graph with at most 7 vertices, all of the longest paths of G intersect. Additionally, we show that, for every simple connected graph G homeomorphic to a simple connected graph with n vertices, $n+6$ edges, and minimum vertex degree 3, all of the longest paths of G intersect. We then show that for every graph with n vertices and at most $n+5$ edges, every three longest paths intersect, independently verifying this result. We also present results for several additional classes of graphs with conditions on the blocks, maximum degree of the vertices, and other properties of the graph, showing that every three longest paths intersect or every six longest paths intersect for these graphs.

Duttatrey Nath Srivastava (University of Canterbury. 2022)

Title: Brauer-Manin obstructions on hyperelliptic curves.
Supervisors: Brendan Creutz and Felipe Voloch (both University of Canterbury)

Abstract: We describe a practical algorithm for computing Brauer-Manin obstructions to the existence of rational points on hyperelliptic curves defined over number fields. This offers advantages over descent based methods in that its correctness does not rely on rigorous class and unit group computations of large degree number fields. We report on experiments showing it to be a very effective tool for deciding the existence of rational points: among a random samples of curves over $\mathbb{Q}$ of genus at least 5 we were able to decide existence of rational points for over 99% of curves.

Yiming Ma (University of Otago. 2022)

Title: Mathematical and statistical modelling of slow slip events.
Supervisors: Fabien Montiel and Ting Wang (both University of Canterbury)

Abstract: Slow slip events (SSEs), a type of slow earthquakes, are thought to play an important role in releasing strain in subduction zones. We may be able to infer from their occurrence pattern the probability of triggering a damaging earthquake within the nearby velocity weakening portion of the plate interface, although the underlying geophysical mechanism governing SSEs remains elusive. In this thesis, we investigate the conditions under which recurrent SSEs can spontaneously occur and develop a new method to detect automatically short-term SSEs in GPS data. For the first of the two works, we conduct an extensive sensitivity analysis on four parameters to investigate the conditions for forming SSEs in a simplified Cascadia-like subduction model, within the modelling framework of rate- and state-dependent friction (RSF) laws. For the second of the two works, we propose a new detection method, called singular spectrum analysis isolate-detect (SSAID), which recasts the problem of detecting SSEs as that of detecting change-points in a piecewise-linear signal. This is achieved by obscuring the deviation from piecewise-linearity in the underlying SSE signals using added noise. We demonstrate its effectiveness using both simulated and observed SSE data. To bring together the two works in the process, we conduct a Bayesian inversion on observed SSE data, which estimates a finite rectangular fault model for each detected SSE candidate. This helps us to evaluate the probability of the occurrence of an actual SSE for each detected SSE candidate. Finally, we illustrate the general applicability of SSAID using both synthetic piecewise-non-linear signals with known structures and real data sets from various disciplines including the number of COVID-19 daily confirmed cases in the United States and the monthly S&P 500 close price index.

Rafael Costa Santana (University of Otago. 2022)

Title: Intra-annual variability in the East Auckland Current and its impact on cross-shelf exchange.
Supervisors: Sarah Wakes (University of Canterbury)

Abstract: Western boundary currents (WBC) balance the heat budget of global oceans by transporting warm waters poleward and vary in timescales from decades to days. WBC can interact with the bottom and provide deeper and nutrient-rich water to the continental shelf. Variability in WBC occurs on timescales of decades, seasons, or days due to external forcing (e.g. winds) or WBC intrinsic nonlinearity (sub- and mesoscale eddies).

The East Auckland Current (EAuC) is a WBC that connects the Tasman Sea to northeast New Zealand. Intra-annual variability in the EAuC was studied using a year-long timeseries of in situ and remotely-sensed velocity, temperature and salinity observations. In this study, we find that mesoscale eddies impact the long-term (> 30 days) EAuC variability. Four mesoscale eddies were observed between May 2015 and May 2016 (over a period of 260 days), generating distinct flows between the continental slope and rise. The EAuC dominated the circulation in the continental upper- and mid-slope and rise for 110 days and generated the most energetic events associated with wind forcing at periods between 4 and 32 days. Bottom Ekman transport, generated by the EAuC, caused the largest temperature anomaly (-1.5°C) at the continental upper slope (500 m depth).

Ocean reanalyses using the Regional Modelling System in conjuction with 4-dimentional variational data assimilation method (ROMS 4D-Var) are developed to better understand cross-shelf exchange in the EAuC system. We assimilate sea surface height (SSH) and temperature (SST), subsurface temperature, salinity, and velocity from three moorings located at the continental upper- and mid-slope, and rise using a 7-day assimilation window. Sensitivity tests are conducted to elucidate the importance of subsurface observations in the quality of the reanalysis. Assimilation of velocity subsurface data is important for improving the mesoscale field up- and downstream of the moorings' locations in comparison to assimilating surface fields (sea surface height (SSH) and temperature (SST)) only. By improving the representation of the mesoscale eddy field, data assimilative runs increased complex correlation between modelled and observed water column velocity vectors in all experiments. In situ subsurface temperature is found to be of utmost importance to correctly simulate the top of the thermocline — one of the most difficult regions to simulate in ocean models. Assimilation of moored CTDs data have little impact in correcting model salinity, however, increasing the tracer decorrelation length scales and using a 2-day assimilation window (instead of a 7-day window) improves model salinity in comparison to independent Argo data. The 2-day window simulation overall better matches the observations but the 7-day window simulation is more dynamically consistent and better suited to study physical processes in the EAuC system.

The 7-day window ocean reanalysis and a freely evolving simulation are used to study drivers of cross-shelf exchange in the region. These one-year simulations are used to study the impact of the EAuC and its associated eddying variability on exchange between the continental shelf and slope. The EAuC is found to drive bottom Ekman transport with variability from 4 to 60 days in the first and last thirds of the New Zealand's northeast shelf. In the mid northeast shelf region, other processes such as submesoscale and frontal eddies dominate cross-shelf velocities. We use an eddy tracking algorithm to identify, classify and analyse eddy-driven impact on cross-shelf exchange. Mesoscale eddies does not show an impact on cross-shelf exchange, however, smaller eddies (radius < 30 km) are ubiquitous on the shelfbreak (200-m isobath) and force on- and offshore velocities while travelling south. We find that cyclones represent most of the eddies that reach the shelfbreak (200-m isobath) and live longer (up to 70 days) compared to anticyclones (< 20 days). Coastal cyclones were smaller eddies (radius < 24 km), formed on the continental shelf and have submesoscale characteristics (Rossby and Richardson numbers O(1)) and can travel offshore representing export of shelf waters. On the other hand, slope cyclones formed in deep waters (> 200 m), had transitional characteristics between submesoscale and large mesoscale eddies (radius > 50 km) and can hardly perform short onshore incursions. Coastal (slope) eddies tended to travel south along the shelf break and generate uplift of upper-slope water onto the shelf with vertical velocity of ~ 30 m/day (~ 15 m/day) causing negative temperature anomalies of -1.5°C (-1°C).

These results represent a substantial step change in knowledge of the understanding of the EAuC and its eddying variability impact on cross-shelf exchange. The EAuC is driven by local winds rather than basin-scale wind stress curl and has its flow largely modified by locally or externally formed mesoscale eddies. The EAuC can generate colder temperature anomalies compared to winds via Ekman dynamics. Data assimilation is vital for accurate simulation of the mesoscale field and subsurface temperature assimilation is of utmost importance for correcting the modelled top of the thermocline. Coastal and slope (frontal) eddies tend to travel south along the shelfbreak forcing colder waters onto the shelf which might impact primary productivity in the region.

GENERAL NOTICES

PhD position available at University of Auckland

One PhD studentship is available in the Department of Mathematics at the University of Auckland, for work on a project in the general field of inverse problems. The successful applicant will have had an Honours or Masters degree in some area of quantitative science (such as Mathematics, Physics or Engineering) and will have a demonstrated interest in applications of mathematical techniques to imaging, particularly those arising in medical imaging, seismology or image processing. A good background in optimisation, functional analysis and scientific programming is desirable. The successful applicant will work with the researchers Marie Graff at the University of Auckland, and Bamdad Hosseini at the University of Washington, Seattle.

The positions will be available starting in March 2023, and come with funding that will cover tuition fees and an annual stipend of $35,000 NZD for three years.

Interested candidates should send their CV, a copy of their academic record, and a brief statement of why they are interested in the position, to Marie Graff, at marie.graff@auckland.ac.nz. There is no formal closing date for applications, but those received by February 1st will receive priority.

ANODE 2023

The ANODE (Auckland Numerical Ordinary Differential Equations) 2023 conference will be held on the dates 20-24 February 2023. The conference website is at https://www2.mathematik.uni-halle.de/anode2023/. Registration can be made from this site.

The subjects of the conference are wide ranging and will impinge on dynamical systems and applications in science and applied mathematics. Several speakers from the Mathematics department will take part. Members of the university are welcome to attend individual lectures without registering for the entire conference. Members of the university will be welcome to attend the conference banquet, for a small charge, while there are still vacant places.

Please contact John Butcher at butcher@math.auckland.ac.nz if you wish to
(a) keep you updated on details of the conference
(b) send you an electronic version of the programme booklet on 16 February 2023.

ANZIAM 2023

Australia and New Zealand Industrial and Applied Mathematics
Annual Conference
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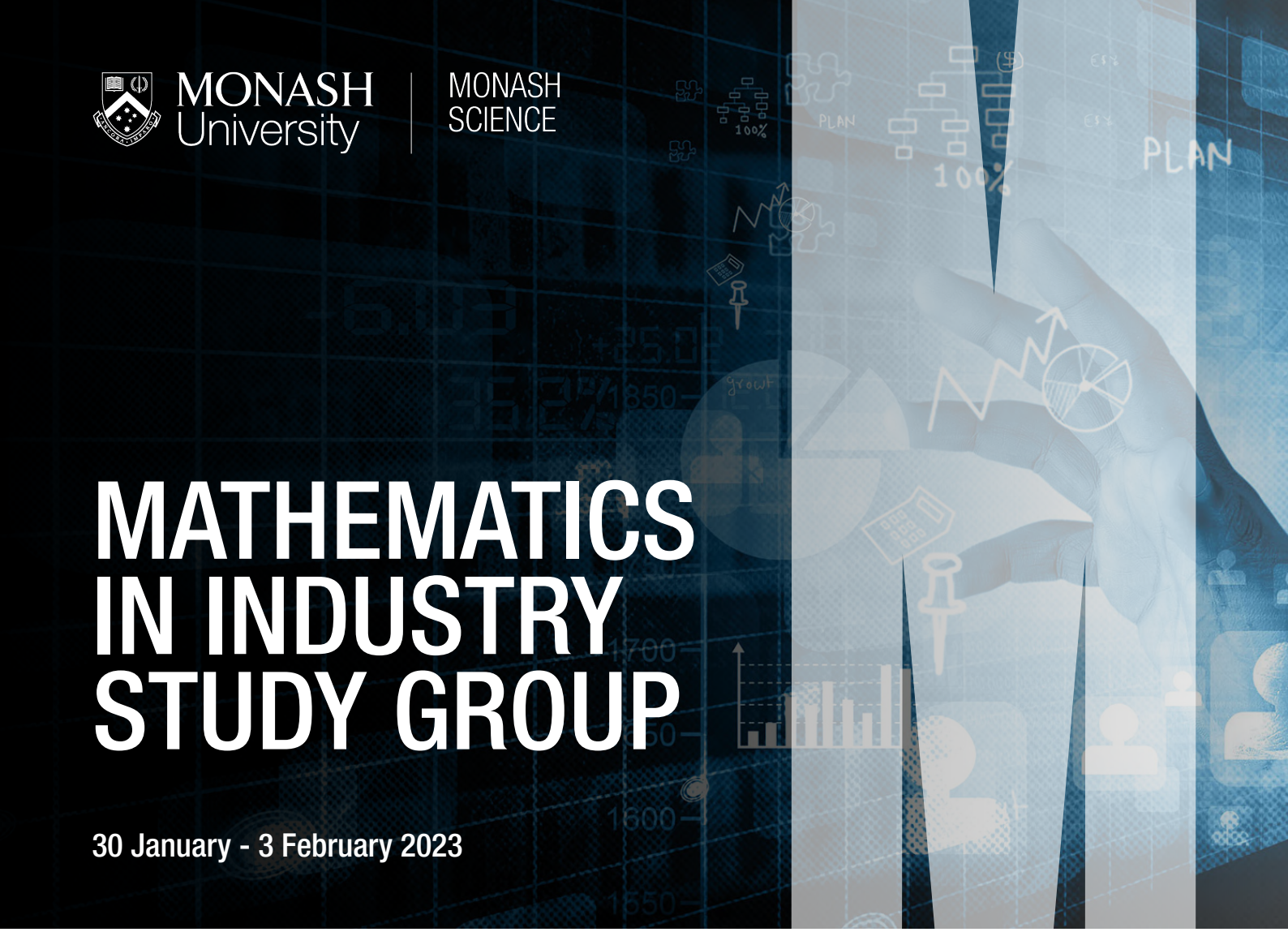

MATHEMATICS IN INDUSTRY STUDY GROUP

30 January - 3 February 2023

Since 1984 the annual MISG workshop has brought together leading applied mathematicians, statisticians, physical scientists and engineers from universities, the public and the private sector from across Australia, New Zealand and around the world. In an effort to tackle complex technical problems facing Australian and New Zealand businesses and industry, the workshop provides practical, working solutions to real-life problems using methods from the mathematical sciences.

We have worked with a diverse range of more than 90 Australian and New Zealand business and industry partners, ranging from large multinational conglomerates to small-to-medium enterprises, on more than 160 different projects spanning a broad spectrum of industry sectors, including mining, railways and freight, manufacturing, metal processing, food and beverages, oil and gas, utilities, biomedical science, and technology.

"Very happy with the MISG experience. Above all, the curiosity and enthusiasm across numerous applied projects was inspiring to see. This will be very relevant to the long term future of optimising our production systems. MISG was structured and facilitated extremely well and productively."

Pia Winberg, CEO Venus Shell Systems

"Congratulations on the MISG week. I was truly impressed with the outcome your group achieved. The result will be a much improved door design that requires less electricity to keep a house comfortable and uses fewer resources to manufacture. Awesome!!"

Nigel Spork, CEO Centor Designs Pty Ltd

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NZMS NOTICES

Deadlines for applications for Financial Assistance

The NZ Mathematical Society has quarterly deadlines for financial assistance applications. Applications must be made well in advance (at least one month before the funded activity, but the earlier the better) and retrospective applications will not be considered. The deadlines for applications for 2023 are: 15 February, 15 May, 15 August, and 15 November. You should hear back from the Council within a month of the deadline. The types of grants are as follows.

NZMS Student Travel Grants

The NZMS invites applications from students for financial support for the presentation of research at conferences, attending workshops, and developing new collaborations. Typical grants for travel within NZ and Australia are in the range $200–$600. For travel further overseas, larger grants may be considered. To be eligible, a student must be based at an institution in New Zealand and be active within the New Zealand mathematical community. NZMS Student Travel Grants can contribute to costs including: flights, conference registration, accommodation, and travel-related costs associated with family responsibilities.

NZMS Student Travel Grants are generously supported by an annual grant from the Margaret and John Kalman Charitable Trust .

NZMS Financial Assistance

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

Further information and application details can be found on the NZMS website: http://nzmathsoc.org.nz/?assistance.

Draft minutes of the 48th Annual General Meeting of the NZMS

University of Canterbury (Christchurch), 6th December 2022.

Present: David Bryant, Simone Linz, SangHyun Kim, Tanya Evans, Dominic Searles, Carlo Laing, David Simpson, Indranil Ghosh, Vivien Kirk, Charles Semple, Cathy Hassell Sweatman, Winston Sweatman, Mick Roberts, Chris Tuffey, Sione Ma'u, Hinke Osinga, Bernd Krauskopf, Alastair Jamieson-Lane, Jonny Stephenson, Nicolette Rattenbury, Priya Subramanian, Florian Beyer, Brendan Harding, Robin Hankin, Pedro H.B. Rosetto, Jiling Cao, Melissa Tacy, Marie Graff, Jeroen Schillewaert, Rua Murray, Boris Baeumer, Graeme Wake

Apologies: No other apologies.

If your name is missing from the list of attendees, or if you have any correction to make, please email the NZMS Secretary at dimitrios.mitsotakis@vuw.ac.nz.

Meeting opened at 1700hrs. David Bryant welcomed everyone to the AGM.

1. **Previous AGM:** The minutes of the 47th Annual General Meeting (7 December 2021) were accepted as a true and accurate record of the meeting. *(Moved from the Chair, passed.)*
2. **Matters arising:** There were no matters arising.
3. **President's report:** See the President's column in this newsletter.
4. **Treasurer's report:** Stephen Marsland reported that it has been another quiet year for NZMS activities. The Society is financially in reasonable health, with a very slight shortfall, primarily due to increased (but still below budget) spend on student travel without the Kalman Trust income. The reduced number of applications for support for student travel in 2022 means that we have significantly under-spent compared to budget. This means that we have reserves to support the interests of mathematics in New Zealand. The Treasurer's report was accepted. *(Moved from the Chair. Passed)*

5. **Appointment of auditors:** Motion to reappoint Nirmala Nath as auditor approved. *(Moved from the Chair. Passed.)*

6. **Membership Secretary's report:** Around 300 members, the largest number for a while. Report accepted with a formal vote of thanks to John Shanks. It was agreed to waive the subscription fee for those who would be made redundant at AUT. *(Moved from the Chair. Passed.)*

7. There were no vacant positions on the NZMS council. Note that Stephen Joe will be replacing Stephen Marsland as treasurer.

8. **Forthcoming colloquia:**

   2023 Victoria

   2024 Joint AMS/NZMS/AustMS Auckland
   The provisional dates for the joint meeting with the Australian and American Mathematical Societies is 9-13 December 2024. We expect that by mid January this meeting will be ratified by both of them. The meeting marks our 50th anniversary. A local organising committee is in place, and we will shortly establish a programme committee with 3 members from each society. Satellite programmes and invited speakers to be determined in 2023.

   2025 Waikato

   2026 Otago

9. **Update on Forder and Aitken lecturer:** LMS has said it will not continue Aitken for environmental reasons (still to be voted by LMS), Forder will continue, we will look beyond the UK, with a name change up for discussion. The Forder lectureship will continue as usual in 2023 with invited speaker Imre Leader. We need volunteers to host Imre in each centre.

10. **Report on the NZ Journal of Mathematics:** Tom's report to be tabled.

11. **Correspondence:** none.

12. Any other business: We discussed the AUT redundancies, members are asked to send ideas for help, both for this specific case and more generally.

The meeting closed at 1815hrs.

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— Randy LeVeque, SIAM Member, Fellow, and Board Member

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