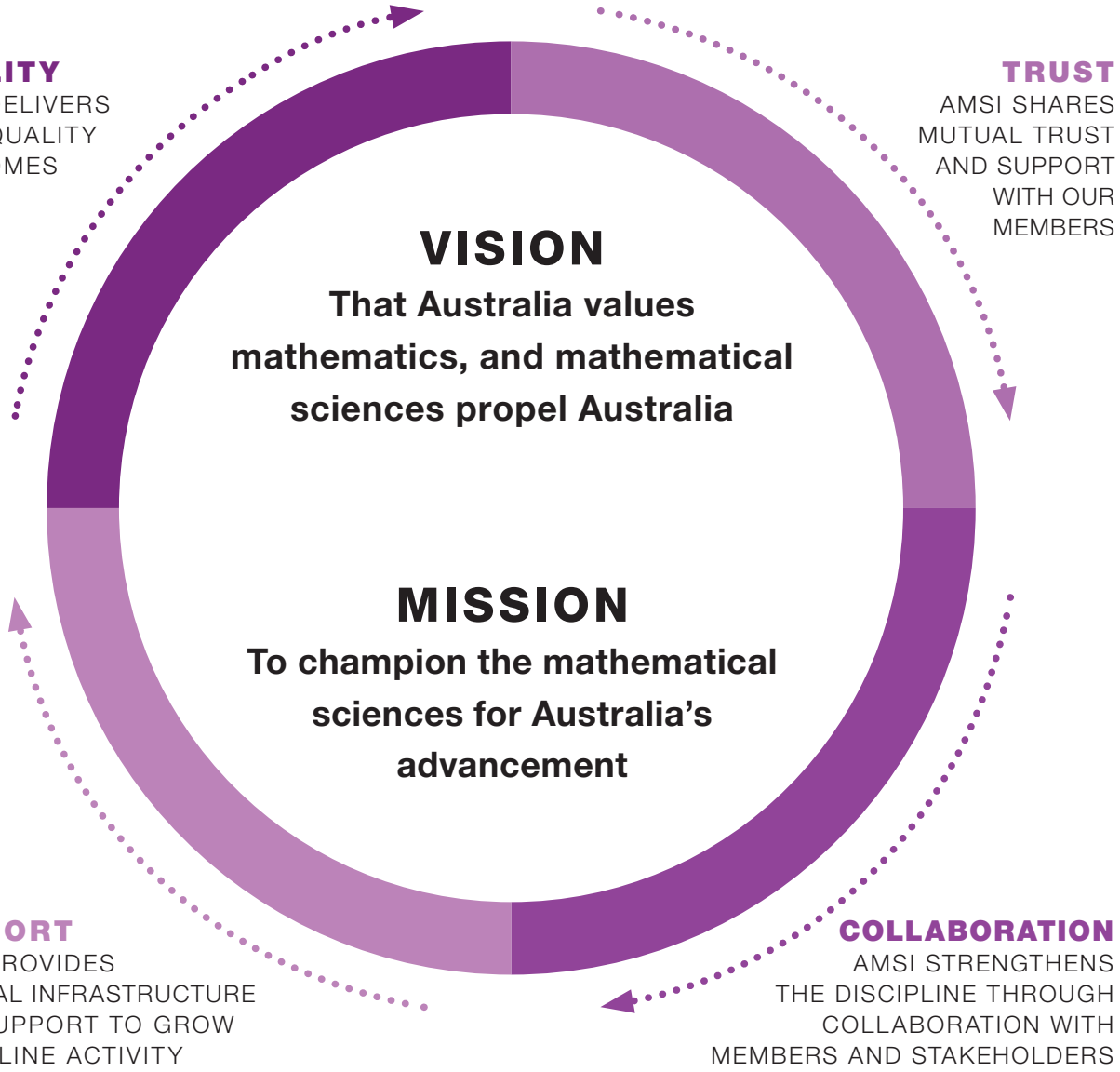
AMSI AUSTRALIAN MATHEMATICAL SCIENCES INSTITUTE

ANNUAL REPORT **2022**

Our Vision & Mission



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AMSI Members

Full Members

La Trobe University

Monash University

QUT

RMIT University

Australian National University

The University of Melbourne

The University of Newcastle Australia

The University Of Queensland Australia

The University of Sydney

The University of Western Australia

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ATSIMA

ANZIAM

Aust MS Australian Mathematical Society

ANZAMP

Australian Bureau of Statistics

Australian Government Bureau of Meteorology

CSIRO

Curtin University

Deakin University

DST Group

Australia ECU Edith Cowan University

Flinders University

Griffith University

James Cook University Australia

Macquarie University

The Mathematical Association of Victoria

ERGA Mathematics Education Research Group of Australasia

Murdoch University

NZMS

The New Zealand Statistical Association

Optiver

Reserve Bank of Australia

Statistical Society of Australia

Swinburne University of Technology

une University of New England

University of South Australia

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University of Wollongong Australia

Victoria University Melbourne Australia

Western Sydney University

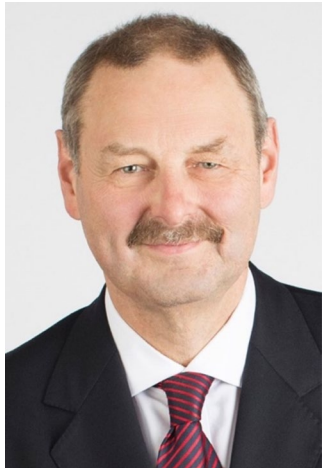
From the Chair

Dr Adelle Howse

It has been an honour to serve on the AMSI board for the past decade with the past three years as Chair. My thanks goes to all the past leaders, board and alumni of AMSI who have helped shape AMSI into the organisation it is today.

It is crucial that AMSI continues to deliver on its mission for the benefit of the mathematical sciences community in Australia and I was very pleased that Dr Les Trudzik took over the Chair role in July 2022, bringing his expertise and passion to further propel AMSI's impact. Despite changes over the years, what remains constant is the overwhelming support and loyalty from the AMSI alumni, members, staff and sponsors. Their dedication and belief in AMSI's mission have been a critical and important driving force.

Dr Adelle Howse
AMSI Chair (July 2019 – July 2022)



Dr Les Trudzik

In my first year as AMSI Chair, I would like to begin by thanking and acknowledging the work of the previous Chair, Dr Adelle Howse, in steering AMSI through a period of significant change and transition. Adelle's 10 years on the board with three as Chair covered not only the COVID-19 pandemic and sustained environmental disasters, but also a rapidly changing funding landscape.

With two significant multi-year grant government and philanthropic foundation programs concluding on schedule in 2021, 2022 was a year of reorientation. It was pleasing to receive ongoing endorsement from government through the Department of Science, Innovation and Resources (DISER) $1M Wise Grant to support female STEM postgraduate internships and also to receive funding from the Tibra Foundation in support of a maths teacher anxiety research pilot project. Two further submissions for philanthropic funding for schools projects were put forward in 2022 and we look forward to receiving news of those outcomes in 2023.

Taking over as Chair in July 2022 represents an important personal step in a long and gratifying journey of studying and applying mathematics in a variety of ways and a range of industry settings. My trajectory from post graduate study in operations research, to implementing emergent technologies into the then State Electricity Commission of Victoria, and more recently in organisational performance modelling and economic impact assessment, has led to this privileged opportunity to assist AMSI promote and champion more widely the national asset that the mathematical sciences represent.

The importance and value of the mathematical sciences to Australia has never been more evident than during the events mentioned above, or indeed in the rapidly changing nature of work largely related to the developing clean economy sectors. As such, in 2022 the efforts of AMSI continued to focus on using its combined resources in supporting and advocating for the mathematical sciences across the full spectrum of schools, academic research and industry. Specific activities included policy submissions to the review of the Australian

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Research Council Act 2001, in which AMSI proposed the inclusion of a provision in the ARC Act to specify discovery research as an explicit and substantial part of the ARC's scope, and the removal of the gap in funding for mathematical research infrastructure. We joined with the Australian Association of Mathematics Teachers (AAMT) and Australian Maths Trust (AMT) to respond to the Treasury Employment White Paper on measures to grow a quantitatively literate teaching workforce; and to the Jobs and Skills Summit to address the need to remove barriers to student participation in school maths; the need to train more teachers and to address the current skills shortages.

The 2022 year heralded a significant 20th anniversary of the annual Summer School which attracted 159 honours and postgraduate students, early career researchers and industry professionals from 23 universities and organisations. The year also saw AMSI respond strongly to the wind down of government NRIP funding for APR. Intern and consolidate the new self-managed national internship program, placing 58 PhD students into industry partnerships in its first year of independent operation. In strengthening engagement with industry, the AMSI Joint Venture Agreement was updated, as part of a suite of changes, to allow for corporate membership of AMSI.

Together with the Statistical Society of Australia, AMSI commenced a broad-ranging review of data science. Given the rising developments in machine learning and AI, the aim is to encourage an interdisciplinary approach to the teaching of data science courses by engaging mathematics, statistics, computer science and business studies. This reflects continued demand from and opportunities within the corporate sector, for high levels of rigour in analysing and utilisation of data driven insights. This is also reflected in scientific research, such as in the increasing use of AI and AMSI is eager to foster ongoing collaboration between industry and the university sectors to further commercially viable translational research.

AMSI achievements over the year have been predicated on the dedication and thoughtful contributions of the AMSI Board and the Joint Venture Partner universities, as well as the AMSI members and alumni more generally. These efforts in themselves indicate the strong level of good will and support amongst the mathematical sciences community. I would like to particularly recognise the efforts of A/Prof. Linda Galligan, Prof. Robyn Owens and Dr Sue Barrell as retiring Board members, and welcome new members Prof. Anthony Dooley and Dr Thomas Barlow to the Board. The role of the University of Melbourne as Lead Agent is also gratefully appreciated for providing its ongoing support and expertise to AMSI across many functions.

Finally, and perhaps most importantly, I would like to single out for thanks and appreciation the efforts of the AMSI Executive and staff, led by Prof. Tim Marchant, for their ongoing dedication to serving the AMSI mission and delivering its programs and initiatives.

Dr Les Trudzik
AMSI Chair (July 2022 - Current)

From the Director

There was a major change to AMSI leadership during 2022 with Dr. Adelle Howse stepping down mid-year as Chair of the AMSI Board. Adelle had been a board member for ten years, served two years as Deputy Chair and three years as AMSI Chair. Adelle worked closely with and supported all the AMSI Directors of the last decade; Geoff Prince, Tim Brown, Asha Rao and myself. Her strategic insight relating to the mathematical sciences and the organisation as a whole, coupled with her deep knowledge and experience of governance was outstanding. Her experience, commitment and contribution was vital in guiding AMSI's direction and strategy. Adelle was awarded the AMSI medal for Distinguished Service for her many contributions.

In the second half of the year our new Chair, Dr. Les Trudzik commenced in the role. Les has an extensive background in mathematics with a PhD in operations research from the University of Melbourne. He is currently a Director and Board member of ACIL Allen Consulting and has over thirty years' of experience in professional advisory firms. He brings to AMSI his extensive skills and capabilities relating to strategic planning, government policy and industry growth, promotion of mathematics and STEM, and stakeholder engagement.

A review into the role of the mathematical sciences in Data Science in Australian Universities was initiated in 2022, by AMSI and the Statistical Society of Australia, with the report to be published next year.

Together with the AustMS and the SSA, AMSI submitted a response to the review of the Australian Research Council. Our submission, which incorporated extensive member feedback, emphasized the key role that fundamental research plays in the mathematical sciences and the need for increased funding for discovery focussed research. Our submission also highlighted the heavy administrative burden associated with ARC grant applications. I'm pleased to report that the administrative burden has now been lessened, with the introduction of a two stage ARC grant application process.

The national scale that the AMSI higher education program bring to research training in the mathematical sciences, is a key feature of our operations. The 2022 Summer School was held at the University of Technology Sydney, in online mode with local event hubs, while the 2022 Winter School was hosted by UQ in partnership with the Mathematical Sciences Research Institute, Berkeley, USA. The Winter School was an exciting example of international cooperation in research training, with two event hubs, one at UQ and one in Hawaii. Other programs offered in 2022 include the Summer Research Scholarships, AMSIConnect and the ACE Network subjects. The quality of our higher-education events is world-class and I believe that they will have growing appeal in future years, not just to students studying in Australia, but to students from across the Indo-Pacific.

AMSI relies on the continued commitment of its members, in order to advance the mathematical sciences in Australia. It also relies on the hard work and commitment of its staff. I have enjoyed working with all the AMSI members and stakeholders over the year-thank you for your support.

Professor Tim Marchant

From the Chief Operating Officer

2022 saw AMSI gradually transition from covid lock down operations to delivering our programs, events and engagement in person again where possible. The pandemic broadened our thinking regarding participation and so we continue to offer a hybrid program model, to ensure the greatest accessibility for our participants and stakeholders Australia-wide. This is now business as usual.

AMSI moved into implementation phase of the new philanthropic arm and finished the year with three projects in the pipeline to the value of $400,000. These projects will focus on the re-write of the highly regarded AMSI maths textbooks, to ensure they comply with the updated Australian curriculum; the professional development of maths and careers teachers so they may better understand the career pathways for students who continue to study maths; and a research project to better understand student anxiety around maths.

AMSI fully transitioned to the new APR.Intern business model in 2022, with eight university subscribers and many others on a pay as you go basis. The program continued to attract an impressive array of industry partners, from start-ups to established multi-nationals and the year ended on a very high note for the program when it was awarded $1M for female STEM internship vouchers from the Department of Industry, Science, Energy and Resources (DISER).

AMSI introduced a corporate membership in 2022, inviting industry to join our impressive networks, access our advocacy and insights, as well as provide AMSI with their view on the mathematical sciences. We are delighted that Optiver was AMSI's first corporate member and they have been very involved in AMSI's Research and Higher Education program over the course of the year.

AMSI hosts a careers day as part of the Research and Higher Education Summer School each year. In 2022 we made it bigger and better by hosting a stand-alone event in partnership with Melbourne Connect where industry presented about opportunities for maths graduates at their organisations; and met postgraduate students to talk about career possibilities. The day was a great success, and we will continue to grow this event in future years.

The Schools division continued AMSI's MathsTalk podcast and ongoing close interaction with maths teachers around Australia. This is a unique forum to engage our teachers and is important for the philanthropic projects we hope to secure for next year.

This year, advocacy and research focussed on the Data Science Review and the next edition of the State of the Mathematical Sciences, as well as grant writing for government and philanthropic opportunities. Our marketing, comms and design have been the backbone as usual, providing the content and design for our website, social media, media releases, reports, posters, events, mailouts and more.

I wish to express my thanks and gratitude to all staff for their flexibility, resilience and loyalty. The AMSI team's willingness to pitch in and go the extra mile is a defining feature of the small but talented team.

Lisa Farrar

Major Achievements 2018–2022

- **$12M** in government funding and **$8.2M** in philanthropic funding generated by **$6.6M** in member subscriptions
- **2,648** participants at **26** AMSI flagship events
- More than **5,000** participants at **74** AMSI-sponsored scientific workshops
- **517** travel grants awarded to students
- **275** international mathematicians sponsored to speak at workshops
- **677** PhD students placed into industry internships, generating **$3,480,500** in research funding for universities, nationally
- A vibrant and influential school mathematics program including **1,719** school visit days at **120** schools across Australia
- **3,284** attendees at **383** professional development days for teachers
- **20,000** downloads of MathsTalk Podcast for teachers
- Publication of AMSI's flagship report, **The State of Mathematical Sciences**, conveying key issues affecting the role and stature of mathematics in Australia
- Publication of additional reports; **2** Occasional Papers, **2** Gender Reports and **5** Survey Data Reports including data on Year 12 mathematics participation
- **Consistent advocacy** to Government on the vital role of the mathematical sciences for Australia's advancement

Policy & Advocacy

The central voice for Australia's mathematical sciences, AMSI actively enters the national debate to advocate for critical reform across the mathematics pipeline spanning school-based and higher education, research, training and funding to industry collaboration and innovation to increase capacity and engagement.

Dr Maaike Wienk
Finance, Advocacy & Policy Manager

AMSI.ORG.AU

Strategy & Policy

In its policy document, *Mathematical Sciences: Foundation for Australia's Future—Policy Priorities realising AMSI's long-term strategic goals*, AMSI proposes immediate action in three areas of priority in line with AMSI's long-term strategic goals for the mathematical sciences in Australia:

- Equity and diversity
- Mathematical education
- Industry engagement in university teaching and research

These priority areas inform AMSI's advocacy for the mathematical sciences and add to its ongoing programs to support mathematical research and education in schools and at universities.

AMSI'S LONG-TERM GOALS FOR THE MATHEMATICAL SCIENCES IN AUSTRALIA:

Australia **recognises and enjoys the benefits** of mathematical sciences

Australia **recognises the necessity for diversity** in the mathematical sciences workforce

Australia has **balanced supply and demand** for the Australian mathematical sciences workforce

Australia values mathematical sciences **research and its contributions**

The overall participation in high-level mathematical sciences at schools and universities **meets Australia's needs**

Policy Document: amsi.org.au/foundation-for-australias-future

2022 Policy Submissions

AMSI represents the mathematical sciences through submission of responses to national issues, papers and reviews.

Treasury Employment White Paper – joint submission by AAMT, AMT & AMSI, November 2022

Building on the outcomes of the Jobs and Skills Summit, AMSI submitted a joint response with AAMT and AMT in the consultation round informing the Treasury Employment White Paper. The White paper focuses on "the objectives of full employment and productivity growth for the benefit of all Australians, along with women's economic participation and equality", providing a "roadmap for Australia to build a bigger, better-trained and more productive workforce – to boost incomes and living standards and create more opportunities for more Australians."

The submission addresses the need to remove barriers to student participation in school maths, the need to train more teachers and to address the current skills shortages.

The full submission is available here: amsi.org.au/wp-content/uploads/2022/12/aamt-amsi-amt-submission-30-11-22.pdf

Review of the Australian Research Council Act 2001, Joint submission by AMSI, AustMS and SSA, December 2022

In December 2022, AMSI, AustMS and SSA collaboratively submitted a response to the consultation on the Independent Review of the Australian Research Council Act (ARC Act) 2001. This review was announced in August 2022 by the Hon Jason Clare MP, Minister for Education, to consider the role and purpose of the ARC within the Australian research system.

On behalf of the mathematical sciences discipline, the submission emphasised the importance of providing support for fundamental research, and the pivotal role of the ARC in facilitating this. The submission recommended the inclusion of a provision in the ARC Act to specify discovery research as an explicit and substantial part of the ARC's scope, and the removal of the gap in funding for mathematical research infrastructure. Other recommendations include scaling back funding proposal requirements and reducing the administrative burden of the research proposal process.

The full submission is available here: amsi.org.au/wp-content/uploads/2022/12/amsi-austms-ssa-submission-arc-review-consultation.pdf

Panel Discussions

AMSI organises panel discussions at its member meetings, which take place twice a year, to engage with topics affecting the mathematical sciences, to inform members of current developments, to foster collaboration among universities and other organisations with an interest in promoting the mathematical sciences, and to elicit input and feedback into AMSI's advocacy and policy program.

In 2022, two panel discussions were organised:

February 2022: Industry Engagement in the Mathematical Sciences

Speakers:

- **Prof. Tim Marchant**, AMSI Director
- **Prof. Howard Bondell**, the Head of School of Mathematics & Statistics at the University of Melbourne
- **Dr Aaron Belbasis**, the Futures Technology Lead at Aurecon
- **Mr Simon Hanson**, the Director of SME Connect at CSIRO

Introductory speaker Professor Marchant reported that the critical technologies expected to drive innovation in Australia include data science and analytics, artificial intelligence, machine learning, blockchain technology, cyber security, logistics and optimisation. At the same time, the shortage of maths science graduates and secondary school maths teachers, high rates of out-of-field teaching and declining performance by Australia's schoolchildren in international benchmarking tests indicate that the supply of the graduates with maths sciences skills is expected to be too low to meet the growing industry demand.

An additional challenge includes the low levels of engagement between academics in Australia and industry. According to the World Bank data, Australia went down by 27 places in rank for university/industry research collaboration from 2013 to 2020. Strengthening the university-industry nexus in research is key to unlocking and levelling-up innovation, productivity, resilience and increasing global competitiveness in Australia.

Professor Bondell stated that the major challenge from the university perspective is that industry partners and Business Development teams at universities lack a complete understanding of how mathematical skills can be applied in industry projects. Therefore, mathematicians need to use the growing interest in STEM skills to explain the value of mathematics better.

Dr Belbasis (Aurecon) provided insight into the existing challenges through the industry lens. He stated that graduates often lack maturity and confidence in their skill set, resulting in difficulty communicating where those skills can be applied commercially. There is not enough advocacy around the value of maths students that can be leveraged within industry, and therefore sometimes companies prefer other STEM graduates.

Mr Hanson (CSIRO) provided an overview of the SME Connect team activities, which help to connect Australian small and medium sized enterprises with Australia's research sector. He reported that the Innovation Connections program is an element of the federal government entrepreneurs program that provides funding for SMEs to carry out research and development. Challenges in this area are mainly around ensuring that researchers and companies understand the project's objective, the intricacies of universities' organisational structure and complicated legal processes.

Feedback from the members noted that AMSI initiatives in the industry-research space focus on bringing students to industry and suggested considering a reverse process where people with tertiary education who are already in industry are reconnected with universities. To bring maths and industry closer, universities should help industry understand the value of mathematical sciences and industry partners should communicate the importance of fundamental education to students.

A discussion arose regarding the industry demand for calculus-based skills taught in applied maths. These skills are required in solving problems that software and other technologies struggle to solve. For example, to introduce new tools, industry needs problem solvers who can break the established models to identify the fundamental modular components to build new solutions. Industry currently struggles to find enough staff with this skill set. However, maths students learn to think outside the box to find new solutions, and retaining fundamental mathematical grounding in other STEM disciplines is essential. To boost STEM degrees with additional fundamental mathematical content it was suggested that promoting double degrees to sustain students' mathematical knowledge could provide a solution.

Panel Discussions – *continued*

July 2022: "The hardest unsolved maths problem - how to remedy declining year 12 participation rates"

Speakers:

- **Dr Maaike Wienk**, AMSI Finance, Advocacy & Policy Manager
- **Mr Trevor Black**, Vice President of the Australian Centre for Career Education (ACCE)
- **Prof. Deborah King**, Director of Bachelor of Science at the University of Melbourne
- **Mr Michael O'Connor**, President of the Australian Association of Mathematics Teachers (AAMT)
- **Mr Glenn Fahey**, Program Director in Education Policy at the Centre for Independent Studies (CIS)

Introductory speaker Dr Wienk shared a presentation on the proportional participation in intermediate and higher maths which has been gradually decreasing from 1995 to 2008, staying more or less at the same level from 2009 to 2019 before dropping dropped to an alarming new low in 2020. At the same time, the number of domestic undergraduate commencements in degrees that require quantitative skills has increased, creating a significant gap between the pool of Year 12 students who studied maths at intermediate or high levels and the pool of undergraduates studying Natural and Physical Sciences, IT and Engineering. Out of 219K students completing Year 12 in 2017, only 67K graduated with intermediate or higher maths, from which 735 started a Maths degree and eventually only 486 students completed their Maths degree in 2020.

Mr Trevor Black outlined the possible factors in declining participation rates, including lower levels of interest in mathematics, the COVID impact, anxiety in students, less tertiary courses requiring mathematics, more bridging mathematics courses offered by universities and alternative pathway options. Considering the high number of Year 12 students that move from doing intermediate and high maths to STEM degrees, students must be aware from a young age of what careers mathematics can lead to.

Professor Deborah King shared her analysis of national as well as state-based trends in maths participation in senior schooling, demonstrating that the current problem is not new and that the student enrolments have been in decline over the last few decades. Reasons for this decline during the 90's comprised the elimination of higher maths pre-requisites for university STEM courses and students' lack of willingness to take two maths subjects to become eligible for higher level maths in Year 12. She also raised concerns around the drop in elementary level maths over the past decade. In addition, participation in all learning areas across Year 12 has decreased over the past decade, potentially because students are taking fewer tertiary preparation subjects and moving towards VET and VCAL instead. What drives students away from doing maths are workload issues and diverse interests. Her recommendations include an increased focus on intermediate and elementary maths participation, a well-defined value proposition of the advanced maths for the students, a less crowded national curriculum and a united voice of the national peak bodies and stakeholders on this critical issue.

Mr Michael O'Connor provided an overview of the topic from teachers' perspective. It is essential to consider the opposite end of the pipeline as it is expected to see a significant drop in maths teachers because of the lower influx of graduate students who want to teach maths and the low teacher retention rate. Emphasis should be given to supporting teachers and promoting maths teaching as a valuable job and long-term career.

Mr Glenn Fahey highlighted the consequences of declining enrolments, potential causes of recent trends and possible solutions. One of the leading causes of declining participation rates in higher maths is declining achievement earlier in the pipeline. In the period 2008-21, students' early achievement has improved in reading but not numeracy. Doing maths, and doing this at a higher level, significantly increases students' chances of doing a STEM degree at university, completing it and ultimately ending up in a STEM-based occupation. Glenn Fahey estimated that of every 100 students not participating in higher or intermediate maths, 37 would have otherwise potentially graduated from a STEM degree. He therefore suggested that raising students' numeracy achievement from a very early age would increase the enrolments in maths in Year 12. The pathways to raising achievement include improving teaching practice and teaching supply.

In the member discussion it was pointed out that hierarchical structure in schools' systems can sometimes impede students from starting maths subjects at any level of their studies. Part of the value proposition of intermediate and higher maths is that students can get good transferable skills such as critical analysis and logical reasoning. The members also discussed the low efficiency of university bridging courses and how they can stimulate the decrease in maths participation in senior schooling.

Discussion also occurred about the lack of accessibility of higher maths in high schools, particularly in regional and rural areas, and the reasons include low demand and lack of prerequisites. AMSI, with the office of the Chief Scientist, conducted an inventory of existing prerequisites at universities around Australia, which showed that very few degrees require specialist maths for science and engineering, most having maths methods as a prerequisite, if any. Members discussed the importance of reinstating the entry requirements at universities and starting with Group of Eight (Go8) universities would have a national influence.

Priority should be given to encouraging maths qualified teachers to work in primary and secondary schools to stimulate early educational achievement and engagement in maths. An element of maths anxiety and lack of confidence is prevalent among primary school teachers. Resources should be allocated to provide support and professional learning for those teachers.

Schools

The AMSI Schools program delivers a range of initiatives that support and strengthen mathematics teaching in schools, including resources for teachers, students and parents, mathematical careers advice and presentations, professional development programs, curriculum consultation and of course our highly popular podcast.

Leanne McMahon
Schools Outreach Officer

SCHOOLS.AMSI.ORG.AU

The ChooseMATHS Legacy

Whilst the major activities of the ChooseMATHS project were completed in 2021, the rich legacy of materials and resources continues to enrich tens of thousands of teachers and students

Outreach

The need for the AMSI Outreach program was highlighted by many teachers in AMSI's interactions, and requests for assistance were plentiful. To this end, the whole of AMSI is seeking further funding opportunities to continue to expand on the foundation built by ChooseMATHS.

Consulting

An area in which AMSI continues our vital role is in the development and consultation of the mathematics curriculum by The Australian Curriculum, Assessment and Reporting Authority (ACARA). AMSI is in the unique position of being an organisation that not only advocates for the mathematical sciences, but has expertise in the teaching of these.

AMSI's understanding of mathematics in schools was vital to the preparation of the AMSI response to the ACARA draft curriculum and highlights the importance of the maintenance of a strong connection to school mathematics educators as a part of the pipeline.

Teacher Professional Learning

Teacher professional development in mathematics is a critical aspect of improving teaching practices and student outcomes in this subject. The complexity of mathematics requires teachers to have a deep understanding of the content, pedagogical knowledge, and strategies to support students' learning. However, teachers often struggle to keep up with new research, teaching methods, and technology advances. The professional learning opportunities provided by AMSI Schools have been crucial to help teachers develop new skills and improve their teaching practice. Attendance at the MAV conference and various online conferences brings the expertise of our mathematics advisor to the teachers at their point of need and has been a big part of the successful transition from the ChooseMATHS project.

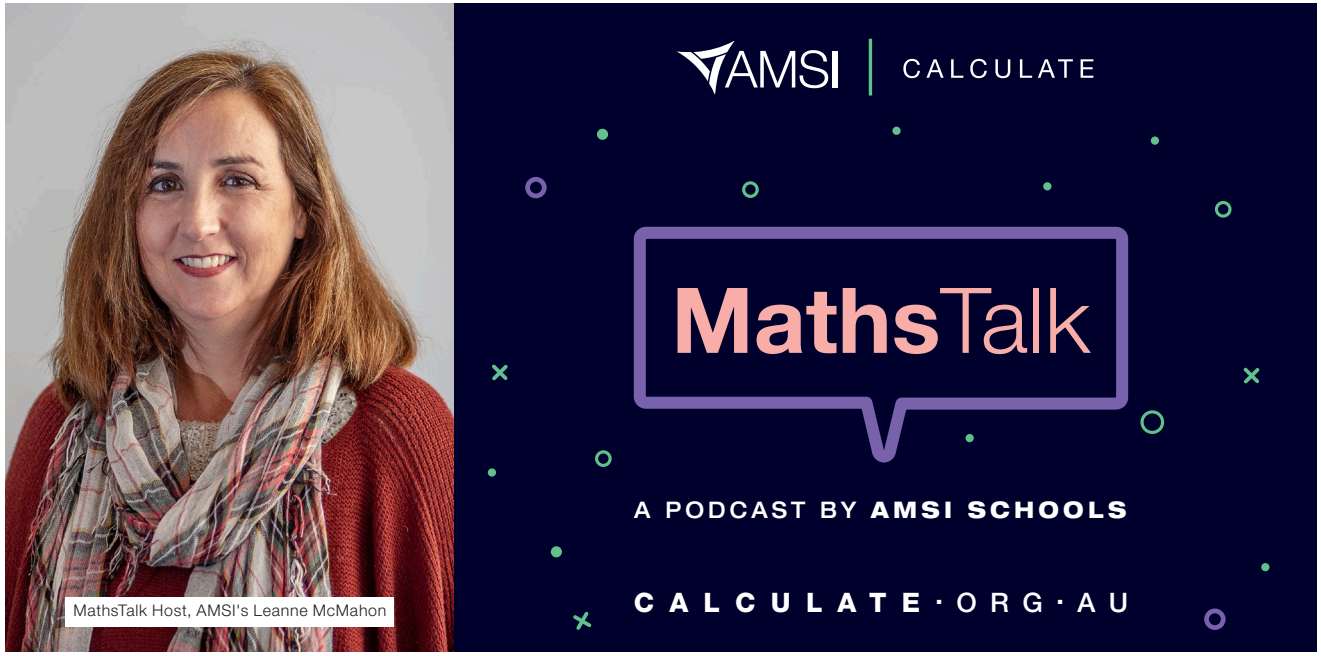
MathsTalk Podcast

The MathsTalk podcast by AMSI Schools continues to go from strength to strength, with over 20,000 downloads, half of which were in 2022.

There are many benefits to using the MathsTalk podcasts as a professional development tool. First, they are convenient and accessible. Teachers can listen to podcasts on their own time, whether it is during their commute, while exercising, or at home. They can also choose episodes and guests that align with their interests and needs. Moreover, the MathsTalk podcast is an excellent way to learn from experts in the field. We have featured interviews with renowned mathematicians, researchers, and educators, all of whom shared their knowledge, experience, and insights. This allows teachers to learn from people who have extensive expertise in mathematics education, and who can provide valuable advice and guidance.

MathsTalk allows teachers to stay up to date with the latest research and trends in mathematics education through our discussions about recent studies and research findings. This can help teachers better understand how students learn mathematics and what strategies are most effective. This information can then be applied to the classroom to improve teaching practices and student outcomes.

MathsTalk stands alone as the only podcast dedicated to the teaching and learning of mathematics in Australia, and it has extended AMSI's Outreach program beyond participating schools to the wider education community in Australia and even overseas.



MathsTalk Host, AMSI's Leanne McMahon

2022 PODCAST EPISODES

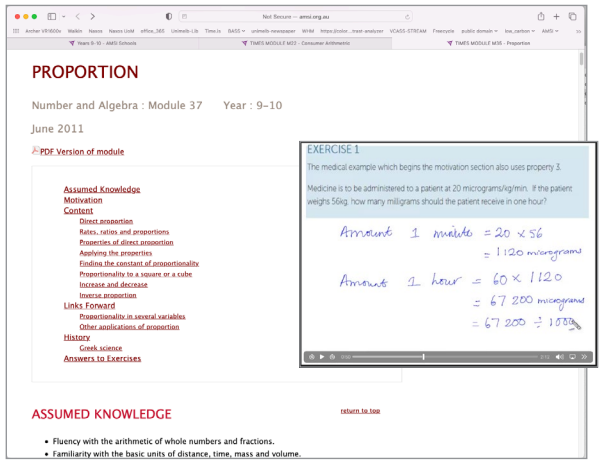
The Problem with Maths (and some digital ideas to fix it) with Greg O'Connor
Creating Success for ALL students with Kerryn Sandford
Creating Success for ALL students Part 2
Conceptual Understanding Part 1 with Nadia Abdelal
Conceptual Understanding Part 2
Ready Set Upskill - The importance of understanding data with Marcus Garrett
Learning to Learn Mathematics with Helen Booth and Vicky Kennard
Maths Anxiety in Teachers with Helen Booth
Senior Maths Revision Special with Vicky Kennard
How to improve curriculum planning in schools: Ending the lesson lottery – A Discussion with Nadia Abdelal

Teacher Resources

AMSI Schools has continued to develop a sizeable collection of teacher resources and modules with support from various funding partners. These resources continue to support teachers from Foundation to Year 12 with free mathematics materials.

The AMSI Schools and Calculate websites also host The Improving Mathematics Education in Schools (TIMES), funded by the Australian Government, and Supporting Australian Mathematics (SAM, funded by Education Services Australia) curriculum resource modules.

Nationally and internationally popular, AMSI's teacher resources continue to be the most visited part of any AMSI website.

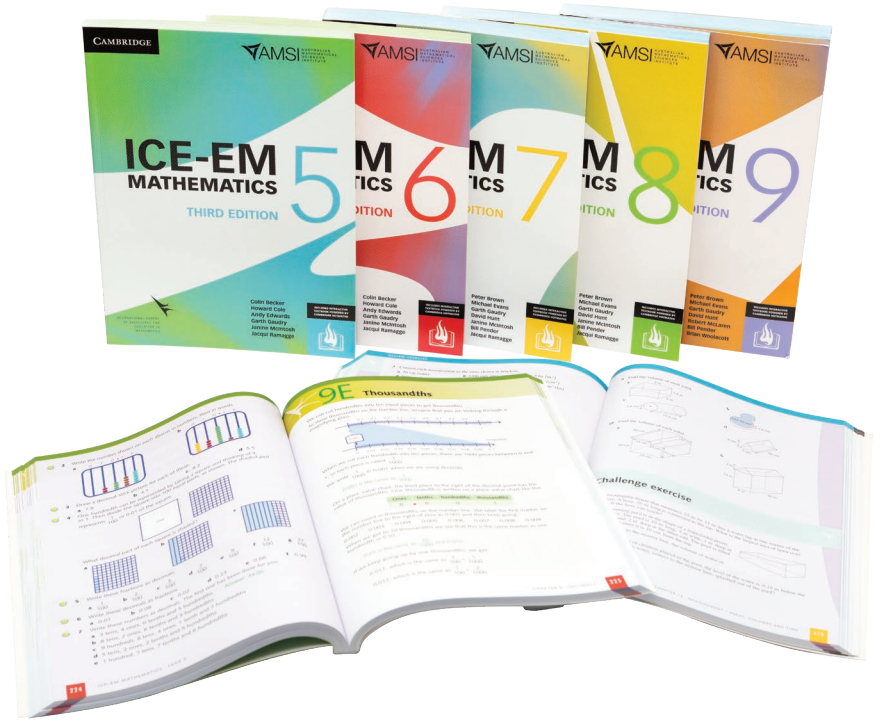


ICE-EM Mathematics

The ICE-EM Mathematics textbooks series was first self-published by AMSI in 2006. Together with AMSI Schools teacher professional development, the textbooks have become a well-regarded source of classroom support in the industry and a vital source of income for AMSI. Now published by Cambridge University Press, the textbooks include a large online component and sales of the Third Edition continue to do well.

The ICE-EM Mathematics series develops a clear understanding of mathematical ideas and concepts for students with a range of abilities, needs and levels of interest.

With the updating of the Australian curriculum, a fourth edition is in the pipeline will incorporate enhanced online resources, many of which were developed as part of the ChooseMATHS project.



Research & Higher Education

AMSI's Research and Higher Education program fosters Australia's mathematical excellence, delivering research training schools, scholarships, careers events, industry-focused symposia, specialised online subjects, national lecture tours and an internationally recognised scientific research workshop.

Angela Coughlin
National Program Manager —
Research & Higher Education

RHED.AMSI.ORG.AU

Empowering students and researchers to grow and develop their mathematics, statistics and data science skills, the AMSI flagship events, and sponsored workshops continue to demonstrate their relevance and importance in the Australian mathematical sciences landscape. Through exposure to cutting-edge methodologies and access to world-class lecturers and researchers, these programs provide participants with the opportunity to deepen knowledge, engage in cross-disciplinary research, forge new networks and drive industry innovation.

A Platform for World-Class Talent

Distinguished academics from diverse global institutions enriched our flagship events with the delivery of presentations, public lectures and hands-on workshops. These included specialists from Seqera labs, JuliaHub, Massachusetts Institute of Technology, University of Chicago (USA), University of Oxford's Big Data Institute, University of Bristol (UK), German Cancer Research Center (DKFZ), EMBL (Germany), The University of Auckland, The University of Otago (NZ) and The Chinese University of Hong Kong (HK). In addition, over 60 national experts contributed specialised courses and seminars, often unavailable within the regular scope of students' academic studies and pursuits.

In 2022, AMSI partnered with the world-renowned Simons Laufer Mathematical Sciences Institute for a highly regarded bicontinental graduate school. Lead by internationally recognised representation theorist Professor Geordie Williamson the program fostered collaborations and connections between Australia and the United States.

Supporting diversity & inclusion

For Australia to reach its full potential our future mathematical workforce needs to be more diverse. AMSI Travel Grants and Registration Scholarships address financial and social barriers to participation of currently under-represented groups, including female, First Nations, and regional, rural, and remote students at AMSI events. Hybrid participation options further increase the accessibility of AMSI flagship events to those unable to travel. In 2022, 70 students including 25 women received registration scholarships or travel grants to participate in the flagship programs and activities. The scholarships were awarded on a competitive basis by the respective event committees.

AMSI events feature a diverse line up of speakers and lecturers ensuring representation from a wide range of mathematical scientists from a variety of backgrounds. AMSI diversity in STEM events held as part of the flagship event programs covered a variety of topics including improved grant funding outcomes for women and non-binary participants, diversity and inclusion in the workplace, how diversity influences innovation, the path to equity in STEM and improved accessibility for people with disabilities.

Careers

AMSI flagship events featured program extras that provided participants with the opportunity to expand their professional networks, connect with the wider mathematical sciences community and foster student-industry engagement. Well-attended Careers sessions held at Summer School and BioInfoSummer connected students with employers of mathematical science graduates to give a clearer idea of the variety of opportunities available to mathematics, statistics and data sciences graduates. A lunchtime lecture during Winter School discussed how to transition from a PhD in pure maths to an industry career, and talks about life as a PhD student and as a researcher were included in the AMSIConnect program, as well as a careers presentation and Q&A session by AMSI Director Tim Marchant.

Outreach

The embedded outreach program, popular among event participants, host university staff and the public, continues to foster community engagement with the mathematical sciences. Accessible cutting-edge research is shared across a range of outreach initiatives such as public lectures, panel discussions, blog posts and speaker and student profiles.

2022 saw the return of the in-person AMSI lecture tour series with Mahler Lecturer Professor Frank Calegari from the University of Chicago delivering nine colloquium and public lectures in six Australian cities from November–December.

Further value is gained by making recordings of our public lectures available on the AMSI YouTube (www.youtube.com/c/AustralianMathematicalSciencesInstitute).

KEY STATS

449 AMSI flagship event participants

31% flagship event participants were female

70 students received AMSI Travel Grants or Registration Scholarships

13 sponsored workshops held in 2022

More than **660** workshop participants

Approx. **25%** of workshop participants were female

45 international workshop speakers

AMSI Flagship Events

Dedicated to advancing knowledge and skills, the AMSI flagship events facilitate collaboration among institutions and provide mathematical sciences students and early-career researchers with world-class introductory research experiences, to support their progression to advanced studies, and the growing data and analysis driven workforce.

AMSI Summer School 2022

10 January – 4 February, University of Technology Sydney
SS.AMSI.ORG.AU

Celebrating its momentous 20th anniversary, AMSI Summer School remains a highlight of the Australian mathematical sciences calendar. The 2022 program, hosted as a virtual event with weekly in-person 'hub days' in Melbourne, Sydney, Brisbane, Perth and Adelaide, attracted 159 honours and postgraduate students, early career researchers and industry professionals from 23 universities and organisations. Eight intensive honours/masters level subjects covering areas of national importance were taught by eminent lecturers from Australia and New Zealand, incorporating a combination of live-streamed lectures, instructional course videos, tutorials, and workshops.

The four-week program started on a high with an interactive panel discussion on current mathematical career and research opportunities lead by Australia's Chief Scientist, Dr Cathy Foley. Other highlights included lunchtime lectures on Ancient Babylonian Mathematics, and The Working Mathematician, social networking events, the inaugural participant talks where 20 students shared their research with the cohort and Professor Kate Smith-Miles' public lecture *When Mathematics becomes Art… The Unexpected Beauty of Self-Evolving Mathematical Functions*.

Enthusiastic students seized the opportunity to connect with representatives from Optiver, CSIRO's Data 61, Australian Signals Directorate, Geoscience Australia, Aurecon, and Bureau of Meteorology at the Industry Careers Day to explore where their highly-sought after mathematical credentials could lead them after graduation.

AMSI Vacation Research Scholarships 2021–22

December 2021 – February 2022
VRS.AMSI.ORG.AU

AMSI's Vacation Research Scholarships provide students with a taste of life as a researcher while developing analytical, critical-thinking and science-communication skills. Fifty undergraduate students from 19 member universities completed real-world mathematical research projects under the supervision of academics from their home university for six-weeks during their 2021-22 summer break.

At the end of summer, the students presented their results and networked with fellow Scholars at the national AMSIConnect student conference, held virtually for the second time over three days in February. They completed the experience by writing blog posts and research reports outlining their findings.

AMSI Winter School 2022

20 June – 1 July, The University of Queensland
WS.AMSI.ORG.AU

AMSI Winter School, now in its 16th year, introduces PhD, postgraduate students and early-career researchers to cutting-edge research and methodologies by drawing upon the knowledge of national and international lecturers at the forefront of their fields.

The long-awaited Winter School on New Directions in Representation Theory in partnership with the Simons Laufer Mathematical Sciences Institute (formerly MSRI), showcased a landmark program curated by world-renowned representation theorist Professor Geordie Williamson. In planning since 2018 and delayed twice due to COVID-19 impacts, the joint graduate school attracted 49 students from Australia and around the world who participated from satellite hubs hosted at The University of Queensland, Australia and The University of Hawai'i, Hilo in America. The two-week program featured modules on linear algebraic groups, representation Zeta functions, Kazhdan-Lusztig polynomials, triangulations, and rigid motions.

Interspersed between classes and problem sessions were a variety of hybrid activities including a career-focused lunchtime lecture from Optiver, social dinners, participant talks and a public lecture by Professor Geordie Williamson on his experiences working with AI technology to help uncover surprising patterns in pure mathematics problems.

Above: *Professor Geordie Williamson (The University of Sydney) delivering the AMSI Winter School 2022 Public Lecture – Maths, AI and Intuition.*

AMSI BioInfoSummer 2022

21 – 24 November, Melbourne Integrative Genomics, The University of Melbourne
BIS.AMSI.ORG.AU

Focused on building Australia's bioinformatics and mathematical/computational biology research capability, AMSI BioInfoSummer explores new and cutting-edge developments and provides training to upskill participants in the latest techniques. The program features global topic expert speakers alongside Australia's leading researchers.

120 students, researchers, and professionals from 27 universities, research institutes and industry organisations participated in-person or virtually in the 2022 hybrid event. The major themes were High-resolution Biology, Genome Architecture, Whole-cell Modelling, and Populations.

Sessions included hands-on introductory workshops tailored to various discipline backgrounds and specialist lectures by local and international experts. Participants received bioinformatic specific careers advice from academic and industry researchers from St Vincent's Institute of Medical Research, JuliaHub, and The University of Melbourne during an interactive afternoon panel. iStem.Co co-founders Dr Morley Muse & Dr Ruwangi Fernando kicked of the Diversity in STEM session with a discussion on how diversity influences innovation and the missed opportunities in the Australian STEM sector before Professor Louise Purton from *Equity in Australian STEMM* shared her personal experiences on the path to equity in STEMM. WEHI's award winning biomedical animator Drew Berry delivered a public lecture on Energising the living fabric of your body: The molecular engines of Metabolism.

Above: *iStem.Co co-founders Dr Morley Muse & Dr Ruwangi Fernando kicked of the Diversity in STEM session.*

Above: *Shila Ghazanfar (The University of Sydney) speaking on Single-molecule, tissue and whole organ resolutions: data analytical approaches for high resolution spatial transcriptomics data at AMSI BioInfoSummer 2022.*

AMSI ACE Network Honours & Masters Courses 2022

RHED.AMSI.ORG.AU/ACE

The AMSI ACE Network allows member universities to broadcast honours and masters subjects in online mode, enabling students, early-career researchers, and academics to participate virtually. This initiative broadens students' subject options, provides access to leading academics outside their current institution and facilitates more honours and masters completions in the mathematical sciences. It is an outstanding example of national collaboration that supports mathematical sciences students studying at smaller universities, particularly those in rural Australia.

The 2022 program included 18 subjects spanning core curriculum areas like statistics, optimisation and computation which are offered on an annual basis, along with varietal subjects addressing national needs. 71 students from 18 AMSI member universities completed a 2022 ACE subject, of which 55 completed for credit.

AMSI Third-Year Undergraduate Subject Collaboration 2022

RHED.AMSI.ORG.AU/THIRD-YEAR-SUBJECT-COLLABORATION

AMSI's online learning program was expanded in 2022 to include specialised third-year undergraduate subjects in the mathematical sciences open for cross-institutional enrolment at AMSI member institutions. This scheme provides students with access to a wider range of specialised subjects and is another element of collaboration between AMSI member institutions.

AMSI Sponsored Scientific Workshop Program

AMSI.ORG.AU/SCIENTIFIC-WORKSHOPS
RHED.AMSI.ORG.AU/WORKSHOP-FUNDING

AMSI closely collaborates with the Australian Mathematical Society (AustMS), MATRIX, and the Sydney Mathematical Research Institute (SMRI) to strengthen Australia's research landscape by supporting scientific workshops and visiting mathematicians.

Through the internationally recognised Scientific Research Workshop Program AMSI and the AustMS provide funding for international keynote speakers, enhancing the workshops' global significance and fostering crucial collaboration and knowledge sharing for impactful mathematical discovery. Successful applications must demonstrate national benefit, emphasising diversity with active encouragement for women and early career researchers.

SMRI funds and hosts keynote researchers' extended stays in Australia to build ongoing national and international collaborations.

The MATRIX-AMSI PhD Student Research Collaboration scheme empowers Australian PhD students to organise symposia and engage in post-event collaboration. After almost two years of global travel restrictions, 2022 marked a return to in-person workshops.

AMSI supported 13 workshops in 2022 covering a variety of topics:

MATRIX-AMSI PhD Student Symposium: Machine Learning and Decision Making: Theory, Algorithms and Applications
17-18 March, The University of Queensland online workshop
Attendees: 31

Mathematics of Tissue Dynamics
30 May – 3 June, MATRIX Creswick
Attendees: 19

MATRIX-AMSI PhD Student Symposium in Combinatorics 2022
30 May – 3 June, Monash University, UNSW, and The University of Queensland online workshop
Attendees: 146

Bridging Maths and Computer Science
31 May – 3 June, The University of Sydney
Attendees: 58

MATRIX-AMSI PhD Student Symposium: (GT)^3 - Graduate Talks in Geometry and Topology Get-Together
25-29 July, MATRIX Creswick
Attendees: 24

MATRIX-AMSI PhD Student Symposium: Categories and Companions Symposium 2022 (CaCS 2022)
19-23 September, MATRIX Creswick and online
Attendees: 28

Workshop on Stochastic Differential Equations and Their Applications
25-30 September, Monash University
Attendees: 28

Computational Aspects of Totally Disconnected Locally Compact Groups
24-28 October, CARMA, The University of Newcastle
Attendees: 19

Mathematics of Risk 2022
31 October – 11 November, MATRIX Creswick
Attendees: 71

Mathematics of Sea Ice and Ice Sheets
9-11 November, The University of Adelaide
Attendees: 43

SSA and NZSA Early Career and Student Statisticians Miniconference 2022
15-17 November, Statistical Society of Australia and New Zealand Statistical Association hybrid conference
Attendees: 97

Statistics and Mathematical Modelling in Combination
16-18 November, La Trobe University
Attendees: 51

Nonlinear Partial Differential Equations - Celebrating Yihong Du's 60th Birthday
21-25 November, The University of Sydney
Attendees: 51

AMSI Lecturers

RHED.AMSI.ORG.AU/PUBLIC-LECTURE

Each year, AMSI partners with the Australia and New Zealand Industrial and Applied Mathematics (ANZIAM) group, the Australian Mathematical Society (AustMS) or the Statistical Society of Australia (SSA) to sponsor an eminent international researcher in the mathematical sciences to undertake a national lecture tour. The funding allows the researcher – whose area of expertise alternates between applied and industrial mathematics and statistics – to visit a broad set of Australian universities and give research presentations at each to members of the mathematical sciences community.

Mahler Lecturer

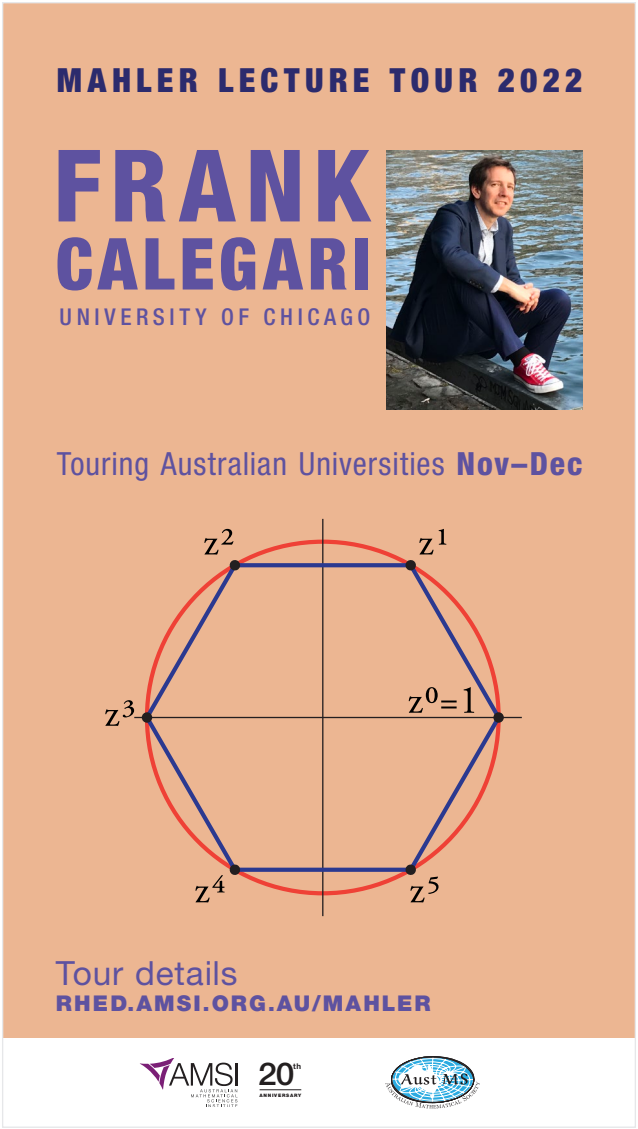
23 November – 16 December

Esteemed algebraic number theorist Professor Frank Calegari from the University of Chicago was invited to deliver the biennial Mahler lecture series in 2022, supported by AustMS and AMSI. Professor Calegari travelled to nine Australian universities in six cities to deliver a public lecture on *The Secrets of Pi (and other transcendal numbers)*, and colloquium lectures *The Arithmetic of Power Series, and Number Theory and the Langlands Program*.

Heidelberg Laureate Forum 2022

RHED.AMSI.ORG.AU/HEIDELBERG-LAUREATE-FORUM

Held annually in Germany, the Heidelberg Laureate Forum (HLF) is a once in a lifetime opportunity for highly talented young researchers to engage with annual recipients of the world's most prestigious Mathematics and Computer Science awards. AMSI and AustMS co-fund a grant to support Australia's presence at this prestigious event, awarding 2022 HLF travel grants to Ayreena Bakhtawar (UNSW), Albert Christian Soewongsono (University of Tasmania), Harini Desiraju (University of Sydney) and Illia Donhauzer (La Trobe University).



AMSI thanks the following people for their leadership in 2022: Summer School Director Professor Anthony Dooley (University of Technology Sydney), Winter School Director Associate Professor Massoud Kamgarpour (The University of Queensland), Winter School Scientific Director Professor Geordie Williamson (The University of Sydney Mathematical Research Institute), BioInfoSummer organising committee Professor Michael Stumpf, Associate Professor Kim-Anh Lê Cao, Dr Heejung Shim, Dr Agnese Barbensi, Dr Davis McCarthy and Dr Yao-Ban Chan (The University of Melbourne), ACE Network Director Associate Professor Stephen Davis (RMIT University), Research Committee Chair Professor Stephen Tillman (The University of Sydney) and Research Committee Deputy Chair Emeritus Professor Phil Broadbridge (La Trobe University). We also acknowledge the contributions of our committee members, of the speakers and lecturers, and Vacation Research Scholarship supervisors and support staff. We are grateful for their generosity in giving their time to ensure the success of these events.

SPONSORS

Australian BioCommons, Australian Mathematical Society (AustMS), Australian New Zealand Industrial Applied Mathematicians (ANZIAM), Gingko Bioworks, Melbourne Integrative Genomics, Office of the NSW Chief Scientist & Engineer, Optiver, QCIF, Statistical Society of Australia (SSA), The University of Melbourne, University of Technology Sydney.

APR.Intern

AMSI's industry engagement arm, Australian Postgraduate Research Intern (APR.Intern), is the only national PhD internship program spanning all sectors and disciplines.

The program connects postgraduate research students with industry through short-term placements, empowering students to thrive in a practical environment. For businesses, APR.Intern is a platform to access Australia's brightest emerging research talent and unlock new frontiers of innovation.

Glen Sheldon
National Program Manager — APR.Intern

APRINTERN.ORG.AU

Stacey Hansen (Business Development Manager) and Glen Sheldon (National Program Manager)

2022 Overview

2022 was a transition year for the APR intern program. By August 2021 the National Research Internship Program (NRIP) had been completed. NRIP had multiple objectives, the key ones being:

- To show students the brilliant career opportunities in industry, especially with their advanced skill sets
- To support women into STEM careers
- To kickstart innovation in industry by bringing cutting edge talent into businesses.

During the NRIP's four-year life 648 internships were executed and though the original, highly ambitious, target numbers were not met, significant progress was made in what was a trailblazing initiative.

Moving into 2022, however, the absence of a broad-based incentive scheme for businesses provided by NRIP created significant headwinds for the new version of the program. In 2021, 197 internships were executed and in 2022, without the NRIP rebate, 58 internships were signed off.

While the number of internships was down in 2022, the impact of the NRIP program had lasting benefits that carried into the new year. In the four years of the NRIP program the business development network expanded significantly. By the end of 2022, APR had engaged with over 450 different businesses and organisations across Australia.

While the initial "price shock" of offering the internship service without the rebate has taken some time to overcome, the underlying business value proposition of the program has reasserted itself. The value of having advanced, PhD level expertise, focussing on an important research project, and having they entire process managed end to end by APR has seen existing customers return, and new clients sign on even with the elevated cost structure.

KEY STATS 2022

58 interns placed from **11** disciplines across **19** Australian Universities

44 industry partners across **13** industry sectors

20 new industry partners

40% female participation rate

29% of internships undertaken by females in STEM*

26 (45%) of interns placed were domestic students

*(Classification is based of Dept of Industry's STEM equity monitor)

Strategic Partnerships

Major new clients in 2022 included Sun Cable who placed three internships through the year with students from three different universities. Lockheed Martin Australia, a valuable returning client, placed three internships and our most loyal customers CSL and Aurecon both continued to place multiple internships.

Other new clients included Brisbane based Impedimed, the world leader in the design and manufacture of medical devices employing bioimpedance spectroscopy (BIS) technologies for use in the noninvasive clinical assessment and monitoring of fluid status and tissue composition.

Metakosmos, another new client, produce "next-generation space suit technology". Their leading product is the Kosmosuit; "an intelligent, advanced and accessible space suit."

Other clients in 2022 included, Thrust Maritime, Genetic Signatures, Sydney Water, The Office of the QLD Chief Scientist and RPA Hospital. The breadth and diversity of the projects is extraordinary and offer rich, and interesting opportunities for our interns. We are deeply appreciative of our industry collaborators for providing these projects in 2022.

While the NRIP rebates were not available in 2022, other organisations provided incentives for companies to bring research talent into their businesses. In 2022 with the support of subsidies from MTP Connect, Industry Growth Centre, 26 interns were placed into Med Tech and Pharma companies. This highly successful collaboration will continue in 2023 and will complete 80 internships.

In 2022 the Innovative Manufacturing CRC (IMCRC) completed its program of 25 internships. Along with the ongoing success of the MTP Connect collaboration, this is another example of APR's ability to deliver on outcomes for its partners. APR also continued its long-standing commitment to Defence through its engagement with the Victorian Defence Science Institute, DST and the West Australian Defence Science Centre.

By the end of 2022, APR had collaborated with over 30 universities across Australia. To deepen this engagement, APR launched a subscription program that afforded subscribing universities access to APR's business development network, APR's program infrastructure, and dedicated support to ensure that universities were able to make the most of internship opportunities at their institution. Eight universities have subscribed, and we look forward to building on this excellent start in 2023.

2022 was a challenging year but most of the major changes to the program post NRIP have been addressed and by focussing of the core values of the program the APR team is looking forward to successful 2023.

2022 Highlights

12 Start-Up industry partners including BrainConnect, Dynomics, Hydgene Renewables

15 Large Corporate industry partners including Aurecon, CSL, DHL, Lockheed Martin, Telstra

23 SME industry partners including Inventia Life Science, Telix, Thrust Maritime

8 government agency, industry association and research institution industry partners including DST Group, Office of the QLD Chief Scientist, Royal Prince Alfred Hospital, Agriculture Victoria

Case Study: Industry-University Collaboration Advances COVID-19 Disinfectant Technology

Ultraviolet (UVC) photon light has long been known for its antimicrobial and disinfecting efficacy.

At the forefront of this UVC photon light technology is Melbourne-based medtech start-up, Mobile UV Innovations (MUVi) that designs and develops disinfection systems for hospitals, healthcare and medical sectors.

When COVID-19 led the healthcare sector to re-evaluate systems, MUVi started developing a new device that used UVC light to rapidly disinfect hospital and medical equipment, contaminated surfaces and minimise the spread of aerosol and surfaces from highly infectious multi-resistance microorganisms.

To fast-track testing, the team engaged a PhD intern through APR.Intern, with financial support from MTPConnect's REDI Initiative, and was matched with Mahjabeen Khan from the University of New South Wales (UNSW) who specialised in microbiology.

Over a 6-month internship, with the guidance of her Academic Mentor, UNSW's Professor Mark Willcox, Mahjabeen applied her expertise to design experiments, test and analyse the efficacy of MUVi's new device.

Incredible results were reported, with the MUVi UVC photon light device killing approximately 99.99% of all tested microorganisms including bacteria, fungi and a COVID-19 surrogate.

> *"The internship was a chance to collaborate with people from different backgrounds and learn how to work in a multidisciplinary team. I also learnt how to develop reports per industry requirements, which differ from academia. I would highly recommend the APR. Intern program to others,"*

Mahjabeen Khan, Former PhD Intern at MUVi

For MUVi's Founder & CEO, Murray McDonald, the APR.Intern project was an opportunity to gain local Australian microbial research data and to build a strong pathway into Australia's university research sector.

> *"APR.Intern, and the financial support we received from MTPConnect, allowed our start-up to access critical talent resources to undertake key testing data at a valued research institution [UNSW],"*

Murray McDonald, Founder & CEO of MUVi

"The project results have the potential to create new job opportunities and bring greater benefits to sectors beyond just healthcare," added Murray.

Following the successful internship, MUVi and UNSW have applied for two international grants to continue their innovative industry-university research.

Above: PhD Intern, Mahjabeen Khan

Marketing & Media

As Australia's national voice for the mathematical sciences, AMSI engages with a broad stakeholder audience including primary and secondary school students, teachers, parents, universities students, the AMSI Membership, government and industry.

In 2022, AMSI continued to maintain its position as an authority on the state of the mathematical sciences in Australia, supporting policy engagement, advocacy and AMSI program activities.

Jo Piltz
Marketing & Communications Coordinator
media@amsi.org.au

Strategy & Brand

Customer-centric marketing supported the rollout of AMSI's revised Schools, Research & Higher Education and APR. Intern program models, AMSI's new Business Development and Philanthropic divisions, and AMSI's mission.

Following the completion of three major program grants in 2021, new suites of collateral were developed for each area, including promotional materials, event design concepts, EDM campaigns and brochures. Updating and improving AMSI websites was also an ongoing project throughout the year, with multiple websites reviewed and improved. Key updates included optimising AMSI's website navigation, re-categorising AMSI's online library of resources, updating the Careers (MathsADDS) website navigation, implementing an email pop-up on the Schools websites, and developing a national PhD student database on the APR.Intern website.

The student database was a significant project. Custom functionality was built in the APR.Intern website's back-end, and hundreds of PhD student profiles from APR.Intern's general applicant pool were manually uploaded over several weeks. The result was an innovative tool for industry to search through available students, and easily identify potential interns. The launch of the database was supported by the implementation of a monthly EDM to industry partners, highlighting new profiles. Success of the project is evidenced by high engagement with the page, and by the multiple internships that have been a direct result of industry sourcing students through the database.

A new area that marketing supported in 2022 was AMSI's Philanthropic arm. A communications plan was developed in collaboration with the Philanthropic Coordinator and the AMSI Executive, and a new custom online donations form is in development to improve the online user experience for donors, and to strengthen AMSI's relationships with donors.

Social Media

AMSI's social media audiences continued to grow across all platforms.

@Discover AMSI: **9%** growth, to **2840** followers
@APRInternau: **3%** growth **720** followers

/australian-mathematical-sciences-institute: **12%** growth, to **1347** followers
/aprintern: **13%** growth, to **1800** followers

AMSI in the Media

With continued national media exposure, AMSI remained a go-to authority on the state of mathematics in Australia. The launch of the Institute's Year 12 Mathematics Participation Report Card was a key media campaign, with the report featuring on the front page of The Australian, followed by news coverage on more than 20 radio stations nationally and extensive online coverage.

A selection of media exposure from January-December 2022:

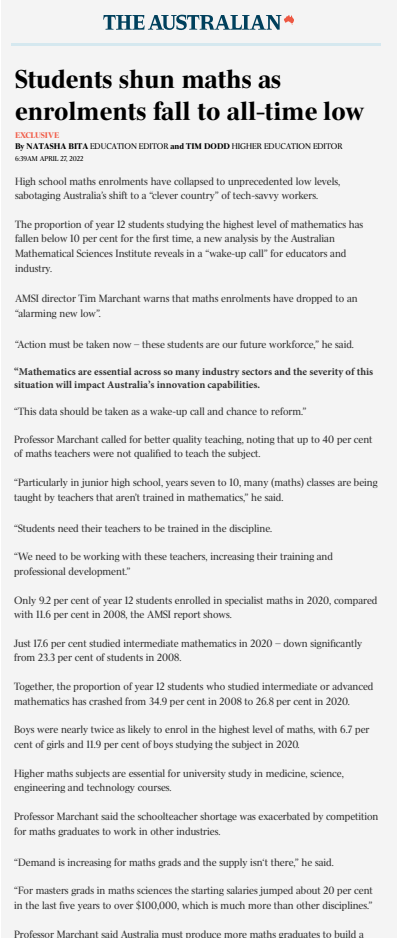
'Cracking the formula: how should Australia be teaching maths under the national curriculum?'
Donna Lu quoted AMSI Director, Professor Tim Marchant, in The Guardian on 13 February 2022.
223,333 daily readership

'We need to change the way we teach maths'
Jordana Hunter refers to AMSI's research on out-of-field mathematics teachers in The Australian on 7 March 2022.
176,666 daily readership

'Maths numbers plunge to new low'
Natasha Bita and Tim Dodd featured AMSI's Year 12 Mathematics Participation Report Card, and AMSI Director commentary, on the front page of The Australian on 27 April 2022.
176,666 daily readership

'Girls outperform boys in VCE results in all but maths and chemistry, data shows'
Adam Carey quoted AMSI Director, Professor Tim Marchant, in The Age on 2 May 2022.
1,96666 daily readership

'Maths anxiety: what is it, what causes it, and how it can be overcome'
Gemma Conroy refers to AMSI's Year 12 Mathematics Participation Report Card in a story on maths anxiety on ABC News Online on 26 July 2022.
336,333 daily readership



THE AUSTRALIAN

Students shun maths as enrolments fall to all-time low

EXCLUSIVE
By **NATASHA BITA** EDUCATION EDITOR **and TIM DODD** HIGHER EDUCATION EDITOR
6:39AM APRIL 27, 2022

High school maths enrolments have collapsed to unprecedented low levels, sabotaging Australia's shift to a "clever country" of tech-savvy workers.

The proportion of year 12 students studying the highest level of mathematics has fallen below 10 per cent for the first time, a new analysis by the Australian Mathematical Sciences Institute reveals in a "wake-up call" for educators and industry.

AMSI director Tim Marchant warns that maths enrolments have dropped to an "alarming new low".

"Action must be taken now – these students are our future workforce," he said.

"Mathematics are essential across so many industry sectors and the severity of this situation will impact Australia's innovation capabilities.

"This data should be taken as a wake-up call and chance to reform."

Professor Marchant called for better quality teaching, noting that up to 40 per cent of maths teachers were not qualified to teach the subject.

"Particularly in junior high school, years seven to 10, many (maths) classes are being taught by teachers that aren't trained in mathematics," he said.

"Students need their teachers to be trained in the discipline.

"We need to be working with these teachers, increasing their training and professional development."

Only 9.2 per cent of year 12 students enrolled in specialist maths in 2020, compared with 11.6 per cent in 2008, the AMSI report shows.

Just 17.6 per cent studied intermediate mathematics in 2020 – down significantly from 23.3 per cent of students in 2008.

Together, the proportion of year 12 students who studied intermediate or advanced mathematics has crashed from 34.9 per cent in 2008 to 26.8 per cent in 2020.

Boys were nearly twice as likely to enrol in the highest level of maths, with 6.7 per cent of girls and 11.9 per cent of boys studying the subject in 2020.

Higher maths subjects are essential for university study in medicine, science, engineering and technology courses.

Professor Marchant said the schoolteacher shortage was exacerbated by competition for maths graduates to work in other industries.

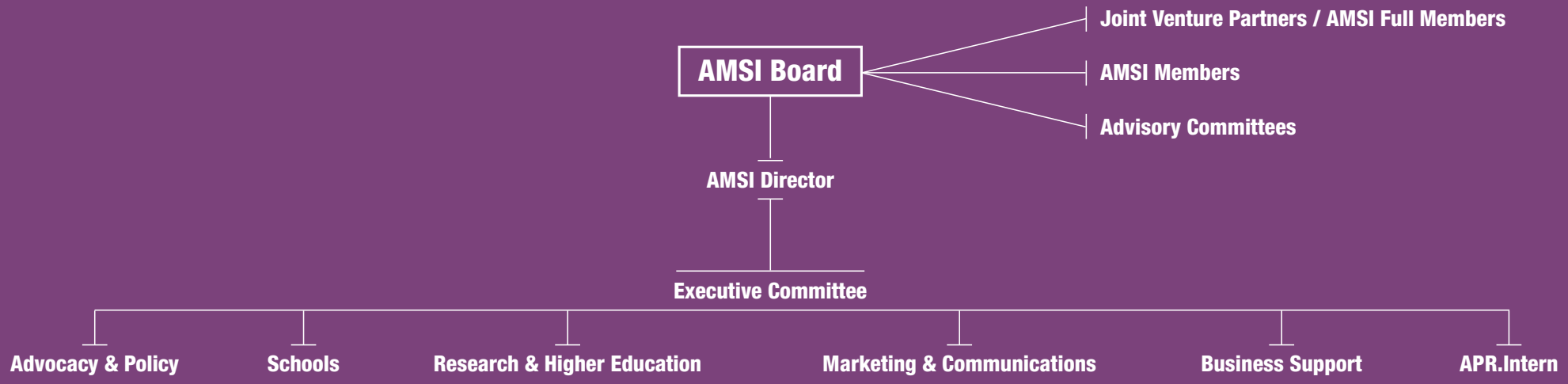
"Demand is increasing for maths grads and the supply isn't there," he said.

"For masters grads in maths sciences the starting salaries jumped about 20 per cent in the last five years to over $100,000, which is much more than other disciplines."

Professor Marchant said Australia must produce more maths graduates to build a

Governance

Effective Organisation Structure



AMSI's Organisational Structure

AMSI is an unincorporated collaborative joint venture of Australia's universities and other bodies related to the mathematical sciences.

In 2002, six universities signed a Joint Venture Agreement (JVA) to become the first full members of AMSI. As of 2022, AMSI's full membership totalled 12 universities, including all of the Group of Eight. The University of Melbourne acts as AMSI's lead agent in the JVA. Beyond the full membership, our extended membership is made up of an additional 16 universities, five government agencies and eight mathematical and statistical learned societies.

AMSI continues to make a significant contribution to the mathematical sciences in Australia. Our initiatives and programs are important parts of an overall strategy to enhance the standing and health of mathematics and statistics across the community.

The Institute is critically dependent upon the support of its membership. Without this support—both financial and via active participation in AMSI's enterprise—it would not be possible to provide the many services that are of direct benefit to the mathematical sciences.

AMSI's full members meet at least four times annually, and all AMSI members meet twice per year. This ensures that AMSI's programs are kept fresh and responsive to its membership.

Management of AMSI

The JVA makes the AMSI Board responsible for the overall direction of the Institute, formulation of policies and oversight of the management of the Institute. Management of the Institute and its activities is the responsibility of the Executive (listed on page 35). External advice is provided by two high-profile advisory committees.

AMSI's four portfolio areas are:

- Research & Higher Education
- Advocacy
- Industry engagement
- Schools education

Activities are detailed in the annual Business Plan and Budget document, authorised annually by the full members and the Board.

AMSI Board Composition

The Board comprises:

- An independent Chair appointed by the full members
- The Institute Director
- The Institute Deputy Director appointed by the full members
- One person representing the lead agent—University of Melbourne
- Two full member representatives appointed by mutual agreement of full members
- Two associate member representatives appointed by mutual agreement of associate members
- Up to five independent persons with relevant affiliations beyond the Institute's membership

Board representatives for the full members and associate members serve two-year terms.

We actively seek participation of women and under-represented groups in AMSI, for diversity across all levels promotes the greatest outcomes for all

Board Meetings

In 2022, scheduled Board meetings were held on the following dates:

Date	Location
Thu 16 February	Video conference
Thu 5 May	Video conference
Thu 14 July	Video conference
Thu 22 September	Video conference

ATTENDANCE:

Dr Adelle Howse (3/3)
Dr Les Trudzik (2/2)
Dr Thomas Barlow (2/2)
Ms Anne Baly (3/4)
Dr Sue Barrell (4/4)
Professor Tim Marchant (4/4)
Mr Joe Forbes (1/1)
Professor Linda Galligan (2/3)
Professor Anthony Dooley (2/2)
Professor Moira O'Bryan (1/1)
Professor Deborah King (2/3)
Professor Robyn Owens (4/4)
Dr Andrew Peele (3/4)
Professor Stephan Tillmann (2/4)
Associate Professor Sanjeeva Balasuriya (3/4)
Associate Professor Bronwyn Hajek (2/4)
Professor Inge Koch (4/4)

Committees & Stakeholders

Board Members

Dr Adelle Howse *Chair* – until July 2022
Dr Les Trudzik *Chair* – from July 2022
Professor Tim Marchant *AMSI Director*
Professor Stephan Tillmann *AMSI Deputy Director* (University of Sydney)
Professor Moira O'Bryan *Lead Agent Representative* (University of Melbourne) – until February 2022
Professor Deborah King L*ead Agent Representative* (University of Melbourne) – from May 2022
Professor Linda Galligan *AMSI Associate Member Representative* (University of Southern Queensland) – until July 2022
Professor Anthony Dooley *AMSI Associate Member Representative* (University of Technology Sydney) – from July 2022
Professor Robyn Owens *External member* (University of Western Australia) – until September 2022
Dr Andrew Peele *External member* (ANSTO)
Ms Anne Baly *External member* (Nous Group)
Dr Sue Barrell *External member* (Science and Technology Australia) - until September 2022
Mr Joe Forbes *External member* (Biarri Commercial Mathematics) - until February 2022
Dr Thomas Barlow *External member* (Barlow Advisory) - from July 2022
Assoc. Prof. Sanjeeva Balasuriya A*MSI Full Member Representative* (University of Adelaide)
Assoc. Prof. Bronwyn Hajek *AMSI Associate Member Representative* (University of South Australia)
Professor Inge Koch *AMSI Full Member Representative* (University of Western Australia)

Board Observers

The President of the Australian Mathematical Society, the President of the Statistical Society of Australia, and the Chair of the National Committee for the Mathematical Sciences (NCMS) are also invited onto the Board as observers.

Professor Alan Welsh Chair, National Committee for the Mathematical Sciences
Associate Professor Jessica Kasza President, Statistical Society of Australia
Professor Ole Warnaar Australian Mathematical Society

AMSI Research & Higher Education Committee

Professor Stephan Tillmann *Chair*
Emeritus Professor Phil Broadbridge *Deputy Chair*
Professor Tim Marchant *AMSI Director*
Angela Coughlin *AMSI RHED National Program Manager*
Associate Professor Stephen Davis *ACE Network Director*
Professor Scott Sisson *University of New South Wales*
Professor Mary Myerscough *University of Sydney*
Associate Professor John Bamberg *University of Western Australia*
Dr Ramiro Lafuente *University of Queensland*
Professor Lesley Ward, *University of South Australia*
Professor Aidan Sims *University of Wollongong*
Professor Ezra Getzler *Northwestern University*
Professor Terry Tao *UCLA / Clay Mathematics Institute*
Professor Yasuhide Fukumoto *Kyushu University*
Professor Linda Cummings *New Jersey Institute of Technology*

AMSI Advisory Panel

Professor Bruce Henry *University of New South Wales*
Associate Professor Gary Glonek *University of Adelaide*
Emeritus Professor Geoff Prince *La Trobe University / AMSI Director 2009-18*
Professor Tim Brown *AMSI Director 2019-20*
Emeritus Professor Cheryl Praeger *University of Western Australia*
Professor Jacqui Ramagge *University of Durham / University of Sydney*
Dr Ron Sandland *AMSI Chair 2011-19*
Professor Hugh Possingham *Chief Scientist Queensland*
Professor Kate Smith-Miles *University of Melbourne*
Professor Doreen Thomas *University of Melbourne*
Jan Thomas *AMSI Honorary / AMSI Executive Officer 2002-11*
Dr Michael Evans *AMSI Schools Programs Manager 2004-13 / AMSI Honorary*
Professor Catherine Attard *University of Western Sydney / MERGA President*
Professor Mike Clapper *Australian Mathematics Trust*
Associate Professor Mary Coupland *University of Technology Sydney*
Professor Gilah Leder *Monash University / La Trobe University*
Dr Mark Lawrence *Mark Lawrence Group / AMSI Board 2012-19*
Dr Eileen Doyle *AMSI Board 2010-18 / FAICD*
Dr Milica Ng *CSL*

Our Staff

Director's Profile

Professor Tim Marchant—Director, AMSI

Professor Timothy Marchant is the Director of the Australian Mathematical Sciences Institute (AMSI) at the University of Melbourne and an Honorary Professor of Applied Mathematics at the University of Wollongong (UOW).

During his career at UOW, Professor Marchant was Head of the School of Mathematics and Applied Statistics 2007–2009 and Dean of Research 2009–2020.

Professor Marchant gained a PhD in Applied Mathematics from the University of Adelaide in 1988 and has published 100 research papers. He has also successfully supervised 20 Masters/PhD students on various topics in Applied Mathematics.

Professor Marchant's research areas include nonlinear optics, nonlinear waves and combustion theory. Professor Marchant is a Fellow and Past President of the Australian Mathematical Society.

He is a past member of the Endeavour Awards selection panel and a current member of the National Colombo Plan selection panel. He is also an editorial board member of the Applied Mathematical Modelling Journal.

Professor Marchant is a member of the Illawarra Bridge Club and speaks intermediate Mandarin.

Executive

Professor Tim Marchant Director, AMSI
Ms Lisa Farrar National Program Manager, APR.Intern, Chief Operating Officer, AMSI
Dr Maaike Wienk Finance, Advocacy and Policy Manager, AMSI

Honorary Staff

Dr Michael Evans Senior Consultant
Jan Thomas OAM Research Fellow
Ms Kally Yuen Statistician

Non-Executive

Darla Trejo Finance & Admin Officer
Elena Panfilova Executive Assistant to the Director

Marketing & Communications

Jo Piltz Marketing & Communications Coordinator
Michael Shaw Art Director & Multimedia Manager

Schools

Leanne McMahon Schools Outreach Officer

Research & Higher Education

Angela Coughlin National Program Manager
Anna Muscara Project Coordinator
Francesca Hoban Ryan Administrative Assistant – until April 2022
Shamvi Berry Program Administration Officer – from June 2022

APR.Intern

Lisa Farrar National Program Manager
Glen Sheldon Deputy Program Manager
Margo Brown Senior Program Coordinator, APR.Intern / AMSI Philanthropy Coordinator
Mark Ovens Business Development Officer
Justin Mabbutt Business Development Officer
Michael Valentine Business Development Officer – until December 2022
Jo Piltz Marketing & Communications Coordinator
Stacey Hansen Project Coordinator
Zak Blayney CRM and Project Officer
Sophie Kennedy Program Officer & Executive Assistant to the National Program Manager

Financials

AMSI's financial records are managed and administered by AMSI Finance staff in accordance with the accounting policies and financial systems of the University of Melbourne.

All financial statements are reconciled to the University of Melbourne's integrated financial system to ensure compliance with relevant policies and to confirm the amount of cash reserves held by the University of Melbourne on behalf of AMSI at the end of each financial year. The University of Melbourne undertakes to provide audited financial statements for all contractually funded activities when required by the relevant funding body.

AMSI's financial performance in 2022 resulted in an operational deficit funded from AMSI reserves, reflecting the adjustment required to operate AMSI programs on a self-sustaining basis without Commonwealth funding. New Commonwealth funding was awarded and received in 2023 and will be included in the 2023 Annual Report.

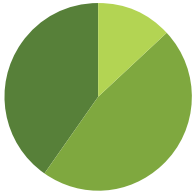
AMSI's revenue for the year ended 31 December 2022 comprised:

Membership income	$ 1,277,473
Trading revenue	$ 1,491,687
Other income (other project income, sponsorships & interest)	$ 421,850
Total Income	**$ 3,191,009**

AMSI's expenditure for the year ended 31 December 2022 comprised:

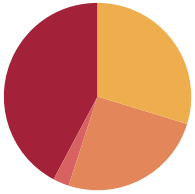
Core business -including Governance and Outreach	$ 1,031,344
Research & Higher Education	$ 870,308
Schools Program including CHOOSEMATHS	$ 95,142
APR.Intern	$ 1,444,498
Total Expenses	**$ 3,441,292**

Institute Income



- Membership income
- Trading revenue
- Other income (other project income, sponsorships and interest)

Institute Expenditure



- APR.Intern
- Schools Program including ChooseMATHS
- Research and Higher Education
- Core Business - Including Governance and Outreach

Statement of Financial Position		**As at 31 December 2022**
ASSETS		$
Funds on Hand:		1,912,688
	Net Assets	1,912,688
EQUITY		
Retained income brought forward after prior period adjustments		2,162,971
Total Operating Result (income less expenses)		(250,283)
	Net Equity	1,912,688

Professor Tim Marchant
AMSI Director

Dr Maaike Wienk
AMSI Finance, Policy and Advocacy Manager

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