ANZIAM Awards

Winner of the 2015 E.O. Tuck Medal

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

Citation for the 2015 E.O. Tuck Medal

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

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articles and conference papers, a book chapter, 12 technical reports as well as many that are confidential and hence unpublished.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

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

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

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

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

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

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

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

Winner of the 2015 John Henry Michell Medal

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

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

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

Citation for the 2015 J.H. Michell Medal

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

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

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

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

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

TM Cherry Prize

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

The AF Pillow Applied Mathematics Top-up Scholarship

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