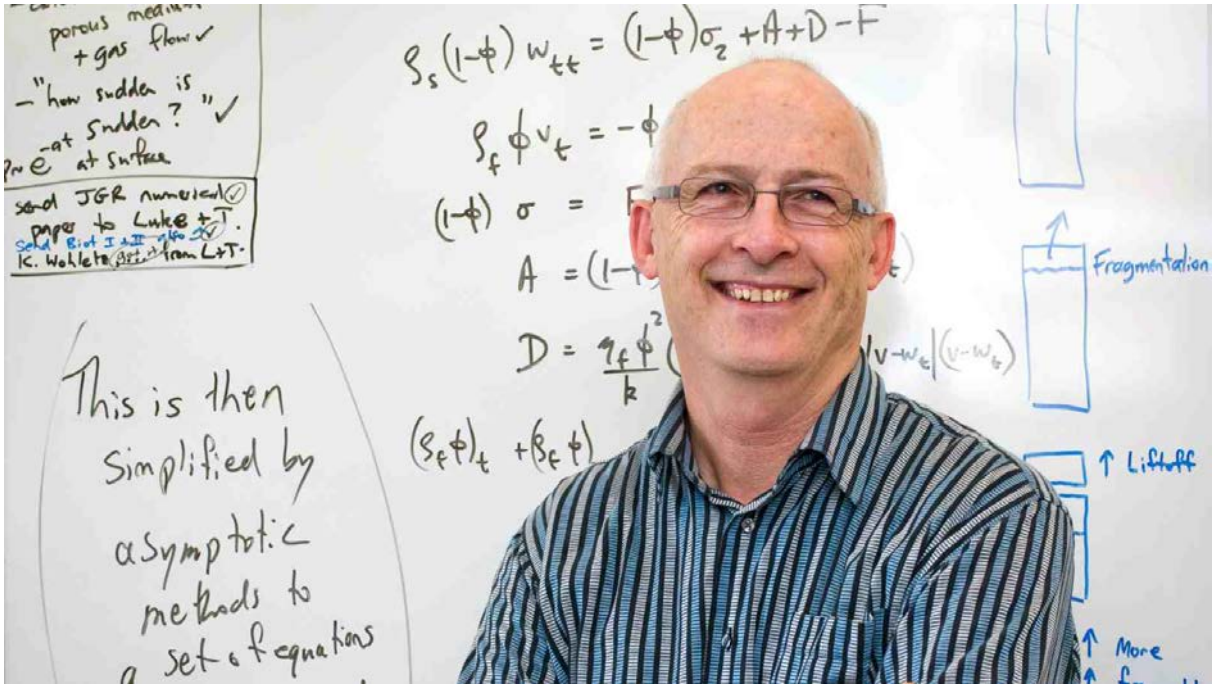
PROFILE

Mark McGuinness



Professor Mark McGuinness exemplifies New Zealand's fine tradition of mathematical modelling and industrial mathematics. As Chair of the Australia and New Zealand Industrial and Applied Mathematics division (ANZIAM), as a Director of Mathematics-in-Industry NZ (MINZ), and as a long-standing Councillor and sometime Treasurer of this Society, Mark has worked tirelessly for the betterment of industrial and applied mathematics and for the sheer pleasure of doing it. Wherever there is a mathematics-in-industry study group, it is more than likely that Mark will have had a hand in its activities.

Mark graduated with a Fist Class Honours degree in Physics from the University of Canterbury in 1975 and, three years later, completed his PhD thesis there, titled "Infinite sets of polynomial conserved densities for nonlinear evolution equations", under the supervision of Professor Walt L. Jones. This led to Mark's first, of over 100, refereed articles, published in the Journal of Mathematical Physics in 1978. Soon after, he took up a three-year post-doctoral research fellowship at the Department of Mathematical Physics at University College Dublin, where he worked with newly appointed lecturer John Gibbon, later Professor of Applied Mathematics at Imperial College, and Trinity College post-doc Andrew Fowler, now a Professor at both Oxford and Limerick. These collaborations sparked his interest in the Lorenz equations, chaos and fractals. It also began a lifelong association with Ireland and with Fowler. From Dublin, Mark took up an instructorship in applied mathematics at Caltech, before returning to New Zealand in 1983 and a position as research scientist in the Applied Mathematics Division of the DSIR, then located on the 7th floor of the Rankine Brown Building at Victoria University of Wellington, and along the corridor from the Department of Mathematics.

In the eight years Mark spent at AMD, his research turned towards modelling with important applications, especially a sequence of papers on geothermal energy with colleagues including Steve White, Roger Young, Graham Weir, Alec McNabb and Warwick Kissling. Alongside his growing body of research, Mark retained a passion for teaching and when, in 1991, a vacancy arose along the corridor, Mark applied and was appointed to a senior lectureship in the Mathematics Department at Victoria University. He has been with us ever since, promoted regularly first to Reader and up that scale, and then to Professor in 2014. During the 90s, new opportunities arose and Mark quickly became engaged in the mathematics-in-industry study groups. The Australia-New Zealand versions had begun in the 1980s and were supported by Oxford applied mathematicians, such as Hilary and John Ockendon, who maintained strong links to this part of the world. Mark's first such meeting was in 1996 and he attended annually for the next 12 years as a moderator. For three of those years, Graeme Wake was instrumental in having them hosted in New Zealand. These events were a highlight of Mark's academic year and he quickly developed

a skill for bringing the best out of his research teams. The industry problems led to a series of fascinating modelling problems: cooking crispier cereals, brewing better beer, grain flow in silos, submarine batteries, high-speed weighing and sustainable water management, among others. For several years, Mark was involved with KAIST in South Korea, helping them develop strength in industrial modelling. He has also been a regular at study groups in Limerick and Oxford. Now MINZ is established here in its own right, Mark co-directed its first incarnation in Wellington in 2016.

An underlying mathematical theme in Mark's research has been the complex dynamics arising from interacting processes. These may be reaction-diffusion processes, delay-differential systems, different time scales operating, or heat and chemical diffusion. The art of modelling involves knowing what to include and what to leave out. It also requires facility with a wide range of approaches that may include asymptotic methods, numerical methods, qualitative dynamics, bifurcation and chaos. Mark has demonstrated an ability to focus on the essentials. As a result, he has been able to contribute significantly to modelling such diverse processes as sea-ice formation, volcanic ejecta, cardiorespiratory systems, and groundwater contamination. As Mark said, when delivering his inaugural professorial lecture in 2016, "curiosity continues to drive my research today — it's really rewarding brainstorming and then solving a problem". This often involves working with scientists in different fields — geophysicists, physiologists, vulcanologists — and converting their knowledge and instincts into mathematics. Mark's early work with Fowler and Gibbon on the Lorenz equation continues to be highly cited. It also underpins one of Mark's current major projects, co-authorship with Fowler of their book "Chaos — An Introduction for Applied Mathematicians". The finishing touches were made on a recent return to Limerick and the book is expected to be published later this year.

In recent years, Mark has made the most of opportunities to promote the pleasure and value of mathematics more widely. As well as giving plenary lectures at research conferences, he has given radio interviews in Ireland and New Zealand, and lectured and talked about his work with University of the Third Age, Zonta and the Rotary Club. Mark has supervised many excellent Master's and PhD students including Irene Pestov, Young Hong, Jonathan Crook and Sione Paea, and continues to do so with Emma Greenbank. Those of us lucky enough to work with Mark appreciate his willingness to take on the less popular roles such as programme director or Faculty representative on various committees. Students always enjoy his light touch in teaching and musical interludes in his lectures. As Mark puts it, he has been on "a 40-year academic journey of discovery" and it still has some way to go.

Peter Donelan