

ANTOINETTE TORDESILLAS is a Professor of Applied Mathematics in the School of Mathematics and Statistics at the University of Melbourne (UoM), Australia. She currently holds a joint appointment as Professor of Geomechanics in the School of Earth Sciences in the same University and, until last year, was an adjunct professor in the Department of Physics at Duke University, USA.

Presently, her group's research activities mainly straddle the two domains of characterization and modelling of microstructured materials. Activities in both are heavily data-driven, with a focus on modern mathematical and statistical techniques (e.g., complex networks, machine learning, combinatorial optimization, dynamical systems) to "mine" multiscale patterns from complex data sets, derived from high-resolution imaging experiments and high-performance computing models and simulations. In material characterization, her research has focused on understanding the material's physical properties across the microscopic and mesoscopic length scales and linking those to material performance and functionality at the macroscopic scale. In modelling, the aim has been to develop abstract representations of phenomena for the purposes of prediction and control, as well as in design of novel granular systems.

She has held research grants from the Australian Research Council (e.g., ARC Discovery, ARC-Linkage International with NASA), US Army, US Air Force, Hong Kong Research Grants Council, the British Council, and the Australian Academy of Science. She has over 100 refereed research publications and has delivered numerous invited lectures at premier international conferences and workshops across physics, mechanics, geophysics, and mathematics. Her group has strong international collaborations across these disciplines with experimentalists, computer scientists and mathematicians in Australia and beyond (e.g., USA, France, China, Japan, UK, Poland, The Netherlands, Hong Kong, Canada and India). A key aspect of these efforts has been a long-term partnership with researchers from various laboratories of the US Department of Defence, especially the US Army Corps of Engineers. These partnerships were recently broadened through two new grants: from the US Air Force Office of Scientific Research grant on control of granular dynamics and another from the US DoD High Performance Computing Modernization Program in the area of informatics and predictive data analytics.

At the University of Melbourne (UoM), her basic research underpins several strategic technologies in the areas *sustainable infrastructure* and *risk assessment for natural hazards*, which are currently being developed by the Melbourne School of Engineering and its partners in industry, government and academia. For example, she is heavily engaged in developing predictive (data-driven) analytics tools for early warning systems in relation to failure of slopes and geotechnical structures (a confidential contract). Another project focuses on large scale dewatering, which is protected by a patent with P Scales, R Batterham and A Stickland (Chem. Engng. UoM) and funded by the Victorian State Government and various energy companies. She is also involved in a study of bio-concrete and bio-cement technologies with self-healing capabilities with A Mukherjee (Curtin), with whom she has written a joint proposal on this topic in collaboration with H Jonkers (TU Delft).

In teaching and learning, her activities have focussed on new methods in Engineering Mathematics, which is taught at UoM in large classes comprising both undergraduate and international masters students. She has published at the teaching-research nexus of Engineering Mathematics with undergraduate and masters level students and teaching specialist C Mangelsdorf (UoM). She has collaborated and co-edited a special issue of the Australasian Journal of Engineering Education with S Barry (Australian National University/Australian Defence Force Academy) aimed at increasing the profile of Engineering Mathematics and providing a means by which colleagues can share ideas and methods in undergraduate teaching of this subject. Her contributions in this area

has been recognized through invited lectures and as member of a distinguished panel of experts at premier conferences including: Science, Technology, Engineering and Mathematics (STEM) Education Conference, International Congress on Industrial and Applied Mathematics, and the National Symposium on Mathematics Education for 21st Century Engineering Students. In curriculum reform, she has led the successful development of a Professional Master of Science in Operations Research and Management Science, involving three Faculties of UoM: Engineering, Melbourne Business School, and Science. At PhD level, she continues to co-supervise students from engineering (currently, she has two from Civil Engineering) and has hosted visits of PhD students from engineering and physics: most recent examples include A Druckrey from the research laboratory of K Alshibli, Dept. of Civil and Environmental Engng., Univ. Tennessee-Knoxville (funded jointly by the US National Science Foundation and the Australian Academy of Science); and Fabian Schaller from the Institute for Theoretical Physics, Universität Erlangen-Nürnberg.

Her engagement with the local and international community has been deep and broad, encompassing activities that are consonant with her multidisciplinary research endeavours and service to her school, faculty and UoM. Leadership roles here includes: **(a) contributions to governance, strategic direction and planning at university, faculty and school level** as associate dean (international and engagement) in 2012 and associate dean (international) in 2011, chair of Science Engagement and Advisory Group (2011-2012), and member of working groups associated with these portfolios (e.g., Industry Advisory Group, China Advisory Forum), as member of our school committees (e.g., Recruitment and Publicity, Research and Graduate Studies, Research & Industry), and as chair of the Masters in Management Science Working Group; **(b) capacity building within UoM through industry, community and alumni links** by filling capability gaps and enhancing cross-disciplinary research through collaborative grants with engineering, chemistry, computer science and pharmacology, contributing to UoM's commercial interests and enterprise through a patent and industry partnerships, and participation in outreach programs to secondary schools like the Residential Indigenous Science Experience and co-development of the highly popular Maths in Action!; **(c) sustained contributions to the Australian mathematics community** through service to the Australia and New Zealand Industrial and Applied Mathematics society at state and national levels in various capacities (e.g., conference organization, invited speakers committee, committee work); **(d) sustained contributions to the international community and professional societies** through service: to governance and activities of international professional societies (AEMMG board member, ASCE-Granular Mechanics committee; to scientific advisory committees of premier international conferences (e.g., American Geophysical Union Fall Meeting, EMI, International Congress in Theoretical & Applied Mechanics, Pacific Rim Mathematical Association Congress), and contributions to overseas government agencies and industry through consultations and collaborative research (e.g., US Army, US Air Force, BHP Billiton, Rio Tinto, JKMRC, Shell); membership of editorial boards, refereeing of scholarly journal articles and proposals, assessment of professional society membership applications, organisation of conferences and workshops; and **(e) contribution to public knowledge and debate** through media related activities (e.g., short science film by Nexus ABC International, print media interviews).

In all these spheres of responsibility, she actively promotes the achievements of women scholars and, in particular, is a persistent advocate of gender balance among speakers at high-profile conferences. For example, as part of the celebrations for the International Year of Mathematics in 2013, she organized "*A Walk on the Wild Side: Rocks, Ice and Sand*" designed to promote women in STEM to schools and the general public. This involved the presentation of three vignettes on the behavior of geomaterials in connection with mineral and energy exploration, environmental conservation and remediation, delivered jointly with: Tracy Rushmer (Earth Sciences, Macquarie Univ.) and Kathryn Mumford (Chemical Engng., UoM).