UNIVERSITY OF CANTERBURY
Te Whare Wānanga o Waitaha
CHRISTCHURCH NEW ZEALAND

Te Tari Pūhanga Pūrere|Mechanical Engineering Department

MECH Seminar Series 2024

3 pm, Friday, 22 March 2024
E16 (Rātā Bldg)

Advanced Multifunctional Materials and Structures - Analysing Extreme Deformation and Dynamic Behaviour using Meshless and Multiscale Methods

Prof Raj Das, PhD
Sir Lawrence Wackett Aerospace Research Centre, School of Engineering, RMIT University, Melbourne, Australia

Abstract: The seminar will present overview of advanced multifunctional materials and structures computational mechanics research at the Centre for Multifunctional and Composite Materials of RMIT University, Australia. Our research covers both fundamental and applied aspects of material behaviour and failure processes. This presentation will encompass computational modelling of material deformation, damage and fracture using multi-scale techniques in conjunction with mesh-less methods, novel composite materials development and damage tolerance structural optimisation. Multi-scale modelling of damage and fracture progression linking nano to macro scales and associated development of coupled computational modelling tools will be highlighted. The strengths of mesh-less methods will be illustrated with reference to both low to high-speed impact induced fractures and small to large scale problems. These include several dynamic fracture and fragmentation processes, such as hypervelocity impact fracture, nano-scale machining, large scale geo-mechanical failures (magma intrusion, caving, slope stability, etc). One of our core areas to be presented is novel impact and blast resistant, light weight composite material developments for aerospace components subjected to high-speed loading and extreme deformations, as occurs in the cases of debris impact on spacecrafts, bird strike on aircraft engines, blast induced failures, etc. Lastly novel shape and topology optimisation methodologies for damage tolerance optimisation, i.e. maximising the residual strength and fatigue life, of aero-structures will be highlighted. Case studies from projects with Royal Australian Air Force and Defence Science and Technology Organisation will be presented to demonstrate the practical implementation and utilities of the developed design and analysis methodologies.

Bio Sketch: Prof Raj Das is the Full Professor of Applied Mechanics and leads the 'Simulation of Advanced Materials and Structures (SAMS)' research group in the 'Sir Lawrence Wackett Defence and Aerospace Centre' of RMIT University in Australia. He has nearly 20 years of experience in the design, analysis and optimisation of engineering materials and structures with a focus on computational mechanics, structural optimisation, composite structures, failure analysis, and damage tolerance design. Prof Das has published 350+ papers in international journals and conferences in collaboration with several universities, institutes and industries. Prof Das has a PhD from Monash University, Australia, in Structural Mechanics and has previously worked at the University of Auckland (New Zealand), the Commonwealth Scientific and Industrial Research Organisation (Australia), and the University of Manchester (UK). Prof Das is associated with various scientific and technical societies. He is currently the President of the 'International Congress on Mechanical Behaviour of Materials (ICM)' and represents Australia in the Executive Committee of the 'International Congress on Fracture (ICF)'. He is also the Chair of the 'Australia Section' of the American Society of Mechanical Engineers'. Prof Das has been granted several national and international awards and fellowships, including the Sir George Julius Medal by Engineers Australia, Science Award by the Sustainable Aviation and Energy Research Society, RMIT Team Award for Impact and Collaboration, Computational Methods Award, Jim & Hazel D. Lord Emerging Faculty Fellowship, Research Excellence Award, and AUEA Emerging Researcher Award, the CONICYT award from Chile, Certificate of Merit Award from the Hong Kong.

All are welcome!