THE UNIVERSITY OF MELBOURNE

Mechanical Engineering

SEMINAR SERIES 2008

Dr Evatt Hawkes

Senior Lecturer

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Tuesday 15th July, 3.30pm

Theatre E1, Mechanical Engineering
Level 3, Building 170, Block E
Grattan St, Carlton.

4.30pm, Refreshments

Conference Room, Mechanical Engineering
Level 4, Building 170, Block E

Massively parallel direct numerical simulations of turbulent combustion.

MORE INFORMATION

For more Mechanical Engineering seminar information contact:

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The advancement of our basic understanding of turbulent combustion processes and the development of physics-based predictive tools for design and optimization of the next generation of combustion devices are strategic areas of research for the development of a secure, environmentally sound energy infrastructure.

Direct numerical simulation (DNS) is a high-fidelity approach that completely resolves all continuum scales of a reacting flow problem, and is used increasingly as a valuable tool for scientific discovery and model development in combustion. Recent large allocations of supercomputing time through the US Department of Energy have provided a unique opportunity to perform the largest ever DNS of a turbulent flame.

Massively parallel DNS of turbulent nonpremixed plane jet flames have been performed with detailed CO/H2 chemistry (representing syngas, a product of biomass gasification). Up to 500 million grid points were employed, allowing jet Reynolds numbers of up to 9000 to be achieved with good resolution. The simulations feature strong finite-rate chemistry effects including extinction and reignition, and are being used to understand fundamental aspects of turbulence-chemistry interactions and to provide a numerical benchmark for the advancement of engineering combustion models. In the seminar, results from these data will be used to 1) shed new light on the physical mechanisms of extinction and reignition and 2) examine consequences for the experimental estimation of the three-dimensional scalar dissipation rate based on one and two dimensional gradient measurements. New challenges relating to performing and analyzing large DNS data-sets will be discussed.

Dr Hawkes' research centres on alternative fuel and low-emissions combustion technologies. He develops and applies high-fidelity computational models to understand and predict the behaviour of the multi-scale, multi-physics flows that govern the performance of these technologies. Dr Hawkes earned BSc and BEng degrees from the University of Western Australia, and a PhD from the University of Cambridge. He worked as a postdoc at the Combustion Research Facility at Sandia National Laboratories and is now a Senior Lecturer at the University of New South Wales.