THE UNIVERSITY OF MELBOURNE

Mechanical Engineering

SEMINAR SERIES 2008

Dr David Lo Jacono

Research Fellow
Department of Mechanical Engineering
Monash University

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IDTC Theatre, Ground floor, Old Engineering, Block A, Bldg 173

The control of vortex breakdown and the study of wakes behind an oscillating cylinder.

Two problems are presented in this seminar: First, the flow within a closed cylinder with a rotating lid is considered. This type of flow can under certain circumstances give rise to a vortex breakdown (VB), characterised by a recirculation zone along the axis of symmetry. Experiments have been conducted in order to identify methods to control VB. In this study, the selected methods of control (full rod, rod, and disk) are rotating in the axis of symmetry. The rotational speed from the control device creates a source of vorticity in the vicinity of the VB, thus changing the flow pattern. Quantitative measurements were conducted by means of stereo-PIV and compared with numerical simulations (finite difference and spectral element methods). The comparisons are in good agreement and a theory unifying these control methods will be presented Second, the flow behind a cylinder undergoing forced motion will be presented. The motion consists of two independent oscillations: cross-stream translation and rotation. Previous studies have extensively investigated the effect of these motions individually on cylinder wakes; however, the investigation of their combined effect is new. The motivation for studying such a flow lies in its application to vortex-induced vibration (VIV), and its suppression, and bio-mimetic motion. The results presented here focus only on the effect of the phase difference between the two motions. The results show that there is an unexpected loss of lock-on (synchronisation) between the vortex shedding and the translational motion for a finite range of phase differences. The possible causes of this are discussed. This work is conducted experimentally and numerically.

After graduating in physics (B.S.) from the University of Tours (France), and in mechanics (B.S. and M.S) from the University of Toulouse (France), he received his Ph.D. from the Swiss Federal Institute of Technology in Lausanne in 2005 with a thesis on instabilities in diffusion flames. This thesis was performed at the Laboratory of Fluid Mechanics (LMF) and was related to instabilities in reaction-diffusion systems. In 2006, he received a Swiss National Science Foundation (SNSF) award for prospective researchers and was invited to the Division of Biological Engineering at Monash University. The research undertaken there varied from imaging techniques (PIV, stereo-PIV, topography, synchrotron angiography) to fluid dynamics in swirling flows. Since 2007, he has been a research fellow funded by an ARC Discovery grant at the Fluids Laboratory for Aeronautical and Industrial Research (FLAIR) at Monash University, working on characterising and suppressing vortex-induced vibration. His areas of interest include hydrodynamic instability, bluff body wakes and flow in confined geometries.

MORE INFORMATION

For more Mechanical Engineering seminar information contact:

Professor Ivan Marusic
Department of Mechanical Engineering
E: imarusic@unimelb.edu.au