



THE UNIVERSITY OF
MELBOURNE

Mechanical Engineering

SEMINAR SERIES 2011

Transition between regular and Mach reflection of shock waves.

Friday 1st April, 3.15pm
Mechanical Engineering Lecture Theatre
Level 3, Building 170
Grattan St, Parkville

Professor Hans G. Hornung

Clarence L. Johnson Professor of Aeronautics
California Institute of Technology

With this talk I want to give you a brief break from turbulence. Transition between regular and Mach reflection of shock waves is important in supersonic engine inlets. In the late 1970's it was discovered that the condition at which the transition occurs is incorrectly given by nearly all gas dynamics texts. Further, the transition is hysteretic, i. e., it occurs at a different point depending on whether the shock angle is being decreased or increased. Hysteresis is always associated with a domain in which both solutions are possible. Stability arguments suggest that Mach reflection is the stable configuration in the dual-solution domain, but there was considerable disagreement about this before the experiments reported here. The background will be presented to set the scene, and new theory, simulations and new experimental results from the supersonic Ludwig Tube at Caltech will be presented. In the latter, high-speed schlieren cinematography is used to show that zapping a regular reflection in the dual-solution domain with a laser can trip it to swing to Mach reflection. Comparisons of theoretical, computational and experimental details of this process will be presented.

MORE INFORMATION

For more Mechanical Engineering seminar information contact:

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Hans Hornung is the Clarence L. Johnson Professor of Aeronautics and Director of the Graduate Aerospace Laboratories (Emeritus) at the California Institute of Technology. (This is the same position previously held by Theodore von Karman). Professor Hornung received his M.Eng.Sc. degree from Melbourne and his Ph.D. from Imperial College London. He previously held positions at the Aeronautical Research Laboratory in Melbourne, in the Physics Department at ANU, and at the DLR in Göttingen, Germany where he was Institute Director.

Professor Hornung is regarded as one of the world leaders in the field of fluid and gas dynamics. He has made ground-breaking contributions to the understanding of hypersonic flows and is considered as the leading expert on the reflection of shock waves, on which he has published an article in Annual Review of Fluid Mechanics that defines the field. Many of his numerous publications are widely cited. He has also been closely involved in the conception and design of a number of unique aerodynamic simulation facilities, including the famous T5 shock tunnel at Caltech. His advice has been sought internationally by academic institutions, industry and government.

Professor Hornung has received many prestigious honours including election to the Royal Swedish Academy of Engineering Sciences, and to the US National Academy of Engineering. He is a recipient of the Ludwig Prandtl Ring, the highest honour conferred by the German Aerospace Society. He is a Fellow of the American Institute of Aeronautics and Astronautics, of the Royal Aeronautical Society, and of the American Association for the Advancement of Science.

Professor Hornung has also become widely known as an educator who meets one-on-one with his graduate students on a daily basis. His students from Australia, from Germany and from the US hold important positions in academia, government and industry throughout the world.