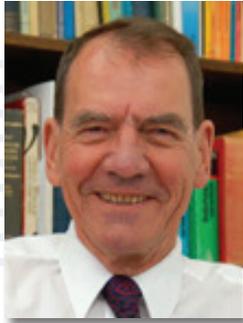


Department of Aerospace Engineering

Minta Martin Seminar Series



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Reflection of an oblique shock wave from an axis of symmetry

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ABSTRACT: Regular shock reflection from an axis of symmetry is forbidden, because the incident-shock strength increases with decreasing distance from the axis. Examples of where shocks reflect from symmetry axes occur in practice will be shown. These include shock reflection at the shock tube end of a reflected shock tunnel, diffraction of a shock from a heavy bubble, rocket nozzle exhausts and scramjet intakes. They motivate theoretical considerations and numerical experiments to be used for studying the reflection of an initially conical shock. This problem is in the class of pseudosteady flows, in which all characteristic lengths increase linearly with time. It turns out that three different Mach reflection configurations can occur, two of which feature an embedded supersonic vortex. The three configurations of Mach reflection also occur in the steady-flow problem of a circular over expanded supersonic jet, such as in a rocket nozzle exhaust, in which the shock wave from the lip of the jet reflects off the axis. In this case two of the configurations turn out to be oscillatory, and the embedded supersonic vortex can provide positive feedback that leads to hysteresis when the back pressure is varied in different directions.

Bio: Hans G. Hornung received his bachelor (1960) and master (1962) degrees from the University of Melbourne and his Ph.D. (1965) in Aeronautics from Imperial College, London. He worked in the Aeronautical Research Laboratories, Melbourne (1962-63, and 1965-67), and in the Physics Department of the Australian National University (1967-80), with a sabbatical year as a Humboldt Fellow in Darmstadt, Germany, 1974. In 1980 he accepted an offer to head the Institute for Experimental Fluid Mechanics of the DLR in Goettingen, Germany. He was appointed director of the Graduate Aeronautical Laboratories at Caltech in 1987. He is Emeritus since 2005. He made contributions in gasdynamics, notably in Mach reflection and effects of dissociation, in separated flows, and in wind tunnel technology. He was elected as a foreign member to the Royal Swedish Academy of Engineering Science in 1991 and as a foreign associate to the National Academy of Engineering in 1997. He received the Ludwig Prandtl Ring for 1999 of the German Aerospace Society (DGLR), and is a Fellow of the Royal Aeronautical Society, of the American Institute of Aeronautics and Astronautics, and of the American Association for the Advancement of Science. Together with three colleagues he received the ICAS von Karman Award for international cooperation in aeronautics in 1988. In 2011 he received the AIAA Fluid Dynamics Award. 2012: Fellow Australasian Fluid Mechanics Society, D.Sc. h. c., ETH Zurich.



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