PhD Scholarship

Shock Wave Focussing Phenomena

Project Details:

Focussing shock waves are a crucial fluid mechanical feature in a large number of diverse applications. These applications include, among others, medical instrumentation, where shock waves are focussed to destroy kidney stones, cavitation in liquids, where focussing waves can be cause and consequence of damage inflicted on nearby solid structures, blast protection devices, where the focussing process can be used to mitigate blast effects, astrophysics, where focussing waves can interact with interstellar clouds, and hypersonic flight, where wave focussing can be used in novel propulsion systems. The focussing of shock waves in gases or liquids is fundamentally different to the focussing of other waves such as electromagnetic waves, because the shock wave strength varies in a complex, nonlinear manner with the local density of the flow. In spite of the topic’s fundamental importance, there currently exists no design method for generating an optimally focussed shock wave.

This PhD project is based at the University of New South Wales’ Canberra campus, in the School of Engineering and Information Technology, and it will investigate the shock wave focussing process analytically, computationally and experimentally. The experiments will mainly be conducted in a shock tube, and they will involve time-resolved density-sensitive flow visualisation using an extremely high-frame-rate imaging system, combined with temperature measurements using diode laser absorption spectroscopy. The experimental results will be compared with state-of-the-art computational flowfield simulations. The project aims to develop a framework for creating optimal shock wave focussing geometries.

The successful applicant, subject to admission to the PhD degree program, will be awarded a UNSW Canberra Research Training Scholarship with an annual tax-free stipend of $25,853 (2013 rate). This scholarship is for a period of 3 years, subject to satisfactory progress reviews. The successful applicant would be expected to be available to commence their studies no later than Session 1, 2014 and must be on campus and enrolled at UNSW Canberra in the relevant PhD program by 31 March 2014. Applications will be accepted until a suitable candidate is found.

The Canberra campus of the University of New South Wales is located at the Australian Defence Force Academy (ADFA). ADFA is located in an Australian bushland setting less than five kilometres from the city centre and the Canberra airport.

The UNSW Canberra campus has a large and comprehensive library, state-of-the-art computing facilities, and well-equipped and modern laboratories.

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