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Public Lecture



Dr. MADHAT ABDEL-JAWAD

Managing Director of GexCon, Australia, Indonesia and the Middle East

“Spacecraft Rockets and Explosions: Unexpected Phenomena in High Speed Gas Dynamics”

3:00-4:00 PM, Tuesday, September 15, 2015
Conference Room - Building D

Abstract

Gases at high speed or high temperature possess specific characteristics that lead to some highly counterintuitive fluid phenomena. For example, the flow around a spacecraft entering a planetary atmosphere, can reach temperatures that cause the gas constituents to dissociate, the resulting species to react, and this in turn, can lead to some unexpected macro flight parameters including a full reversal of aerodynamic stability. These characteristics of a high speed gas can also be exploited to create air-breathing engines (complete with compression, heat addition and expansion) out of what are effectively contoured pipes, with no moving parts, called supersonic combustion ramjets (Scramjets). In both the above examples, the high velocity of the gas, sometimes hypersonic, (ie exceeding Mach 5), results in very high heating which either initiates combustion of a fuel or completely drives the dissociation of what are normally viewed as products (such as CO₂ in the case of Martian atmospheric entry). At the same time, the supersonic portions of the flow experience an information cut-off through the gas medium which also significantly affects the behaviour of the gas. Conversely, in the case of a deflagration to detonation transition, the reacting fuel releases heat which, along with turbulent interaction, drives the gas to reach supersonic speeds, also displaying a similar information cut-off with interesting and sometimes devastating results. In this presentation, Madhat Abdel-jawad attempts to briefly cover some of the most interesting fluid phenomena at play in cases such as those described above, which he has examined over the last 15 years of his career.

About the Speaker

Dr. Madhat Abdel-jawad received his undergraduate degree from Applied Science University, Jordan and a PhD from the Center of Hypersonics at the University of Queensland in Australia. He worked with the HyShot Scramjet flight testing group which was responsible for the first flight test of these airbreathing vehicles and the ARC center for Functional Nanomaterials. Madhat specialises in high energy gas dynamics and has carried out CFD, shock tunnel testing and flight testing. He has and continues to carry out research in explosions particularly detonations and DDT. His work has been credited with providing insight into the failure of the British Beagle2 Martian Lander which failed to land on Mars in 2003. Madhat currently holds the position of Director, Australia, Indonesia and the Middle East (AIME) for GexCon. He is also sits on the board of directors for Vanguard Middle East and is visiting Associate Professor of Engineering at Curtin University in Australia. A former rocket scientist, and academic with significant industry experience, he has authored or co-authored over 40 refereed papers in his fields.