High-speed reacting flow

Thursday, October 5, 2017 | 4:00 p.m. | 202 Reed McDonald

Abstract
Modern propulsion systems involve very fast air flows to generate high thrust and have high efficiency. Combustion under those conditions resembles “striking a match in a hurricane.” For example, flow within a scramjet -the engine that will propel future hypersonic aircraft- is a lot faster than all the chemical reactions that are supposed to take place inside the device. The talk will describe this extreme “flow-chemistry” interaction problem and present some modern approaches that are used to solve it. Laser diagnostics allows for measurement of the complete thermochemistry in a supersonic reacting flow by obtaining pressure, temperature, density, and chemical species mass fractions in this extreme environment. A miniature combustor system that generates ‘canonical’ supersonic flames will be presented in this talk, along with some 3D reduced-chemistry CFD that was used to understand its operation. Finally 1D detailed-chemistry calculations through a shock system will be used to understand the level of reaction inside a supersonic flow and predict what is necessary for the proverbial match to ignite, and stay lit in the proverbial hurricane.

Dr. Karpetis graduated from Aristotle University in Greece with a Diploma Ing. He received a M.Sc. from Princeton University, for work in two-phase flows, and M.Phil and Ph.D. degrees from Yale University, for work in spray combustion and laser diagnostics. He completed post-doctoral appointments at Yale, working in liquid-helium turbulence and at Sandia Nat’l Labs, working in turbulent combustion and laser diagnostics. The latter work was awarded the Silver Medal of the Combustion Institute in 2004. Karpetis joined the faculty of the Department of Aerospace Engineering at Texas A&M University where he is conducting research in high-speed combustion for propulsion applications, supported by NSF, AFOSR, ARL and industry sponsors. He is author/co-author of 35 journal and 50 conference publications.

Refreshments served at 3:45 p.m.