Boulder Fluid and Thermal Sciences Seminar Series

Tuesday, September 19, 2017
3:30pm-4:30pm (refreshments at 3:15pm)
Bechtel Collaboratory in the Discovery Learning Center (DLC)
University of Colorado, Boulder

DNS and LES study of turbulent reacting flows with applications to industrial combustion systems

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In the last decade, there has been an exponential increase in the application of computational tools for design and study of industrial combustion systems. Simulation based tools are increasingly relied upon to evaluate new product designs from conceptual design stage to product launch for both energy generation and propulsion based systems. In order to increase the deployment of these computational tools, research is needed in: (a) simulation tools development utilizing the full potential of supercomputing capabilities to reduce the design cycle time; and (b) to improve the predictive nature of models describing the underlying physics of combustion. This talk, divided into two distinct sections, will describe development and application of high performance computing algorithms and physical models geared towards application to industrial combustion systems.

In the first part of the talk, a finite rate chemistry Direct Numerical Simulation (DNS) study investigating the phenomenon of auto-ignition in liquid spray combustion will be described. In this DNS, Liquid *n-heptane* is represented using Lagrangian spray droplets and the chemical kinetics is described using a 42-species mechanism. Code development needed to enable computationally intensive calculations will be discussed first. Thereafter, the learnings from the DNS study and their implications on developing predictive models will be discussed.

The second part of the talk will highlight the numerical simulations of a novel gas turbine combustor concept, rotating detonation combustor (RDC). Numerical simulations of an H2-Air 6 [inch] RDC being tested at AFRL and GE GRC will be presented. Some of the design challenges associated with wide scale adoption of this technology will conclude the talk.

Biography: Shashank Yellapantula is a research scientist at National Renewable Energy Laboratory (NREL) in Golden, Colorado. Previously he was a lead Research Engineer at General Electric (GE) Global Research Center (GRC). Prior to GE GRC, Shashank Yellapantula completed his M.S. and PhD in Mechanical Engineering from Stanford University, CA.