OLD DOMINION UNIVERSITY
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MAE Graduate Student Seminar

Experimental Studies of Confined Turbulent Flames Stabilized using Bluff Bodies and Fluidic Jets

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ABSTRACT

Flame stabilization is the act of maintaining combustion in the presence of a high-speed premixed flow, and continues to be an important process that influences the performance and limitations for propulsion applications. A common approach for current generation flame holders involves the employment of a low-speed recirculation zone where hot combustion products are maintained and act as a continuous ignition source. The recirculation zone is often induced using a wake-generating bluff body that is submerged in the flow, or through the use of a rearward facing step. A fluidic-based flame holder using a transverse slot jet issuing into a cross flow offers potential thrust and efficiency benefits for propulsion. The transverse slot jet flame holder has been shown to develop a low-speed recirculation zone capable of stabilizing a stationary flame, analogous to a rearward-facing step (i.e. a wall-bounded bluff body). Turbulent flame structures were investigated for various flame holders with emphasis on the downstream shear region. The role of baroclinic torque on turbulent flame structures evolution and the flowfield will be described. Comparisons will be made to a rearward-facing step flame holder. The details of the turbulent flow with and without combustion will be described, showing the potential advantages achieved using fluidics. The fluidic flame holder provides competitive flame holding performance to the mechanical counterpart, while having enhanced combustion rates that result in higher combustor efficiencies and/or shorter burners.

Biography: Dr. Kareem Ahmed is an Assistant Professor at the Mechanical & Aerospace Engineering Department at Old Dominion University. Before joining ODU he served as a Senior Aero/Thermo Engineer at Pratt & Whitney Military Engines. Previous to that, he served as a faculty at Florida State University. He attained his Ph.D. and M.S. degree in Mechanical Engineering from University at Buffalo, and his B.S. degree in Mechanical Engineering from the State University of New York at Alfred. His research interests are in the area of propulsion and energy focusing on multi-phase turbulent reacting flows, fluid mechanics, turbulent combustion, combustion dynamics, supersonic compressible flows, flow control, fluid-structure interaction, fluidic-flow interaction, flame-fluidic interaction, hydrodynamic instabilities, experimental methods and advance optical diagnostics.