Boulder Fluid and Thermal Sciences Seminar Series

Tuesday, September 5, 2017
3:30pm-4:30pm (refreshments at 3:15pm)
Bechtel Collaboratory in the Discovery Learning Center (DLC)
University of Colorado, Boulder

Characterization of the Output from a Catalytic Combustor Using Wavelength Modulation Spectroscopy

Torrey Hayden, *University of Colorado, Boulder*

We characterize temperature and water vapor mole fraction in the output of a catalytic combustor. Catalytic combustion is used extensively in power production, propulsion, and industrial treatments. Wavelength modulation spectroscopy enables sensitive, non-intrusive, and fast measurements of temperature and water vapor mole fraction in the flow above the combustor. The sensor is first validated under known conditions in a controlled furnace. We then measure the temporal and spatial profiles of temperature and water vapor mole fraction at fuel lean conditions in a model combustor to quantify stability and uniformity, and develop boundary conditions for computational fluid dynamic studies of the flow.

Large Eddy Simulation of Rectangular Turbulent Buoyant Jets for Industrial Applications

Nicholas Wimer, *University of Colorado, Boulder*

Many engineering systems involve the use of high-temperature jets to heat nearby objects or surfaces. In such instances, proximity to the jet exit means that specific properties of the exit velocity and temperature can be of substantial importance in determining conditions at the heated object or surface. Moreover, compared to non-heated jets, the flow field complexity of high-temperature jets is substantially increased due to the presence of buoyant forcing. Through the use of Large Eddy Simulation, we examine the near-field instability and far-field scaling laws of rectangular turbulent buoyant jets and how they specifically apply to industrial applications. We study the effects of non-uniformities of temperature and velocity on both the near and far-field characteristics. The importance of these results for the prediction and understanding of engineering applications involving high-temperature jets is outlined.