Facility and Methodologies for Evaluation of Hydrogen-Air Mixer Performance

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Abstract

Increased efficiency and reduced emissions from gas turbine (GT) engines are of consistently growing concern for the current gas turbine community and for the political environment. GT engines commonly produce undesirable emissions such as Carbon Monoxide (CO), Carbon Dioxide (CO_2), Nitric Oxides (NO_x), and Unburned Hydrocarbons (UHC), which all pose various threats to the environment. Lean premixed combustion of hydrogen provides a potential solution to these concerns. A key component of successful lean hydrogen combustion is the fuel-air mixer.

A facility and methodology for the evaluation of such a hydrogen-air mixer is developed and discussed in this thesis. The facility developed utilizes three experimental techniques: Mie scattering flow visualization, schlieren flow visualization, and Laser Doppler Velocimetry (LDV) to characterize and evaluate mixer performance. Results from the two flow visualization experiments illustrate the effectiveness of the established facility. The results from the Mie scattering experiment are post processed and overlaid on CFD predictions of mixer performance and many similarities are found. Capability of the LDV to measure two components of mean velocity is also demonstrated.

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