Announcing the Final Examination of Ian Dunn for the degree of Master of Science

Time & Location: June 15, 2020 at 3:00 PM in Virtual Defense https://meet.lync.com/knightsucfedu39751-knights/i
Title: Optimization of Flame Kernel Ignition and Evolution Induced by Modulated Nanosecond-Pulsed High-Frequency Discharge

The enhanced growth of ignition kernels through modulation of nanosecond pulsed high-frequency discharges is investigated quantitatively in a reactive flow. High-frequency discharge and new notions of rotational temperature coupling per subsequent pulse (< 30 kHz) existing within the breakdown regime have led to the discovery of the “fully-recoupled” regime. The evolution of flame kernels is observed in a methane-air mixture at an equivalence ratio of 0.6 flowing at 12.5 m/s, with an interelectrode gap of 1.7 mm. Energy deposition into the flow per pulse was previously found to be 2.9 ± 0.23 mJ/pulse, where the number of pulses per effective modulation type was 10 (? 30mJ). By holding A.P. (average power) constant through each pulse train, the CPRF (Constant Pulse Repetition Frequency) partially-coupled and decoupled regimes were directly compared against the MPRF (Modulated Pulse Repetition Frequency) fully-recoupled regime through kernel growth measurements via high-speed schlieren. It was found that by utilizing the inter-pulse coupling of rotational temperatures through modulating the PRF (Pulse Repetition Frequency), the ignition probability and kernel area increased as to create the fully-recoupled regime as a new form of ignition optimization.

Major: Aerospace Engineering

Educational Career:
Bachelor's of Aerospace Engineering, BS, 2017, University of Central Florida

Committee in Charge:
Kareem Ahmed, Chair, Mechanical & Aerospace Engineering
Subith Vasu, MAE
Samik Bhattacharya, MAE

Approved for distribution by Kareem Ahmed, Committee Chair, on June 1, 2020.

The public is welcome to attend.