

Mechanical Engineering Department Seminar

3:30pm October 7, 2009
1130 Mechanical Engineering



Premixed Hydrogen Combustion

Flashback Behavior & Mechanisms

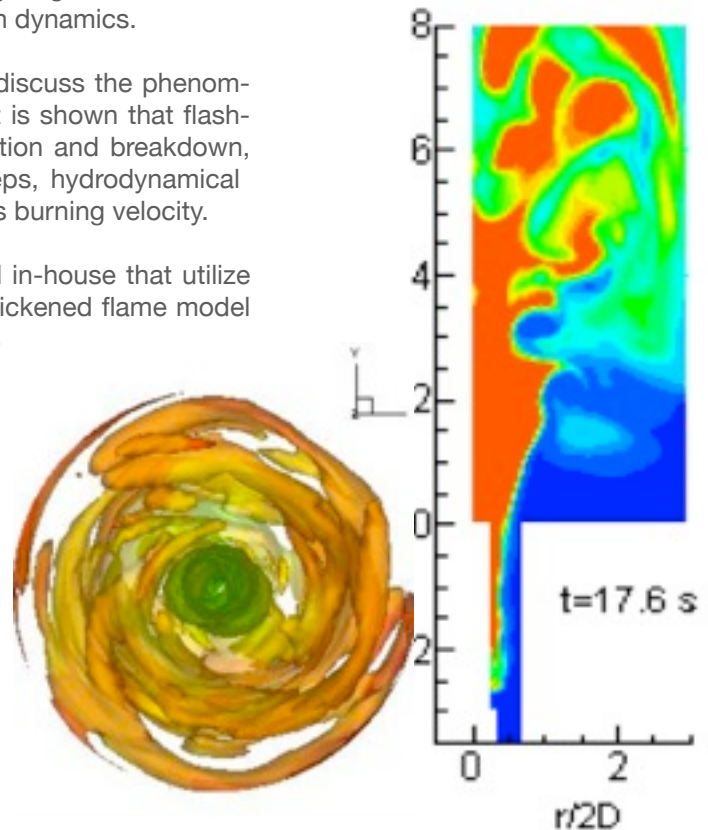
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Land based gas turbines using natural gas represent nearly 70% of the new power generation installed capacity in the last decade. However, with diminishing domestic sources of natural gas and the volatility of foreign imports, there is increasing pressure on utilizing the abundant U.S coal and biomass reserves for power generation. A “clean” technology that is being seriously considered by the U.S Department Of Energy (U.S DOE) is the Integrated Gasification Combined Cycle where coal (or biomass) is initially gasified to produce syngas (mostly hydrogen and Carbon monoxide), and then syngas is used as the fuel of choice in the gas turbine combustion process. However, existing gas turbines that are designed for natural gas do not perform optimally with high-hydrogen content fuel, and encounter problems such as flashback and combustion dynamics.

In this presentation, simulation results are presented that discuss the phenomena of flashback in premixed hydrogen-enriched flames. It is shown that flashback is induced by processes related to vortex propagation and breakdown, and is influenced by geometrical parameters such as steps, hydrodynamical parameters such as swirl, and chemical parameters such as burning velocity.

The simulations presented are based on codes developed in-house that utilize Large Eddy Simulation for resolving turbulence, and the thickened flame model for modeling the combustion processes. Simulation results are compared with published data and measurements collected in-house and show reasonable agreement.



Bio Sumanta Acharya is the L. R. Daniel Professor and the Fritz and Francis Blumer Professor in Mechanical Engineering at Louisiana State University (LSU). He received his PhD from the University of Minnesota in 1982, and joined LSU the same year. He is also the Director of the Turbine Innovation & Energy Research (TIER) Center at LSU. His interests are in computational and experimental aero-heat transfer and combustion with a focus on gas turbine applications. He has published 150 archival journal papers, over 200 refereed conference papers, and has supervised nearly 60 graduate students in his career at LSU. His current funding comes from NASA, NSF, DOE, AFOSR and ONR.