MECHANICAL ENGINEERING *SEMINAR*

Challenges and opportunities for high-fidelity modeling of turbulent reacting flows

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Abstract: Combustion processes in gas turbines, rocket engines, and other propulsion devices are often accompanied by unstable operating conditions. Examples are thermo-acoustic instabilities in gas turbines, auto-ignition in oxygen-diluted combustors, and flame lift-off in high-speed propulsion systems. While such conditions provide unique opportunities for improving fuel efficiency and for reducing pollutant emissions, the accurate prediction and control of such combustion-dynamical processes introduces significant challenges.

This presentation discusses results of recent research efforts on the development of LES-combustion models for the prediction of unstable combustion regimes. Beginning with the LES-analysis of a jet diffusion-flame, model-challenges associated with extinction, auto-ignition, kinetics-controlled combustion, and heat-loss-effects are examined. By separately addressing individual modeling aspects, and different approaches are presented to predict these combustion-physical processes. Underlying assumptions are assessed using direct numerical simulation data, and modeling results for combustion simulations of increasing physical complexity are presented. The presentation closes by providing an overview about further research directions for the LES-modeling of turbulent reacting flows.

Matthias Ihme is currently Assistant Professor in the Department of Mechanical Engineering at Stanford University. He holds a BSc. degree in Mechanical Engineering and a MSc. degree in Computational Engineering. In 2008, he received his Ph.D. in Mechanical Engineering from Stanford. After being on the faculty of the Aerospace Engineering Department at the University of Michigan for five years, he returned to Stanford in 2013. He is a recipient of the NSF CAREER Award (2009), the ONR Young Investigator Award (2010), and the AFOSR Young Investigator Award (2010).

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11:00 am Seminar in 233 Mudd
Lunch served at 12:00pm
in MECE Lobby