PHYSICAL MATHEMATICS SEMINAR

Droplets, Stability and Reacting Shear Flows

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ABSTRACT:

The interaction between turbulence, chemical kinetics and droplet dynamics plays an important role in reacting flows and can lead to instability. Understanding the underlying mechanisms that drive these processes is critical for predicting and controlling them. In this talk, we discuss results from theoretical and experimental studies of different reacting shear flow configurations. We show that large-scale turbulent flame instabilities may be driven by laminar non-reacting shear flow modes, under non-premixed conditions. However, adding liquid droplets into the system completely changes the dynamic response. Furthermore, under lean premixed conditions, we show that the dynamic response of a reactive flow is strongly impacted by the fuel chemistry. In order to gain insight into some of the underlying mechanisms we formulate a new linear stability model that incorporates the impact of finite rate chemistry on the hydrodynamic stability of shear flows. In contrast to previous studies which typically assume that the velocity field is independent of the kinetic rates, temperature coupled mechanisms are accounted for through a variable density Navier-Stokes formulation. This formulation is shown to agree with results of our recent experimental and numerical studies and suggests a physical explanation for the observed impact of finite rate chemistry on shear flow stability.

TUESDAY, FEBRUARY 13, 2018
2:30 PM
Building 2, Room 136

Reception following in Building 2, Room 290
(Math Dept. Common Room)

http://math.mit.edu/seminars/pms/

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