Abstract Submitted
for the DFD17 Meeting of
The American Physical Society

Hydrodynamic Stability Analysis of the Externally Excited Axisymmetric Mode in Reacting, Swirling Jets BENJAMIN EMERSON, TIM LIEUWEN, Georgia Institute of Technology — This study investigates the forced response characteristics of axisymmetric structures in density-stratified swirling jets. The reacting, swirling jet is an important canonical flow field for modern combustion systems. This work is motivated by the combustion instability problem for such systems, where acoustically excited vortical structures may drive oscillatory heat release of combustion. Previous hydrodynamics studies have shown that the stability of helical structures is highly sensitive to the swirl number. However, the combustion literature has shown that axisymmetric structures (in contrast to helical structures) are often responsible for most of the heat release response. Therefore, this work performs a spatial stability analysis to study the swirl number sensitivity of the forced response of the axisymmetric mode. A spatio-temporal analysis is conducted in tandem to investigate the swirl number sensitivity of the impulse response of this mode. The results show that at low values of the swirl number, the axisymmetric mode stability is a weak function of the swirl number, but that new modes and stability bifurcations appear at high swirl numbers.

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Date submitted: 31 Jul 2017 Electronic form version 1.4