Abstract Submitted
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The twisted global instability of lifted flames on round variable-density jets[1] JOSEPH W. NICHOLS, JEAN-MARC CHOMAZ, PETER J. SCHMID, Laboratoire dHydrodynamique (LadHyX), CNRS-Ecole Polytechnique, France — The theory of resonant modes is revisited and extended to finite length systems containing pinch points (k_0, ω_0) with arbitrary $\omega_{kk}^0 = \partial^2\omega/\partial k^2$. When $\mathrm{Im}\left(\omega_{\mathrm{kk}}^0\right) > 0$, the pinch point is twisted, and the system may be destabilized by resonant modes with growth rates greater than that of the unbounded absolute mode, *i.e.* the system may be globally unstable while locally only convectively unstable. Lifted flames on round variable-density jets serve as motivation for this theory since the premixing zone between the nozzle and flame is an example of a streamwise-confined system containing a twisted pinch point. This flow is studied by means of direct numerical simulation (DNS) and linear stability analysis, the latter of which is used to calculate the locus of resonant modes in the complex k- and ω-planes. In agreement with DNS observations, inspection of the solution curve in the ω-plane suggests both a mechanism for stabilization with decreasing system length l and a mechanism for low-frequency fluctuations owing to beating between modes of closely-spaced frequencies.

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