Abstract Submitted
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Sensitivity analysis of low-density reacting jets[1] GARY CHANDLER, University of Bristol, JOSEPH NICHOLS, Center of Turbulence Research, Stanford University, MATTHEW JUNIPER, Department of Engineering, University of Cambridge, PETER SCHMID, Laboratoire d'Hydrodynamique (LadHyx), CNRS-Ecole Polytechnique — A Low-Mach-number formulation of the Navier–Stokes equations is used to simulate an axisymmetric low-density jet diffusion flame that exits into stationary surroundings through a hole in a flat solid wall. A lifted flame that is marginally-stable in a hydrodynamic sense is considered. The equations are linearized about a steady solution of the nonlinear system and a corresponding set of adjoint equations is formed. Direct-linear and adjoint global modes are found with direct numerical simulation (DNS) and provide a map of the most sensitive locations to external forcing and external heating. Acoustic excitation is modeled as an external force in the momentum equation and a map of the most sensitive locations of the flame to acoustic excitation is given. The most sensitive locations to force feedback and to heat and drag from a hot-wire are then analyzed. Force feedback can occur from the placement of a sensor-actuator in the flow or can be considered as a mechanism for global instability. The lifted flame is particularly sensitive to outside disturbances and acoustic forcing in the non-reacting zone.

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