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Stability of reacting gas jets[1] JOSEPH W. NICHOLS, JAMES J. RILEY, University of Washington, Seattle, PETER J. SCHMID, LadHyX, CNRS-École Polytechnique, Palaiseau, France — The stability of a viscous, reacting, variable-density jet is analyzed by means of linear stability analysis and direct numerical simulation (DNS). The spatial branches of the transformed linearized low Mach number equations are solved using a matrix method to obtain a complete spectrum of eigenmodes. The effect of reaction is isolated by comparing results from the reacting jet to those from a non-reacting jet with the same mean profiles (in which the density is lowered in the region where the flame would otherwise be). While reaction serves to stabilize the flow at most frequencies, it is also found to excite a low frequency numerical instability which may mask physically relevant results from DNS if the mixture fraction is not explicitly constrained. Furthermore, this instability mode takes on physical significance in the case of partially premixed jets. Results from the stability theory are compared to results of direct numerical simulation of the fully nonlinear problem. In order to understand the effect of streamwise development of the jet on its stability, linear analysis is applied to mean profiles measured from DNS at various axial locations.

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