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Global modes of a lifted flame on a light round fuel jet JOSEPH W. NICHOLS, PETER J. SCHMID, Laboratoire dHydrodynamique (LadHyX), CNRS-Ecole Polytechnique, Palaiseau, FRANCE — The stability and dynamics of a lifted flame are studied by means of direct numerical simulation (DNS) and linear stability analysis of the reacting, low-Mach number equations. For light fuels (such as nonpremixed methane/air flames), the non-reacting premixing zone upstream of the lifted flame base supports self sustaining oscillations. Local linear stability analysis of the flow downstream of the flame base, however, shows that reaction stabilizes the flow. We show that the global dynamics of the lifted flame can then be interpreted as a superposition of global modes which are "quenched" by the change of local properties encountered at the flame base. The quenched global modes are extracted using a Krylov-subspace method about a steady, but unstable, spatially developing base flow obtained by selective frequency damping. The essential dynamics at the flame base are then recovered by finding the optimal superposition of the extracted global modes.

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