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Numerical simulations of Rayleigh-Taylor instability in non-premixed flames using detailed chemistry NITESH ATTAL, PRAVEEN RAMAPRABHU, University of North Carolina at Charlotte — The Rayleigh-Taylor (RT) instability occurs at a perturbed interface separating fluids of different densities, when the lighter fluid accelerates the heavier fluid. We examine the occurrence of the RT instability, when the perturbed interface demarcates a light, fuel stream from a heavier air stream at elevated temperatures. The study is conducted using the FLASH code with modifications that include detailed chemistry, temperature-dependent EOS, and diffusive transport. The fuel-air interface is initialized at thermal equilibrium ($T_{fuel} = T_{air} = 1000K$) in a constant background acceleration (g). We vary the density difference across the interface by diluting the H_2 fuel stream with inert N_2. The non-premixed flame formed across a burning interface alters the underlying density (ρ) stratification, so that an initially RT unstable (stable) interface can be locally stabilized (destabilized). We observe this change in local stability for both single-wavelength and multimode perturbations, and draw some conclusions on the implications of these findings to applications such as ultra-compact combustors. We also make some comparisons of the reacting, non-premixed RT problem with the corresponding inert flow.

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