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Hydrodynamic instabilities of finite width layers MARC HENRY DE FRAHAN, ERIC JOHNSEN, R. PAUL DRAKE, Univ of Michigan - Ann Arbor — The understanding of multi-material mixing in areas such as inertial confinement fusion and astrophysics relies on accurate characterization of fluid mixing from hydrodynamic instabilities, including the Rayleigh-Taylor, and Kelvin-Helmholtz instabilities. We investigate these instabilities by studying the problem of an extended perturbed shear layer with and without the presence of gravity. An initially perturbed fluid layer is placed in a shear flow. The velocity difference at the interfaces leads to the development of vortical structures and fluid mixing at the interfaces. The presence or absence of gravity dictates the strength of the Rayleigh-Taylor instability phase relative to the Kelvin-Helmholtz instability. Using a high-order numerical method that accurately represents material and flow discontinuities, we identify stable and unstable configurations depending on the Richardson number, and the ratios of the initial perturbation amplitude and layer thickness to the wavelength.

Marc T. Henry de Frahan
Univ of Michigan - Ann Arbor

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