Abstract Submitted
for the DFD17 Meeting of
The American Physical Society

Stability and structure of fields in a flow with a hydrodynamic discontinuity DANIIL ILYIN, Caltech, YASUHIDE FUKUMOTO, Kyushu University, Japan, WILLIAM GODDARD, Caltech, SNEZHANA ABARZHI, The University of Western Australia — We consider from a far field the evolution of a hydrodynamic discontinuity separating incompressible ideal fluids of different densities, with mass flow across this interface. By solving the boundary value problem and finding fundamental solutions of linearized dynamics, we directly link interface stability to structure of the flow fields. We find that the classic Landau system of equations for the Landau-Darrieus instability has a degenerate and singular character. Eliminating this degeneracy leads to appearance of a neutrally stable solution whose vortical field can seed the instability. We further find that the interface is stable if the flux of energy fluctuations produced by the perturbed interface is small compared to the flux of specific kinetic energy across the planar interface. The interface is unstable if the energy fluctuations flux is large compared to the kinetic energy flux. Landaus solution is consistent with the latter case. Keywords: hydrodynamic instabilities, interfacial dynamics, mixing

Daniil Ilyin
Caltech

Date submitted: 01 Aug 2017 Electronic form version 1.4