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Hydrodynamic instabilities in sharp boundary approximation[1]
SNEZHANA I. ABARZHI, University of Chicago — For the first time, on the basis of conservation principles and thermodynamics laws, we derive the generalized Rankine-Hugoniot conditions that can be applied at unsteady and curved fronts. These conditions describe the dynamics of the front in an explicit and covariant form and can be applied in convergent or Cartesian system of coordinates. The theoretical framework is applied to the instabilities of Landau-Darrieus (LD), classical Rayleigh-Taylor (RT) and ablative Rayleigh-Taylor (ART). It is shown that in the case when if there is mass flow across the front and no acceleration presents (LD), the front is unstable only if three conditions are satisfied (1) bulk vorticity is generated; (2) energy flux across the front is imbalanced; (3) energy imbalance is large. When acceleration presents (RT and ART), the dependence is obtained of the instability growth-rate on the mass flow and energy imbalance across the front. Connection between the ablative RTI and classical RTI is made, and control parameters of the system are derived. The obtained results provide a theoretical framework for design of experiments in ICF-relevant conditions.

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