# A mixed interface capturing/tracking scheme for sharp interface simulation of flow instability problem

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## Abstract

A coupled interface capturing and interface tracking method is implemented for the simulations of interfacial flows. The proposed technique is presented to accurately predict the motion of discontinuous interface between immiscible fluids with different densities. The classical Rayleigh-Taylor instability problem is investigated. The configuration in the vicinity of the interface is unstable and as time evolves, the heavy fluid will sink while the light fluid will rise. Any disturbance grows to produce spikes of heavy fluids moving downward and bubbles of light fluids moving upward and to cause a mushroom-like shape. These simulations in our two-fluid numerical model are performed by the improved volume-of-fluid (VOF) method in conjunction with a localized height function concept. Besides, a Lagrangian approach used to track the sharp interface precisely is incorporated with the VOF-based system. It has advantages of being conceptually simple, reasonably accurate and phenomena such as interface breakup, fragmentation and coalescence are inherently included. Some physical characteristics are tested and discussed, including the convergence test, the relation between the density ratio and interface length and the formation of the bubble and spike for the flow instability problem.

**Keywords:** Immiscible Fluid, Rayleigh-Taylor Instability, Volume of Fluid, Interface Capturing, Bubble