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Numerical Modeling of Rayleigh Taylor Instability in Confined Geometries

Apoorv Giriya
Department of Mechanical Engineering, IIT Bombay

Synopsis

The Rayleigh-Taylor instability is an instability of the interface separating two immiscible fluids where denser fluid rests on the lighter one. In case of a disturbance of the interface, the dense fluid enters the light fluid. Although it has been an area of active research in fluid dynamics for the last twenty years, relatively little attention has been paid to the dynamics of problems where Rayleigh-Taylor instability plays a role but is only one component of a more complex system. Various real-life phenomena and applications of RT instability include explosions in supernovae, instabilities in liquid metal batteries, plasma fusion reactors, and inertial confinement fusion.

In this project, Rayleigh-Taylor instability between miscible fluids is to be examined in situations where it is confined by a cuboidal geometry. When the fluids are confined by a small geometry, it is known that there is a critical depth in which the RTI can be suppressed. The initial condition of the simulation will be that the interface is flat. By varying the geometrical parameters, the critical depth for a given geometry will be determined.

This project was migrated from the paper
Title: Confinement-induced stabilization of the Rayleigh-Taylor instability and transition to the unconfined limit
Authors: Samar Alqatari, Thomas E. Videbæk, Sidney R. Nagel, A. E. Hosoi, Irmgard Bischofberger
Journal name: Science Advances, Applied Science and Engineering