Linear stability of Magnetohydrodynamic Richtmyer-Meshkov Instability in Cylindrical Geometry

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Abstract

We investigate the Richtmyer-Meshkov instability (RMI) that occurs when an incident shock impulsively accelerates the interface between two different fluids. RMI is important in many technological applications such as Inertial Confinement Fusion (ICF) and astrophysical phenomena such as supernovae. We consider RMI in the presence of the magnetic field in converging geometry through both simulations and analytical means in the framework of ideal magnetohydrodynamics (MHD). In this thesis, we perform linear stability analyses via simulations in the cylindrical geometry, which is of relevance to ICF. In converging geometry, RMI is usually followed by the Rayleigh-Taylor instability (RTI). We show that the presence of a magnetic field suppresses the instabilities. We study the influence of the strength of the magnetic field, perturbation wave numbers and other relevant parameters on the evolution of the RM and RT instabilities. First, we perform linear stability simulations for a single interface between two different fluids in which the magnetic field is normal to the direction of the average motion of the density interface. The mechanism of suppression is the transport of vorticity away from the density interface by two Alfvén fronts.

Keywords
MHD, Richtmyer-Meshov instability, Rayleigh-Taylor instability