Linear Analysis of the Magnetohydrodynamics Richtmyer-Meshkov Instability of Three-Dimensional Perturbed Interfaces

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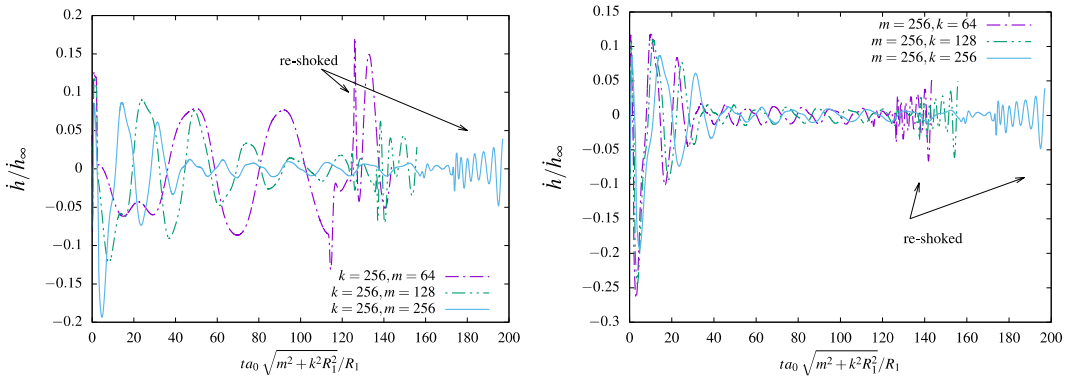
Abstract:

Richtmyer-Meshkov instability (RMI) grows when a perturbed density interface is impulsively accelerated by a shock wave. This is one of the reasons why RMI may be considered a special case of the Rayleigh Taylor instability (RTI). They occur frequently in many technological applications and natural phenomena, such as inertia confinement fusion (ICF) and supernovas. In general, these hydrodynamic instabilities are the key concern in all forms of nuclear fusion. In this work, we numerically investigated the linear evolution of multi-layer RMI in the cylindrical geometry using a combined azimuthal (m) and axial (k) wavenumbers. The varying combinations of wavenumbers are studied in this work. In addition, the effect of an external azimuthal magnetic field on RMI is investigated. Fig. 1 presents the effect of varying wavenumbers in the presence of azimuthal magnetic field with strength β=4 for the first contact discontinuity, denoted by 〖CD〗_1 which is initialized at the positions R_1. It shows that the growth rates of the instabilities are more stabilized by increasing the wavenumber in terms of the applied magnetic field for the specific combination (m,k)=(256,256).



a) CD_1 for fixed k b) CD_1 for fixed m

Figure1. Normalized growth rates of the perturbed contact discontinuity with β=4 at 〖CD〗_1 for a) k=256, m=64,128, 256 and b) m=256, k=64,128, 256.