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Dale Pullin
Vincent Wheatley
Ravi Samtaney</td></tr>
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<tr><th>abstract</th><td>We utilize the incompressible, Hall-magnetohydrodynamics (MHD) model for conducting fluids to investigate the effect of Hall current on the stability of an impulsively accelerated, perturbed density interface, or contact discontinuity (CD) separating two fluids in the presence of a background magnetic field. This is used as a simple model, in a conducting fluid, of a Richtmyer-Meshkov type flow that is characterized in a neutral fluid by a shock-wave-density-interface interaction. Two versions of the Hall-MHD equations are explored. In the first, the ions are treated as an incompressible fluid but the electron gas retains its compressibility, while for the second version the incompressible limit for both species is invoked. The linearized equations of motion are first formulated for a sinusoidal interface perturbation and then solved as an initial-value problem using a Laplace transform method with general numerical inversion but with analytical inversion for some limiting-parameter cases. While the field equations are identical for both Hall-MHD models, the CD-jump conditions differ leading to qualitatively similar but quantitatively different CD dynamics. For both models, the presence of the magnetic field is found to suppress the incipient interfacial growth associated with neutral-gas, Richtmyer-Meshkov instability (RMI). When the ion skin depth is finite, the vorticity dynamics that drive the suppression of the RMI differ markedly from the ideal MHD, RMI flow. On the interface, the Hall-MHD description allows the presence of a tangential slip velocity which leads to finite circulation deposition. Away from the interface, vorticity is produced by the perturbed magnetic fields and transported to infinity by a dispersive wave system. This leads to decay of the velocity slip at the interface with the effect that interface growth remains bounded but distorted by damped oscillations associated with the ion cyclotron effect. The flow behavior for several limits of the ion skin depth and the Larmor radius is explored. Specific comparisons with the results from both models against ideal MHD are presented</td></tr>
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