

Stability of multidimensional contact discontinuities in compressible MHD

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Abstract

In this talk we study the stability of multidimensional contact discontinuities in compressible fluids. There are two kinds of contact discontinuities, one is so-called the vortex sheet, mainly due to that the tangential velocity is discontinuous across the front, and the other one is the entropy wave, for which the velocity is continuous while the entropy has certain jump on the front.

It is well-known that the vortex sheet in two dimensional compressible Euler equations is stable when the Mach number is larger than $\sqrt{2}$, while in three dimensional problem it is always unstable. But, some physical phenomena indicate that the magnetic field has certain stabilization effect for waves in fluids. The first goal of this talk is to rigorously justify this physical phenomenon, and to investigate the stability of three-dimensional current-vortex sheet in compressible magneto-hydrodynamics. By using energy method and the Nash-Moser iteration scheme, we obtain that the current-vortex sheet in three-dimensional compressible MHD is linearly and nonlinearly stable when the magnetic fields on both sides of the front are non-parallel to each other.

The second goal is to study the stability of entropy waves. By a simple computation, one can easily observe that the entropy wave is structurally unstable in gas dynamics. By carefully studying the effect of magnetic fields on entropy waves, we obtain that the entropy wave in three-dimensional compressible MHD is stable when the normal magnetic field is continuous and non-zero on the front.

This is a joint work with Gui-Qiang Chen.