Solution to Magnetogasdynamics

T. Raja Sekhar

Department of Applied Mathematics, NIT Rourkela, Rourkela, Orissa, India
tungalar@nitrkl.ac.in

2000 Mathematics Subject Classification. 35L67, 58J45, 76N15

The Riemann problem for a quasilinear hyperbolic system of equations governing the one dimensional unsteady simple wave flow of an inviscid and perfectly conducting compressible fluid, subjected to a transverse magnetic field, is solved approximately. This class of equations includes as a special case the Euler equations of gasdynamics. It is noticed that in contrast to the gasdynamic case, the pressure is varying across the contact discontinuity. The iterative procedure is used to find densities, between left acoustic wave and right contact discontinuity, and between right contact discontinuity and right acoustic wave, respectively. All other quantities follow directly throughout the (x, t)-plane, except within rarefaction waves, where an extra iterative procedure is used along with Gaussian quadrature rule to find particle velocity; indeed, the determination of the particle velocity involves numerical integration when the magneto-acoustic wave is a rarefaction wave. Lastly, we discuss numerical examples and study the solution influenced by the magnetic field.

References

[1] E.F. Toro, *Riemann solvers and numerical methods for fluid dynamics*, Springer-Verlag, Berlin, 2nd ed. 1997.

[2] R. Gundersen, *Magnetohydrodynamic shock wave decay*, Z. Angrew. Math. Phys. **40** (1989), 501-509.