Numerical Methods for Conservation Laws

Assignment 3 (system of nonlinear equations)

The fluctuation-signal algorithm with and without entropy fix (Harten-Hyman) is to be used to solve shock tube type problem for inviscid Euler equations of gas dynamics. Details of the governing equation as discussed in class.

Plot ρ, u, p at required time t, assuming an initial discontinuity at the center of the domain for the two problems given as:

1. $\rho_l = 1, u_l = 0, p_l = 1$

   $\rho_r = 0.125, u_r = 0, p_r = 0.1$

   result required at $t = 2.0$

   This is a common validation test case for which results are widely available in literature as Sod's test case. The code without entropy fix is to be validated against this before proceeding further.

2. $\rho_l = 3.857, u_l = 0.92, p_l = 10.33$

   $\rho_r = 1.0, u_r = 3.55, p_r = 1.0$

   Result *with and without the entropy fix* required at $t = .72$

Domain $[-5, 5]$, 101 points, CFL $= 0.9$ for both the cases.