

Project #1: **Exact Solution of the Riemann Problem for Euler Equations in 1D**

Due on November 2, 2015

This project deals with the exact solution of the Riemann Problem for 1D Euler equations, as discussed in Chapter 4 of Toro's book. Start from the source code `E1RPEX.F` in the library *NUMERICA* that is available online.

1. Run the code for Tests 1 through 5 in Chapter 4 and show that you obtain the same results as those in the book.
2. Modify subroutine `GUESSP` to enforce the choice of the Initial Guess Values p_0 for solving the p_* equation based on each of the values p_{TR} , p_{pV} , p_{TS} as described in Chapter 4. Run Tests 1 through 5 using these different methods for Initial Guess Value and compare the number of iterations needed for convergence in different cases.
3. For each one of Tests 1 through 5, change one initial condition, run the case and compare it to the original case. As an example, see Figure 1 that shows the results for Test 2 for $\rho_L = 0.2$ compared to the case with $\rho_L = 1.0$ shown in Chapter 4 of Toro's book. Carefully discuss the results.
4. Write a complete Technical Report for the project.

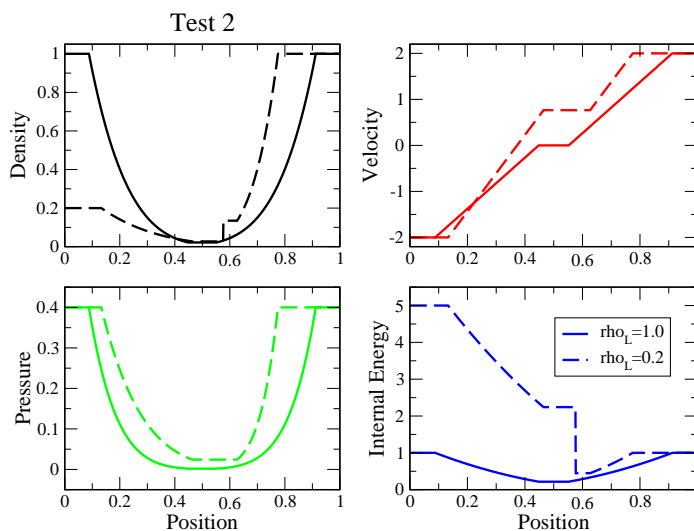


Figure 1: Test 2 from Toro's book, Chapter 4: Exact solution for density, velocity, pressure and specific internal energy for $\rho_L = 1.0$ at $t = 0.15$ units and for $\rho_L = 0.2$ at $t = 0.1$ units.