Numerical study on 2D Riemann problems using state of the art solvers

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Outline

Introduction | Numerical schemes | Software and computations
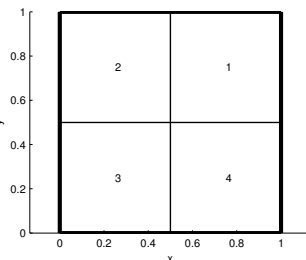●○ | ○○○○○ | ○○
Euler equation for HD

Introduction

Riemann problem in 2D

A Riemann problem consists of a system of conservation equation together with a piecewise constant initial condition.

$$U_t + F(U)_x + G(U)_y = 0$$

$$U_0(x, y) = \begin{cases} u_1 & (x, y) \in [0.5, 1]^2 \\ u_2 & (x, y) \in [0, 0.5] \times [0.5, 1] \\ u_3 & (x, y) \in [0, 0.5]^2 \\ u_4 & (x, y) \in [0.5, 1] \times [0, 0.5] \end{cases}$$

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The equations

Euler equation for compressible fluids

$$U_t + F(U)_x + G(U)_y = 0$$

with

$$U = \begin{pmatrix} \rho \\ \rho u \\ \rho v \\ e \end{pmatrix} \quad F = \begin{pmatrix} \rho u \\ \rho u^2 + p \\ \rho uv \\ u(e + p) \end{pmatrix} \quad G = \begin{pmatrix} \rho v \\ \rho uv \\ \rho u^2 + p \\ v(e + p) \end{pmatrix}$$

Equation describing the dynamics of a compressible fluid.
Conserved quantities are: ρ density, ρu momentum in x , ρv momentum in y and the total energy e.

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Overview of different numerical methods

Numerical methods

5 different numerical schemes tested:

- ▶ TVDLF
- ▶ HLL
- ▶ HLLC
- ▶ TVD-MUSCL
- ▶ FD

TVDLF

content...

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Overview of different numerical methods

TVD-MUSCL

content...

HHL and HLLC

content...

FD

content...

MPI-AMRVAC and HPC

Maar heel even aanhalen... Iedereen kent dit toch al.

Introduction   Numerical schemes   Software and computations
oo   ooooo   o●
Software and computations

Personal working method

Talk about the scrip we wrote to set up the project and run everything.

Tell them we ran the code succsefully for small problem on the cw network on 5 computers. =¿ network was not stable or something else went wrong.