Physical model and governing equations

Prof. Chien-Cheng Chang

1. Fluid as continuum

2. Local kinematics

3. Lagrangian & Eulerian descriptions

4. Mass conservation

5. Momentum conservation

6. Energy conservation

7. Equation of state & thermodynamics

8. Equations in conservation form

Basic numerical methods

Prof. Feng Xiao

1. Conservative and non-conservative schemes

2. Finite volume method

3. Godunov scheme and extension

4. Entropy issue for hyperbolic conservation lows

5. Reconstruction and high-order schemes

6. Numerical oscillation and non-linear schemes (TVD etc.)

7. High resolution shock-capturing schemes

Riemann solvers

Prof. Keh-Ming Shyue

1. The Riemann problem and its solution for Euler equations of compressible gas dynamics

2. Approximate Riemann solvers

Online reference:

D.I. Ketcheson, R.J. LeVeque, and M. del Razo Sarmina, Riemann Problem for Hyperbolic PDEs: Theory and Approximate Solvers

https://github.com/clawpack/riemann_book

DG and WENO schemes for solving hyperbolic equations

Prof. San-Yih Lin

1. DG scheme for 1D and 2D scalar hyperbolic equations.

2. DG scheme for system hyperbolic equations.

3. DG scheme for Navier-Stokes equations.

4. WENO scheme for hyperbolic equations.

5. WENO scheme for aeroacoustics.

Flux vector splitting type schemes for solving the Euler equations

Prof. Yang-Yao Niu

1. Review of flux vector splitting schemes since 1981

2. Experiences of the AUSM family schemes

3. Application on the multiphase flow simulations.

Solution-structure preserving reconstruction of finite volume method for compressible flow

Prof. Feng Xiao

Numerical algorithms for compressible cavitating multiphase flows

Prof. Keh-Ming Shyue

Numerical methods for fluid-structure interaction flows

Prof. San-Yih Lin

Towards robust and accurate hybrid AUSMD schemes for shock-liquid interactions and cavitations

Prof. Yang-Yao Niu

END