Abstract for Case 1.5

Radial Flow Expansion

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1. Code description

- We employ the CPR-DG formulation [1-4] for space discretization
- The classical 4-stage RK scheme is used for time integration
- The code was run in a serial mode

2. Case summary

- Taubench ran in 9.525s
- Purely radial flow field
- Supersonic outflow boundary condition
- Largest time step that ensuring stability was used

3. Meshes

- Uniform Cartesian meshes (dx = 1/8, 1/16 and 1/32) were used.

4. Results

The 2D simulation was performed until t = 2 with gamma = 3. The entropy errors vs Work Units and length scales are plotted in Figures 1 and 2. The error histories on three different meshes are displayed in Figures 3.

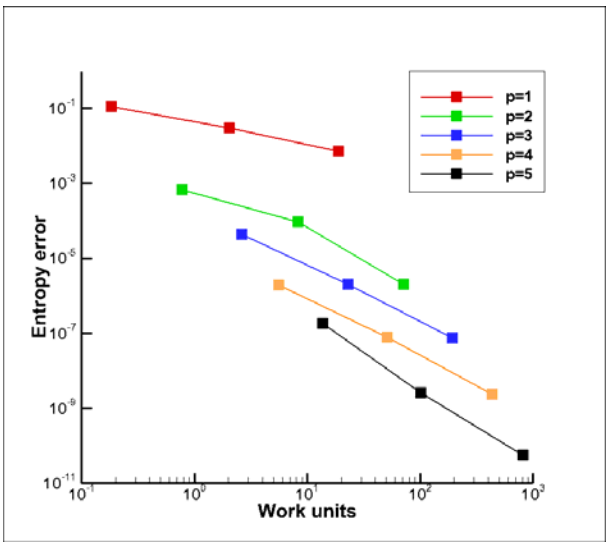

Figure 1. Entropy errors vs. work units for different h and p

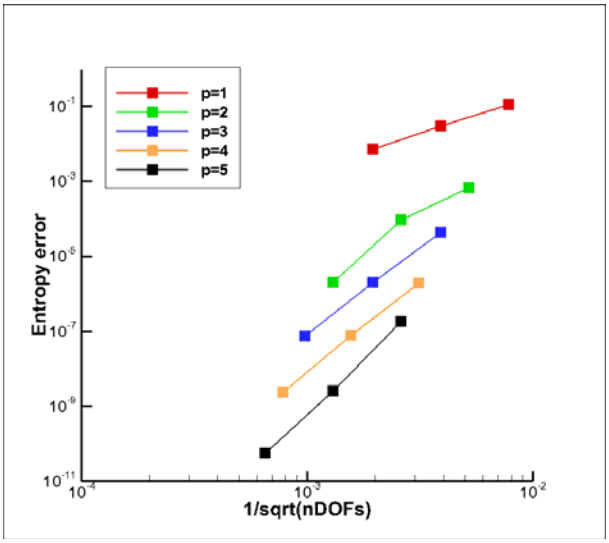

Figure 2. Entropy errors for different h and p

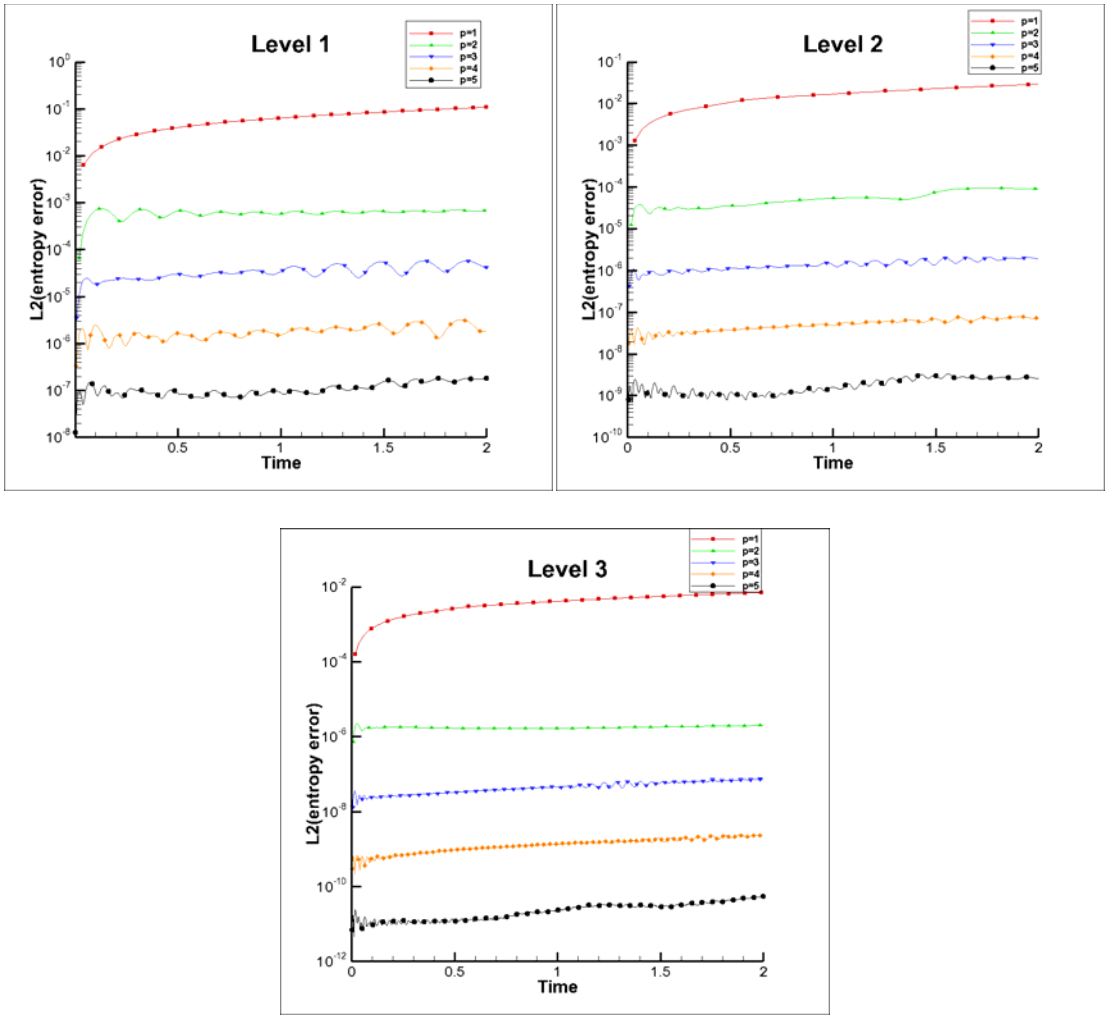

Figure 3. The entropy error histories on 3 different meshes for all p

After numerical test, biggest time steps that ensuring stability were used. Time steps for all cases are presented in Table 1.

p	1	2	3	4	5
Level1	0.042	0.019	0.010	0.007	0.004
Level2	0.0174	0.0082	0.0048	0.0032	0.0022
Level3	0.0079	0.0038	0.0023	0.0015	0.0010

Table 1. Time step for each case

5.References

[1] H.T. Huynh, A flux reconstruction approach to high-order schemes including discontinuous Galerkin methods, AIAA Paper 2007-4079.

[2] Z.J. Wang and Haiyang Gao, "A unifying lifting collocation penalty formulation including the discontinuous Galerkin, spectral volume/difference methods for conservation laws on mixed grids," Journal of Computational Physics 228 (2009) 8161–8186.

[3] Z.J. Wang, H. Gao and T. Haga, "A Unifying Discontinuous Formulation for Hybrid Meshes," Adaptive High-Order Methods in Computational Fluid Dynamics, Edited by Z.J. Wang, World Scientific Publishing, 2011.

[4] H. Gao, Z.J. Wang and H.T. Huynh, "Differential Formulation of Discontinuous Galerkin and Related Methods for the Navier-Stokes Equations", Communications in Computational Physics, accepted.