Abstract for Case 1.6

Vortex Propagation

Yanan Li and Z.J. Wang
Iowa State University

1. Code description

- We employed the CPR-DG formulation [1-4] for space discretization
- Flux points were chosen coinciding with solution points
- Roe Riemann solver was employed
- The classical 4-stage RK scheme was used for time integration
- Cases were run 50 periods without any low-speed preconditioning on uniform grids
- The standard posted quad meshes were used in the simulations with p = 1 to 5
- The code was run in a serial mode

2. Simulation details

- Taubench ran in 9.525 second
- Largest time steps were found for stability

	P1	P2	P3	P4	P5
Level0	4.1e-06	2.0e-06	1.2e-06	8.0e-07	3.0e-07
Level1	1.0e-06	1.0e-06	6.0e-07	4.0e-07	1.5e-07
Level2	1.0e-06	5.0e-07	3.0e-07	2.0e-07	7.5e-08

Table 1 The largest stable time steps for different discretization levels

3. Meshes

- Standard meshes were used

4. Results

We computed the “Slow vortex” 50 periods without any low-speed preconditioning on uniform grids. We are still doing the computations on random disturbed meshes. Results are presented in Figure 1.

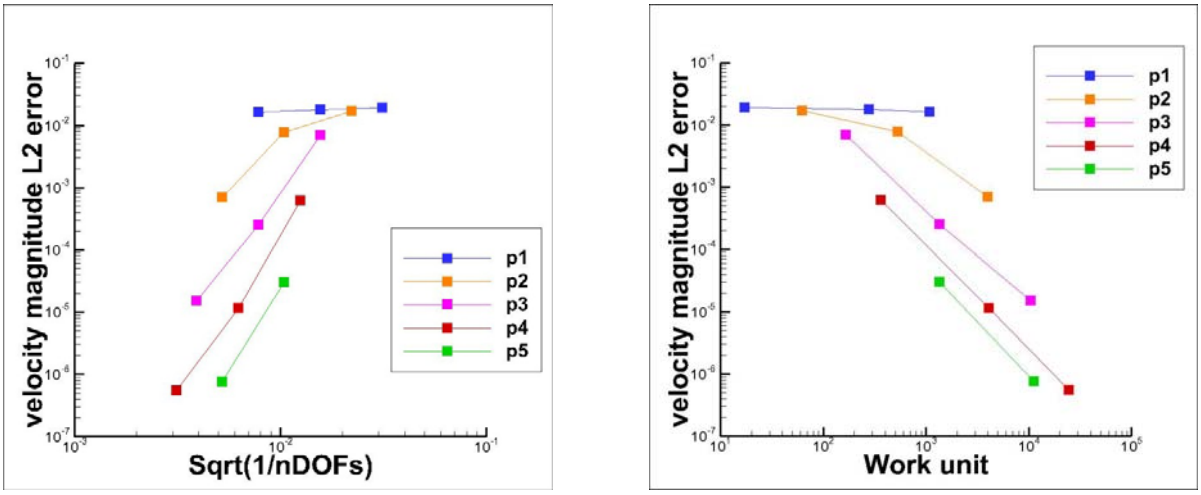

Figure 1. Velocity magnitude L2 error vs. length scale as well as the work unit

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.