Abstract for Case 1.1

Inviscid Flow over a Bump in a Channel

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
- A GMRES solver with a LU-SGS [5] as a preconditioner. Only the diagonal blocks were stored
- The standard p4 meshes were used in the simulation with p = 1 to 5
- The code was run in a serial mode

2. Simulation details

- Time steps changed from various optional original ones to infinity
- 30 search directions were employed in GMRES
- We were able to converge 10 orders for all the cases
- Taubench ran in 9.525 second
- All the cases started from the free stream, and we never restarted

3. Meshes

- Standard Workshop p4 triangular meshes were used. The coarsest is shown in Figure 1
- The curved wall were p-4

4. Results.

The entropy errors are shown in Figure 2 with hp-refinements and work units.

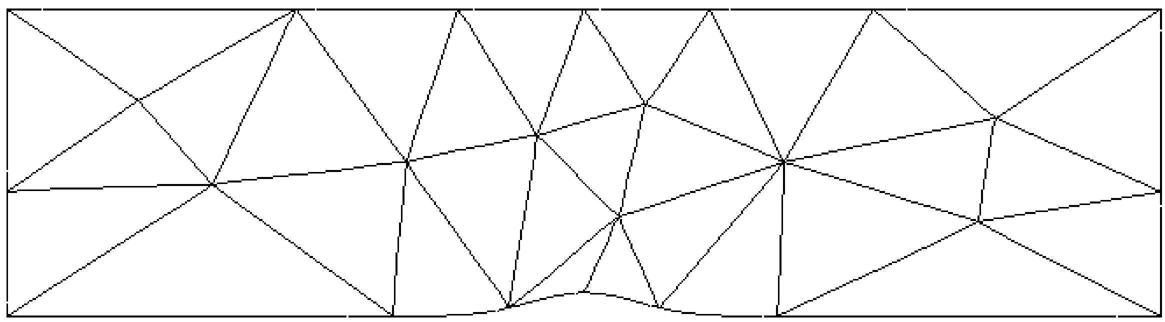

Figure 1. The Coarsest Mesh

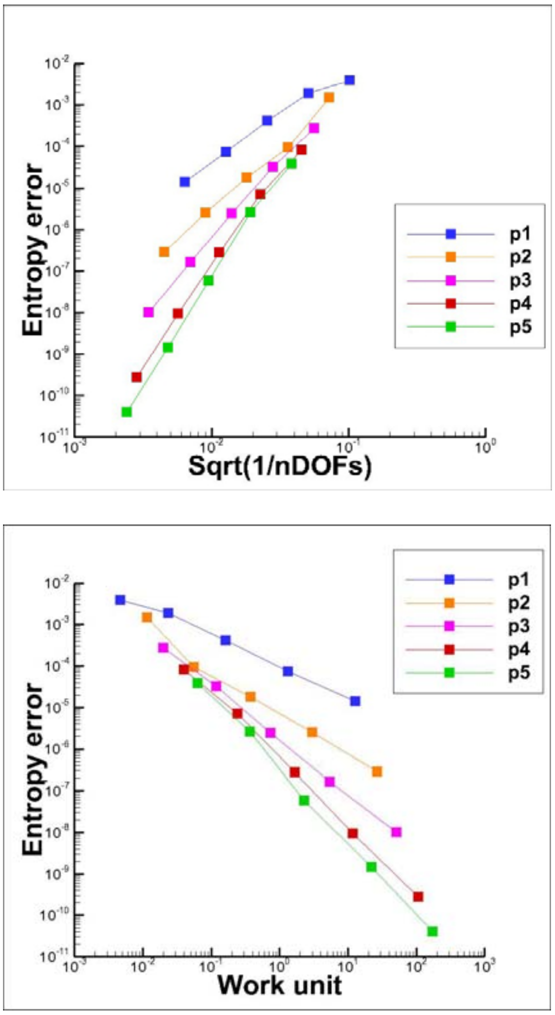

Figure 2. Convergence of entropy error with hp refinement and work units

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.

[5] Y. Sun, Z.J. Wang and Y. Liu, "Efficient Implicit Non-linear LU-SGS Approach for Compressible Flow Computation Using High-Order Spectral Difference Method", Communications in Computational Physics, Vol. 5, No. 2-4, pp. 760-778 (2009).