Abstract(v2) for the Testcase C2.4
by Ralf Hartmann, DLR, Braunschweig

1 Code description

The PADGE code implements higher order discontinuous Galerkin methods on unstructured possibly curved and locally adapted meshes.
Parameter settings for the current test case:

- Discretization/Higher order capability:
  - Lagrange polynomial basis functions of polynomial degrees 1-4.
  - Roe flux with entropy fix
  - BR2 scheme
  - Characteristic farfield boundary conditions
- Solver/Parallel capability
  - Implicit solver (full Newton)
  - Residual and matrix assembly is parallelized
  - Linear solver: GMRES with ILU preconditioner (parallelized by PETSc)

2 Case summary

- The density residual has been reduced to 10^{-10} relative to the density residual at freestream conditions.
- Computations have been performed on the ANTON cluster (24 compute nodes with 8 cores (two Intel Xeon E5540, 2.53GHz, quad core processors)). The number of cores used ranged between 1 and 6. TAUBench was between 10.868 sec and 10.923 sec.

3 Meshes

The meshes as provided on the HOW webpage

- delta.1.msh 408 cells
- delta.2.msh 3,264 cells
- delta.3.msh 26,112 cells
- delta.4.msh 208,896 cells

4 Results

Reference values (taken from [LH10][1]): $C_d^{\text{ref}} = 0.1658$, $C_l^{\text{ref}} = 0.347$.

[1] T. Leicht and R. Hartmann. Error estimation and anisotropic mesh refinement for 3d laminar aerodynamic flow simulations. J. Comput. Phys., 229(19), 7344-7360, 2010.

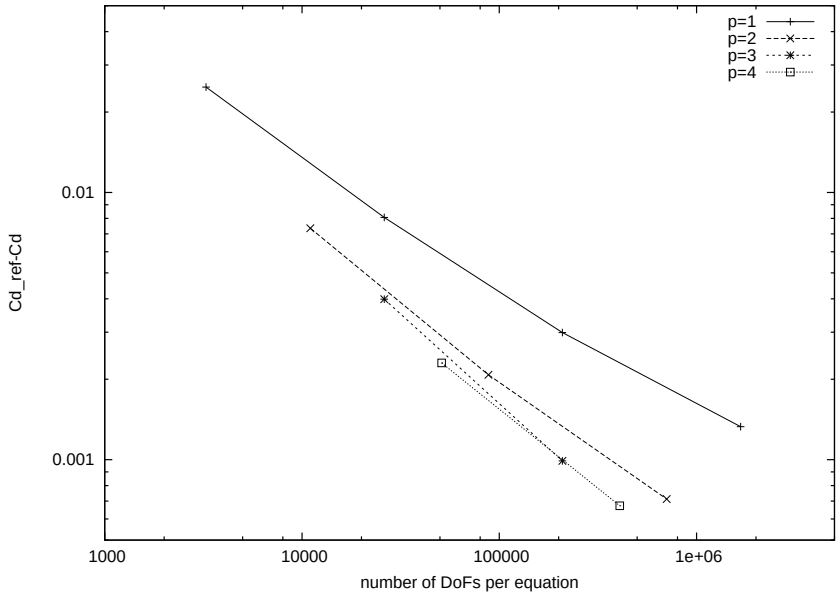

Figure 1: Error in C_d vs. number of DoFs per equation

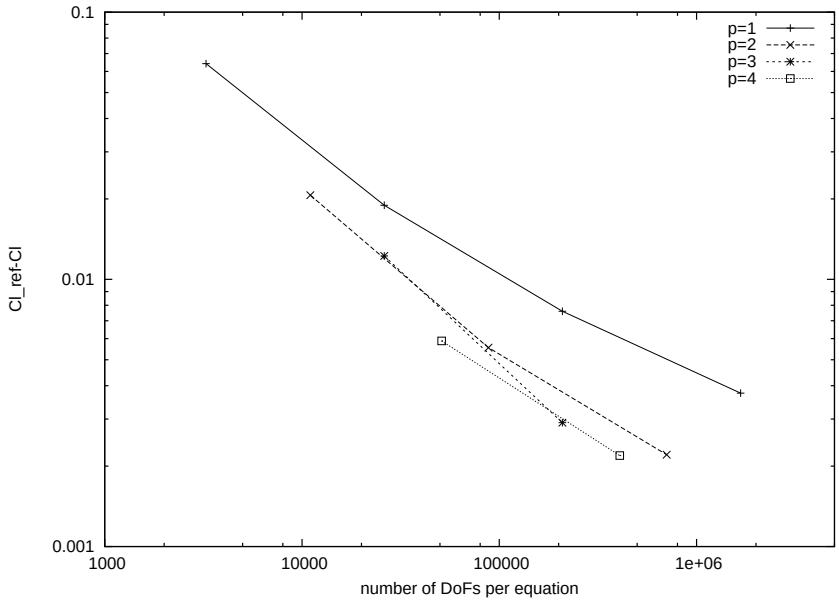

Figure 2: Error in C_l vs. number of DoFs per equation

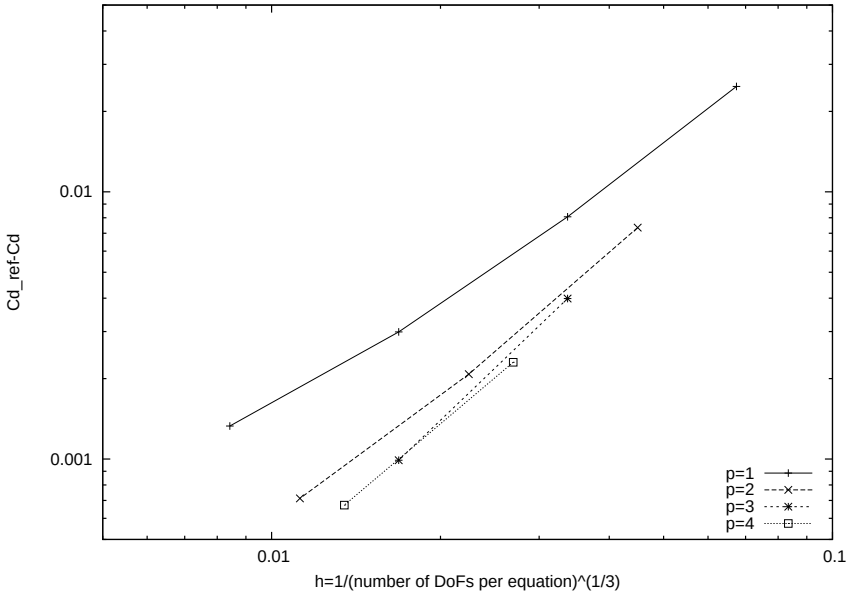

Figure 3: Error in C_d vs. $h = 1/\sqrt[3]{\text{number of DoFs per equation}}$

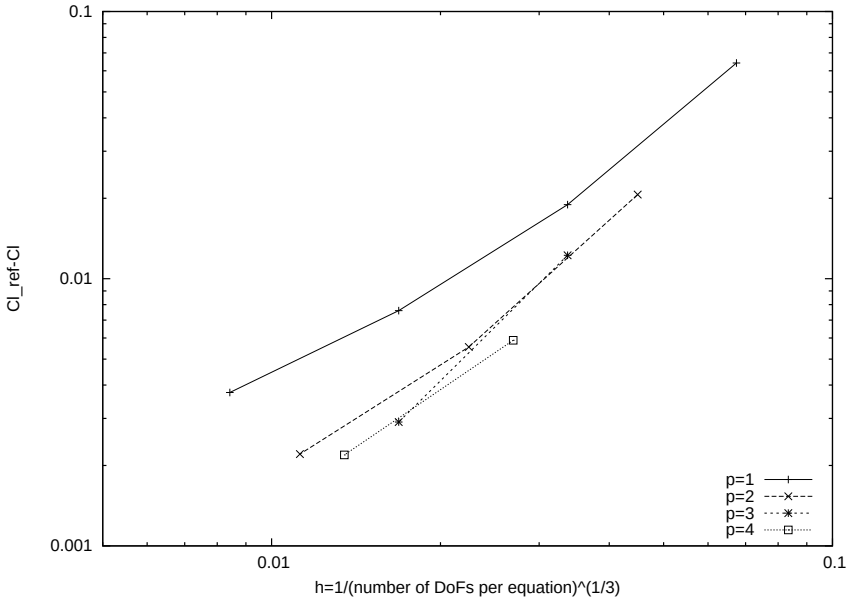

Figure 4: Error in C_l vs. $h = 1/\sqrt[3]{\text{number of DoFs per equation}}$

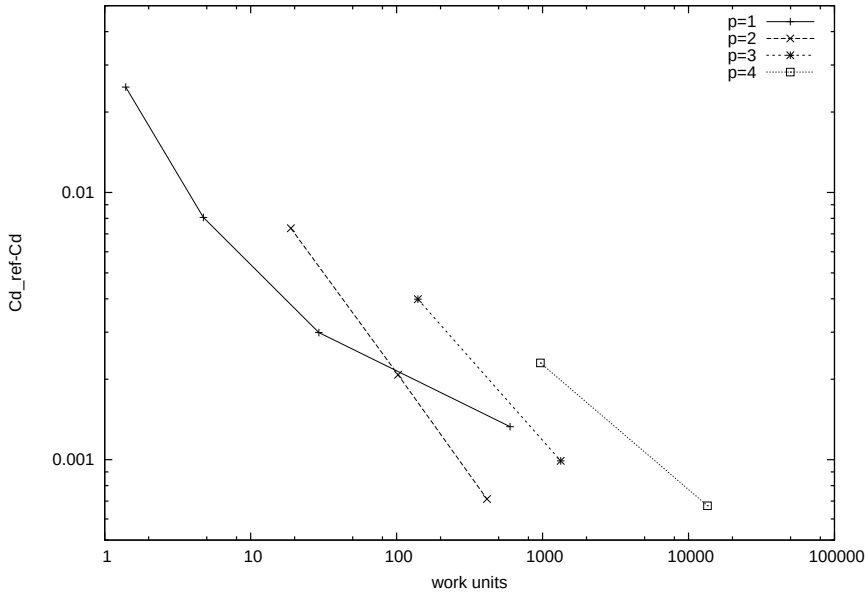

Figure 5: Error in C_d vs. work units

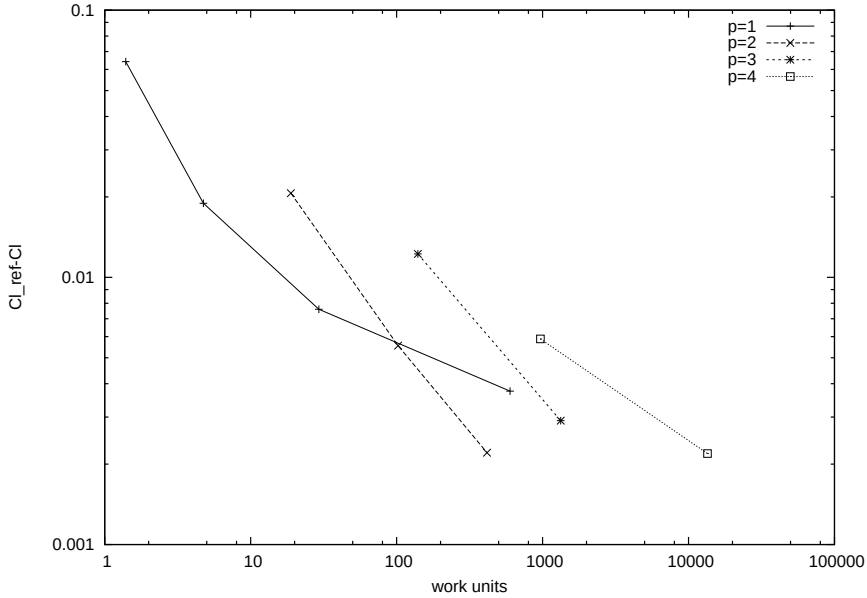

Figure 6: Error in C_l vs. work units