

Abstract for the Testcase C1.3c)
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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 0-4.
 - Vijayasundaram flux
 - 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^{-8} relative to the density residual at freestream conditions. Note, that a factor of 10^{-10} could not be achieved as the density residual stagnates at about 3×10^{-10} .
- Computations have been performed on the C²A²S²E cluster (648 compute nodes with 12 cores (two Intel Xeon X5670, 2.9GHz processors). The number of cores used ranged between 1 and 2. TAUBench on one core required 8.223 sec.

3 Meshes

The p4 quad meshes as provided on the HOW webpage

- naca_ref2.gmsh 2240 cells
- naca_ref3.gmsh 8960 cells
- naca_ref4.gmsh 35840 cells
- naca_ref5.gmsh 143360 cells

4 Results

Reference values: $C_d^{\text{ref}} = 0.055316555$, $C_l^{\text{ref}} = 0.018265945$.

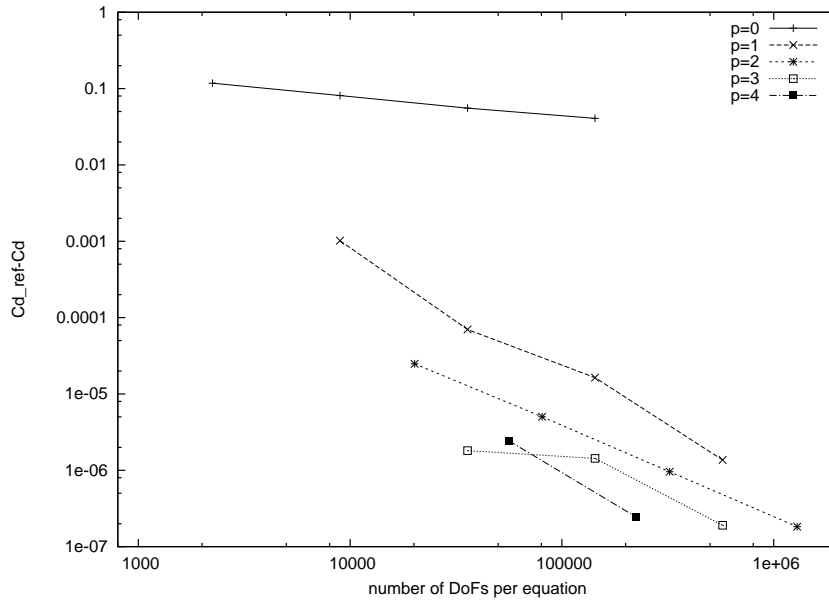


Figure 1: Error in C_d vs. number of DoFs per equation

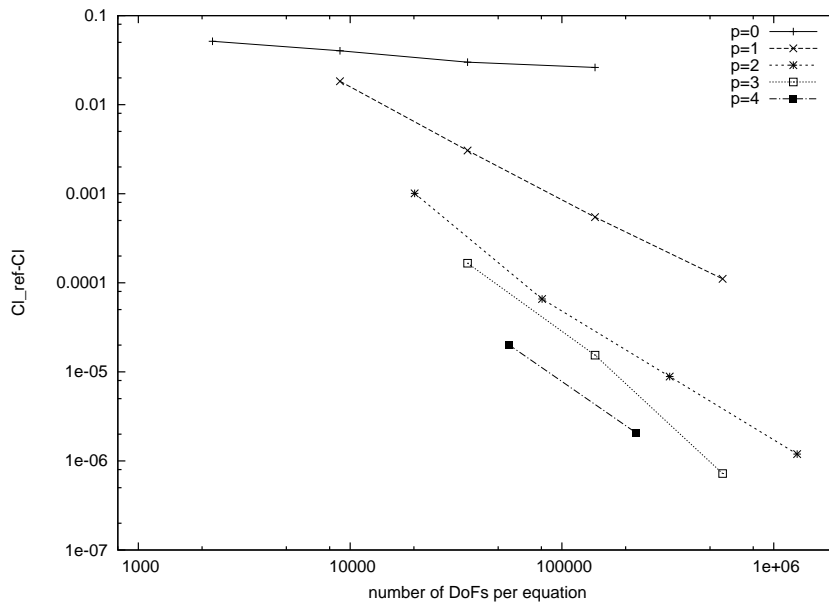


Figure 2: Error in C_l vs. number of DoFs per equation

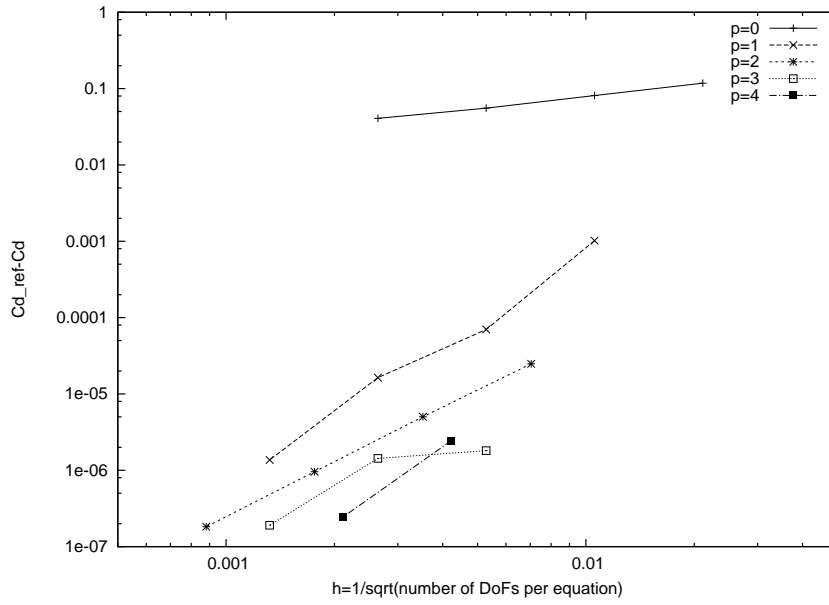


Figure 3: Error in C_d vs. $h = \sqrt{\text{number of DoFs per equation}}$

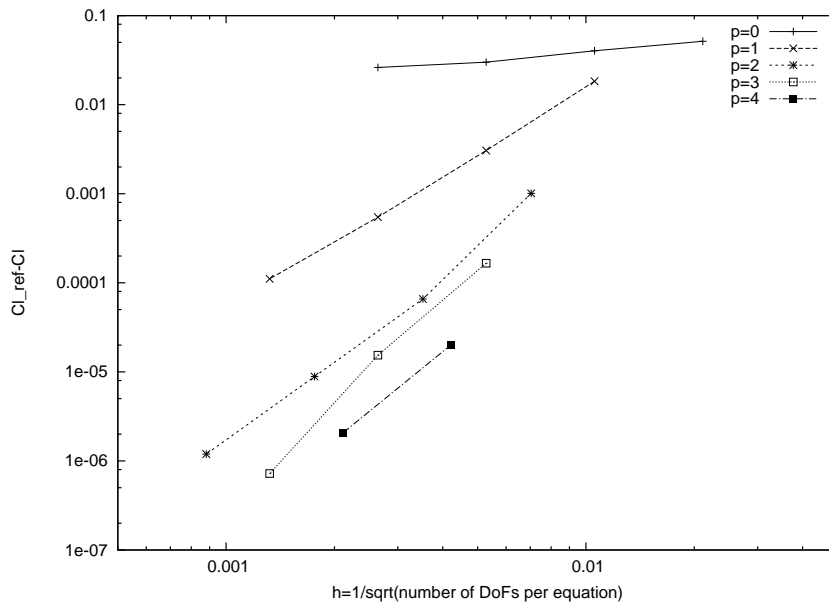


Figure 4: Error in C_l vs. $h = \sqrt{\text{number of DoFs per equation}}$

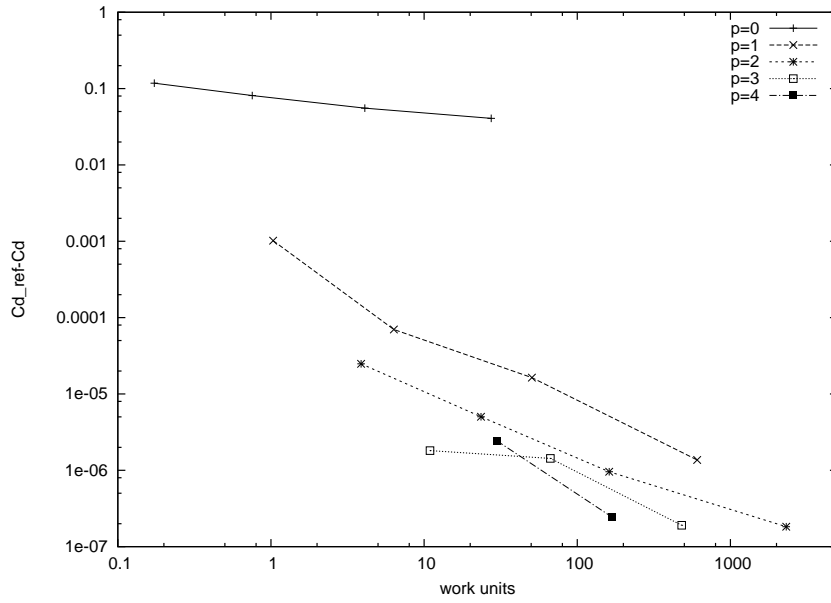


Figure 5: Error in C_d vs. work units

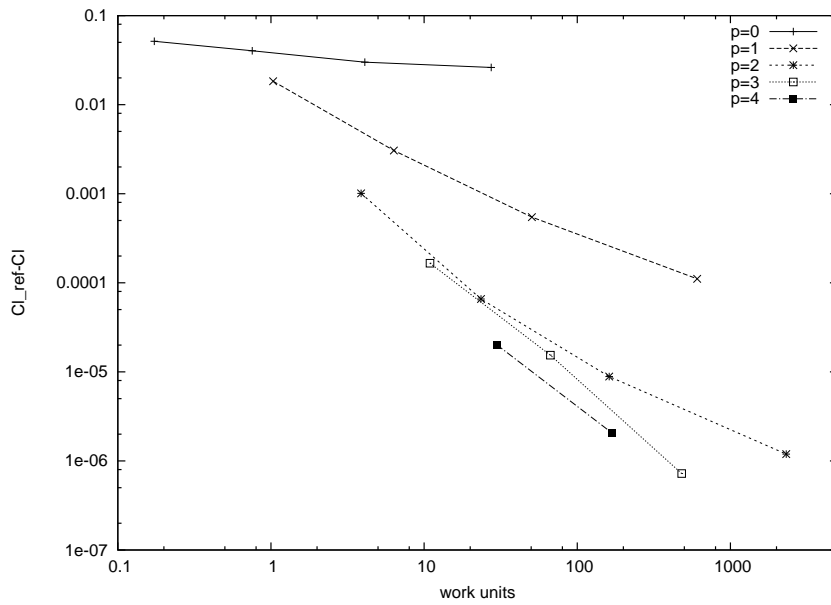


Figure 6: Error in C_l vs. work units