DLR-PADGE code presentation

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DLR

The DLR-PADGE code

Discretization and solver settings used in the test cases

- AR1 Common Research Model
- C1 Computational/meshing challenge: DLR-F11

Discretization:

- Discontinuous Galerkin discretization of the RANS and Wilcox-kω equations
- Legendre polynomial basis functions
- Parametric basis functions on hexes, prisms, tets and pyramids
- Roe flux with Harten entropy fix (fraction=0.2)
- BR2 discretization of viscous terms
- For stability use same flux (Roe) on the wall boundary like on interior faces
- For adjoint consistency use the same flux for evaluation of force coefficients
- Use same flux for evaluation of surface pressure and skin friction (cp and cf)

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Solver:

- Fully implicit solver (Backward Euler) with GMRes (PETSc) and
  - ILU per process, or
  - line preconditioner
- Exact Jacobian matrix (most parts hand-differentiated, small parts with AD)
- Damping of updates to ensure that pressure and density do not decrease more than 20% in each iteration step
- CFL number is increased as the nonlinear residual decreases
- Diverging steps are recomputed with CFL/2

The DLR-PADGE code

Adaptive mesh refinement settings used in the test cases

- AR1 Common Research Model

Adaptive mesh refinement:

- Local refinement of curved hexahedral meshes
- Anisotropic mesh refinement
- Refinement indicators:
  - residual-based refinement
  - adjoint-based refinement targeting force coefficients