

Steady-State Navier-Stokes for the Spectral Element Method

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We explore several approaches to steady-state solution of the incompressible Navier-Stokes equations using the spectral element method (SEM) as the spatial discretization. Strategies include pseudo-timestepping, Jacobi-free Newton Krylov methods, and full Newton with exact Jacobians. GMRES is used to solve for the divergence-free updates at each Newton step. Hybrid-Schwarz multigrid is used to solve for pressure within each GMRES iterate. We present performance results for a variety of 2D and 3D applications, including steady-state Reynolds-averaged Navier-Stokes solutions based on a new k-w formulation.