A REYNOLDS SEMI-ROBUST AND PRESSURE-ROBUST HYBRID HIGH-ORDER METHOD FOR THE SOLUTION OF THE INCOMPRESSIBLE NAVIER–STOKES EQUATIONS ON GENERAL MESHES

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ABSTRACT. In this presentation we introduce and analyze a novel Reynolds semi-robust and pressure-robust Hybrid High-Order method for the time dependent incompressible Navier–Stokes equations on general meshes. A numerical scheme is called "Reynolds semi-robust" if its velocity error estimates are independent of the Reynolds number (or ν^{-1}). On the other hand, pressure robustness means that the velocity error estimates are independent of the pressure. The importance of the pressure robustness property is that gives a proper momentum balance for the numerical simulation of the Navier–Stokes equations which is crucial when large rotational body forces are present. The proposed method supports arbitrary approximation orders, and is (relatively) inexpensive thanks to the possibility of statically condensing a subset of the unknowns at each time iteration. In particular, using polynomials of degree $k \geq 0$ at mesh faces, and polynomials of degree $(k+1)$ at mesh elements, we formally prove a velocity error estimate in the $L^\infty(\boldsymbol{L}^2(\Omega))$-norm of order $h^{k+\frac{1}{2}}$ which equals to the best known velocity error estimate on simplicial meshes.

Keywords: hybrid high-order methods; time-dependent incompressible flow; general meshes; Re-semi-robust error estimates; pressure robustness

Mathematics Subject Classifications (2010): 35Q30, 65M15, 65M60, 76D17, 76M10

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