hp estimates for hybrid DG methods for incompressible flow

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We discuss a hybrid discontinuous Galerkin method for incompressible flow. Besides the usual coercivity and boundedness estimates, we establish the inf-sup stability for the discrete incompressibility constraint with a constant which is only sub-optimal by one half order of the polynomial degree of approximation. This result holds on irregular and hybrid meshes in two and three spatial dimensions, and its proof is based on a new stability estimate for the L^2 projection on simplex elements. The sharp estimate for the inf-sup constants in turn allows to derive a-priori estimates which are optimal with respect to the mesh-size and only slightly sub-optimal with respect to the polynomial degree. In addition to the a-priori results, we also present a rigorous hp analysis of a residual-type a-posteriori error estimator. Reliability and efficiency are proven and the explicit dependence of the estimates on the polynomial approximation order is elaborated. The validity of the theoretical results is demonstrated in numerical tests.

References:

[1] H. Egger and C. Waluga, *hp-Analysis of a Hybrid DG Method for Stokes Flow*, IMANUM, 2012.

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