ON *A POSTERIORI* ERROR ANALYSIS OVER STAR-SHAPED ELEMENTS

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ABSTRACT

In this work, we revisit the results of Babuška and Suri [1] in the setting of mesh elements that are star-shaped with respect to a ball, with the goal of deriving *hp*-approximation estimates featuring fully computable multiplicative constants. To this end, we establish in particular an H^1 extension theorem with completely explicit stability bound. This further allows us to derive Poincaré–Friedrichs-type inequalities for L^2 polynomial projections with explicit dependence on the geometric parameters and on the polynomial degree.

Building on these refined estimates, we devise a reliable residual-type *a posteriori* error estimator for the Hybrid High-Order (HHO) discretization of the Poisson problem which is fully explicit with respect to h, p, and the chunkiness parameter ϱ. The resulting bound is robust with respect to the polynomial degree and provides a quantitative foundation for *hp*-adaptive strategies on general (star-shaped) polytopal meshes.

Our results help bridge the gap between the abstract theory on general meshes (see, e.g., [2]) and practical adaptive implementations that require fully computable bounds. They may also be of independent interest for other nonconforming methods based on L^2 polynomial projections, such as weak Galerkin schemes.

References

[1] I. Babška and M. Suri. *The optimal convergence rate of the p-version of the finite element method.* SIAM Journal on Numerical Analysis, 1987.

[2] D. A. Di Pietro and J. Droniou. *The Hybrid High-Order Method for Polytopal Meshes.* Springer, Cham, 2020. Modeling, Simulation and Applications, Vol. 19.

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