A priori and a posteriori error analysis in **H**(curl): localization, minimal regularity, and *p*-optimality

We design a stable local commuting projector from the entire infinite-dimensional Sobolev space **H**(curl) onto its finite-dimensional subspace formed by the Nédélec piecewise polynomials on a tetrahedral mesh. The projector is defined by simple piecewise polynomial projections and is stable in the L2 norm, up to data oscillation. It in particular allows to establish the equivalence of local-best and global-best approximations in **H**(curl). This in turn yields to a priori error estimates under minimal Sobolev regularity in **H**(curl), localized elementwise, optimal both in the mesh size *h* and in the polynomial degree *p*. In the heart of the projector, there is an **H**(curl)-conforming flux reconstruction procedure. This itself leads to guaranteed, fully computable, constant-free, and *p*-robust a posteriori error estimates in **H**(curl). Details can be found in [1−3].

[1] Chaumont-Frelet, Théophile and Vohralík, Martin. Equivalence of local-best and global-best approximations in **H**(curl). *Calcolo* **58** (2021), 53.

[2] Chaumont-Frelet, Théophile and Vohralík, Martin. *p*-robust equilibrated flux reconstruction in **H**(curl) based on local minimizations. Application to a posteriori analysis of the curl−curl problem. *SIAM Journal on Numerical Analysis* **61** (2023), 1783–1818.

[3] Chaumont-Frelet, Théophile and Vohralík, Martin. A stable local commuting projector and optimal *hp* approximation estimates in **H**(curl). HAL Preprint 03817302, submitted for publication, 2023.