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Adaptive least-squares finite element methods

The least-squares functional is a reliable and efficient error estimator with global upper and lower bounds and can be very accurate. The elementwise contributions to the global L^2 norm serves well as refinement indicators in adaptive mesh-refining algorithms but the convergence analysis is less well understood. Those local contributions do not involve an explicit mesh-size factor and hence their reduction is unclear. The paper Bringmann, Carstensen, and Park (Numer. Math. 2017) guarantees the plain convergence for a bulk parameter close to one and that is far away from the arguments for rate optimality.

The axioms of adaptivity in Carstensen, Feischl, Page, and Praetorius (Comp. Math. Appl. 2014) are not available and an alternative error estimator is derived and exploited in Carstensen and Park (SIAM J. Numer. Anal. 2015) and enforces a separate marking strategy with an overall abstract theory by Carstensen and Rabus (arXiv 1606.02165 2016).

The presentation discusses on all those aspects for the Laplace, the Stokes and the Lame-Navier equations as in Bringmann and Carstensen (Numer. Math. 2017). Numerical experiments confirm the proven optimal convergence rates. If time permits, a nonlinear model problem shall be discussed as well.