The Current Landscape of Energy A-posteriori Error Estimators

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In this talk, we try to review the different existing versions of a posteriori estimators in the context of energy error control for the Laplace equation. We in particular consider residual-based, averaging, hierarchical, functional, equilibrated residual, geometric (interpolation), and equilibrated flux (constitutive relation) estimators. We examine whether they lead to a guaranteed error upper bound, local efficiency, asymptotic exactness, robustness (with respect to the data and the polynomial degree of the approximation), and whether they have low evaluation cost. We also discuss if they are problem-dependent or not, implicit (local solves necessary) or completely explicit (directly prescribed from the approximate solution), ensure guaranteed maximal (local) overestimation, and enable to distinguish the different error components. Conforming, nonconforming, discontinuous Galerkin, and mixed finite element discretizations are considered. Computational examples, also for more involved unsteady and nonlinear problems, are presented for the equilibrated flux estimators.

References:

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[2] Di Pietro, D. A., Vohralík, M., and Yousef, S. Adaptive regularization, linearization, and discretization and a posteriori error control for the two-phase Stefan problem. Math. Comp. 84, 291 (2015), 153–186.

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