On Convergence of Adaptive Finite Element Methods

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Typical adaptive mesh-refining algorithms for first-oder (conforming) finite element methods consist of a sequence of the following steps:

$$\text{SOLVE} \Rightarrow \text{ESTIMATE} \Rightarrow \text{MARK} \Rightarrow \text{COARSEN/REFINE}$$

Unlike uniform mesh-refinements, the goal of adaptive finite element methods (AFEM) is to omit some basis functions in oder to save degrees of freedom and so reduce computational costs. Thus, the sequence of generated subspaces in an AFEM is on purpose *not* necessarily dense and hence the question of strong convergence has a priori *no* trivial affirmative answer.
It is the aim of this presentation to analyze and discuss conditions sufficient for convergence for a class of adaptive finite element methods applied to convex minimization problems. Newer applications include relaxed models in optimal design tasks, 2-well problems allowing for microstructures, or Hencky elastoplasticity.

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