Convergence and optimality of adaptive finite elements

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Adaptive finite elements are successfully used since the 1970s for the efficient approximation of solutions to partial differential equations. The typical adaptive iteration is a loop of the form

$$\mathsf{SOLVE} \quad \rightarrow \quad \mathsf{ESTIMATE} \quad \rightarrow \quad \mathsf{MARK} \quad \rightarrow \quad \mathsf{REFINE}.$$

Traditional a posteriori error analysis was mainly concerned with the step ESTIMATE by deriving computable error bounds for the true error. During the last years there is an increasing interest in proving convergence of the above iteration, this means that the sequence of discrete solutions converges to the exact solution. Once convergence is established, we would like to show that the discrete solutions provide quasi-optimal approximations in terms of degrees of freedom.

In this talk we give a brief overview of the current state of the art in the convergence and optimality analysis of conforming adaptive finite element discretizations.

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