Comparison of hp-adaptive finite element strategies

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Adaptive finite element methods have been studied for nearly 30 years now. Most of the work has focused on h-adaptive methods where the mesh size, h, is adapted locally by means of a local error estimator with the goal of placing the smallest elements in the areas where they will do the most good. h-adaptive methods for elliptic partial differential equations are quite well understood now, and widely used in practice. Recently, the research community has begun to focus more attention on hp-adaptive methods where in addition to h-adaptivity one locally adapts the degree of the polynomials, p. One attraction of these methods is that they can achieve exponential rates of convergence [1]. But the design of an optimal strategy to determine when to use p-refinement, when to use h-refinement, and what p's to use in h-refined elements is an open area of research. Many such hp-adaptive strategies have been proposed over the past two decades [2]. In this talk, we will briefly describe 13 hp-adaptive strategies and present the results of a numerical experiment to determine which strategies are most effective in terms of error vs. degrees of freedom in different situations.

References:

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