Can We Have Superconvergent Gradient Recovery Under Adaptive Meshes?

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We study adaptive finite element methods for elliptic problems with domain corner singularities. Our model problem is the two-dimensional Poisson equation. Results of this paper are twofold. First, we prove that there exists an adaptive mesh (gauged by a discrete mesh density function) under which the recovered gradient by the polynomial preserving recovery (PPR) is superconvergent. Second, we demonstrate by numerical examples that an adaptive procedure with an a posteriori error estimator based on PPR does produce adaptive meshes that satisfy our mesh density assumption, and the recovered gradient by PPR is indeed superconvergent in the adaptive process.

This is a joint work with Zhimin Zhang.