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First-Order System Least-Squares (FOSLS) for Problems with Boundary Singularities

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Many elliptic boundary value problems have the fortunate property of a guaranteed smooth solution as long as the data and domain are smooth. However, many problems of interest are posed in nonsmooth domains and, as a consequence, lose this property at the boundary. In this talk we consider problems that have nonsmooth solutions at "irregular boundary points", that is, points that are corners of polygonal domains, locations of changing boundary condition type, or both.

Least-squares discretizations in particular suffer from a global loss of accuracy due to the reduced smoothness of the solution. We investigate a weighted-norm least squares method that recovers optimal order accuracy in the weighted functional norm and weighted H^1 norm, and retains L^2 convergence even near the singularity. The method requires only *a priori* knowledge of the power of the singularity, not the actual singular solution. The theory of this general technique is studied in terms of a simplified div-curl system and shown to be similarly effective when applied to other problems.