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A Comparison of Finite Element Spaces for $H(div)$-Conforming First-Order System Least Squares

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First-order system least squares (FOSLS) is a commonly used technique in a wide range of physical applications. FOSLS discretizations are straightforward to implement and offer many advantages over traditional Galerkin or saddle point formulations. Often these problems are formulated in $H(div)$ spaces and $H(div)$-conforming elements are used. These elements have lesser regularity assumptions than the commonly used H^1-conforming elements and are therefore believed to be more suited for singular problems arising in many applications. This talk will compare the approximation properties of the $H(div)$-conforming Raviart-Thomas and Brezzi-Douglas-Marini elements to H^1-conforming piecewise polynomials in a $H(div)$-setting. Furthermore a H^1-formulation for these problems will be used and compared to the $H(div)$-formulation. For the comparison typical Poisson/Stokes problems are examined and singular solutions will be addressed by adaptive refinement strategies.