Raviart-Thomas Elements on Curved Domains

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Optimal order convergence of a first-order system least squares method using lowest-order Raviart-Thomas elements combined with linear conforming elements is presented for domains with curved boundaries. Parametric Raviart-Thomas elements are introduced in order to retain the optimal order of convergence in the higher-order case in combination with the isoparametric scalar elements. In particular, an estimate for the normal flux of the Raviart-Thomas elements on interpolated boundaries is derived in both cases. This is illustrated numerically for the Poisson problem on the unit disk. As an application of the analysis derived for the Poisson problem, boundary values of forces are estimated in the Stokes problem and the effect of interpolated interface condition for a stationary two-phase flow problem is then studied.

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