Optimal L^2 Error for a Modified Crouzeix-Raviart Stokes Element

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The talk is concerned with optimal L^2 error estimates for the velocity approximation in a nonconforming finite element approximation for the incompressible Stokes equation.

Instead of the standard weak form, the method considered modifies the right hand side of the Stokes problem, by considering the, lowest order, Raviart-Thomas projection of the test-function in the right hand side. This modification allows an estimation of the H^1-error of the velocity of optimal order depending on higher norms of the continuous velocity only – and not on the pressure.

The contribution of this presentation is to show that also optimal velocity estimates in L^2, independent of the pressure, can be derived. These estimates are complicated by the fact, that the lowest-order elements can not be handled by techniques useful for all higher-order elements – since the available polynomial degree does not allow for an $O(h^2)$ interpolation error in the L^2 norm to deal with the non-conformity error.