Convergence of an adaptive C^0-interior penalty Galerkin method for the biharmonic problem

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In this talk we present a basic convergence analysis for an adaptive C^0-interior penalty Galerkin method for the Biharmonic problem. Conforming discretisations of fourth order problems require C^1-elements which are typically very cumbersome to implement. For this reason mixed and non-conforming methods gained attraction. In this talk we consider the C^0-interior penalty Galerkin discretisation, which uses standard Lagrange Finite elements, ensures consistency and jumps of normal derivatives across inter element boundaries are penalised. Convergence theory of adaptive C^0-interior penalty Galerkin methods turns out to be a particular challenging task due to two reasons. First, the presence of the negative power of the mesh-size function h in the discontinuity penalisation term. Second, we have to deal with the fact that the Lagrange finite element spaces may possibly contain no proper C^1-conforming subspace. Based on recent convergence results of Kreuzer and Georgoulis [1], we develop a suitable limit space and use several embedding properties of (broken) Sobolev and BV spaces to prove convergence of the discrete approximations to the weak solution in the limit space. Coincidence with the exact solution follows thanks to properties of the marking strategy.

References

[1] C. Kreuzer and E. H. Georgoulis, *Convergence of adaptive discontinuous Galerkin methods*, Math. Comp. **87** (2018), no. 314, 2611–2640.