On a new refinement strategy for adaptive hp finite element method

V. Heuveline

University Karlsruhe (TH)
Institute for Applied Mathematics II
vincent.heuveline@math.uni-karlsruhe.de

Abstract

We consider finite element methods with varying meshsize h as well as varying polynomial degree p. Such methods have been proven to show exponentially fast convergence in some classes of partial differential equations if an adequate distribution of $h-$ and $p-$refinement is chosen. In order to find $hp-$refinement strategies that show up automaticaly with optimal complexity, it is a first step to establish convergent adaptive algorithms. We develop a strategy that automatically construct a solution adapted approximation space by combining local $h-$ and $p-$ refinement and that can be proven for the 1d case to be convergent with a linear rate. This construction is based on an a posteriori error estimate with respect to the error in the energy norm. We then extend the proposed approach to the 2d and 3d case. Numerical experiments as well as implementation issues are considered in that framework.