Finite Element Methods for High Order Partial Differential Equations

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Abstract

After a brief discussion of the concept of consistent piecewise polynomial approximation to function in Sobolev spaces and its relationship with finite element methods for high order partial differential equations, I will present a universal construction of consistent nonconforming finite element spaces for 2m-th order elliptic boundary value problems in R^n for any $n\ge m\ge 1$ and discuss various relevant issues including: both a priori and a posteriori error estimates, convergence and optimality for the corresponding adaptive finite element methods, comparisons between conforming, nonconforming , discontinuous Galerkin and finite volume methods, and the subtlety of breaking a higher order PDE into a system of lower order PDEs.