MS92: HIGHER ORDER FINITE ELEMENT METHODS FOR CHALLENGING MATHEMATICAL PROBLEMS IN ENGINEERING AND APPLIED SCIENCES

Non-Polynomial Trial Shape Functions in the DPG Method

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The idea of building singular contributions into a standard conforming Finite Element (FE) Bubnov-Galerkin ansatz is half a century old (see e.g. papers of J. Whiteman or P. Ciarlet). Technical difficulties related to conformity have been succesfully circumvented in the Partition of Unity (PUM) method of I. Babuska and his collaborators but only for H1-conforming discretizations.

In this context, the Ultra Weak (UW) variational formulation, and the corresponding Discontinuous Petrov-Galerkin (DPG) Method with Optimal Test Functions offer perhaps the weakest possible conforming discretization setting and a chance to try out one more time the old ideas.

We shall use the notoriously challenging 2D convection-dominated diffusion (in the range of 10^{-7} diffusion) example, to present our investigations on using trial functions using an exponential function modeling the boundary layer.