ON THE ROLE OF BOUNDARY CONDITIONS FOR CIP STABILIZATION OF HIGHER ORDER FINITE ELEMENTS[*]

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Abstract. We investigate the Continuous Interior Penalty (CIP) stabilization method for higher order finite elements applied to a convection diffusion equation with a small diffusion parameter ε. Performing numerical experiments, it turns out that strongly imposed Dirichlet boundary conditions lead to relatively bad numerical solutions. However, if the Dirichlet boundary conditions are imposed on the inflow part of the boundary in a weak sense and additionally on the whole boundary in an ε-weighted weak sense due to Nitsche then one obtains reasonable numerical results. In many cases, this holds even in the limit case where the parameter of the CIP stabilization is zero, i.e., where the standard Galerkin discretization is applied. We present an analysis which explains this effect.

Key words. diffusion-convection-reaction equation, finite elements, Nitsche type boundary conditions, error estimates

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