A Stabilized Nitsché Cut Element Method for the Wave Equation

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Abstract

We give a weak formulation for solving the wave equation ($\ddot{u} = \nabla^2 u + f$) on a 2-dimensional fictitious domain. In the spatial finite element discretization, boundaries do not conform to element boundaries. Dirichlet and Neumann boundary conditions are enforced weakly by Nitschés method. Additional penalty terms act on the gradient jumps over the *interior faces of the elements cut by the boundary.* These terms ensure ensure a non-stiff temporal system. We give optimal a priori error estimates: second order accuracy for $u - u_h$ and $\dot{u} - \dot{u}_h$ and first order accuracy for $\nabla(u - u_h)$ in L_2-norm. Numerical results verify this.