SARAH MALICK, Clemson University

A connection between grad-div stabilized FE solutions and pointwise divergence-free FE solutions on general meshes

We prove, for Stokes, Oseen, and Boussinesq finite element discretizations on general meshes, that grad-div stabilized Taylor-Hood velocity solutions converge to the pointwise divergence-free solution (found with the iterated penalty method) at a rate of γ^{-1}, where γ is the grad-div parameter. However, pressure is only guaranteed to converge when $(X_h, \nabla \cdot X_h)$ satisfies the LBB condition, where X_h is the finite element velocity space. For the Boussinesq equations, the temperature solution also converges at the rate γ^{-1}. We provide several numerical tests that verify our theory. This extends work that required special macroelement structure in the mesh.