Discontinuous Galerkin Approximation of Anisotropic Viscous Flows

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Abstract

This talk delves into the analysis of some Discontinuous Galerkin (DG) approximations of anisotropic Stokes equations (where the vertical diffusion coefficient is small) which generalize, for instance, hydrostatic equations in Oceanography. It is known that, in this case, the well-known Ladyzhenskaya-Babuška-Brezzi condition is not sufficient to stabilize usual finite elements approximations, because a new stability condition appears. We show that this new restriction can be avoided by Interior Penalty (IP) DG approximations, using the same discontinuous discrete space for velocity and pressure.

In more detail, we first introduce IP DG formulations for elliptic PDE and their application to classical Stokes equations. Then we prove, in the anisotropic case, well posedness for a DG formulation obtained by addition of adequate terms for stabilizing vertical velocity. And finally, we show some numerical experiments that support our theoretical analysis.