Quasi-optimal and pressure robust methods for the instationary Stokes equations

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Pressure robust methods decouple the velocity error from the pressure error, i.e. $\|u - u_h\|$ is independent of $\|p - p_h\|$. This is desirable for instances with small viscosity or if the pressure is difficult to approximate, see [Lin14]. Quasi-optimal methods ensure that the discretization error is bounded by the best error. For a quasi-optimal and pressure robust method we therefore have the Céa-type estimate

$$\|u - u_h\| \leq C \inf_{v_h} \|u - v_h\|.$$

Methods with these characteristics are established for the stationary Stokes equations (e.g. [KVZ21]). Quasi-optimal methods for time dependent problems have been introduced by e.g. [BM97], [Tan14] for the heat equation. In this talk we combine both concepts to derive discretizations for the instationary Stokes equations which are quasi-optimal and pressure robust. Central to the quasi-optimality is a discrete inf-sup-condition for the underlying bilinear form with respect to the considered (discrete) norms. We measure the velocity error in a variety of norms including $L^2(H^1)$- and $L^2(L^2)$-type norms.

References:

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