Numerical analysis for the Stokes problem with non-homogeneous Dirichlet boundary conditions. Part 1: Weak solutions

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This talk addresses the finite element approximation of the Stokes problem

$$\begin{aligned} -\Delta y + \nabla p &= 0 \quad \text{in } \Omega, \\ \nabla \cdot y &= 0 \quad \text{in } \Omega, \\ y &= u \quad \text{on } \Gamma = \partial\Omega. \end{aligned}$$

The domain $\Omega \subset \mathbb{R}^d$, $d = 2, 3$, is assumed to be polygonal or polyhedral and may be non-convex. The focus is on different strategies for approximating non-homogeneous Dirichlet boundary data $u \in H^t(\Gamma)^d$, and on deriving error estimates in both the energy norm and the $L^2(\Omega)$ norm. We assume $t \geq \frac{1}{2}$ so that a weak solution $(y, p) \in H^1(\Omega)^d \times L^2_0(\Omega)$ exists. The more singular case $t \leq \frac{1}{2}$ will be addressed in Part 2 by Katharina Lorenz.

References:

[1] Th. Apel, K. Lorenz, and J. Pfefferer. Numerical analysis for weak and very weak solutions of the Stokes problem with non-homogenuous boundary condition, in preparation.

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