Numerical Analysis of a Dirichlet Boundary Control Problem for the Stokes Equation

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In this talk, we consider a Dirichlet boundary control problem governed by the stationary Stokes equations with boundary controls in $L^2(\Gamma)^d$. The low regularity of the boundary control requires the use of a very weak formulation of the state equation. Within this framework, we derive the first-order optimality system for the control problem. Furthermore, we investigate the regularity of the adjoint variables, highlighting the limitations imposed by corner and edge singularities and identifying the maximal regularity that can be expected. The resulting regularity theory provides the analytical foundation for the finite element discretization and the derivation of a priori error estimates. Numerical experiments confirm the theoretical convergence rates.

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