Well-Posedness of the Stokes Equations on a Wedge with Navier-Slip Boundary Conditions

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I will present well-posedness and regularity results in a certain class of weighted Sobolev spaces for the stationary and incompressible Stokes equations subject to Navier-slip boundary conditions

$$\begin{cases} -\nu\Delta\mathbf{u} + \nabla p = \mathbf{f} & \text{in } \Omega, \\ \operatorname{div}\mathbf{u} = 0 & \text{in } \Omega, \\ \mathbf{u}\cdot\mathbf{n} = 0 & \text{on } \partial\Omega, \\ \mathbf{u}\cdot\boldsymbol{\tau} + \beta\partial_{\mathbf{n}}(\mathbf{u}\cdot\boldsymbol{\tau}) = 0 & \text{on } \partial\Omega, \end{cases}$$

where Ω is the two-dimensional wedge-shaped domain

$$\Omega := \{(x,y) \in \mathbb{R}^2 : x, y > 0 \text{ and } y < \tan(\theta)x\}$$

for some opening angle $\theta \in (0,\pi)$.

The novelty of these results is the combination of an unbounded wedge-type domain and the Navier-slip boundary condition which is *not scaling invariant.* The resulting difficulties are overcome by first constructing a variational solution in a second order weighted Sobolev space and subsequently proving higher regularity up to the tip of the wedge by employing an iterative scheme.

The talk is based on joint work with Marco Bravin, Manuel Gnann, Hans Knüpfer, Nader Masmoudi and Floris Roodenburg.

References

[1] M. Bravin, M. V. Gnann, H. Knüpfer, N. Masmoudi, F. Roodenburg, and J. Sauer, *Well-Posedness of the Stokes Equations on a Wedge with Navier-Slip Boundary Conditions*, arXiv:2407.15517.