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Maximal $L^p - L^q$ regularity to the Stokes Problem with Navier boundary conditions

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SUMMARY

Since the pioneer work of Leray [2] and Hopf [1], Stokes and Navier-Stokes problems have been often studied with Dirichlet boundary condition. Nevertheless, in the opinion of engineers and physicists such a condition is not always realistic in industrial and applied problems of origin. Thus arises naturally the need to carry out a mathematical analysis of these systems with different boundary conditions, which best represent the underlying fluid dynamic phenomenology. Based on the study of the complex and fractional powers of the Stokes operator with Navier boundary condition, we prove the maximal $L^p - L^q$ regularity to the Stokes Problem with Navier boundary conditions

$$\begin{cases} \frac{\partial \boldsymbol{u}}{\partial t} - \Delta \boldsymbol{u} + \nabla \pi = \boldsymbol{f}, & \operatorname{div} \boldsymbol{u} = 0 \quad \text{in} \quad \Omega \times (0,T), \\ \boldsymbol{u} \cdot \boldsymbol{n} = 0, & [\mathbf{D}(\boldsymbol{u})\boldsymbol{n}]_{\boldsymbol{\tau}} = \mathbf{0} \quad \text{on} \quad \Gamma \times (0,T), \\ & \boldsymbol{u}(0) = \mathbf{0} \quad \text{in} \quad \Omega. \end{cases}$$

Keywords: Stokes Problem, Navier boundary conditions, Fractional powers, Maximal $L^p - L^q$ regularity.

AMS Classification: 35B65, 35D30, 35D35, 35K20, 35Q30, 76D05, 76D07, 76N10.

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