

# **The Maximal $L_p$ - $L_q$ Regularity and Free Boundary Problem in the Mathematical Study of Viscous Fluid Flows**

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*Lecture 1:*

## **Regularity for the Stokes equations with free boundary condition**

Lecture 1 is devoted to the maximal  $L_p$ - $L_q$  regularity for the Stokes equations with free boundary condition. We start with the existence of  $R$  bounded solution operators of the generalized resolvent problem for the Stokes equations and combining this with Weis operator valued Fourier multiplier theorem we prove the maximal  $L_p$ - $L_q$  regularity for the non-stationary Stokes equations with free boundary problem.

*Lecture 2:*

## **Well-posedness for the free boundary Navier-Stokes problem**

Lecture 2 is devoted to proving the local well-posedness and also global well-posedness for the free boundary problem of the Navier-Stokes equations.

These lectures are given essentially in the bounded domain case. The exterior domain case is now a work in progress.