

# Navier-Stokes equations with “natural” boundary conditions based on vorticity

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## Abstract

For an incompressible viscous fluid flow, the Navier-Stokes equations are mainly treated with the homogeneous Dirichlet boundary conditions. However, the fact that the tangential component of the velocity field is zero on the boundary is a matter of discussion, and we can observe in particular that this information is not sufficient to induce a well-posed boundary-value problem for the vorticity. In this lecture, we review our recent results on an alternative approach, based on the analysis of operator  $\text{curl}(\cdot)$  and on the introduction of suitable boundary conditions which we call the generalized impermeability conditions. We also consider the inhomogeneous case. The main questions concern the existence of solutions and their regularity. The generalized impermeability boundary conditions can be understood to be an intermediate case between Navier’s condition and the no-slip condition.

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