# Viscous flow around an obstacle with oscillating boundary

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**Abstract**

We consider the flow of an incompressible viscous fluid in a domain with a periodically moving boundary. The problem is reformulated as a time-periodic quasilinear problem in a domain with fixed boundary. Time-periodic maximal $L^p$-regularity for the linearized problem is established using the theory of operator-valued Fourier multipliers. The existence of solutions to the nonlinear problem in a bounded domain follows by a fixed-point argument under suitable smallness assumptions. For the case of an exterior domain the situation is more involved: If the net motion over one period is non-zero, then one can derive a similar existence result in the framework of homogeneous Sobolev spaces. If the net motion vanishes, existence is shown by combining the maximal-regularity result with pointwise decay estimates that follow from the associated time-periodic fundamental solutions.

**Keywords:** exterior domain, time-periodic solution, Navier–Stokes equations, moving domain, maximal regularity.