
On the two-dimensional stationary Navier-Stokes equations

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Abstract

The stationary Navier-Stokes equations in two-dimensional unbounded domains are still not completely understood mathematically. In 1933, Leray proved the existence of weak solutions for this problem, but their behavior at infinity is still an open question. If the prescribed velocity at infinity is a nonzero constant vector field, some results were obtained by different methods. If the velocity at infinity is zero, almost nothing is known, unless particular symmetries or boundary conditions are assumed. In this talk, we discuss the main reasons which make this problem highly nontrivial: the well-known Stokes paradox but also the decay the non-linearity, which is critical or even supercritical in some cases. We will present asymptotic expansions and numerical simulations, which show that the velocity field decays like $|\boldsymbol{x}|^{-1/3}$ and has a wake-structure.

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