Nonhomogeneous boundary value problem for the steady Navier-Stokes equations in multiply-connected domains

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We consider the nonhomogeneous boundary value problem for the steady Navier-Stokes equations under the slip boundary conditions in a two-dimensional bounded domain with multiple boundary components. By the incompressibility condition of the fluid, the total flux of the given boundary datum through the boundary must be zero. We prove that this problem has a solution if the friction coefficient is sufficiently large compared with the kinematic viscosity constant and the curvature of the boundary. No additional assumption (other than the necessary requirement of zero total flux through the boundary) is imposed on the boundary datum. We also show that such an assumption on the friction coefficient is redundant for the existence of a solution in the case when the fluxes across each connected component of the boundary are sufficiently small, or the domain and the given data satisfy certain symmetry conditions. This talk is based on the joint work with Prof. Giovanni P. Galdi (University of Pittsburgh).