Stationary Euler Equation on Lipschitz Domains in Riemannian Manifolds

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The Euler and Navier-Stokes equations are one of the most studied nonlinear equations. They model the flow of an incompressible fluid, (viscous in the case of the Navier-Stokes equation and with zero viscosity in the case of the Euler equation). Both equations give rise to the stationary problems, i.e., when the fluid flows is not time dependent. Stationary problems for both equations are not trivial for example, the existence of a solution for the stationary Navier-Stokes equation on smooth domains in known in dimensions 6 or less.

In our paper we present new results on the existence of stationary solution for the Euler equation in dimensions 4 or less. The main theorem claims that the equation

$$\nabla_u u + dp = f, \quad \delta u = 0, \quad \text{Tr } u = g \in B^{2,2}_{1/2}(\partial\Omega)$$

has a solution u in $L^2_1(\Omega, \Lambda^1 TM)$ for any conservative force f and boundary data g such that $\langle g, \nu \rangle = 0$.