Shape optimization in Stokes fluids

Mickaël NAHON, LAMA - Chambéry

We consider a viscous fluid in a bounded box $B \Subset \mathbb{R}^n$ that flows around an obstacle $K \subset B$, we suppose the fluid is governed by the stationnary Stokes equation with Navier boundary condition at ∂K, and we minimize the drag of K among every obstacle of given measure, with an additional perimeter constraint for regularization. Up to normalizing the constants this amounts to studying the problem

$$\inf \left\{ T(K) + c\mathrm{Per}(K), K \subset B \text{ compact s.t. } |K| = m \right\},$$

for some $m \in (0, |B|)$, where

$$T(K) = \inf_u \left\{ \int_{B \setminus K} |\nabla u + (\nabla u)^*|^2 + \int_{\partial K} |u|^2 \right\}$$

with u being taken in the admissible space

$$\left\{ u \in H^1(B \setminus K) \text{ s.t. } \mathrm{div}(u) = 0,\ u_{|\partial K} \cdot \nu_K = 0,\ u_{|\partial B} = u_\infty \right\}$$

where ν_K is the normal of K and $u_\infty \in \mathbb{R}^n$ is a boundary condition. I will present theoretical existence results in any dimension, as well as regularity results in dimension two.

Contact : `mickael.nahon@univ-smb.fr`