PARTICLES ALMOST IN CONTACT : THE GENERAL METHOD OF REDUCED FUNCTIONALS IN 3D

DENIS BONHEURE

Abstract. The formal analysis of the forces and torques on two moving solid particles suspended in a laminar flow and almost in contact with each other (or on a particle almost in contact with the wall of a container) traces back at least to Brenner and Cox in the late 1960's by using lubrication theory. While the stream function is defined up to a constant in 2D, the vector potential in 3D is defined up to a gradient and the choice of a gauge. I will show that by choosing an ad-hoc gauge, one can find the optimal potential by solving the dual formulation of a resulting Euler-Lagrange equation. This allows to compute (and fully justify) the asymptotic expression of the Stokes resistance matrix.

The construction is fully variational while the sharp asymptotics are basically based on estimates for a weighted elliptic operator in divergence form. I will start the talk by explaining the method on the easier problem of estimating the relative capacity of sets close to contact and showing a link with a missing weighted Hardy inequality.

The talk is based on a joint project with E. Bocchi (Pol. Milano) and M. Hillairet (Univ. Montpellier).