Generalized slip condition GIUSEPPE ANTONIO ZAMPOGNA, JACQUES MAGNAUDET, Institut de Mécanique des Fluides de Toulouse, ALESSANDRO BOTTARO, Università degli Studi di Genova — Using a homogenisation technique, we generalize the well-known Navier slip condition in the form: $u_i = -W_{ij}\partial_j p + E_{ilk}(\partial_k u_l + \partial_l u_k)$. This condition may be applied to any flow over a rough or only partially wetted surface, without any limitation on the flow regime. The macroscopic velocity depends on W_{ij}, a "wettability" tensor formally analogous to a permeability, and on the tensorial slip length E_{ijk}. Components of these tensors are obtained as solutions of microscopic problems arising during the derivation of the above condition. We validated the latter by performing DNS of the flow about a rough sphere under various conditions. This rational framework clarifies the missed analogy between the microscopic characterization of Navier's classical slip length and its applicability to a macroscopic boundary condition.

Giuseppe Antonio Zampogna
Institut de Mécanique des Fluides de Toulouse