# SIMULATIONS OF SMALL SCALE FLUID FLOWS DOMINATED BY CAPILLARITY AND WETTING

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## ABSTRACT

Capillarity and dynamic wetting phenomena are increasingly important in microfluidic applications, where very small liquid volumes need to be transported, mixed and analyzed. In many materials processes capillarity, also in the sense of surface tension at a liquid surface, is the driving force. In nature phenomena where wetting and capillarity are crucial abound, for example on the feet of insects on water, liquid repellent surfaces on plants, etc. From a computational point of view there are still important challenges in accurate representation of free interfaces, capillarity, and in particular wetting phenomena.

Diffuse interface models, for example the Cahn-Hilliard equations, coupled with the Navier-Stokes equations for fluid flow, provide a good description of many such cases. From a modeling point of view this approach has advantages, as it is built on a thermodynamic description of the system at hand, and allows incorporation of different physical effects. Computations may however require particular care, as the interfaces must be appropriately resolved.

In this talk, some such flows will be investigated using numerical simulations of diffuse interface models. Examples to be discussed are: The impact of a small solid body on a liquid surface will be strongly influenced by the dynamic wetting and the capillary forces acting on the body, and may or may not penetrate the surface or stay afloat. In microfluidics, droplet creation and handling is a key ability. We have explored numerically the conditions for splitting a droplet at a channel bifurcation. Capillary driven reacting flows in materials processing may also be discussed briefly.