Lubricated motions near a viscoelastic wall

Quentin Ferreira,[1] Bharti Bharti,[1,2] Aditya Jha,[1] Andreas Carlson,[2] David Dean,[1] Yacine Amarouchene,[1] Tak Shing Chan,[2] and Thomas Salez[1]

[1] *Univ. Bordeaux, CNRS, LOMA, UMR 5798, F-33400, Talence, France.*

[2] *Mechanics Division, Department of Mathematics, University of Oslo, Oslo 0316, Norway.*

Ideally, the mechanical responses of materials are separated into two classes : elastic solids store mechanical energy, whereas viscous liquids dissipate it. However, most materials we commonly refer to as "elastic" combine a mix of these two behaviors. Here, we study the effects of a viscoelastic substrate on the motion of a 2D immersed object in its vicinity. We uncover the complex interactions at play between the hydrodynamic pressure generated by the motion and the time-dependant deformation of the solid wall. Furthermore, we present preliminary experiments using an atomic force microscope where we investigate how the wall viscoelasticity impacts the Brownian motion of a nearby colloidal sphere. The response of the power spectral density with respect to the distance between the colloidal probe and an agarose gel matrix indicate signature of the wall viscoelasticity. This work could lead to a better comprehension of the dynamics of microscopic objects confined by complex boundaries, which are ubiquitous in nanosciences and biophysics.