

LadHyX Seminar – October 8th, 1:30

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Surface tension based liquid-solid interactions: Practical use in microrobotics.

Surface tension arising at the interface of two fluids dominates for microsystems as it scales linearly with size. The impact of this force on solid is exploited in nature for complex phenomena such as the locomotion of water striders at the water surface or the curling of spider thread inside a liquid drop. My research focuses on understanding how the surface tension dominated liquid/solid interaction can allow for a more compact and autonomous development of sub-millimetre microrobots. Indeed, despite surface tension prominence in physics and chemistry, its potential in micro-mechanisms remains underexplored. In this presentation, I will first present liquid joints consisting of liquid droplets connecting two solids as mechanical joints. I will present their natural compliance, their actuation for motion generation and their use as sensors to retrieve microrobot positions based on model and experimental demonstration. Second, I will demonstrate how surface tension can be used as a deformable membrane for the development of hydraulic micro-actuators toward serial multiple degrees of freedom microscale manipulators. Finally, I will explore how the non-linearity brought by surface tension to small-scale Stokes fluid flow could be used to achieve fluid-based pressure signal amplification, logical operations and energy generation, all these functionalities being needed to create a fully autonomous liquid based microrobot.