Capillary Bridges on Liquid-Infused Surfaces

Alvin Shek[1], Ciro Semprebon[2], and Halim Kusumaatmaja[1]

[1]Department of Physics, Durham University, Durham, DH1 3LE, UK
[2]Department of Mathematics, Physics and Electrical Engineering, Northumbria University, Newcastle upon Tyne, NE1 8ST, UK

Abstract

Inspired by pitcher plants, the so-called liquid infused surfaces are constructed by infusing rough or porous materials with a lubricant. They exhibit many advantageous surface properties, including self-cleaning, drag reduction, and anti-fouling [1, 2, 3]. These applications exploit the fact that liquids move with very little resistance parallel to the surface. In contrast, here we will computationally study the displacement of liquids perpendicular to the substrate. Using Surface Evolver [4], we simulate the behaviour of a capillary bridge sandwiched between two LIS, and quantify the force and maximum separation distance before the capillary bridge breaks up. Interestingly, for LIS, we find the capillary forces are stronger and the capillary bridge can be stretched further, when compared to the standard case of a capillary bridge between two smooth homogenous surfaces. We will also discuss the effects of varying the surface tensions of the fluid-interfaces and the size of the liquid bridge compared to the emerging lubricant ridge.

References

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