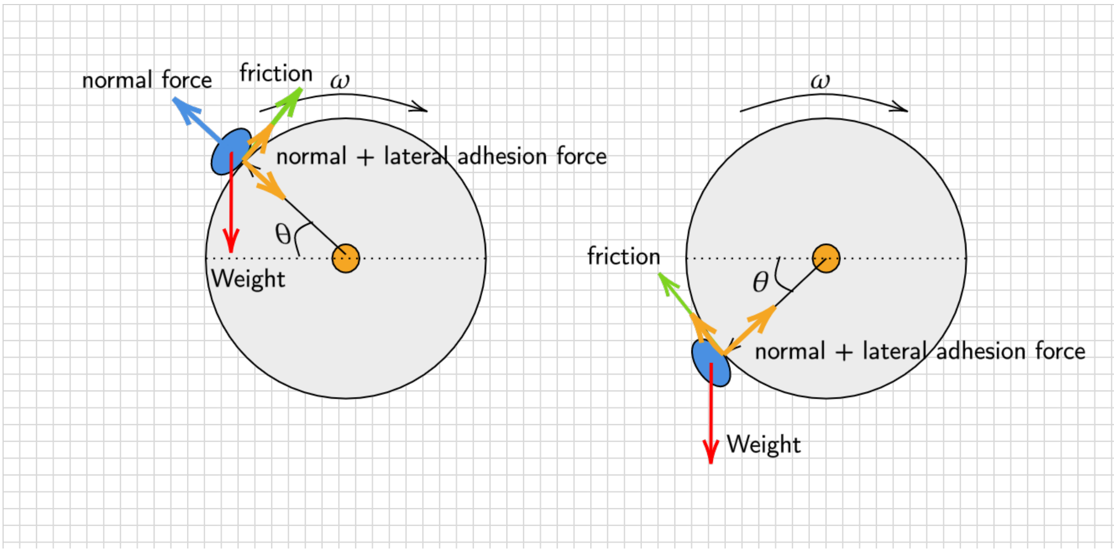
Saving Honey

December 2020

1 23/10/2021-Modelling motion of single drop on cylinder



From online: Adhesion force characterizes the force that is required to detach a liquid droplet from a surface that it contacts. It provides a way to quantify the attractive interaction between liquid and solid.
It is impossible for the droplet to remain stationary at the top and bottom points of the rotating cylinder (there is nothing to balance out friction)

1.1 condition for drop to remain stationary on the rotating cylinder

- net tangential force $= 0$
- drop must remain in contact with the surface of the cylinder

Adhesion force is quite complicated so let's just call it F_{lat} and F_{norm} for now i guess.

1.2 balancing tangential forces

$$mg\cos\theta = \mu N + F_{lat} \tag{1}$$

1.3 balancing radial forces

For the first case (left) where the drop is resting on the surface

$$F_{norm} - N = mr\omega^2 \tag{2}$$

For the second case (right)where the drop is hanging from the surface

$$F_{norm} = mr\omega^2 \tag{3}$$

1.4 more about adhesion force

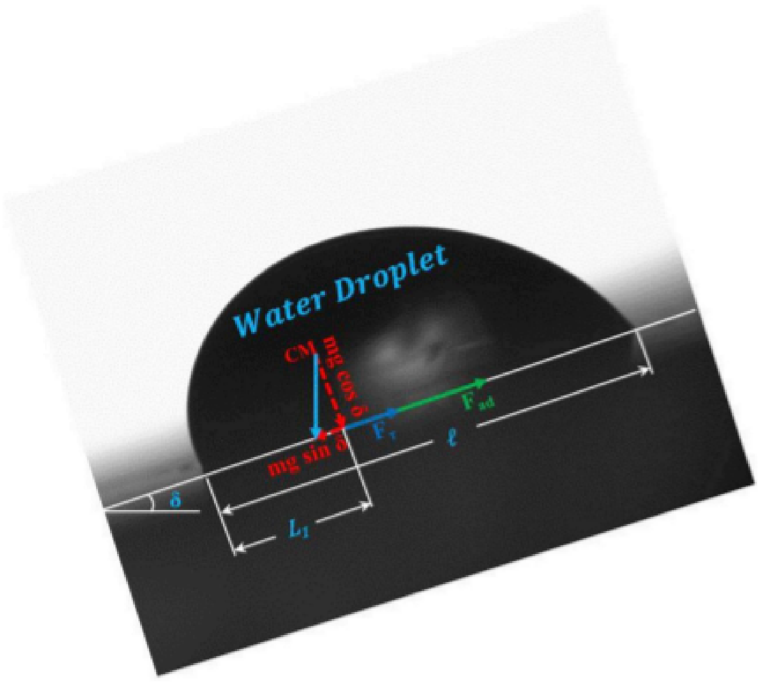
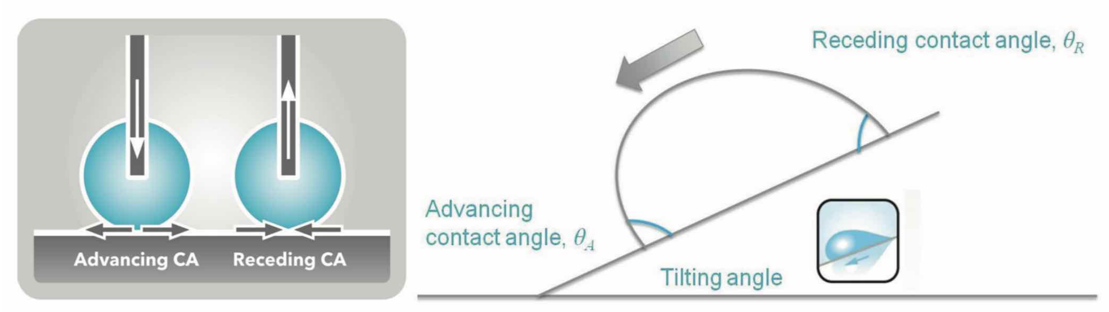


Fig. 4. High speed camera image of a droplet on inclined hydrophilic surface and force diagram.

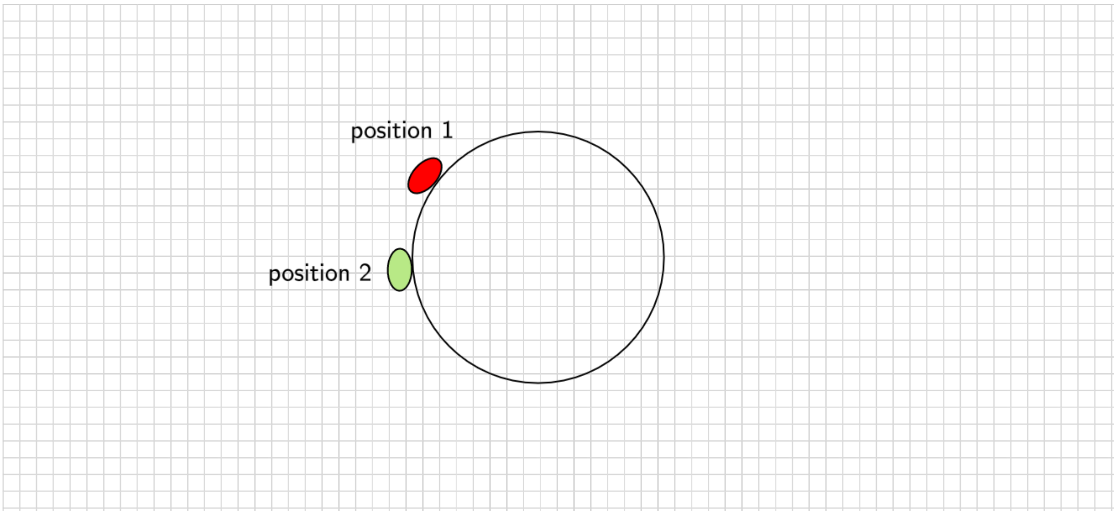
$$F_L = \frac{24}{\pi^3}\gamma_{LS}d(cos\theta_R - cos\theta_A) \tag{1}$$

θ_A and θ_R are the advancing and receding angle respectively.
As tilting angle increases, the advancing contact angle (θ_A) would decrease, and the receding angle (θ_R) would increase. so the value of lateral adhesion force would

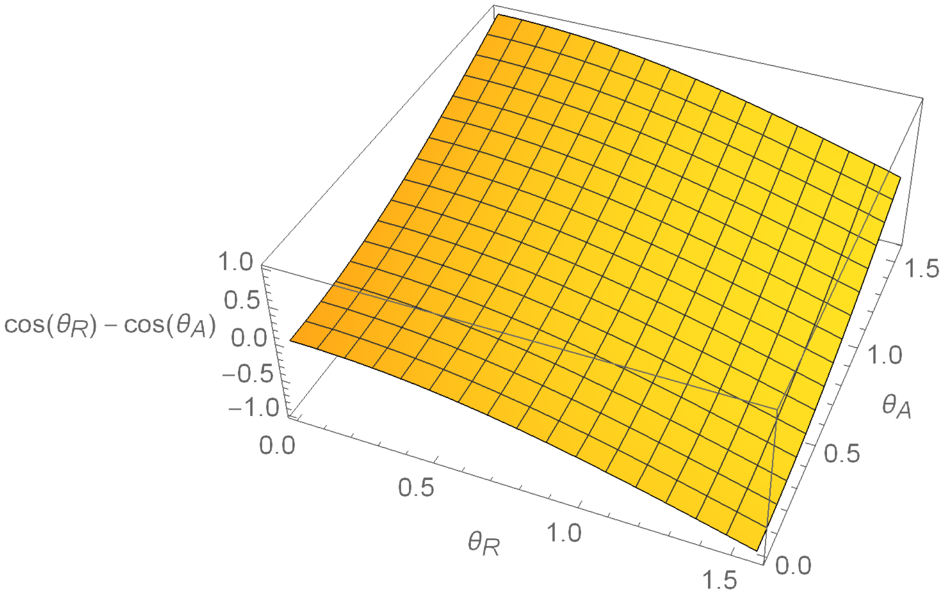


(a) (b)

1.5 Oscillation?



If the drop is perturbed by dk what then it moves from position 1 to position 2, the advancing contact angle would increase and receding contact angle would decrease.



Shown in this figure, $\cos\theta_R - \cos\theta_A$ increases as θ_A increases and θ_R decreases. Lateral adhesion force increases.

$$\mu N + F_{lat} - mg\cos\theta > 0 \tag{4}$$

2 04/11/2021-modelling height of fluid as a function of angle