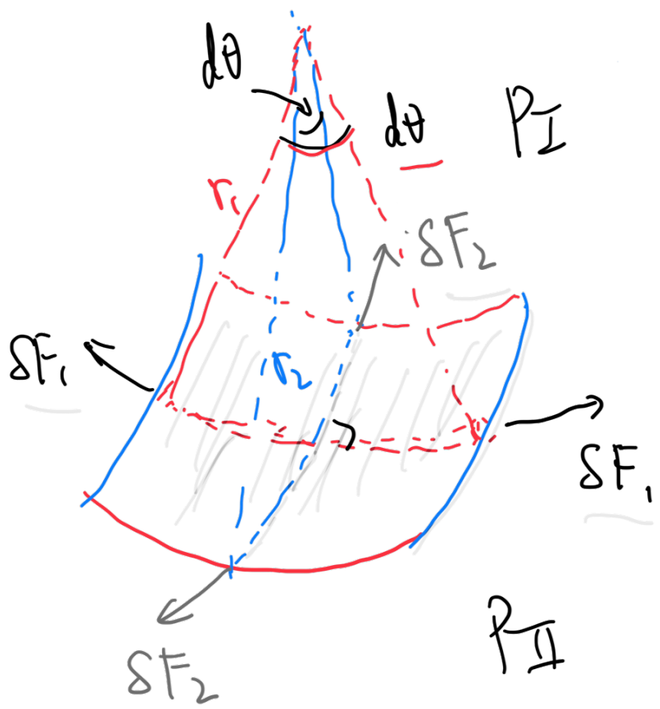


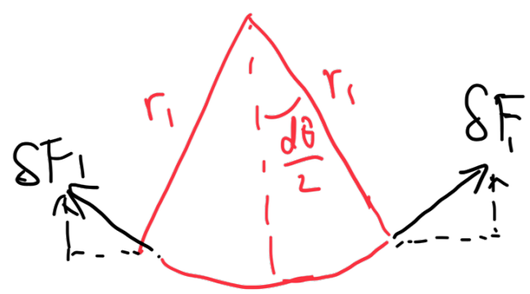
Area of the differential surface

$$dS = r_1 d\theta \cdot r_2 d\theta = r_1 r_2 d\theta^2$$

Surface tension force in Plane 1

$$\delta F_1 = r_2 \cdot d\theta \cdot \sigma$$

In Plane 1, the component perpendicular to the surface is



$$\delta F_1 \cdot \frac{d\theta}{2} \cdot 2 = r_2 d\theta^2 \sigma$$

Similarly, in Plane 2, the component of the combined surface tension force perpendicular to the surface is

$$\delta F_2 \cdot \frac{d}{2}\theta \cdot 2 = r_1 d\theta^2 \sigma$$

Force balance requires

$$(P_I - P_{II}) dS = r_1 d\theta^2 \sigma + r_2 d\theta^2 \sigma$$

$$\Rightarrow \boxed{P_I - P_{II} = \sigma\left(\frac{1}{r_1} + \frac{1}{r_2}\right)}$$

Y-L equation