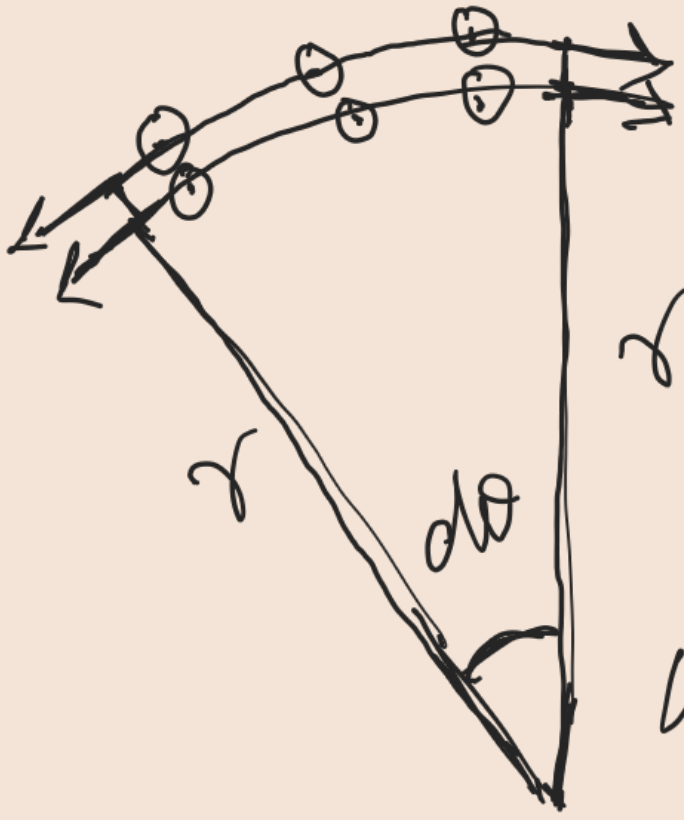


Let consider a very small section of the bubble. We have taken symmetric $d\theta$ angular section $\perp r$ to the plane of figure as well. Since thermal equilibrium is established immediately,

$$P \times \frac{4}{3}\pi r^3 = \text{Const.}$$

$$(P)\, 4\pi r^2 dr + \frac{4}{3}\pi r^3 (dP) = 0$$

$$dp = \frac{3\rho\, dr}{r}. \quad \text{(lowering)}.$$

Mass of the section considered is $(r\,d\theta)^2 h(\rho)$.

When radius increases to $(r+dr)$, the net force of surface tension is

$$4\tau (r+dr)(d\theta)\tfrac{1}{2}$$ so equation of dynamics will be

$$4\tau (r+dr)\cancel{(d\theta)} \times \frac{\cancel{d\theta}}{\cancel{2}} \times \cancel{2} - (\rho - dp)(r+dr)^2 \cancel{(d\theta)^2}$$

$$= r^2 \cancel{(d\theta)^2} (h)(f) \times (Arc)$$

$$4\sigma (r+dr) - p\left[1 - \frac{3dr}{r}\right](r+dr)^2$$

$$= r^2 h(f) . \times (Acc)$$

$$4\sigma r^2 + 4\sigma r dr$$

$$- \frac{4\sigma}{r}(r - 3dr)(r^2 + 2rdr)$$

$$= r^2 h f . \times (Acc)$$

$$4\sigma r^2 + 4\sigma r dr$$

$$- \{4\sigma r^2 + 8\sigma dr - 12\sigma r dr\}$$

$$= r^2 h \rho \times (\text{Acc}).$$

$$\delta\tau \propto dr = (r^2 h \rho)(\text{Acc})$$

$$a = \left(\frac{\delta\tau}{r h \rho}\right) dr \rightarrow \omega^2$$

$$\boxed{T = 2\pi \sqrt{\frac{r h \rho}{\delta\tau}}}$$