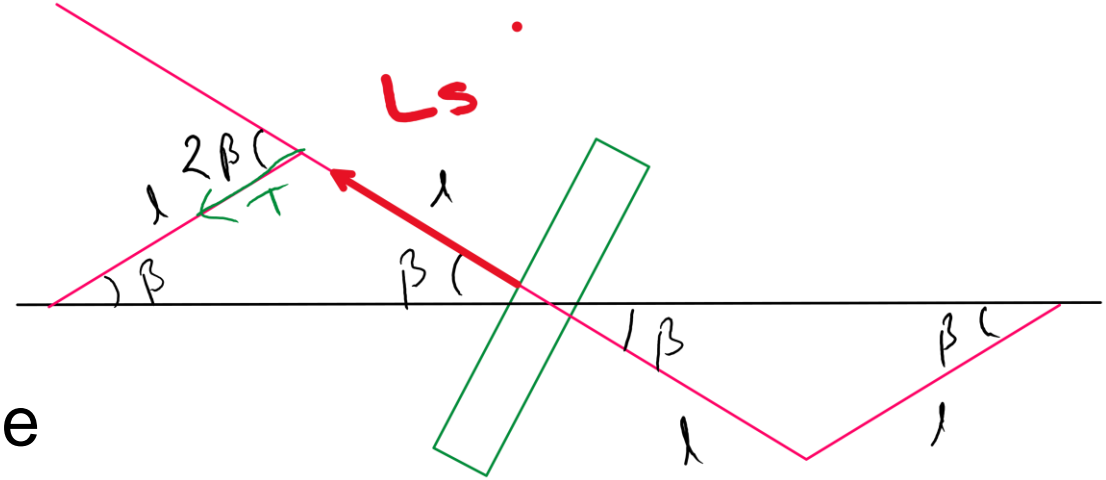Torque due to tension
$$= 2 \times l\,T \sin(2\beta) \approx 4\,l\,T\,\beta$$

L_s is precessing about Ω, so torque
$$= \Omega L_s$$

So $\beta = \dfrac{\Omega L_s}{4\,l\,T}$

See Prof. A V Kulkarni's notes

Torque due to forces (about CM)
$$= f\, b \cos(\alpha) - N\, b \sin(\alpha)$$

L_S is precessing about Ω, so torque
$$= \Omega L_S \cos \alpha$$

Now,

$$f\, b \cos(\alpha) - N\, b \sin(\alpha) = \Omega L_S \cos \alpha$$

$$\left(\frac{MV^2}{R}\right) b \cos(\alpha) - Mg\, b \sin(\alpha) = \left(\frac{\omega_s b}{R}\right)(I_0 \omega_s)\, \cos \alpha$$

$$\tan \alpha = \frac{1}{2}\frac{V^2}{Rg}$$