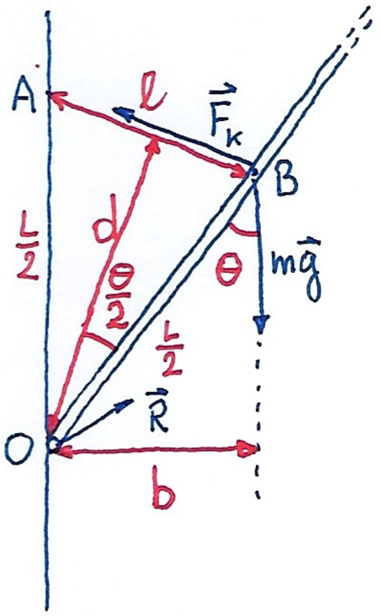

VISTA LA FIGURA, IN OGNI MOMENTO SI HA

$l = \frac{L}{\cancel{2}} \cdot \cancel{2} \sin\frac{\theta}{2} \qquad d = \frac{L}{2}\cos\frac{\theta}{2} \qquad b = \frac{L}{2}\sin\theta$

$F_k = K\left(l - \frac{L}{4}\right) \qquad I_o = \frac{1}{3} m L^2$ E LA II EQ. CARD. È

$mgb - F_k d = I_o \ddot{\theta}$ CIOÈ

$mg\frac{\cancel{L}}{2}\sin\theta - KL\left(\sin\frac{\theta}{2} - \frac{1}{4}\right)\frac{\cancel{L}}{2}\cos\frac{\theta}{2} = \frac{1}{3} m L^{\cancel{2}}\ddot{\theta}$ (1)

NELLA POSIZIONE DI EQUILIBRIO SI HA

$\theta = \theta_0 \quad \sin\theta_0 = \frac{\sqrt{3}}{2} \quad \cos\frac{\theta_0}{2} = \frac{\sqrt{3}}{2} \quad \sin\frac{\theta_0}{2} = \frac{1}{2} \quad \ddot{\theta} = 0$

QUINDI

$\frac{mg}{\cancel{2}}\frac{\sqrt{3}}{\cancel{2}} - KL\left(\frac{1}{4}\right)\frac{1}{\cancel{2}}\frac{\sqrt{3}}{\cancel{2}} = 0 \Rightarrow K = \frac{4mg}{L}$ (2)

INSERENDO LA (2) NELLA (1) SI OTTIENE

$\cancel{m}\frac{g}{2}\sin\theta - \cancel{m}\frac{\cancel{4}^{2} g}{\cancel{2}}\left(\sin\frac{\theta}{2} - \frac{1}{4}\right)\cos\frac{\theta}{2} = \cancel{m}\frac{L}{3}\ddot{\theta}$

SE ORA SI PONE $\theta = \theta_0 + \delta$ SI HA $\ddot{\theta} = \ddot{\delta}$ ED INOLTRE SI POSSONO SVILUPPARE LE F TRIGONOMETRICHE DIMENTICANDO I TERMINI IN δ^2 VISTO CHE $\delta \ll 1$

$\sin\theta = \sin\theta_0\cos\delta + \cos\theta_0\sin\delta \approx \frac{\sqrt{3}}{2} + \frac{\delta}{2}$

$\sin\frac{\theta}{2} = \sin\frac{\theta_0}{2}\cos\frac{\delta}{2} + \cos\frac{\theta_0}{2}\sin\frac{\delta}{2} \approx \frac{1}{2} + \frac{\sqrt{3}}{4}\delta$

$\cos\frac{\theta}{2} = \cos\frac{\theta_0}{2}\cos\frac{\delta}{2} - \sin\frac{\theta_0}{2}\sin\frac{\delta}{2} \approx \frac{\sqrt{3}}{2} - \frac{\delta}{4}$ ED ALLORA...

$\frac{g}{2}\left(\frac{\sqrt{3}}{2} + \frac{\delta}{2}\right) - 2g\left(\frac{1}{4} + \frac{\sqrt{3}}{4}\delta\right)\left(\frac{\sqrt{3}}{2} - \frac{\delta}{4}\right) = \frac{L}{3}\ddot{\delta}$

II ORDINE

$\frac{g}{2}\left(\frac{\sqrt{3}}{2} + \frac{\delta}{2}\right) - 2g\left(\frac{\sqrt{3}}{8} - \frac{\delta}{16} + \frac{3\delta}{8} - \cancel{\frac{\sqrt{3}}{16}\delta^2}\right) = \frac{L}{3}\ddot{\delta}$

$\cancel{g\left(\frac{\sqrt{3}}{4} - \frac{\sqrt{3}}{4}\right)} + g\left(\frac{1}{4} + \frac{1}{8} - \frac{3}{4}\right)\delta = \frac{L}{3}\ddot{\delta}$

$-\frac{3}{8}g\delta = \frac{L}{3}\ddot{\delta} \Rightarrow \ddot{\delta} + \frac{9}{8}\frac{g}{L}\delta = 0$ QUINDI

$$\omega = \frac{3}{2}\sqrt{\frac{g}{2L}}$$