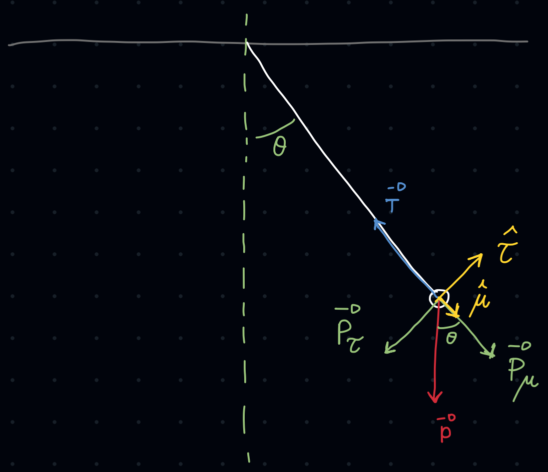

$$\vec{P}_\mu = m \cdot g \cdot \cos\theta$$
$$\vec{P}_\tau = m\, g\, \sin\theta$$

$$\begin{aligned} \hat{\mu} &\quad \begin{cases} mg\cos\theta - T = m \cdot \vec{a}_\mu \\ -mg\sin\theta = m\, \vec{a}_\tau \end{cases} \\ \hat{\tau} & \end{aligned}$$

$$\vec{a}_{\hat{\mu}} = \text{Centripeta} = -\frac{v^2}{R} = \left(-\frac{\dot{s}^2}{\ell}\right) \vec{a}_{\hat{\mu}}$$
$$\vec{a}_{\hat{\tau}} = \text{Tangenziale} = ?? = \ddot{s} \cdot \hat{\tau}$$
$$\uparrow$$
$$|\vec{a}|$$

$$\Rightarrow \begin{cases} mg\cos\theta - T = -\dfrac{m\dot{s}^2}{\ell}\hat{\mu} \\ -mg\sin\theta = m \cdot \ddot{s}\,\hat{\tau} \end{cases}$$

Approssimazione per piccole oscillazioni $\sin\theta \sim \theta$

$$\Rightarrow -m\vec{g}\,\theta = m\,\ddot{s}\,\hat{\tau}$$ se $m_I = m_g \rightarrow -\vec{g}\,\theta = \ddot{s}\,\hat{\tau} \rightarrow \ddot{s}\,\hat{\tau} + \vec{g}\,\theta = \emptyset$

ma θ Radianti $\rightarrow 1\,\text{Rad} = \dfrac{\ell}{R} \Rightarrow \ddot{s}\,\hat{\tau} + \dfrac{g}{R} \cdot \ell = 0$ pongo $R = \ell$ ovvero il "FILO" del pendolo

$\ell = s$ ovvero l'Arco

$$\Rightarrow \ddot{s}\,\hat{\tau} + \left(\frac{g}{\ell}\right) \cdot s = 0 \rightarrow \ddot{s}\,\hat{\tau} + k^2 \cdot s = 0$$

Battezzo $\dfrac{g}{\ell} = k^2$ Eq. diff

$$\Rightarrow \text{Soluzione: } \quad s(t) = A \cdot \cos(kt + \varphi)$$

Cos è periodico di $T = 2\pi$

Trovare k: Cos è periodico $\rightarrow s(t + T_0) = A \cdot \cos(kt + \varphi + 2\pi)$

$$\rightarrow \cancel{A}\cos(kt + kT_0 + \varphi) = \cancel{A}\cos(kt + \varphi + 2\pi) \rightarrow \cancel{kt} + kT_0 + \cancel{\varphi} = \cancel{kt} + \cancel{\varphi} + 2\pi$$

$$\rightarrow kT_0 = 2\pi \Rightarrow k = \frac{2\pi}{T_0}$$

$$\Rightarrow s(t) = A\cos\left(\frac{2\pi}{T_0}t + \varphi\right) = A\cos(\omega t + \varphi)$$

$$\omega = \frac{d\alpha}{dt} = \frac{2\pi}{T_0}$$

Periodo $\quad k = \omega = \dfrac{2\pi}{T} \rightarrow k^2 = \dfrac{g}{\ell} \Rightarrow k = \sqrt{\dfrac{g}{\ell}} \Rightarrow \dfrac{2\pi}{T} = \sqrt{\dfrac{g}{\ell}}$

$\Rightarrow 2\pi\sqrt{\dfrac{\ell}{g}} = T$ Periodo del pendolo