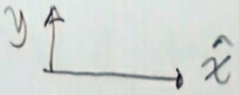
P2)

sistema S.



sistema S'

$\vec{R} = x\hat{x}$ $\ddot{\vec{R}} = a_0\hat{x}$

$\hat{x} = -\cos\theta\,\hat{\theta} - \operatorname{sen}\theta\,\hat{r}$

$\vec{\Omega} = 0.$

$\hat{r} = -\operatorname{sen}\theta\,\hat{x} - \cos\theta\,\hat{y}$

$\hat{\theta} = \operatorname{sen}\theta\,\hat{y} - \cos\theta\,\hat{x}$

$\sum F = -T\hat{r} - mg\,\hat{y}$

$\hat{y}$ ↓

$= -T\hat{r} - mg\,(-\cos\theta\,\hat{r} + \operatorname{sen}\theta\,\hat{\theta})$

$= -T\hat{r} + mg\cos\theta\,\hat{r} - mg\operatorname{sen}\theta\,\hat{\theta}$

$\vec{r}' = L\hat{r}$

$\vec{v}' = L\dot{\theta}\hat{\theta}$

$\vec{a}' = -L\dot{\theta}^2\hat{r} + L\ddot{\theta}\hat{\theta}$

$\Rightarrow \quad m(-L\dot{\theta}^2\hat{r} + L\ddot{\theta}\hat{\theta}) = -T\hat{r} + mg\cos\theta\,\hat{r} - mg\operatorname{sen}\theta\,\hat{\theta} + ma_0(\cos\theta\,\hat{\theta} + \operatorname{sen}\theta\,\hat{r})$

$\underline{\hat{r}|}\quad -mL\dot{\theta}^2 = -T + mg\cos\theta + ma_0\operatorname{sen}\theta$

$\underline{\hat{\theta}|}\quad mL\ddot{\theta} = -mg\operatorname{sen}\theta + ma_0\cos\theta.$

$\underline{\hat{\theta}|}$

$$mL\ddot{\theta} = -mg\,\text{sen}\,\theta + ma_0\cos\theta \;/\dot{\theta}$$

$$mL\frac{d}{dt}\left(\frac{\dot{\theta}^2}{2}\right) = mg\frac{d\cos\theta}{dt} + ma_0\frac{d\,\text{sen}\,\theta}{dt}$$

$$mL\frac{\dot{\theta}^2}{2} = mg\cos\theta + ma_0\,\text{sen}\,\theta + K$$

$t=0 \quad \dot{\theta}=0 \quad \theta=0$

$$0 = mg + K \Rightarrow K = -mg.$$

$$\dot{\theta}^2 = \frac{2g}{L}\cos\theta + \frac{2a_0}{L}\text{sen}\,\theta - \frac{2g}{L}$$

Desviación máx $\dot{\theta}=0$

$$\Rightarrow \frac{2g}{L}(1-\cos\theta) = \frac{2a_0}{L}\text{sen}\,\theta$$

$$g^2(1-2\cos\theta+\cos^2\theta) = a_0^2\,\text{sen}^2\theta = a_0^2(1-\cos^2\theta)$$

$$(g^2-a_0^2) - 2g^2\cos\theta + (g^2+a_0^2)\cos^2\theta = 0$$

$$\cos\theta = \frac{2g^2 \pm \sqrt{4g^4 - 4(g^4-a_0^4)}}{2(g^2+a_0^2)}$$

$$= \frac{2g^2 \pm 2a_0^2}{2g^2+2a_0^2}$$

$\cos\theta = 1 \Rightarrow \theta = 0$ X

$\theta = \pi$.

$$\boxed{\cos\theta_{máx} = \frac{g^2-a_0^2}{g^2+a_0^2}}$$

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(b) $\underline{T_{máx}}$

$$T = mL\dot{\theta}^2 + mg\cos\theta + ma_0\,\text{sen}\theta.$$

$$= mL\left(\frac{2g}{L}(\cos\theta - 1) + \frac{2a_0}{L}\,\text{sen}\theta\right) + mg\cos\theta + ma_0\,\text{sen}\theta$$

$$= 3mg\cos\theta - 2mg + 3ma_0\,\text{sen}\theta.$$

máx $(\cos\theta + \text{sen}\theta)$?

$$T' = -3mg\,\text{sen}\theta + 3ma_0\cos\theta = 0$$

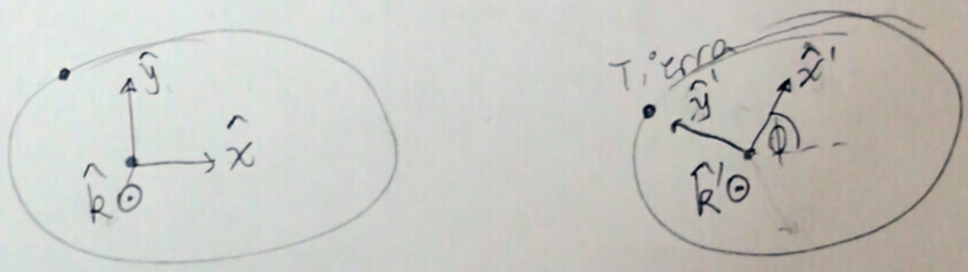
$$g\,\text{sen}\theta = a_0\cos\theta$$

$$\boxed{\tan\theta_{máx} = \frac{a_0}{g}}$$

$$\boxed{T_{máx} = 3mg\cos\left(\arctan\left(\frac{a_0}{g}\right)\right) - 2mg + 3mg\,\text{sen}\left(\arctan\left(\frac{a_0}{g}\right)\right)}$$

P3

S $\qquad\qquad\qquad\qquad$ S'



$$\vec{R} = 0 \qquad \vec{\Omega} = \dot{\phi}\,\hat{k} \rightarrow \dot{\vec{\Omega}} = \ddot{\phi}\,\hat{k}$$

$$\vec{r}\,' = r\,\hat{y}' \rightarrow \vec{v}\,' = \dot{r}\,\hat{y}' \qquad \vec{a}\,' = \ddot{r}\,\hat{y}'$$

$$\vec{F} = -\frac{GMm}{r^2}\,\hat{y}'$$

$$\boxed{\vec{\Omega}\times\vec{v}\,' = \dot{\phi}\,\dot{r}\;\hat{k}\times\hat{y}' = -\dot{\phi}\,\dot{r}\,\hat{x}'}$$

$$\vec{\Omega}\times\vec{r}\,' = \dot{\phi}\,r\;\hat{k}\times\hat{y}' = -\dot{\phi}\,r\,\hat{x}'$$

$$\boxed{\vec{\Omega}\times(\vec{\Omega}\times\vec{r}\,') = -\dot{\phi}^2 r\,(\hat{k}\times\hat{x}') = -\dot{\phi}^2 r\,\hat{y}'}$$

$$\boxed{\dot{\vec{\Omega}}\times\vec{r}\,' = \ddot{\phi}\,r\;\hat{k}\times\hat{y}' = -\ddot{\phi}\,r\,\hat{x}'}$$

$$m\vec{a}\,' = \vec{F} - 2m\vec{\Omega}\times\vec{v}\,' - m\vec{\Omega}\times(\vec{\Omega}\times\vec{r}\,') - m(\dot{\vec{\Omega}}\times\vec{r}\,')$$

$\hat{x}'$: $\quad 0 = 2m\dot{\phi}\dot{r} + m\ddot{\phi}r \Rightarrow \frac{1}{r}\frac{d}{dt}(mr^2\dot{\phi}) = 0 \rightarrow$ momentum angular

$\hat{y}'$: $\quad m\ddot{r} = -\frac{GMm}{r^2} + \dot{\phi}^2 r\,m$

$$mr^2\dot{\phi} = l \Rightarrow r\dot{\phi}^2 = \frac{l^2}{m^2r^3}$$

En $\underline{\hat{y}l}$

$$\Rightarrow \boxed{m\ddot{r} = -\frac{GMm}{r^2} + \frac{l^2}{mr^3}}$$