$v_O = 0$, $O \equiv CM$, $v_{CM} = 0$

$$\boxed{\bar{M}_O^{E} = \frac{d\bar{L}_O}{dt}}$$

$$\bar{F} = m\bar{a} = \frac{d\bar{p}}{dt}$$

$$\bar{M} = \bar{r} \times \bar{F}$$

$$\bar{L} = \bar{r} \times \bar{p}$$

z asse p. i.

$$\underline{\underline{\bar{L}_O}} = \bar{\bar{I}}\,\bar{\omega} \overset{\bar{\omega} = \omega \bar{u}_z}{=} I_{zz}\bar{\omega} + \bar{L}_{\perp} \overset{!}{=} \underline{\underline{I_z \bar{\omega}}}$$

$$\bar{M}_O^{E} = \frac{d\bar{L}_O}{dt} = \frac{d}{dt}\left(I_z \bar{\omega}\right) = I_z \frac{d\bar{\omega}}{dt} = I_z \bar{\alpha}$$

$$\boxed{\bar{M}_O^{E} = I_z \bar{\alpha}}$$ $\leftarrow$ eq. differenziale del moto di rotazione

$$\boxed{\bar{\alpha} = \frac{\bar{M}_O^{E}}{I_z}} \Rightarrow \boxed{\bar{\alpha} = \bar{\alpha}(t)}$$

$\alpha = \alpha(t)$ $\Rightarrow$ moto di rotazione vario

$\alpha = \text{cost} \ (\neq 0)$ $\Rightarrow$ moto di rotazione unif. accelerato

$$\Rightarrow \omega(t) = \omega_0 + \alpha t$$

$$\theta(t) = \theta_0 + \omega_0 t + \frac{1}{2}\alpha t^2$$

$\alpha = 0$ $\Rightarrow$ $\omega(t) = \omega = \text{cost}$

$$\theta(t) = \theta_0 + \omega t$$

z non è asse principale di inerzia $\quad L_\perp \neq 0$

$$\bar{\omega} = \omega \bar{u}_z$$

$$\Rightarrow \bar{L}_0 = I_z \bar{\omega} + \bar{L}_\perp$$

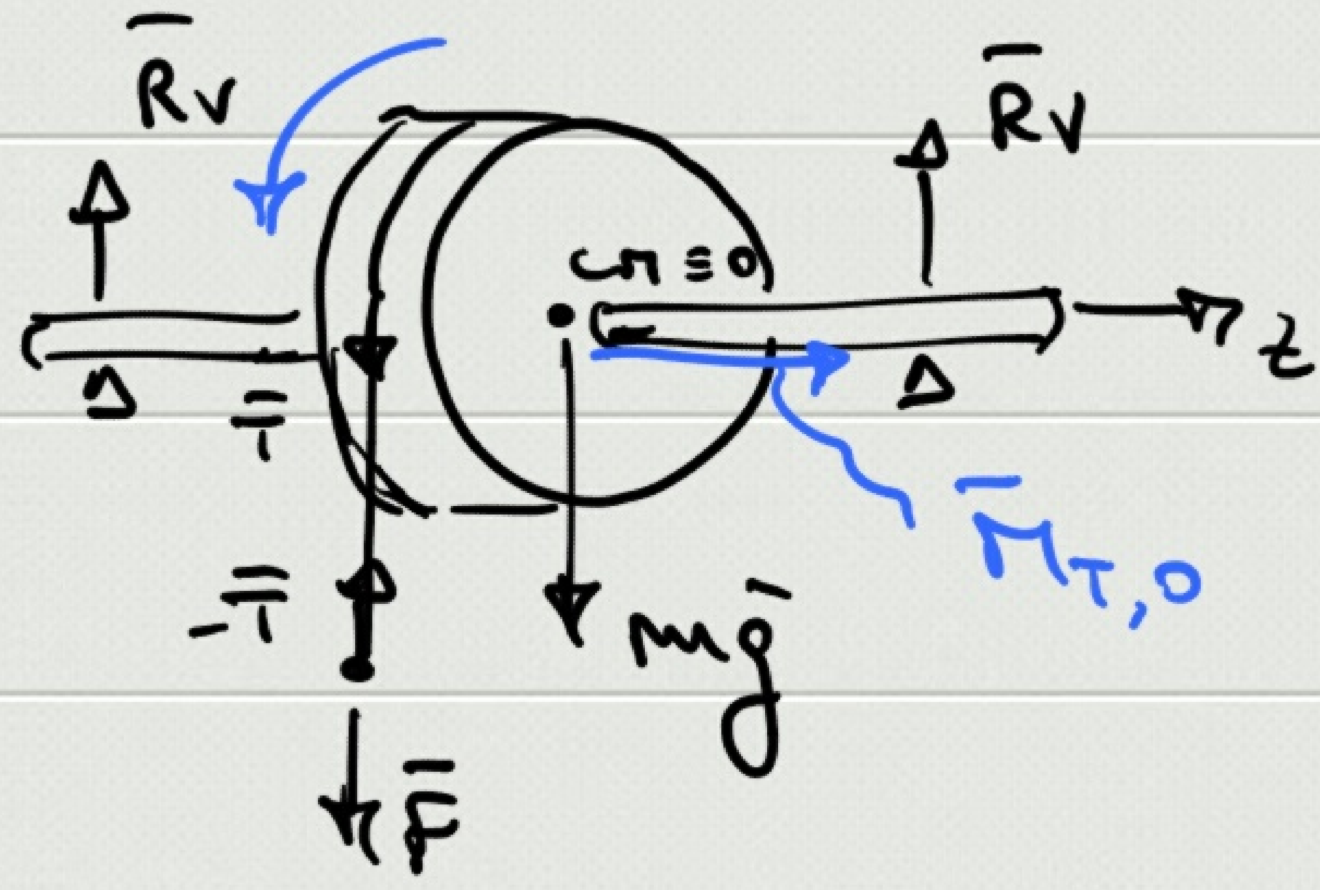
$$\bar{M}_0^E = \frac{d\bar{L}_0}{dt} = \frac{d}{dt}\left(I_z \omega + \bar{L}_\perp\right) =$$

variazione modulo $\bar{L}$

$$\Rightarrow \quad \bar{M}^E_O = I_z \bar{\alpha} + \frac{d\bar{L}_\perp}{dt}$$

$\longrightarrow$ variazione orientazione di $\bar{L}$

$$\bar{F} = \frac{d\bar{p}}{dt} = m \frac{dv}{dt} \bar{u}_T + m \frac{v^2}{R} \bar{u}_N$$



$m = 20\ kg$

$R = 0.5\ m$

$F = 9.8\ N$

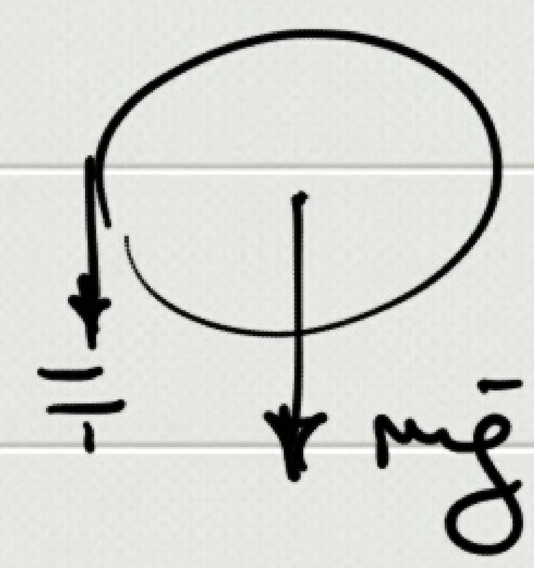
$\omega_0 = 0$

$\alpha = ?\qquad \omega(t = 2s) = ?$

CM ≡ polo

$v_{CM} = 0 \Rightarrow \bar P = 0 \Rightarrow \bar R^E = 0$

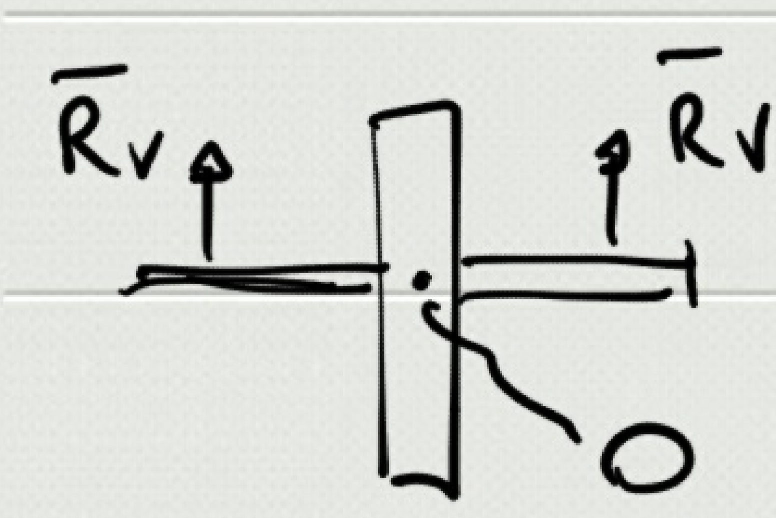
$$\overset{!}{=} m\bar g + \underset{\bar F}{\underset{\parallel}{\bar T}} + 2\underset{\Uparrow}{\bar R_V}$$



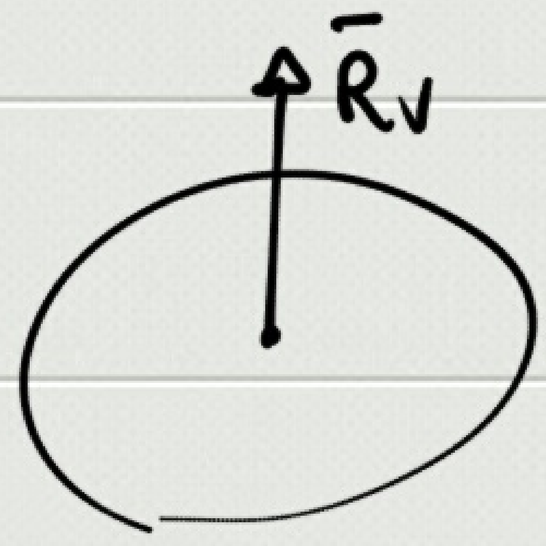
$\bar M^E_O = I_z\bar\alpha \qquad \bar M = \bar r \times \bar F$

$\bar M_{peso,CM} = 0 \qquad (r = 0)$

$$\boxed{\bar M_T = \bar r \times \bar T = R\,T\,\hat u_z}$$



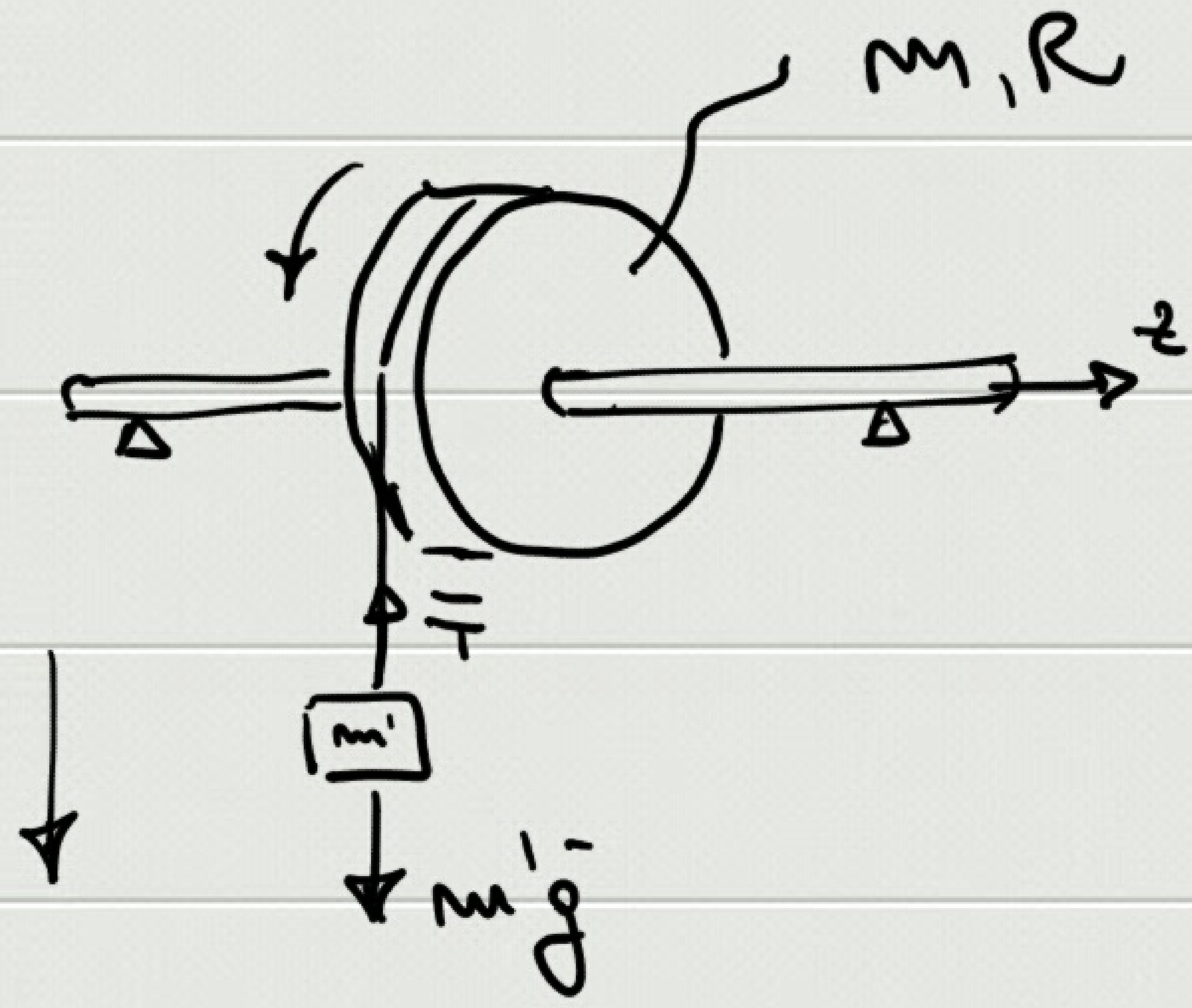
$\bar M_{R_V} = 0$



$M_{R_V} = 0$

$$\left.\begin{aligned} M^E_O &= RT \\ &\overset{!}{=} I_z\alpha = \frac{1}{2}mR^2\alpha \end{aligned}\right\} \Rightarrow \alpha = \frac{2T}{mR} = \frac{2F}{mR} = 1.96\ rad/s^2$$

$\omega(t = 2s) = \alpha t = 3.92\ rad/s$



$m' = 1\ kg$

$P = 9.8\ N$

$$M^E = \begin{cases} RT = I_z \alpha \\ m'g - T = m'a \\ a = a_T = \alpha R \end{cases}$$

$$\Rightarrow \cancel{R}T = \frac{1}{2} m R^{\cancel{2}} \alpha$$

$$m'g - T = m'\alpha R$$

$$m'g = \left(\frac{1}{2}m + m'\right)\alpha R$$

$$\Rightarrow \alpha = \frac{2m'g}{R(m+2m')} = 1.8\ rad/s^2$$