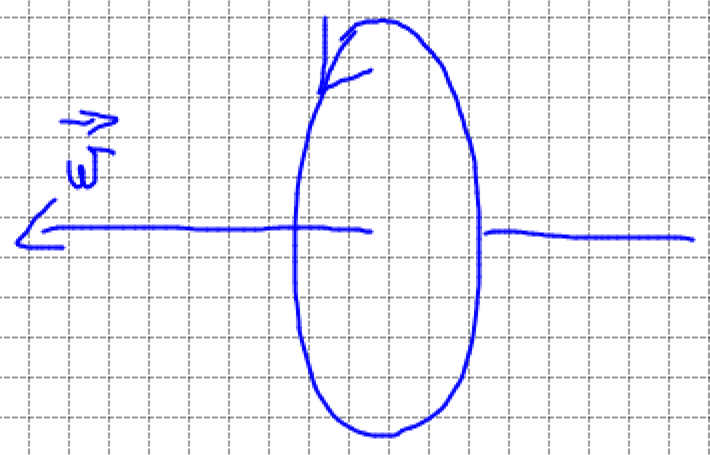
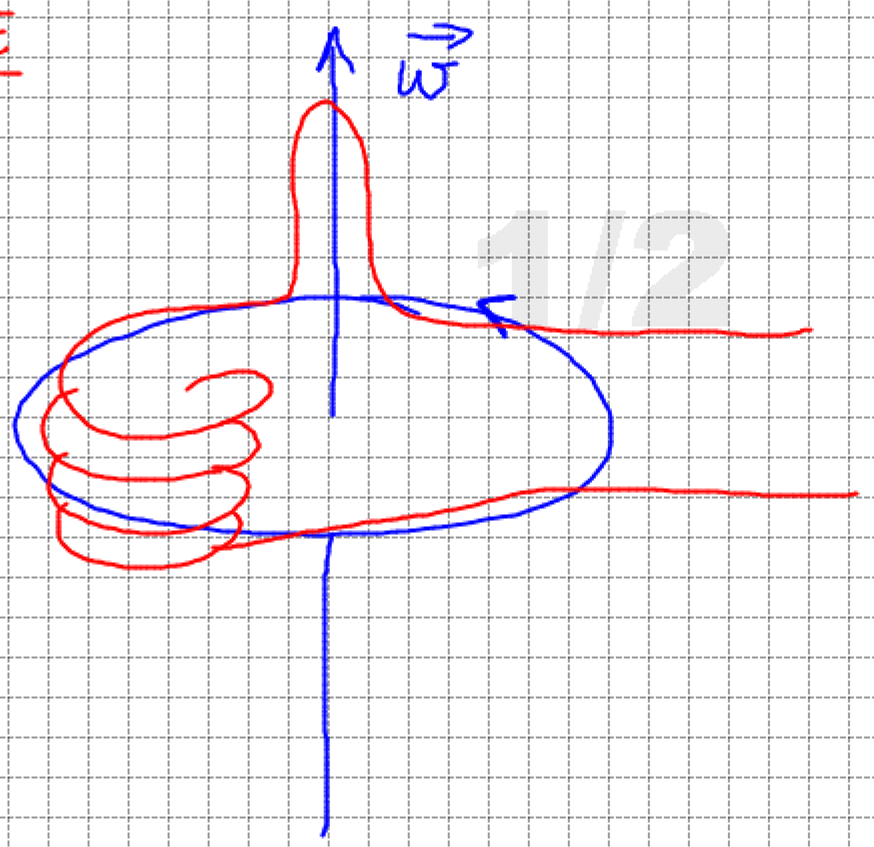
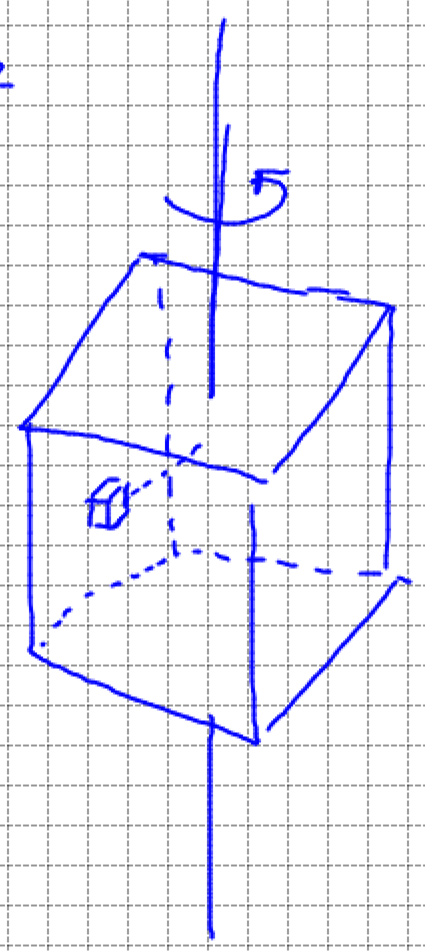
DINAMICA ROTAZIONALE

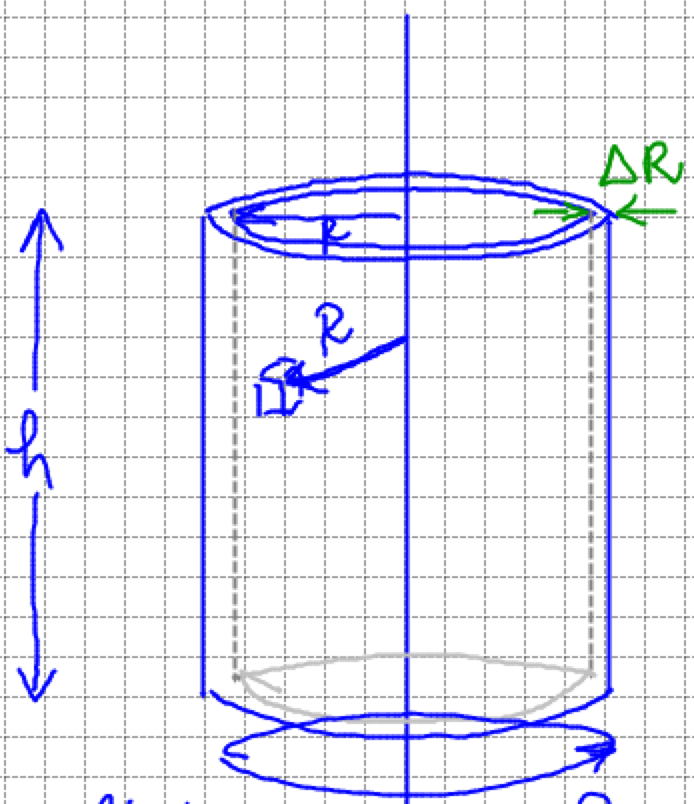




$$E_{cin} = \frac{1}{2} m v^2$$



Prendiamo per esempio un pezzo di Tubo di spessore "ridotto" (cilindro cavo)



lunghezza circonferenza $= L = 2\pi R$

Tutti i cubi piccoli hanno la stessa velocità angolare ω perché hanno la stessa distanza dal centro.

Δm = massa del cubo piccolo

$$\Delta m = \Delta V \delta = \Delta h \Delta R \Delta L \delta$$

$$v = \omega R$$

$$\Sigma \Delta L = L = 2\pi R$$

$$\Sigma \Delta h = h$$

$$E_{cin_R} = \Sigma E_{cin} = \Sigma \frac{1}{2} \Delta m v^2 = \Sigma \frac{1}{2} \Delta m \omega^2 R^2 =$$

$$= \Sigma \frac{1}{2} \Delta h \Delta R \Delta L \delta \omega^2 R^2 = \frac{1}{2} \underbrace{h \Delta R 2\pi R}_{V} \delta \omega^2 R^2 = \frac{1}{2} V \delta \omega^2 R^2 =$$

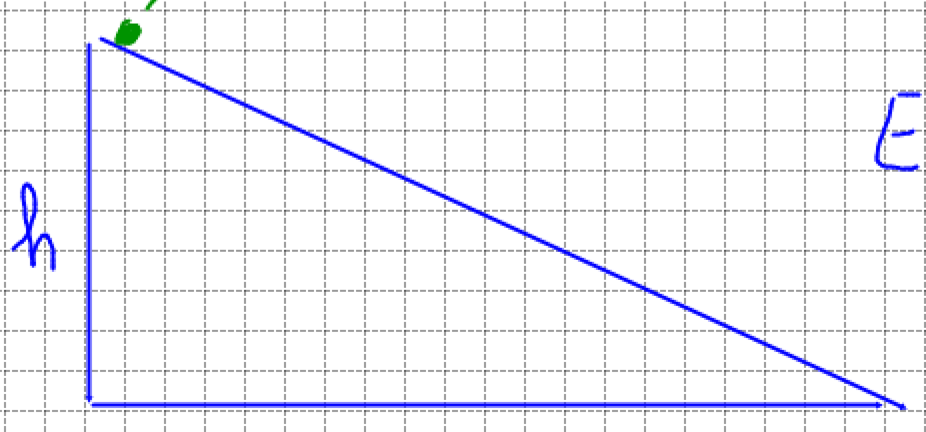
$$= \frac{1}{2} m \omega^2 R^2 = \frac{1}{2} (m R^2) \omega^2$$

$$E_{cin} = \frac{1}{2} m v^2 \qquad E_{cin_R} = \frac{1}{2} \underbrace{(m R^2)}_{\substack{I \\ \text{momento} \\ \text{di inerzia}}} \omega^2$$

$$E_{cin_R} = \frac{1}{2} I \omega^2$$

ESEMPIO

punto materiale (massa puntiforme)



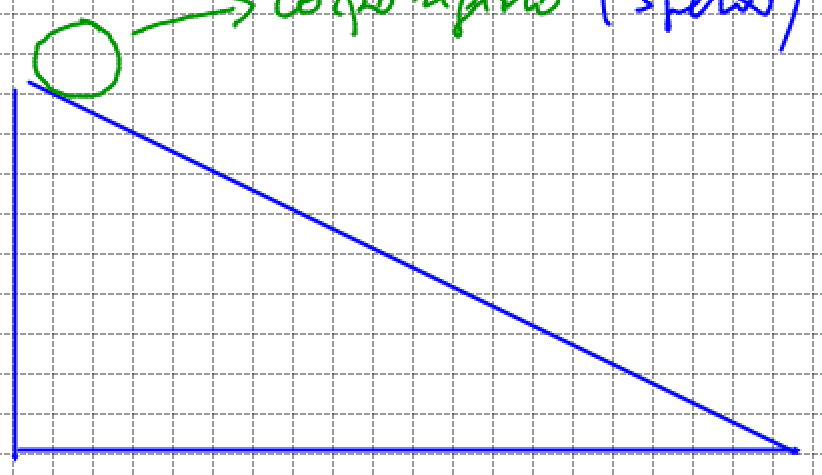
$$E_{T_i} = E_{cin_i} + E_{P_i} = 0 + mgh$$

$$E_{T_f} = E_{cin_f} + E_{P_f} = \frac{1}{2} m v_f^2 + 0$$

$$E_{T_i} = E_{T_f} \qquad \cancel{m} g h = \frac{1}{2} \cancel{m} v_f^2$$

$$\boxed{v_f = \sqrt{2gh}}$$

corpo rigido (sfera)



$$E_{T_i} = E_{cin_i} + E_{P_i} = 0 + mgh$$

$$E_{T_f} = (E_{cin_f}) + E_{P_f} = \left(\frac{1}{2} m v^2 + \frac{1}{2} I \omega^2\right) + 0 =$$

energia cinetica traslatoria — energia cinetica rotatoria

$$= \frac{1}{2} m v^2 + \frac{1}{2} I \frac{v^2}{R^2} = \frac{1}{2} v^2 \left(m + \frac{I}{R^2}\right) = \frac{1}{2} v^2 \left(m + \frac{2}{5} m\right) = \frac{1}{2} v^2 \left(\frac{7}{5} m\right) = \frac{7}{10} m v^2$$

$$v = \omega R$$

$$I_{sfera} = \frac{2}{5} m R^2$$

$$E_{T_i} = E_{T_f}$$

$$\cancel{m} g h = \frac{7}{10} \cancel{m} v^2$$

$$\boxed{v = \sqrt{\frac{10}{7} g h}}$$ con rotolamento

$$\frac{v_{rot_{sfera}}}{v_{punto\ mat.}} \simeq \sqrt{\frac{\frac{10}{7}}{2}} = \sqrt{\frac{5}{7}} = 0{,}85$$

$$v_{rot} = 85\%\, v$$

TRASLAZIONE

$$\vec{p} = m \vec{v}$$ si conserva

ROTAZIONE

$$\boxed{\vec{L} = I \vec{\omega}}$$ MOMENTO ANGOLARE