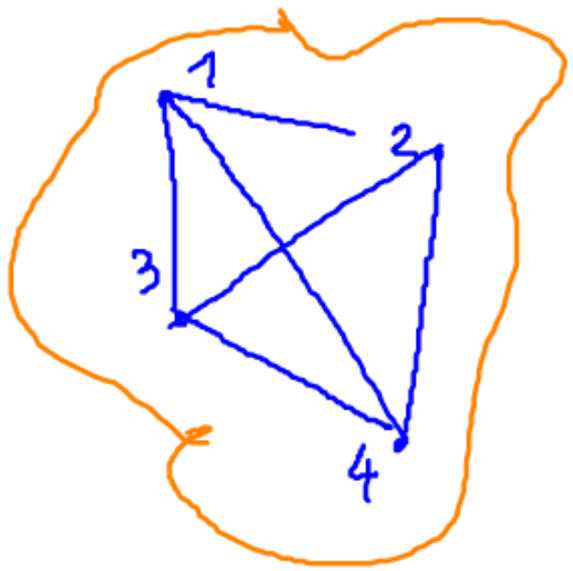
* VRTENJE TOGIH TELES

- TOGO TELO (T.T.) – telo, ki je veliko v primerjavi s premikom
  - medsebojne razdalje med posameznimi točkami togega telesa se ohranjajo

$r_{12}, r_{23}, r_{24}, r_{34}, r_{13}, r_{14}$ – razdalje med izbranimi točkami



* GIBANJE – opazujemo le gibanje težišča T.T.

TEŽIŠČE – središče mase (v težišču prijemlje REZULTANTA vseh tež

- določanje težišča (ročunsko)
- PONOVI!

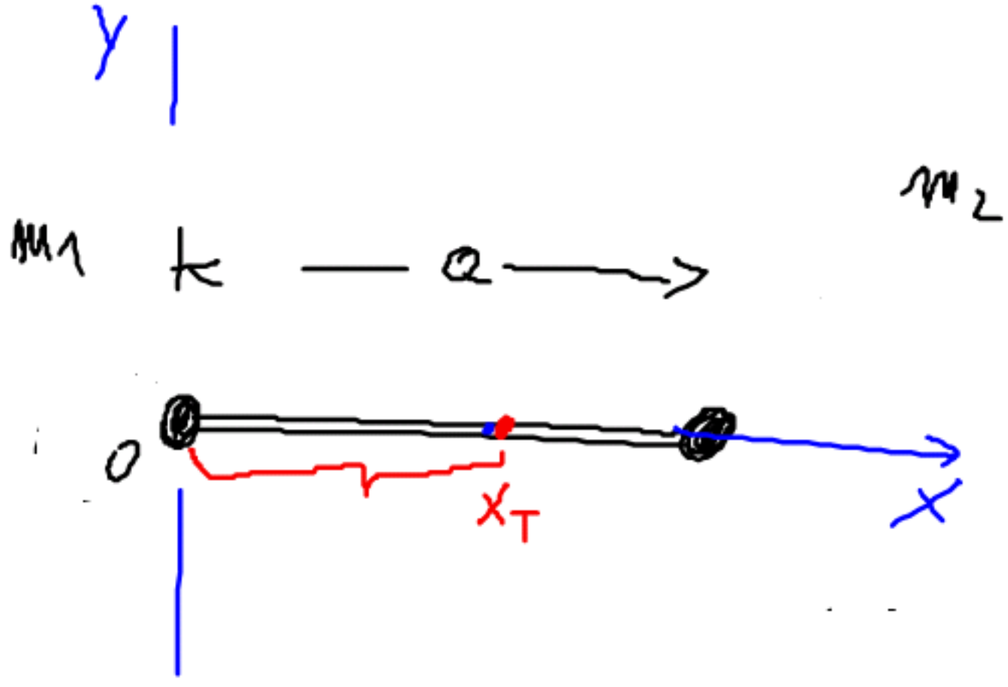
LEGA TEŽIŠČA:

$$x_T = \frac{m_1 \cdot x_1 + m_2 x_2 + m_3 x_3 + \dots}{m_1 + m_2 + m_3 + \dots}$$

$$y_T = \frac{m_1 y_1 + m_2 y_2 + m_3 y_3 + \dots}{m_1 + m_2 + m_3 + \dots}$$

$$z_T = \frac{m_1 \cdot z_1 + m_2 z_2 + m_3 z_3 + \dots}{m_1 + m_2 + m_3 + \dots}$$

Primer



$a = 2\,m$

$m_1 = 10\,kg$

$m_2 = 20\,kg$

$x_T = ?$

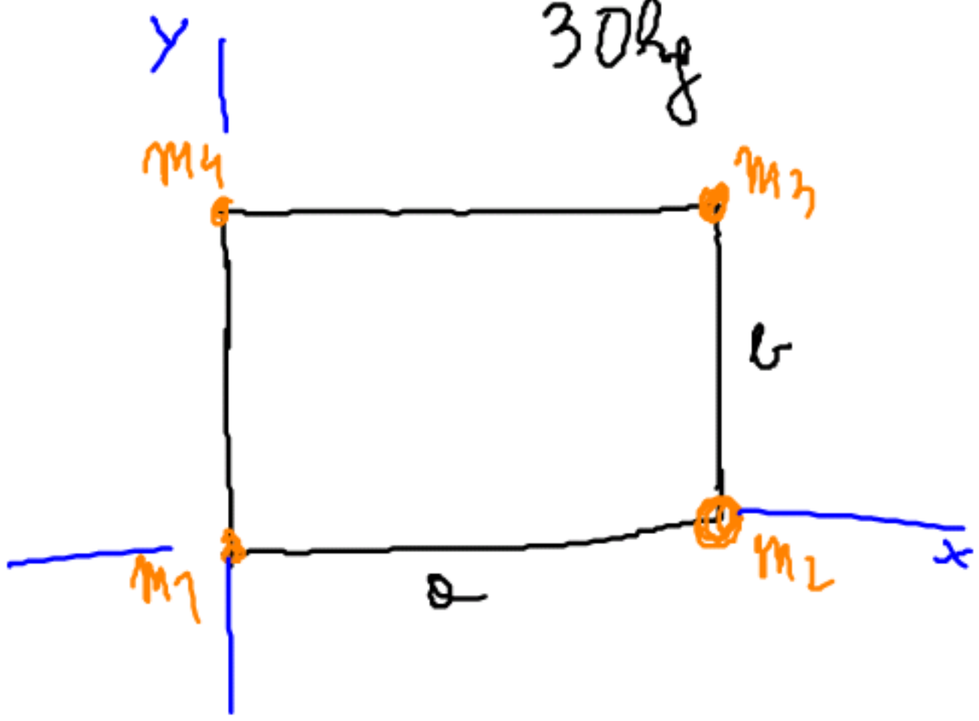
$y_T = ?$

$x_1 = 0 \quad x_2 = a$

$$y_T = 0 \qquad x_T = \frac{m_1 \cdot x_1 + m_2 x_2}{m_1 + m_2} =$$

$$x_T = \frac{10\,kg \cdot 0\,m + 20\,kg \cdot 2\,m}{30\,kg} = \frac{4}{3}\,m = 1,\overline{3}\,m$$

Primer:



$a = 1\,m$

$b = 0,5\,m$

$m_1 = 10\,kg$

$m_2 = 3\,kg$

$m_3 = 5\,kg$

$m_4 = 15\,kg$

$x_T, y_T = ?$

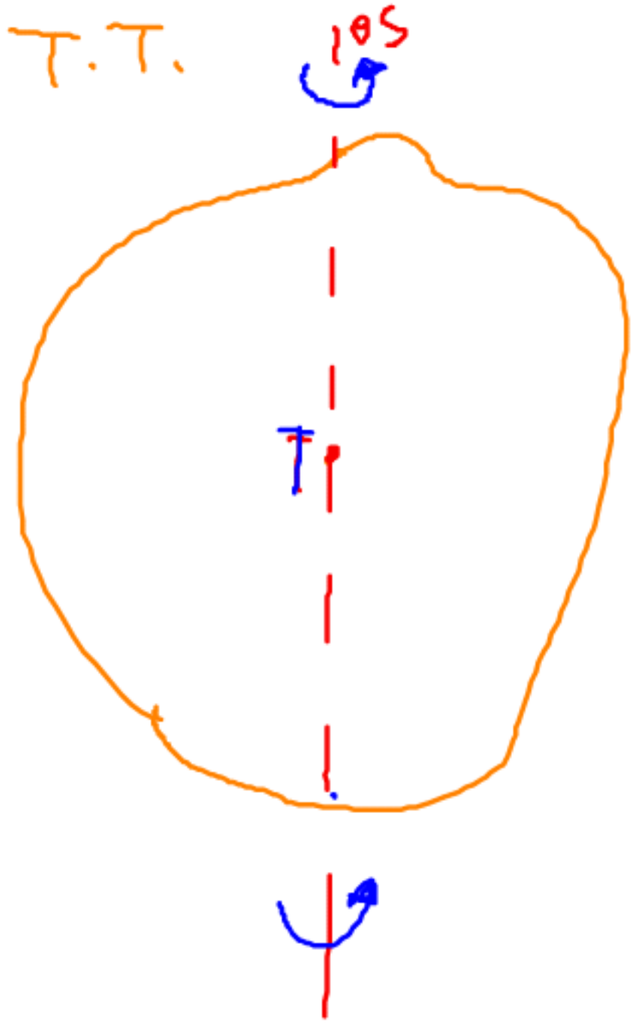
$x_1 = 0 \quad y_1 = 0$

$x_2 = a \quad y_2 = 0$

$x_3 = a \quad y_3 = b$

$x_4 = 0 \quad y_4 = b$

(D.N. - izračunaj)



- vrtenje je gibanje posameznih delov t. t. okrog "OSI" (OSIŠČA)
- VRTENJE opišemo s kotno hitrostjo ω ali s kotnim pospeškom α

MEHANSKI NAVOR M vrti toga

- kotni pospešek je sorazmeren navoru

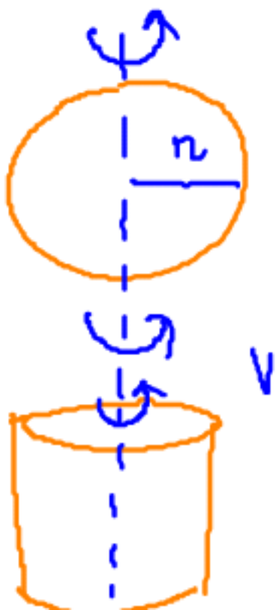
delo $[Nm]$

$$\alpha \propto M$$

$$M = J\,\alpha \rightarrow \boxed{J = \frac{M}{\alpha}} \quad \left[\frac{Nm}{s^{-2}} = kgm^2\right]$$

VZTRAJNOSTNI MOMENT (lastnost TOG. TELESA)

Primeri teles:



KROGLA

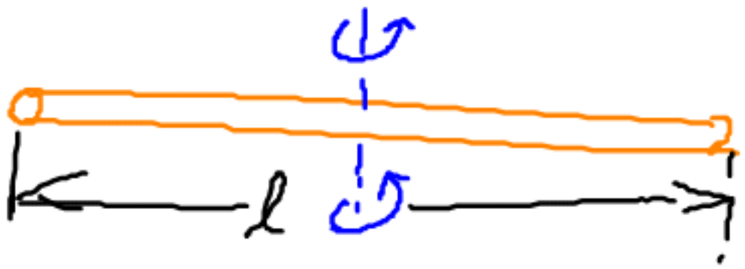
m - masa
r - polmer

$$J = \frac{2}{5} m r^2$$

VALJ

m - masa
r - polmer

$$J = \frac{1}{2} m r^2$$

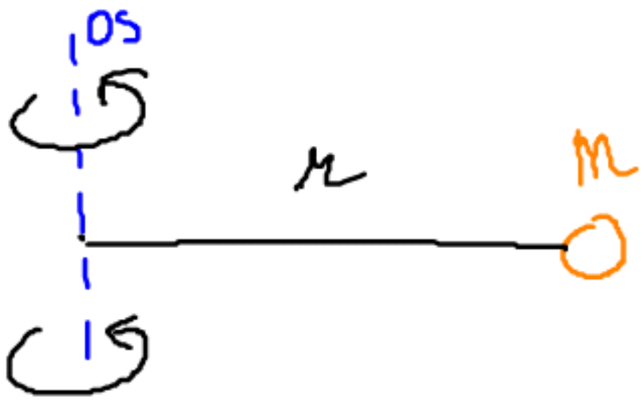


m - masa
l - dolžina

$$J = \frac{1}{12} m l^2$$

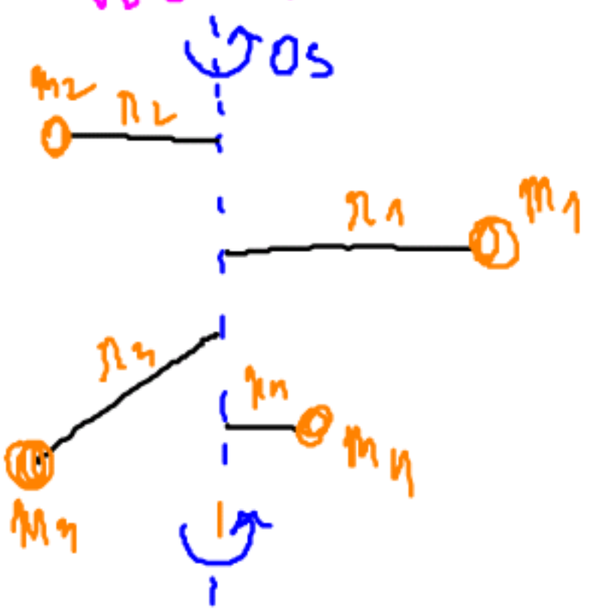
(LAHKA PALICA)

TOČKASTO TELO



$$J = m r^2$$

VEČ TOČK. TELES



$$J = m_1 r_1^2 + m_2 r_2^2 + m_3 r_3^2 + \dots$$

Vsi vztrajnostni momenti se podajajo "OSIŠČE" skozi težišče.

$$\vec{M} = J \cdot \vec{\alpha}$$

II. Newtonov zakon za vrtenje togega telesa:

Rezultanta vseh zunanjih navorov povzroči T.T. vztrajnostnega momenta J, kotni pospešek α.

Primer:

Krogla $r = 0{,}5\,m$

$m = 100\,kg$

$\alpha = 1\,s^{-2}$

$J = ?$

$M = ?$

$$J = \frac{2}{5} m \cdot r^2 = \frac{2}{5} \cdot 100\,kg\,0{,}5^2\,m^2 = 10\,kg\,m^2$$

$$M = J \cdot \alpha = 10\,kg\,m^2 \cdot 1\,s^{-2} = 10\,\frac{kg\,m^2}{s^2}\,Nm$$

$$M = 10\,Nm$$