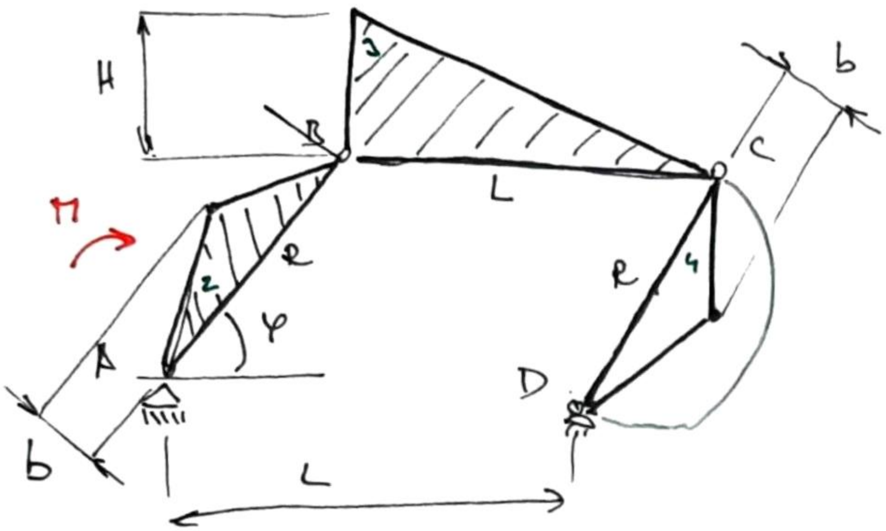
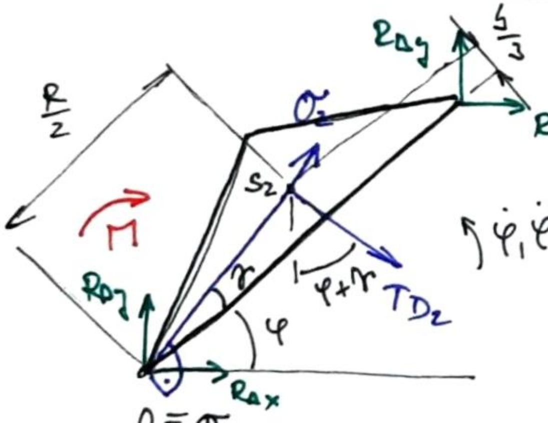


D: $M, L, H, b, R, \rho_2 = \rho_3\ [kg/m^2], \rho_4\ [kg/m]$

U: UVOLNĚTE TĚLESA A SESTAVTE SOUSTAVU ROVNIC

„2" a „4" – rotační pohyb

„3" – posuvný pohyb



$M_{D_2} = J_{S_2} \cdot \ddot{\varphi}$

$\dot{\varphi}, \ddot{\varphi}$ (vždy tak, aby se zvětšoval úhel)

T_D méně vhodné

(2)

$\overrightarrow{x}: R_{Ax} + R_{Dx} + O_2 \cos(\varphi+\gamma) + T_{D_2} \cdot \sin(\varphi+\gamma) = 0$

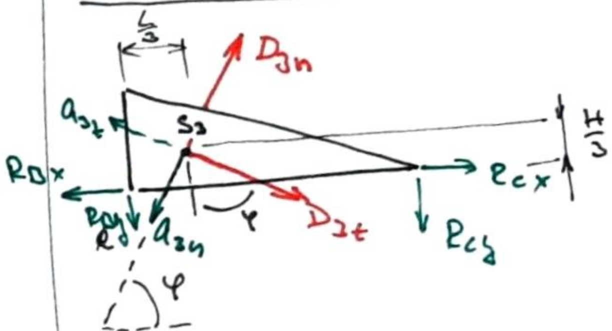
$y\uparrow: R_{Ay} + R_{Dy} + O_2 \sin(\varphi+\gamma) - T_{D_2} \cdot \cos(\varphi+\gamma) = 0$

$\curvearrowright A: M + M_D + R_{Bx} \cdot R \cdot \sin\varphi - R_{By} \cdot R \cos\varphi + T_{D_2} \cdot \sqrt{\frac{R^2}{4} + \frac{b^2}{9}} = 0$

$O_2 = m_2 \sqrt{\frac{R^2}{4} + \frac{b^2}{9}} \cdot \dot{\varphi}^2$

$T_{D_2} = m_2 \sqrt{\frac{R^2}{4} + \frac{b^2}{9}} \cdot \ddot{\varphi}$

$M_{D_2} = J_{S_2} \cdot \ddot{\varphi}$! m_2, J_{S_2} neznáme !



(3)

$\overrightarrow{x}: -R_{Bx} + R_{Cx} + D_{3t} \cdot \sin\varphi + D_{3n} \cdot \cos\varphi = 0$

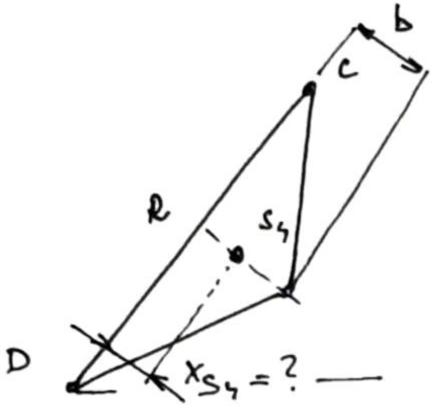
$y\uparrow: -R_{By} - R_{Cy} \pm D_{3t} \cdot \cos\varphi + D_{3n} \cdot \sin\varphi = 0$

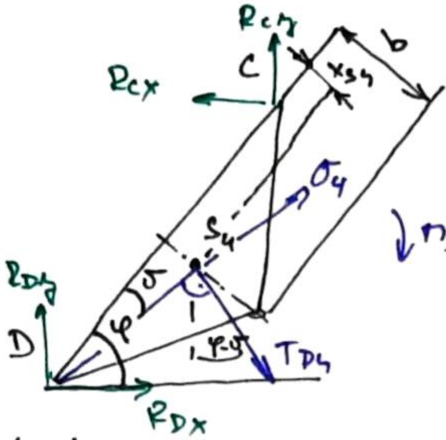
$\curvearrowright S_3: R_{Bx} \cdot \frac{H}{3} - R_{By} \cdot \frac{L}{3} \pm R_{Cx} \cdot \frac{H}{3} + R_{Cy} \cdot \frac{2}{3} L = 0$

$D_{3t} = m \cdot a_{3t} = m_3 R \cdot \ddot{\varphi}$

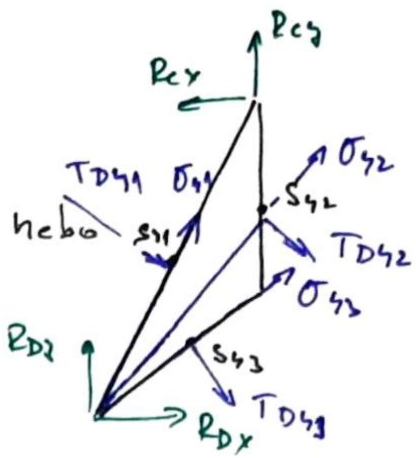
$D_{3n} = m \cdot a_{3n} = m_3 R \cdot \dot{\varphi}^2$

! m_3 neznáme !





$\downarrow M_{D4}$ $\uparrow \dot\varphi, \ddot\varphi$ nebo



! těleso je z drátu !

(4) $\vec{x}: \; -R_{Cx} + R_{Dx} + O_4 \cdot \cos(\varphi - \vartheta) + T_{D4} \cdot \sin(\varphi - \vartheta) = 0$

$y\uparrow: \; R_{Cy} + R_{Dy} + O_4 \cdot \sin(\varphi - \vartheta) - T_{D4} \cdot \cos(\varphi - \vartheta) = 0$

$\curvearrowright D: \; -R_{Cx} \cdot R \cdot \sin\varphi - R_{Cy} \cdot R \cdot \cos\varphi + T_{D4} \cdot \sqrt{\frac{b^2}{4} + x_{S_4}^2} + M_{D4} = 0$

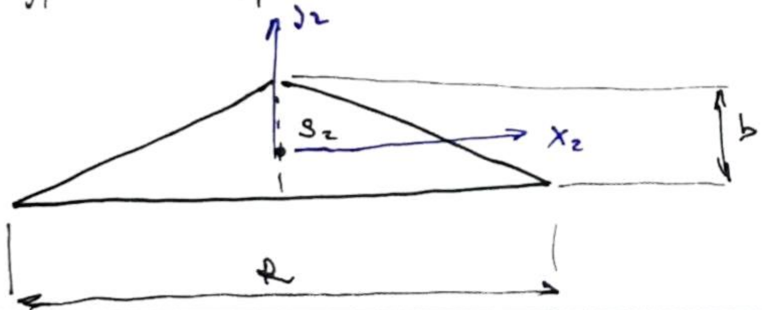
$O_4 = m_4 \sqrt{\frac{b^2}{4} + x_{S_4}^2} \cdot \dot\varphi^2$

$T_{D4} = m_4 \sqrt{\frac{b^2}{4} + x_{S_4}^2} \cdot \ddot\varphi$

$M_{D4} = \cancel{\ddot\varphi} \; J_{S_4} \cdot \ddot\varphi$

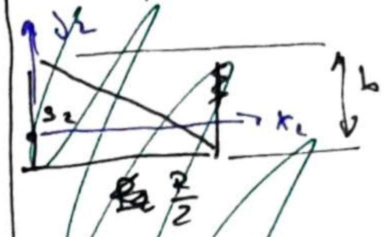
! J_{S_4} a m_4 neznáme !

Výpočet m_2, J_{S2}



$m_2 = \rho_2 \cdot \frac{R \cdot b}{2}$

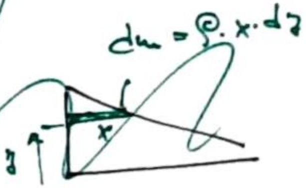
lze použít pouze $\frac{1}{2}\Delta$ pro J_{S2}

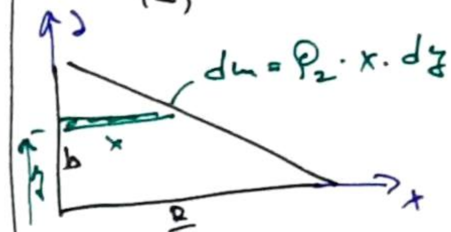


$\cancel{J_{S2} = 2 \cdot J_2}$

$\cancel{J_2 = J_{x2} + J_{y2}}$

$\cancel{J_{x2} = \int_{(m)} y^2 \, dm}$





$J_{x2} = \int_{(m)} y^2 \, dm = \int \rho_2 \, x \, y^2 \, dy$

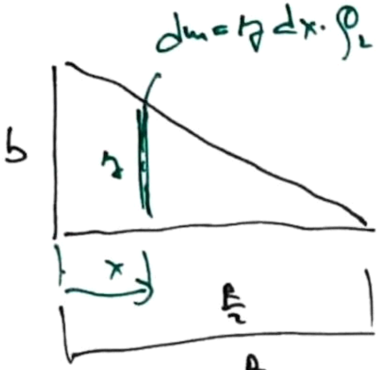
$\frac{x}{b-y} = \frac{R}{2b}$ – podobnost Δ

$x = \frac{R(b-y)}{2b}$

$J_{x2} = \int_0^b \rho_2 \frac{R(b-y)}{2b} \cdot y^2 \, dy =$

$= \frac{\rho_2 R}{2} \cdot \int_0^b y^2 \, dy - \frac{\rho_2 R}{2b} \int_0^b y^3 \, dy =$

$= \frac{\rho_2 R}{6} b^3 - \frac{\rho_2 R}{8 \cancel{b}} \cdot b^{\cancel{4}3} = \underline{\underline{\frac{1}{24} \rho_2 R b^3}}$



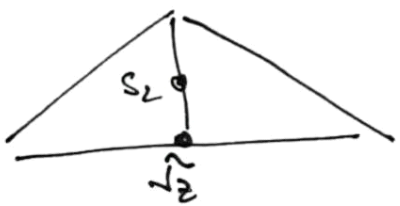
$$J_{yz} = \int_{(m)} x^2\,dm = \int_{(m)} x^2 y \rho_2\,dx$$

$$\frac{y}{\frac{R}{2}-x} = \frac{2b}{R} \to y = \frac{2b\left(\frac{R}{2}-x\right)}{R}$$

$$J_{yz} = \int_0^{\frac{R}{2}} x^2\,\frac{2b\left(\frac{R}{2}-x\right)}{R}\,\rho_2\,dx = \int_0^{\frac{R}{2}} b x^2 \rho_2\,dx - \int_0^{\frac{R}{2}} \frac{2b}{R}\rho_2 x^3\,dx =$$

$$= \frac{1}{24} b R^3 \rho_2 - \frac{1}{32} b \rho_2 R^3 = \frac{1}{96}\rho_2 b R^3$$

$$J_z = J_{yz} + J_{xz} = \frac{5}{96}\rho_2 b R^3$$

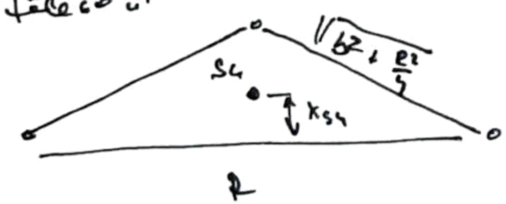


$$\tilde{J}_z = 2\cdot J_z = \frac{5}{48}\rho_2 b R^3 = \frac{5}{24} m_2 R^2$$

$$J_{S_2} = \tilde{J}_z - m_2\left(\frac{1}{3}b\right)^2 = \frac{5}{24} m_2 R^2 - \frac{1}{9} m_2 \cancel{R^2} b^2$$

$$m_3 = \rho_3\cdot\frac{L\cdot H}{2}$$

těleso „4"

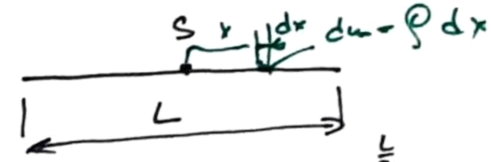


$$m_4 = \rho_4\cdot\left(R + 2\cdot\sqrt{b^2+\frac{R^2}{4}}\right)$$

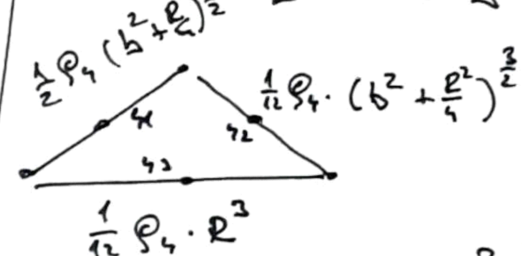
$$x_{S4}\cdot m_4 = \frac{b}{2}\cdot\rho_4\cdot\sqrt{b^2+\frac{R^2}{4}}\cdot 2$$

$$x_{S4} = \frac{b\rho_4\sqrt{b^2+\frac{R^2}{4}}}{\rho_4\left(R+2\cdot\sqrt{b^2+\frac{R^2}{4}}\right)} = \frac{b\cdot\sqrt{b^2+\frac{R^2}{4}}}{R+2\sqrt{b^2+\frac{R^2}{4}}}$$

TYČ



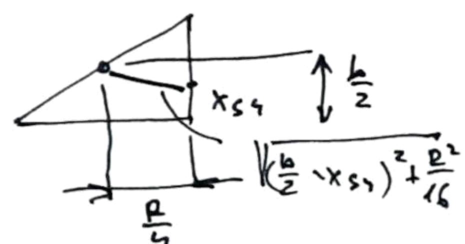
$$J_S = \int x^2\,dm = \rho\cdot\int_{-\frac{L}{2}}^{\frac{L}{2}} x^2\,dx = \frac{1}{3}\rho\left[\frac{L^3}{8}+\frac{L^3}{8}\right] = \frac{1}{12}\rho L^3$$



$$J_{41} = J_{42} = \frac{1}{12}\rho_4\left(b^2+\frac{R^2}{4}\right)^{\frac{3}{2}}$$

$$J_{43} = \frac{1}{12}\rho_4 R^3$$

$$J_S^{41} = J_{41} + \rho_4\cdot\sqrt{b^2+\frac{R^2}{4}}\cdot\left[\left(\frac{b}{2}-x_{S4}\right)^2+\frac{R^2}{16}\right]$$



$$J_S^{42} = J_S^{41}$$

$$J_S^{43} = J_{43} + \rho\cdot R\cdot x_{S4}^2$$

$$J_{S4} = J_S^{41} + J_S^{42} + J_S^{43}$$