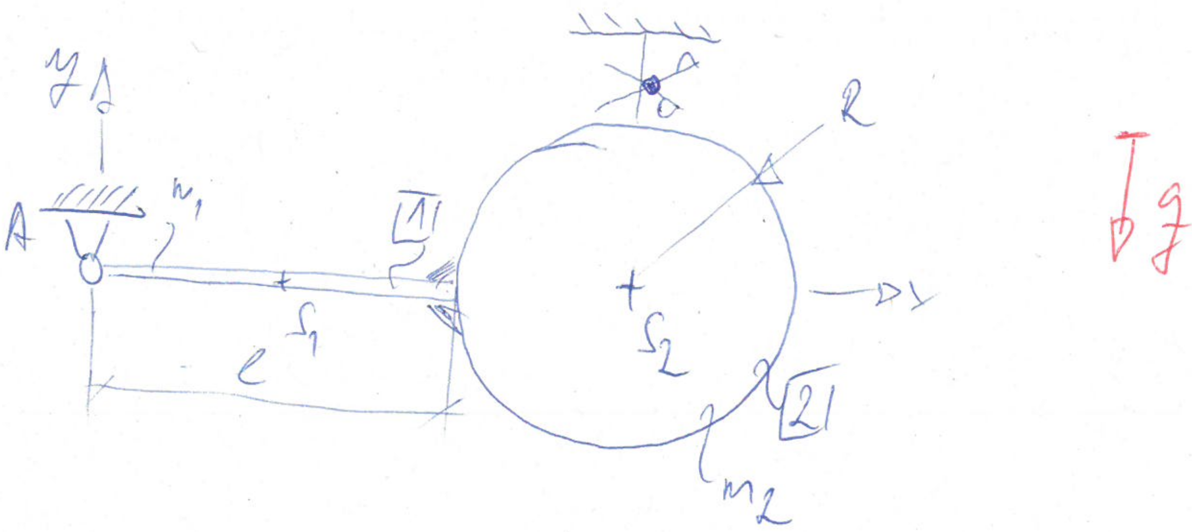
1/



$m_1 = 4\,[kg]$, $m_2 = 3\,[kg]$, $l = 0.8\,[m]$, $R = 0.3\,[m]$

a) A reakcióerő az elvágás pillanatában

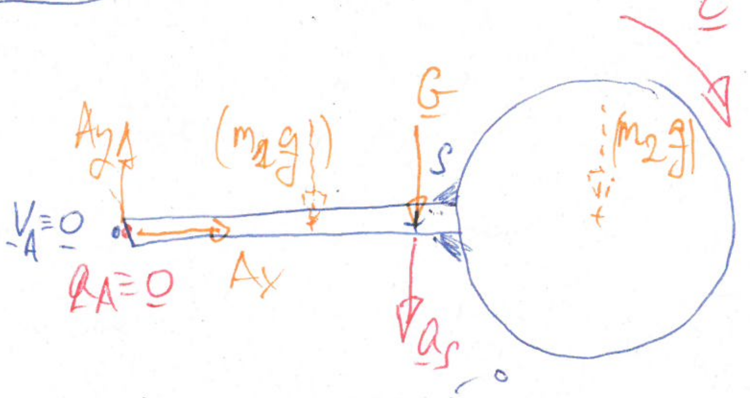
b) sebességállapot függőleges helyzetben

(0.) közös súlypont meghatározása

$$\underline{r}_S = \frac{m_1 \underline{r}_{S1} + m_2 \underline{r}_{S2}}{m_1 + m_2} = \frac{1}{m_1+m_2}\left(m_1 \begin{bmatrix} l/2 \\ 0 \\ 0 \end{bmatrix} + m_2 \begin{bmatrix} l+R \\ 0 \\ 0 \end{bmatrix} \right) = \begin{bmatrix} 0.7 \\ 0 \\ 0 \end{bmatrix} [m]$$

a)

SZTA',



$$\underline{\varepsilon} = \begin{bmatrix} 0 \\ 0 \\ -\varepsilon \end{bmatrix}$$

$$\underline{a}_S = \underset{=0}{\underline{a}_A} + \underline{\varepsilon} \times \underline{r}_S - \underset{=0}{\omega^2} \underline{r}_S = \begin{bmatrix} 0 \\ -r_S \varepsilon \\ 0 \end{bmatrix}, \quad \begin{pmatrix} 0 \\ a_{Sy} \\ 0 \end{pmatrix}$$

Dinamika alaptétele $[\dot{\underline{I}}, \dot{\underline{D}}_A]_A = [\underline{F}, \underline{M}_A]_A$ A álló pontra (Hatásan!)

$[\dot{\underline{I}}, \dot{\underline{D}}_S]_S = [\underline{F}, \underline{M}_S]_S$ S súlypontra

$m \underline{a}_S = \underline{F}$

x: ~~$M 0 = A_x$~~ $(m_1 + m_2) \cdot 0 = A_x$

~~y: $M a_{Sy} = A_y - Mg$, $M = m_1 + m_2$~~ $(m_1 + m_2) a_{Sy} = A_y - (m_1 + m_2) g$

$\underline{D}_A = \underline{M}_A$

z: ~~$+\Theta_A(-\varepsilon) = -r_S M \cdot g$~~ $\Theta_A(+\varepsilon) = r_S (m_1 + m_2) g$

$a_{Sy} = -r_S \varepsilon$ kinematika

$\Theta_A = \Theta_{S1}^{RUD} + m_1 \left(\frac{l}{2}\right)^2 + \Theta_{S2}^{KOL} + m_2 (l+R)^2,$

$\Theta_{S1}^{RUD} = \frac{1}{12} m_1 l^2, \quad \Theta_{S2}^{KOL} = \frac{1}{2} m_2 R^2$

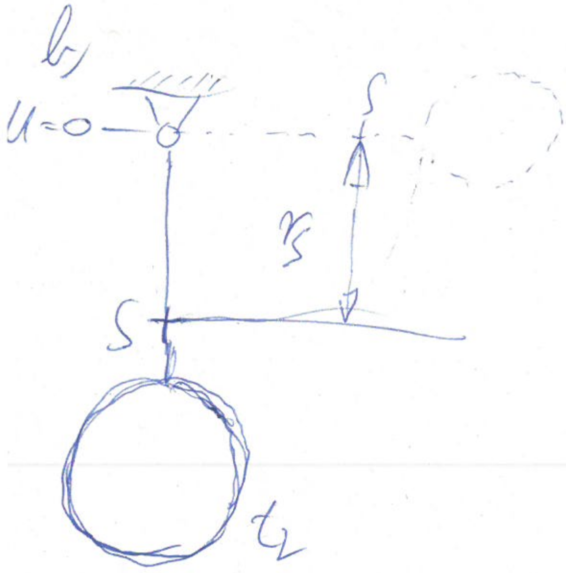
$\Theta_A = 4.618 \, [kg\, m^2]$

$\varepsilon = \frac{r_S (m_1 + m_2) g}{\Theta_A} = 10.41 \left[\frac{rad}{s^2}\right], \quad \underline{\varepsilon} = \begin{bmatrix} 0 \\ 0 \\ -10.41 \end{bmatrix} \left[\frac{rad}{s^2}\right]$

$a_{Sy} = -7.286 \, [m/s^2], \quad \underline{a}_{S} = \begin{bmatrix} 0 \\ -7.286 \\ 0 \end{bmatrix} [m/s^2]$

$A_y = (m_1 + m_2)(+a_{Sy} + g) = 17.67 \, [N], \quad \underline{A} = \begin{bmatrix} 0 \\ 17.67 \\ 0 \end{bmatrix} [N]$

b)



munkatétel

$$T_2 - T_1 = W_{12}$$

$$T_2 = \frac{1}{2}\Theta_A \omega^2 \quad \text{A álló pontra}$$

$$T_1 = 0$$

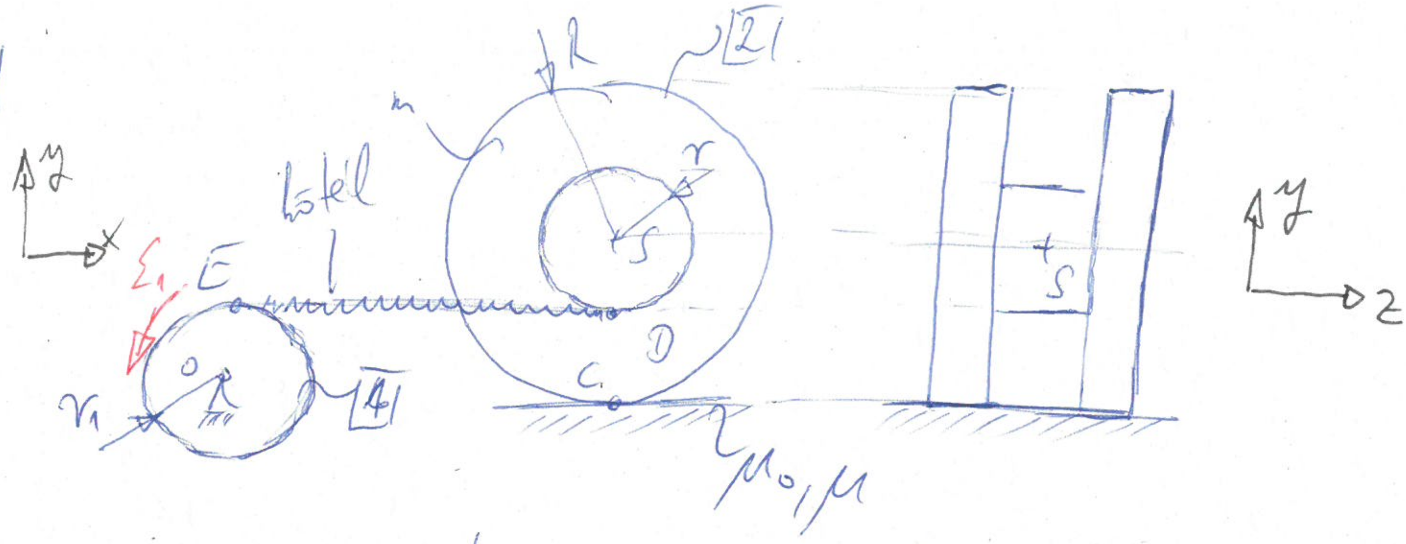
$$W_{12} = \int_{t_1}^{t_2} P\,dt = -(U_2 - U_1) = -(-r_S(m_1+m_2)g)$$

$$\omega = \sqrt{\frac{2(m_1+m_2)g r_S}{\Theta_A}} = 4.563\left[\frac{rad}{s}\right], \quad \underline{\omega} = \begin{bmatrix} 0 \\ 0 \\ -4.563 \end{bmatrix}[rad/s]$$

$$[\underline{0}, \underline{\omega}]_A, \quad \underline{v}_S = \underline{v}_A + \underline{\omega} \times \underline{r}_{AS} = \underline{0} + \begin{bmatrix} 0 \\ 0 \\ -\omega \end{bmatrix} \times \begin{bmatrix} 0 \\ -r_S \\ 0 \end{bmatrix} = \begin{bmatrix} -r_S\omega \\ 0 \\ 0 \end{bmatrix} =$$

$$= \begin{bmatrix} -3.193 \\ 0 \\ 0 \end{bmatrix}\left[\frac{m}{s}\right], \quad [\underline{v}_S, \underline{\omega}]_S$$

2|



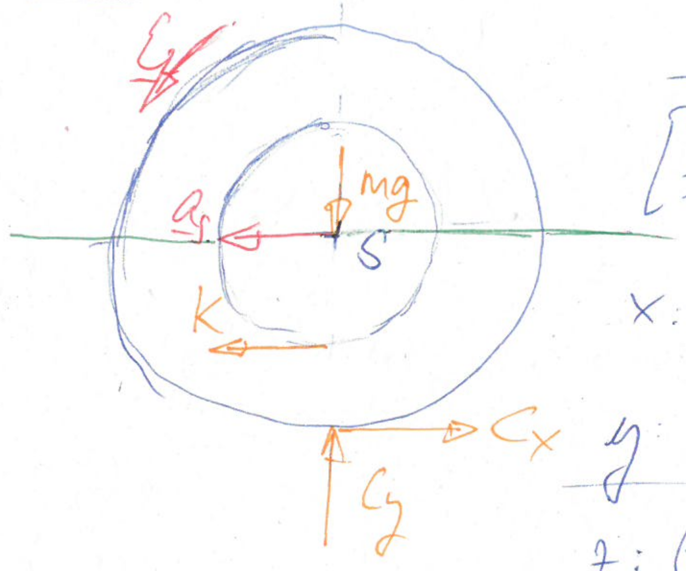
nyugalomból indul!

$R = 450\,[mm]$, $r = 150\,[mm]$, $r_1 = 250\,[mm]$, $\varepsilon_1 = 3\,[rad/s] = áll$

$m = 70\,[kg]$, $\Theta_S = 4.37?\,[kg]$, $\mu_0 = 0.25$, $\mu = 0.2$

a, $\underline{K} = ?$, b, $\underline{C}$ kényszererő

a, SZTA'



Dinamika alaptétele

$$[\dot{\underline{I}}, \dot{\underline{D}}_S]_S = [\underline{F}, \underline{M}_S]_S$$

$$x: -m a_S = -K + C_x$$

$$y: m \cdot 0 = C_y - mg$$

$$z: \Theta_S \varepsilon_2 = -K r + C_x R$$

Tfh gördül

$$a_S = R \varepsilon_2$$

Kinematikai feltétel

$$a_{Dx} = a_{Ex}, \quad a_{Dx} = -(R-r)\varepsilon_2, \quad a_{Ex} = -r_1 \varepsilon_1$$

$$\varepsilon_2 = \frac{r_1}{R-r}\,\varepsilon_1 = 2.5\left[\frac{rad}{s^2}\right]$$

$$a_s = R\,\varepsilon_2 = 1.125\left[\frac{m}{s^2}\right]$$

$$C_y = mg = \underline{686.7\,[N]}$$

$$C_x = K - m\,a_s$$

$$\Theta_1\,\varepsilon_2 + m\,a_s R = (R-r)K \;\rightarrow\; K = \frac{\Theta_1\,\varepsilon_2 + m\,a_s R}{R-r} = 154.6\,[N]$$

$$C_x = 75.83\,[N]$$

$\frac{C_x}{C_y} = 0.11 \le \mu_0$ tényleg gördül

$$\underline{K} = \begin{bmatrix} -154.6 \\ 0 \\ 0 \end{bmatrix}[N], \quad \underline{C} = \begin{bmatrix} 75.83 \\ 686.7 \\ 0 \end{bmatrix}[N]$$

$\varepsilon_1 = 10\left[\frac{rad}{s^2}\right]$, $\varepsilon_2 = 8.33\left[\frac{rad}{s^2}\right]$, $K = 515.3\,[N]$, $C = \begin{bmatrix} 252.8 \\ 686.7 \\ 0 \end{bmatrix}[N]$

$\frac{C_x}{C_y} = 0.36 > \mu_0$ megcsúszik számítás újra

$a_s \neq R\,\varepsilon_2$, de $\boxed{C_x = \mu C_y}$

$$-m\,a_s = -K + C_x$$

$$0 = -mg + C_y$$

$$\Theta_1\,\varepsilon_2 = -K r + C_x R$$

$$C_x = \mu C_y$$

$a_s = a_{Dx} + r\,\varepsilon_2$, $\varepsilon_2 = 2.51\left[\frac{rad}{s^2}\right]$

$C_y = mg = 686.7\,[N]$

$K = 338.7\,[N]$

$C_x = 137.3\,[N]$