



AKADEMIA EDUKACYJNO - INŻYNIERSKA

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MATURA STUDIA PRAKTYKA STAŻ PRACA BIZNES PRZEMYSŁ STEAM

KOMPLEKSOWE WSPARCIE EDUKACYJNE ON – LINE NA KAŻDYM ETAPIE KSZTAŁCENIA INŻYNIERSKIEGO

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MECHANIKA II

"DYNAMIKA UKŁADU BRYŁ SZTYWNYCH"

PROJEKT

Oblicz:

- przyspieszenie liniowe "3"
- siłę tarcia
- siłę w linie

dla układu brył sztywnych.

DANE:

- 1) $F_1, \mu_1, m_1, \alpha = OK$
- 2) $m_2, M_2, r_2, R_2 = OK$
- 3) $m_3, r_3, f_3 = OK$

SZUKAM:

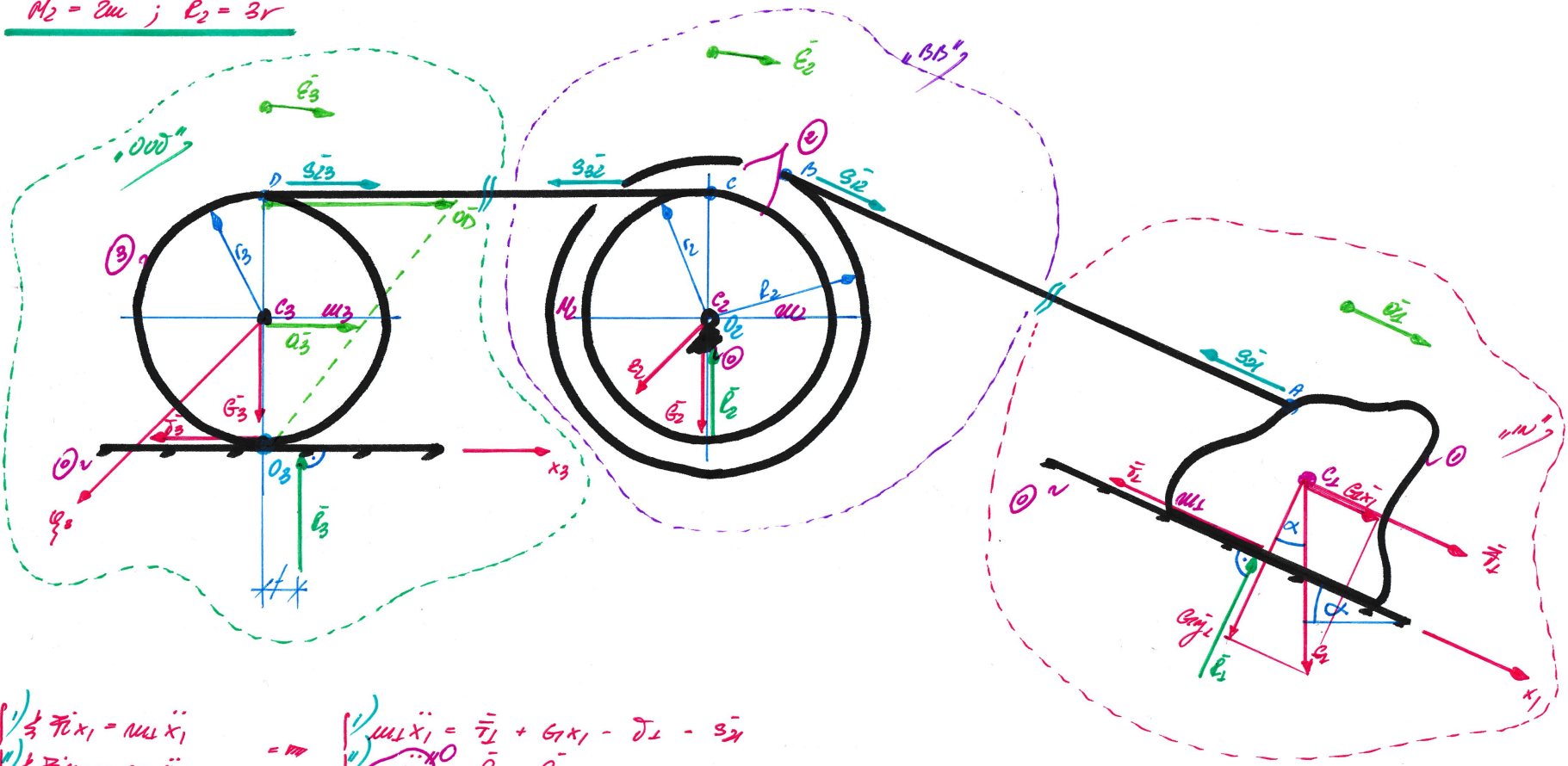
$$x_3''(t), T_3, S = ?$$

1) $\vec{F}_1, \vec{M}_1, \vec{M}_1 = 4m, \alpha = \checkmark$

2) $m_2 = m; r_2 = r$
 $M_2 = 2m; r_2 = 3r$

3) $M_3 = m$
 $r_3 = r$
 $f_3 = 0.001r$

$\vec{F} = m \cdot \vec{a}$
 $\vec{M} = I \cdot \vec{\epsilon}$



1) $\frac{1}{2} \vec{F}_1 x_1 = m_1 \ddot{x}_1$
 $\frac{1}{2} \vec{F}_1 y_1 = m_1 \ddot{y}_1$
 $\Rightarrow \begin{cases} m_1 \ddot{x}_1 = \vec{F}_1 + G_1 x_1 - \vec{J}_1 - \vec{S}_1 \\ m_1 \ddot{y}_1 = \vec{E}_1 - G_1 y_1 \end{cases}$

c) $\frac{1}{2} M_2 \ddot{\varphi}_2 = I_2 \ddot{\varphi}_2$
 $\Rightarrow I_2 \ddot{\varphi}_2 = 3r_2 \cdot \vec{E}_2 - 3r_2 \cdot \vec{F}_2$

3) $\frac{1}{2} \vec{F}_3 x_3 = m_3 \ddot{x}_3$
 $\frac{1}{2} \vec{F}_3 y_3 = m_3 \ddot{y}_3$
 $\frac{1}{2} M_3 \ddot{\varphi}_3 = I_3 \ddot{\varphi}_3$
 $\Rightarrow \begin{cases} m_3 \ddot{x}_3 = 3r_3 \cdot \vec{E}_3 - \vec{J}_3 \\ m_3 \ddot{y}_3 = \vec{E}_3 - G_3 \\ I_3 \ddot{\varphi}_3 = 3r_3 \cdot \vec{F}_3 + \vec{J}_3 \cdot \vec{r}_3 - \vec{E}_3 \cdot \vec{f}_3 \end{cases}$

$$\frac{G_{x_1}}{G} = \sin \alpha \Rightarrow G_{x_1} = m_1 g \sin \alpha$$

$$\frac{G_{y_1}}{G} = \cos \alpha \Rightarrow G_{y_1} = m_1 g \cos \alpha$$

$$\eta_1 = \frac{\vec{r}_1}{l_1} \Rightarrow \vec{r}_1 = \eta_1 l_1$$

$$e) \quad \vec{T}_2 = \frac{1}{2} (m_2 \dot{r}_2^2 + M_0 l_2^2)$$

$$3) \quad G_3 = m_3 g$$

$$\vec{T}_3 = \frac{1}{2} m_3 \dot{r}_3^2$$

$$1) \quad m_1 \ddot{x}_1 = \vec{T}_1 + m_1 g \sin \alpha - \eta_1 l_1 - S_{21}$$

$$2) \quad 0 = l_1 - m_1 g \cos \alpha$$

$$3) \quad \frac{1}{2} (m_2 \dot{r}_2^2 + M_0 l_2^2) \ddot{\varphi}_2 = S_{12} \cdot l_2 - S_{32} \cdot r_2$$

$$\Rightarrow m_3 \ddot{x}_3 = S_{23} - \vec{T}_3$$

$$1) \quad 0 = l_3 - m_3 g$$

$$2) \quad \frac{1}{2} m_3 \dot{r}_3^2 \ddot{\varphi}_3 = S_{23} \cdot r_3 + \vec{T}_3 \cdot r_3 - l_3 \cdot f_3$$

$$0 = l_1 - m_1 g \cos \alpha \Rightarrow l_1 = m_1 g \cos \alpha$$

$$0 = l_3 - m_3 g \Rightarrow l_3 = m_3 g$$

$$1) \quad m_1 \ddot{x}_1 = \vec{T}_1 + m_1 g \sin \alpha - \eta_1 m_1 g \cos \alpha - S_{21}$$

$$2) \quad \frac{1}{2} (m_2 \dot{r}_2^2 + M_0 l_2^2) \ddot{\varphi}_2 = S_{12} \cdot l_2 - S_{32} \cdot r_2$$

$$3) \quad m_3 \ddot{x}_3 = S_{23} - \vec{T}_3$$

$$\frac{1}{2} m_3 \dot{r}_3^2 \ddot{\varphi}_3 = S_{23} \cdot r_3 + \vec{T}_3 \cdot r_3 - m_3 g f_3$$

$$q = \dot{x}_1$$

$$\ddot{x}_1 = \ddot{\varphi}_2 \cdot l_2 \Rightarrow \ddot{\varphi}_2 = \frac{\ddot{x}_1}{l_2}$$

$$\ddot{x}_c = \ddot{\varphi}_2 \cdot r_2 = \frac{r_2}{l_2} \ddot{x}_1$$

$$\ddot{x}_D = \ddot{x}_c = \frac{r_2}{l_2} \ddot{x}_1$$

$$\ddot{x}_D = \ddot{\varphi}_3 \cdot l_{r3} \Rightarrow \ddot{\varphi}_3 = \frac{\ddot{x}_D}{l_{r3}} = \frac{r_2}{l_2 l_{r3}} \ddot{x}_1$$

$$\ddot{x}_3 = \ddot{\varphi}_3 \cdot r_3 = \frac{r_2}{l_2 l_{r3}} \cdot r_3 \cdot \ddot{x}_1 = \frac{r_2}{l_2} \ddot{x}_1$$

$$1) \quad m_1 \ddot{x}_1 = T_1 + m_1 g \sin \alpha - q_1 m_1 g \cos \alpha - S_{21}$$

$$2) \quad \frac{1}{2} (m_2 r_2^2 + M_2 l_2^2) \cdot \frac{\ddot{x}_1}{l_2} = S_{12} l_2 - S_{32} l_2$$

$$3) \quad m_3 \cdot \frac{r_2}{2 l_2} \ddot{x}_1 = S_{23} - T_3$$

$$4) \quad \frac{1}{2} m_3 r_3^2 \cdot \frac{r_2}{2 l_2 r_3} \ddot{x}_1 = S_{23} r_3 + T_3 r_3 - m_3 g r_3$$

4?

$$1) \quad 4m \ddot{x}_1 = T_1 + 4m g \sin \alpha - 4q_1 g \cos \alpha - S_{21}$$

$$2) \quad \frac{1}{2} (m r^2 + 2m \cdot (3r)^2) \cdot \frac{\ddot{x}_1}{3r} = S_{12} \cdot 3r - S_{32} \cdot r$$

$$3) \quad m \cdot \frac{r}{2 \cdot 3r} \ddot{x}_1 = S_{23} - T_3$$

$$4) \quad \frac{1}{2} m \cdot \frac{r}{2 \cdot 3r} \ddot{x}_1 = S_{23} \cdot r + T_3 \cdot r - m g r$$

$$1) \quad 4m \ddot{x}_1 = T_1 + 4m g \sin \alpha - 4q_1 g \cos \alpha - S_{21}$$

$$2) \quad \frac{19}{6} m \ddot{x}_1 = S_{12} \cdot 3r - S_{32} \cdot r$$

$$3) \quad \frac{1}{6} m \ddot{x}_1 = S_{23} - T_3$$

$$4) \quad \frac{1}{12} m \ddot{x}_1 = S_{23} \cdot r + T_3 \cdot r - m g \cdot 0,001r$$

$$1) \quad 4m \ddot{x}_1 = T_1 + 4m g \sin \alpha - 4q_1 m g \cos \alpha - S_{21}$$

$$2) \quad 3,16 m \ddot{x}_1 = 3S_{12} - S_{32}$$

$$3) \quad 0,16 m \ddot{x}_1 = S_{23} - T_3$$

$$4) \quad 0,083 m \ddot{x}_1 = S_{23} + T_3 - 0,001 m g$$

$$5) \quad T_3 = 0,083 m \ddot{x}_1 - S_{23} + 0,001 m g$$

$$6) \quad 0,16 m \ddot{x}_1 = S_{23} - T_3$$

$$0,16 m \ddot{x}_1 = S_{23} - 0,083 m \ddot{x}_1 + S_{23} - 0,001 m g$$

$$0,16 m \ddot{x}_1 + 0,083 m \ddot{x}_1 = 2S_{23} - 0,001 m g$$

$$S_{23} = \frac{0,243 m \ddot{x}_1 + 0,001 m g}{2}$$

$$S_{23} = 0,1215 m \ddot{x}_1 + 0,0005 m g$$

$$7) \quad 3,16 m \ddot{x}_1 = 3S_{12} - S_{32}$$

$$3,16 m \ddot{x}_1 = 3S_{12} - 0,1215 m \ddot{x}_1 - 0,0005 m g$$

$$S_{12} = \frac{3,2815 m \ddot{x}_1 + 0,0005 m g}{3}$$

$$S_{12} = 1,09 m \ddot{x}_1 + 0,00016 m g$$

$$i) \quad 4m\ddot{x}_1 = F_1 + 4mg\sin\alpha - 44_1mg\cos\alpha - S_{21}$$

$$4m\ddot{x}_1 = F_1 + 4mg\sin\alpha - 44_1mg\cos\alpha - 1103m\ddot{x}_1 - 0,00016mg$$

$$4m\ddot{x}_1 + 1,09m\ddot{x}_1 = F_1 + 4mg\sin\alpha - 44_1mg\cos\alpha - 0,00016mg$$

$$5,09m\ddot{x}_1 = F_1 + mg(4\sin\alpha - 44_1\cos\alpha - 0,00016) \quad | : 5,09m$$

$$\ddot{x}_1(t) = \frac{F_1 + (4\sin\alpha - 44_1\cos\alpha - 0,00016)mg}{5,09m} \quad \text{A}$$

$$\ddot{x}_3 = \frac{12}{26} \ddot{x}_1 \Rightarrow \ddot{x}_3(t) = \frac{1}{2,31} \ddot{x}_1(t)$$

$$\ddot{x}_3(t) = 0,16 \ddot{x}_1(t)$$

$$iii) \quad S_{12} = 1103m\ddot{x}_1 + 0,00016mg \Rightarrow S_{12} = (1103 \ddot{x}_1(t) + 0,00016g)m$$

$$iv) \quad S_{23} = 0,1215m\ddot{x}_1 + 0,0005mg \Rightarrow S_{23} = (0,1215 \ddot{x}_1(t) + 0,0005g)m$$

$$vi) \quad T_3 = 0,083m\ddot{x}_1 - S_{23} + 0,001mg$$

$$T_3 = 0,083m\ddot{x}_1 - 0,1215m\ddot{x}_1 - 0,0005mg + 0,001mg$$

$$T_3 = -0,0385m\ddot{x}_1 + 0,0005mg$$

$$T_3 = (-0,0385 \ddot{x}_1(t) + 0,0005g)m$$

