

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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TEORIA MECHANIZMÓW I MANIPULATORÓW

"ANALIZA DYNAMICZNA – RÓWNANIA WEKTOROWE"

PROJEKT

Przeprowadź:

- analizę strukturalną
- analizę dynamiczną

dla układu mechanicznego jarzmowego w zadanym położeniu.

DANE:

$F_1, F_2, M_1, q = OK$

SZUKAM:

$R, M_R = ?$

14)

D: $x_A = 0$ [m] = 0 [cm]

$y_A = 0{,}05$ [m] = 5 [cm]

$x_E = 0{,}16$ [m] = 16 [cm]

$y_E = 0{,}24$ [m] = 24 [cm]

$x_F = 0{,}09$ [m] = 9 [cm]

$y_F = 0$ [m] = 0 [cm]

$|AB| = 0{,}1$ [m] = 10 [cm]

$|AC| = 0{,}1$ [m] = 10 [cm]

$|BC| = 0{,}1$ [m] = 10 [cm]

$|DE| = 0{,}09$ [m] = 9 [cm]

$h_3 = 0{,}03$ [m] = 3 [cm]

$\alpha = 30°$

$\varphi_6 = 15°$

$\bar{F}_2 = 2500$ [N]

$\bar{F}_3 = 900$ [N]

$\bar{e}, \bar{M}_6 = ?$

2) uczniowie.

$W_e = W_T - W_L + W_B$

$W_T = 3k - 2p_1 - p_2$

$k = 5$

$p_1 = 4$

$p_2 = 0$

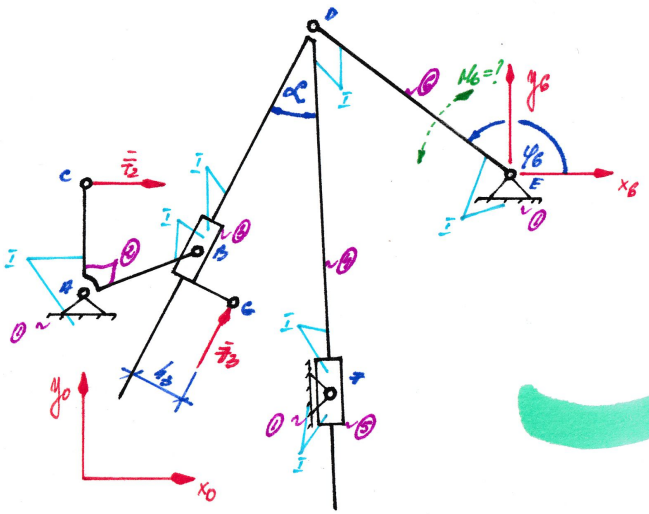
$\Rightarrow W_T = 3 \cdot 5 - 2 \cdot 4 = 15 - 14 = 1$

$W_L = 0$

$W_B = 0$

$\Rightarrow W_e = W_T = 1$

1) schemat technologiczny ucisku.



-1-

3) podobnost (nacrt)

$$M_L = \frac{l}{(l)}$$

$$\Rightarrow M_L = \frac{y_E}{(y_E)} \Rightarrow (y_E) = \frac{y_E}{M_L} = \frac{24}{2} = 12 \text{ [cm]}$$

$$\Rightarrow M_L = 2$$

$$\Rightarrow (x_A) = \frac{x_A}{M_L} = \frac{0}{2} = 0 \text{ [cm]} \qquad (h_3) = \frac{h_3}{M_L} = \frac{3}{2} = 1{,}5 \text{ [cm]}$$

$$(y_A) = \frac{y_A}{M_L} = \frac{5}{2} = 2{,}5 \qquad \alpha = 30°$$

$$(x_E) = \frac{x_E}{M_L} = \frac{16}{2} = 8{,}0 \qquad \varphi_6 = 15°$$

$$(y_E) = \frac{y_E}{M_L} = \frac{24}{2} = 12{,}0$$

$$(x_F) = \frac{x_F}{M_L} = \frac{9}{2} = 4{,}5$$

$$(y_F) = \frac{y_F}{M_L} = \frac{0}{2} = 0$$

$$(|AB|) = \frac{|AB|}{M_L} = \frac{10}{2} = 5{,}0$$

$$(|AC|) = \frac{|AC|}{M_L} = \frac{10}{2} = 5{,}0$$

$$(|BC|) = \frac{|BC|}{M_L} = \frac{10}{2} = 5{,}0$$

$$(|DE|) = \frac{|DE|}{M_L} = \frac{9}{2} = 4{,}5$$

4) analiza mehanizma.

$$\left|\begin{array}{l} 2)\ \sum \vec{T}_{i2} = 0 \\ 3)\ \sum \vec{T}_{i3} = 0 \end{array}\right. \Rightarrow \left|\begin{array}{l} \vec{T}_2 + \vec{l}_{12}^{\,u} + \vec{l}_{12}^{\,v} + \vec{l}_{32} = 0 \\ \vec{T}_3 + \vec{l}_{43} + \vec{l}_{23} = 0 \end{array}\right.$$

$$23)\ \sum \vec{T}_{i23} = 0 \Rightarrow \vec{T}_2 + \vec{l}_{12}^{\,u} + \vec{l}_{12}^{\,v} + \vec{l}_{32} + \vec{T}_3 + \vec{l}_{43} + \vec{l}_{23} = 0$$

$$2)\ \sum M_2^{(13)} = 0 \Rightarrow T_2 \cdot h_2 - l_{12}^{v} \cdot |AB| = 0$$

$$\Rightarrow l_{12}^{v} = \frac{T_2 \cdot h_2}{|AB|}$$

$$(h_2) = 2{,}5 \text{ [cm]} \quad ; \quad M_L = 2$$

$$\Rightarrow h_2 = M_L \cdot (h_2) = 2 \cdot 2{,}5 = 5 \text{ [cm]} = 0{,}05 \text{ [m]}$$

$$\Rightarrow l_{12}^{v} = \frac{T_2 \cdot h_2}{|AB|} = \frac{2500 \cdot 0{,}05}{0{,}1} = \frac{125}{0{,}1} = 1250 \text{ [N]}$$

$$\Rightarrow 23)\ \sum \vec{T}_{i23} = 0 \Rightarrow \vec{T}_2 + \vec{l}_{12}^{\,u} + \vec{l}_{12}^{\,v} + \vec{l}_{32} + \vec{T}_3 + \vec{l}_{43} + \vec{l}_{23} = 0$$

$$\vec{l}_{12}^{\,u} + \vec{l}_{12}^{\,v} + \vec{T}_2 + \vec{T}_3 + \vec{l}_{43} = 0$$

23) $\sum \bar{F}_{i23} = 0 \quad \Rightarrow \quad \bar{R}_{12}^{u} + \bar{R}_{12}^{\bar{t}} + \bar{F}_2 + \bar{F}_3 + \bar{R}_{43} = 0$

$$H_F = \frac{\bar{F}}{(\bar{F})}$$

$\Rightarrow \quad H_F = \frac{\bar{F}_2}{(\bar{F}_2)} \quad \Rightarrow \quad (\bar{F}_2) = \frac{\bar{F}_2}{H_F} = \frac{2800}{1000} = 2{,}80 \ [cm]$

$\Rightarrow \quad H_F = 1000$

$\Rightarrow \quad (\bar{F}_2) = \frac{\bar{F}_2}{H_F} = \frac{2800}{1000} = 2{,}80 \ [cm]$

$(\bar{F}_3) = \frac{\bar{F}_3}{H_F} = \frac{900}{1000} = 0{,}90$

$(\bar{R}_{12}^{\bar{t}}) = \frac{R_{12}^{\bar{t}}}{H_F} = \frac{1250}{1000} = 1{,}25$

$$\begin{cases} (\bar{R}_{12}^{u}) = 5{,}90 \ [cm] \\ (\bar{R}_{43}) = 4{,}46 \end{cases} \quad ; \quad H_F = 1000$$

$$\Rightarrow \quad \begin{cases} R_{12}^{u} = (\bar{R}_{12}^{u}) \cdot H_F = 5{,}90 \cdot 1000 = 6900 \ [N] \\ R_{43} = (\bar{R}_{43}) \cdot H_F = 4{,}45 \cdot 1000 = 4460 \end{cases}$$

$\sum M_B^{(B)} = 0 \quad \Rightarrow \quad R_{43} \cdot h_{43} - \bar{F}_3 \cdot h_3 = 0$

$\Rightarrow \quad h_{43} = \frac{\bar{F}_3 \cdot h_3}{R_{43}}$

$\Rightarrow \quad h_{43} = \frac{900 \cdot 0{,}03}{4460} = \frac{27}{4460} = 6{,}06 \cdot 10^{-3} \ [m] = 0{,}61 \ [cm]$

$\Rightarrow \quad H_L = 2$

$\Rightarrow \quad (h_{43}) = \frac{h_{43}}{H_L} = \frac{0{,}61}{2} = 0{,}305 \ [cm]$

$\Rightarrow \quad (\bar{R}_{12}) = 6{,}0 \ [cm] \quad ; \quad H_F = 1000$

$\Rightarrow \quad R_{12} = (\bar{R}_{12}) \cdot H_F = 6 \cdot 1000 = 6000 \ [N]$

$\sum \vec{F}_{i4} = 0 \Rightarrow \vec{R}_{54} + \vec{R}_{34} + \vec{R}_{64} = 0$

$\Rightarrow R_{34} = R_{43} = 4450 \ [N]$

$H_F = 1000$

$(\bar{R}_{34}) = (\bar{R}_{43}) = 4,45 \ [cm]$

$\Rightarrow \begin{cases} (\bar{R}_{54}) = 3,40 \ [cm] \\ (\bar{R}_{64}) = 2,40 \end{cases}$; $H_F = 1000$

$\Rightarrow \begin{cases} R_{54} = (\bar{R}_{54}) \cdot H_F = 3,40 \cdot 1000 = 3400 \ [N] \\ R_{64} = (\bar{R}_{64}) \cdot H_F = 2,40 \cdot 1000 = 2400 \end{cases}$

$R_{61} = R_{64} = 2400 \ [N]$

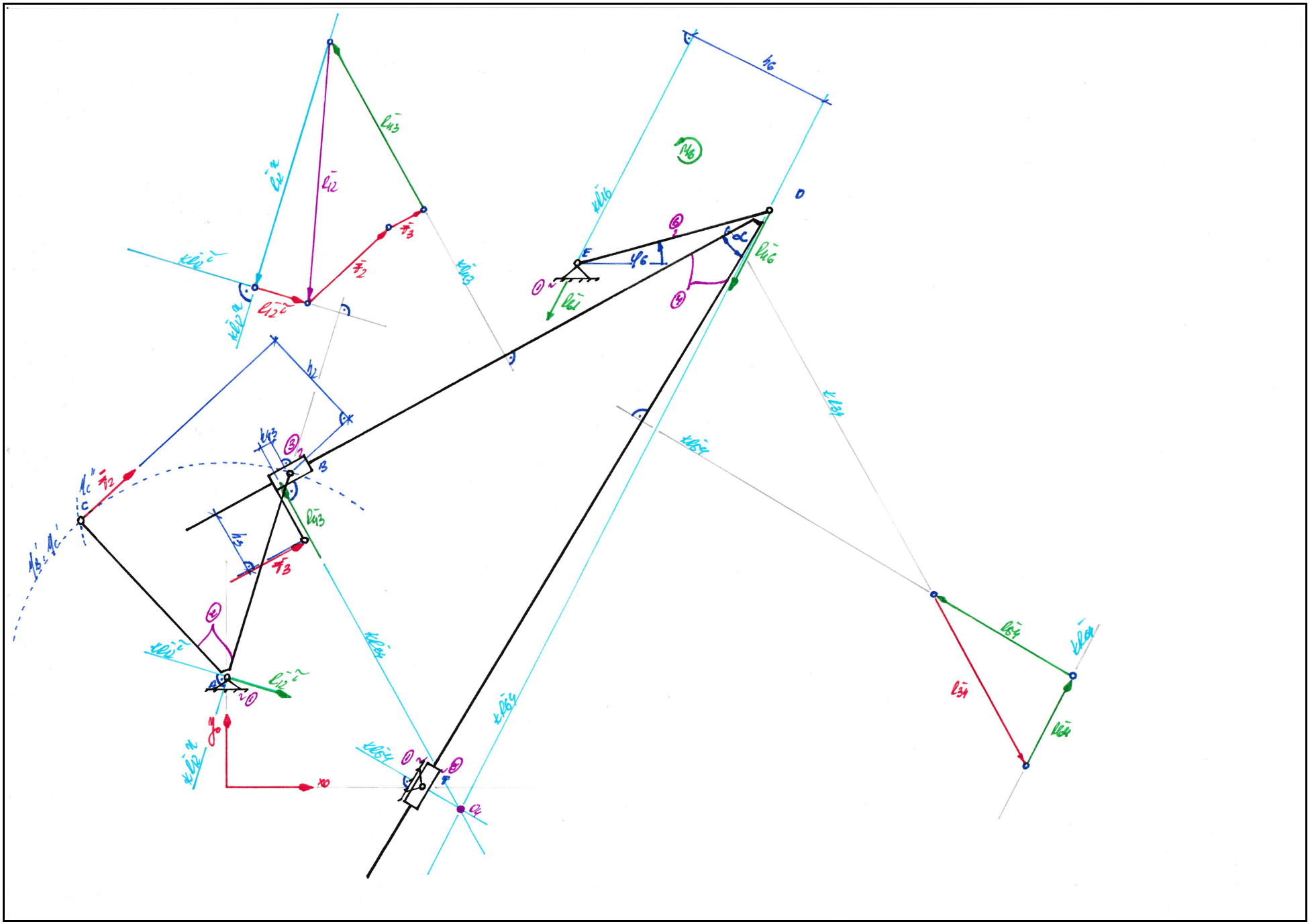
$\sum M_{iG} = 0 \Rightarrow M_G + R_{6G} \cdot h_G = 0$

$\Rightarrow M_G = - R_{6G} \cdot h_G$

$(h_G) = 3,35 \ [cm]$; $H_L = 2$

$\Rightarrow h_G = H_L \cdot (h_G) = 2 \cdot 3,35 = 6,40 \ [cm]$

$\Rightarrow M_G = - 2400 \cdot 0,064 = 160,8 \ [Nm]$




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