Dane: $m = 0{,}5\ kg$, $V_A = 0\ \frac{m}{s}$, $T_{BD} = 0{,}2\ s$

$R = 0{,}5\ m$, $f = 0{,}2$, $h_0 = 50\ cm$, $c = 0{,}8\ N/cm$

$\beta = 30^\circ$, $\alpha = 45^\circ$

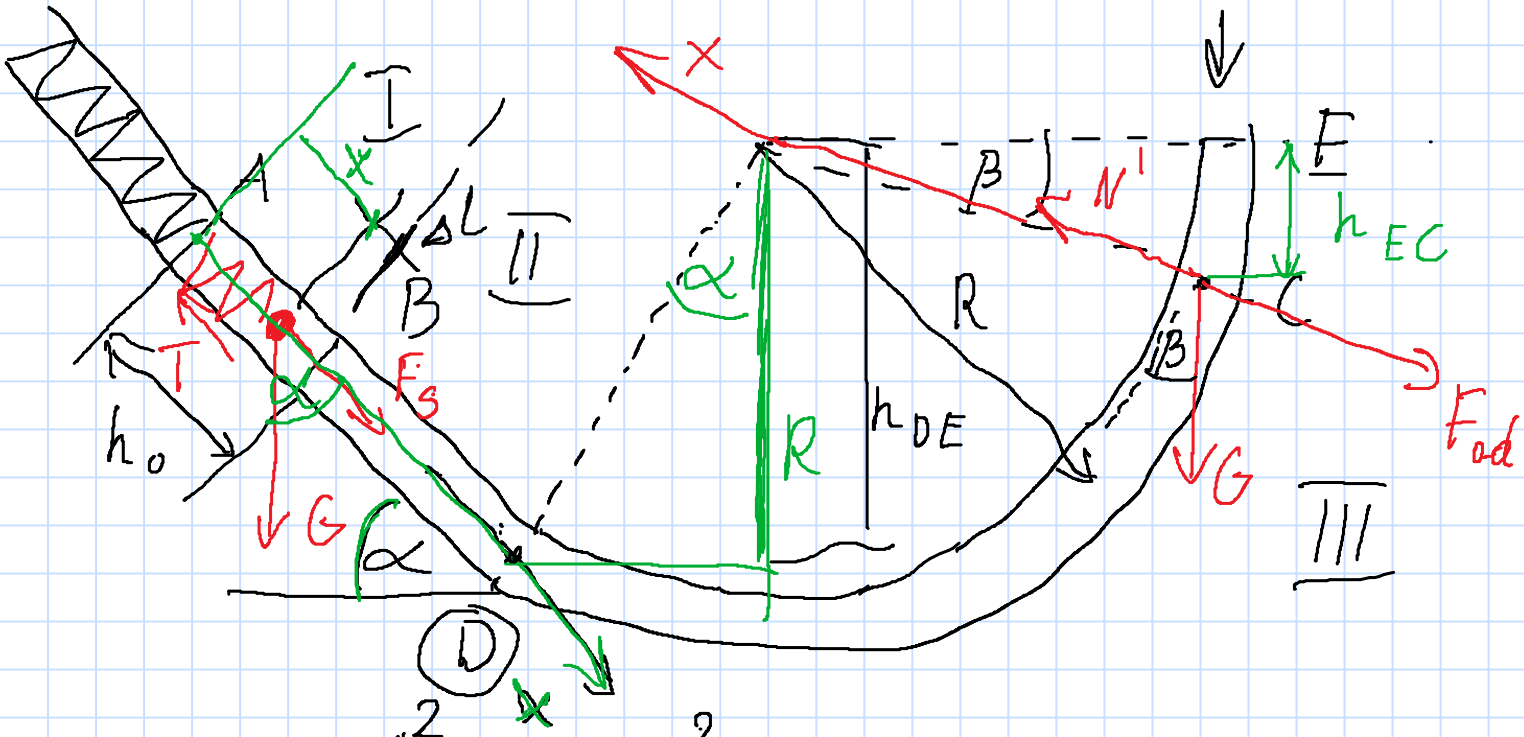
$c = 80\ N/m$

Szukane

V_D i N_C

$F_S = c \cdot \Delta l$

$\Delta l = h_0 - x$



I $\quad \frac{mV_B^2}{2} - \frac{mV_A^2}{2} = \int_S \Sigma F_{ix}\, dx$

II $\quad mV_D - mV_B = \int_T \Sigma F_{ix}\, dt$

III $\quad E_1 = E_2$

$\frac{mV_B^2}{2} - \frac{mV_A^2}{2} = \int [+G\cos\alpha + c(h_0 - x) - h_0 - G \cdot f \sin\alpha]\, dx$

$$\frac{m V_B^2}{2} = \int_0^{h_0} \left(G\cos\alpha + c\,h_0 - G f \sin\alpha - c\cdot x\right) dx$$

$$h_0\left(G\cos\alpha \cdot x + c h_0 x - G f \sin\alpha \cdot x - c\frac{x^2}{2}\right)\Big|_0^{h_0}$$

$$\frac{m V_B^2}{2} = \left(G\cos\alpha - G f \sin\alpha\right) h_0 + c h_0^2 - c\frac{h_0^2}{2}$$

$$V_B = \sqrt{\frac{2 \cdot G h_0 (\cos\alpha - f \sin\alpha)}{m} + \frac{c h_0^2}{2m}}$$

$$V_B = \sqrt{\frac{2 \cdot 5 \cdot 0{,}5 \cdot 0{,}566}{0{,}5} + \frac{80 \cdot 0{,}25}{0{,}5}}$$

$$V_B = \sqrt{5{,}66 + 40} = 6{,}75 \ \frac{m}{s}$$

II

$$m V_D - m V_B = \int_{T_{BD}} \left(G\cos\alpha - G f \sin\alpha\right) dt$$

$$m V_D - m V_B = G(\cos\alpha - f \sin\alpha)\, T_{BD}$$

$$V_D = V_B + g(\cos\alpha - f \sin\alpha)\, T_{BD}$$

$$V_D = 6{,}75 + 10 \cdot 0{,}566 \cdot 0{,}2 = 6{,}75 + 1{,}132$$

$$V_B = 7{,}882$$

III

$$E_{kD} + E_{pD} = E_{kE} + E_{pE}$$ ($E_{pD} = 0$)

$$\frac{m V_D^2}{2} = \frac{m V_E^2}{2} + m g h_{DE}$$

$$h_{DE} = R \cos\alpha$$

$$V_E = \sqrt{V_D^2 - 2 g R \cos\alpha}$$

$$V_E = \sqrt{7,882^2 - 2 \cdot 10 \cdot 0,5 \cdot 0,707}$$

$$V_E = \sqrt{62,12 - 7,07} = \sqrt{55,05} \approx 7,42$$

$$V_E = 7,42$$

$$E_{kC} + E_{pC} = E_{kE} + E_{pE}$$ ($E_{pC} = 0$)

$$h_{EC} = R \sin\beta$$

$$\frac{m V_C^2}{2} = \frac{m V_E^2}{2} + m g h_{EC}$$

$$V_C = \sqrt{V_E^2 + 2 g R \sin\beta}$$

$$V_C = \sqrt{7,42^2 + 2 \cdot 10 \cdot 0,5 \cdot 0,5}$$

$$V_C = \sqrt{55,06 + 5} = 7,75$$

$$N' - G \sin\beta - F_{od} = 0$$

$$F_{od} = \frac{m V_c^2}{R}$$

$$N' = \underset{10 \cdot 0{,}5}{G} \sin\beta + \frac{m V_c^2}{R}$$

$$N' = 10 \cdot 0{,}5 \cdot 0{,}5 + \frac{0{,}5 \cdot 60{,}06}{0{,}5}$$

$$N = 2{,}5 + 60{,}06 = 62{,}56$$