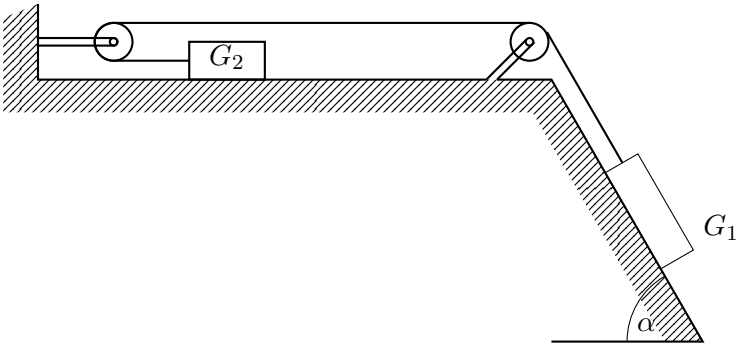
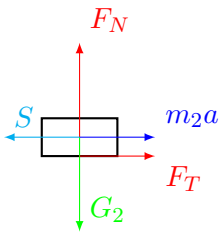
TEHNIČKA MEHANIKA
2016./2017.
ZAVRŠNI ISPIT

1. Zadano:$\mu = 0.2$, $\alpha = 60°$, $G_1 = 2G$, $G_2 = G$, $G = 10kN$. Traži se: a, S. D'Alembert



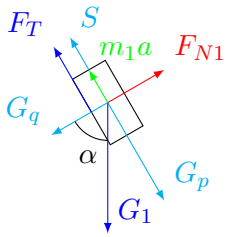


$$\sum F_x = -S + m_2a + F_T = 0 \tag{1}$$

$$\sum F_y = F_N - G_2 = 0 \tag{2}$$

iz (1) i (2) se dobije:

$$S = \frac{G_2}{g}a + F_T = \frac{G_2}{g}a + \mu G_2 \tag{3}$$



$$\sum F_x = G_1 \sin\alpha - S - m_1a - F_T = 0 \tag{4}$$

$$\sum F_y = F_{N1} - G_1 \cos\alpha = 0 \tag{5}$$

iz (4) i (5) se dobije:

$$S = G_1 \sin\alpha - \mu G_1 \cos\alpha - \frac{G_1}{g} a \tag{6}$$

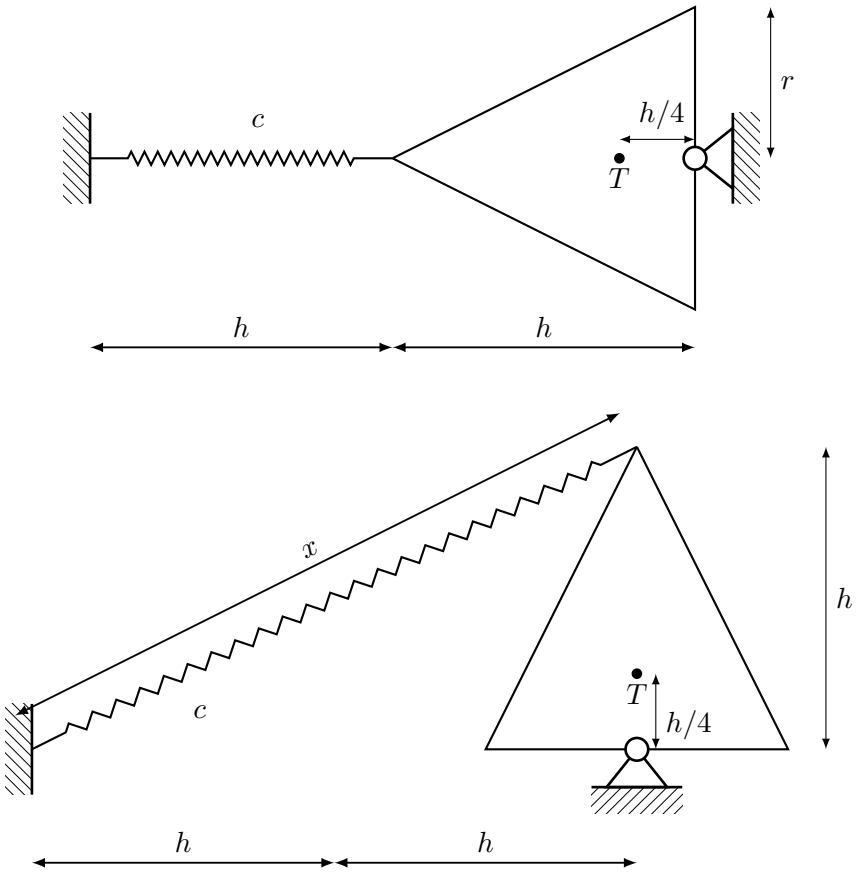
(3)i(6)

$$a = g\frac{G_1(\sin\alpha - \mu\cos\alpha) - G_2\mu}{G_1 + G_2} = 4.36\,\frac{\mathrm{m}}{\mathrm{s}^2} \tag{7}$$

iz (3)

$$S = 6.44\,\mathrm{kN} \tag{8}$$

2. Stožac se otkloni za kut $\pi/2$. Izračnati kutnu brzinu dok prolazi kroz početni položaj kada opruga nije rastegnuta. Zadano:m, r, $h = 2r$, c, $J_T = \frac{3}{10}mr^2$. Koristiti Z.K.E.



Prema Steineru:

$$J_O = J_T + m(\frac{h}{4})^2 \tag{1}$$

$$J_O = \frac{3}{10}mr^2 + m(\frac{2r}{4})^2 = \frac{11}{20}mr^2 \tag{2}$$

Z.K.E.:

$$E_k = E_p \tag{3}$$

$$\frac{J_O\omega^2}{2} = \frac{1}{2}c(\Delta x)^2 + mg\frac{h}{4} \tag{4}$$

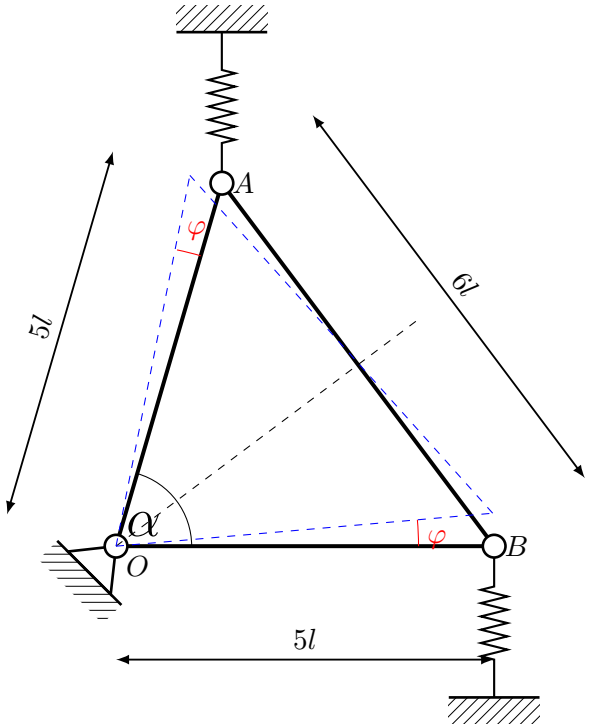
$$\Delta x = x - h = \sqrt{(2h)^2 + (h)^2} - h = h(\sqrt{5} - 1) \tag{5}$$

(2) i (5) u (4), nakon sređivanja dobije se:

$$\omega = \sqrt{\frac{20}{11}\frac{g}{r} + \frac{160(3-\sqrt{5})}{11}\frac{c}{m}} \tag{6}$$

USMENI ISPIT

1. Odrediti frekvenciju titranja. Sustav se nalazi u horizontalnoj ravnini. Zadano: m, l, c.



$$J_{OA}\Big|_O = J_{OB}\Big|_O = \frac{\frac{5}{16}m(5l)^2}{3} = \frac{125}{48}ml^2 \tag{1}$$

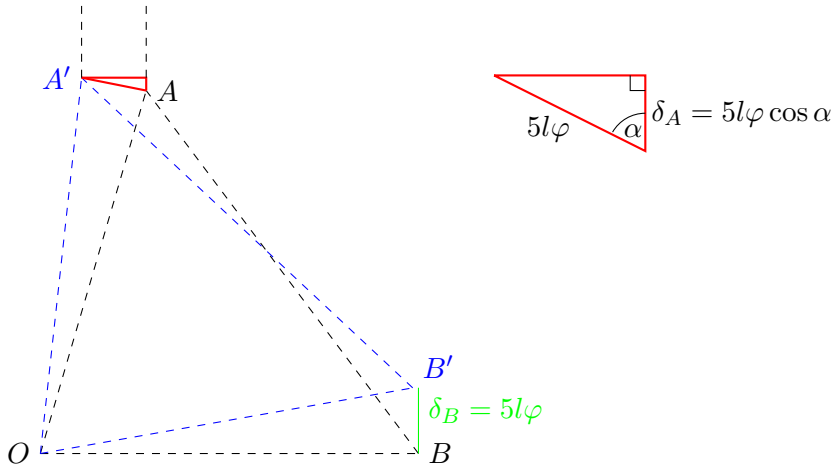
$$J_{AB}\Big|_O = J_{AB}\Big|_T + \frac{6}{16}m(4l)^2 = \frac{\frac{6}{16}m(6l)^2}{12} + \frac{3}{8}m(4l)^2 = \frac{57}{8}ml^2 \tag{2}$$

Za male vibracije vrijedi:

$$E_k + E_p = konst. \tag{3}$$

$$E_k = \frac{J_{OA}\dot{\varphi}^2}{2} + \frac{J_{OB}\dot{\varphi}^2}{2} + \frac{J_{AB}\dot{\varphi}^2}{2} \tag{4}$$

$$E_p = \frac{c(\delta_A)^2}{2} + \frac{c(\delta_B)^2}{2} \tag{5}$$



iz (4) se dobije:

$$E_k = \frac{37}{6} m l^2 \dot{\varphi}^2 \tag{6}$$

iz (5) uz sliku:

$$E_p = \frac{25}{2} c l^2 \varphi^2 (1 + \cos^2 \alpha) \tag{7}$$

(6) i (7) u (3):

$$E_k + E_p = \frac{37}{6} m l^2 \dot{\varphi}^2 + \frac{25}{2} c l^2 \varphi^2 (1 + \cos^2 \alpha) = konst. \Big/ \frac{d}{dt} \tag{8}$$

$$2\cancel{\dot{\varphi}}\ddot{\varphi}\frac{37}{6} m \cancel{l^2} + 25 c \cancel{l^2} \varphi \cancel{\dot{\varphi}} (1 + \cos^2 \alpha) = 0 \tag{9}$$

$$\omega = \sqrt{\frac{75}{37}(1 + \cos^2 \alpha)\frac{c}{m}} \tag{10}$$