Modul 10 - Zadaci

Saturday, January 6, 2024 3:47 PM

10.3) $a = 0,180\,m$

$F_1 = 18,0\,N$

$F_2 = 26,0\,N$

$F_3 = 14,0\,N$

$d = a\sqrt{2}$, $\frac{d}{2} = \frac{a\sqrt{2}}{2}$

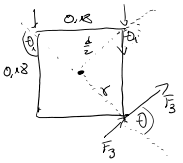
$M_O^{\vec{F}_1} = F_1 \frac{d}{2} \sin(135°)(-1)$

$M_O^{\vec{F}_2} = F_2 \frac{d}{2} \sin(135°)$

$M_O^{\vec{F}_3} = F_3 \cdot \frac{d}{2} \cdot \sin(90°)$

$M_O = \frac{d}{2}\sin(135°)(-F_1 + F_2) + F_3 \frac{d}{2}$

$\boxed{M_O = 2,50\,Nm}$



$\vartheta_1 = 90° + 45° = 135°$

10.17) $m_A = 12,0\,kg$ → kutija

$m_B = 5,00\,kg$ → teg

$m_C = 2,00\,kg$ → kotur (homogen disk)

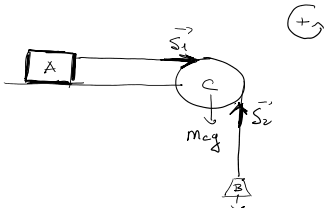
$r_C = 0,50\,m$

a) $S_1, S_2 = ?$

b) $a_A = ?$

c) $X_O = ?$ $Y_O = ?$

$\boxed{a = R\varepsilon}$



A) $F = ma$

$S_1 = m_A a$

B) $m_B a = m_B g - S_2 \Rightarrow S_2 = m_B(g - a)$

C) $(S_2 - S_1) r_C = J\varepsilon$

$(m_B g - m_B a - m_A a) R = \frac{1}{2} m_C r_C^2 \varepsilon$

$m_B g - a(m_B + m_A) = \frac{1}{2} m_C a$

$m_B g = m_C a \frac{1}{2} + a(m_B + m_A)$

$a = \frac{m_B g}{\frac{1}{2} m_A + m_B + m_A}$ $\boxed{a = 2,725\,m/s^2}$

$X_O = S_1$

$Y_O = m_C g + S_2$

$\boxed{X_O = 32,7\,N}$

$\boxed{Y_O = 55,045\,N}$

$\boxed{S_1 = 32,7\,N}$

$\boxed{S_2 = 35,425\,N}$

10.32) $9\,kJ = 9 \cdot 10^3\,J$

$t_1 = 1\,min = 60\,s$

$E = \frac{2}{3} A = 6 \cdot 10^3\,J$

$\omega_2 = 2500\,°/min \cdot \frac{\pi}{30°/s}$

$A = \frac{E}{t_1}$ $\boxed{A = 100\,W}$

$\omega_2 = 261,79\,rad/s$

$A = M_2 \omega_2 \Rightarrow M_2 = \frac{A}{\omega_2}$

$\boxed{M_2 = 0,3819\,Nm}$

10.35) a) $P = 150\,kW = 150 \cdot 10^3\,W$

$\omega_2 = 4000\,°/min \cdot \frac{\pi}{30°/s}$

$\boxed{\omega_2 = 418,879\,rad/s}$

$M_2 = ?$

$M_2 = \frac{P}{\omega_2}$ $\boxed{M_2 = 358\,Nm}$

c) $v = ?$

$v = r_A \cdot \omega_2$

$\boxed{v = 83,77\,m/s}$

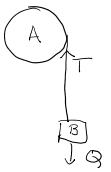
b) $R_A = 0,40\,m$

$r_A = 0,2\,m$

$Q = ?$

$\omega \to const.$

$\Rightarrow a = 0$



$Q = T$

$M_2 = r_A \cdot T$

$T = \frac{M_2}{r_A} \Rightarrow Q = \frac{M_2}{r_A}$

$\boxed{Q = 1790\,N}$

10.42) $m = 0{,}025\ kg$

$r_1 = 0{,}3\ m$

$\omega_1 = 1{,}75\ rad/s$

$r_2 = 0{,}15\ m \Rightarrow r_2 = \frac{r_1}{2}$

a) $K_1 = \frac{1}{2} J \omega_1^2$

?

b) $L_1 = L_2$

blok je materijalna točka

$\Rightarrow J = mr^2$

$J_1 \omega_1 = J_2 \omega_2$

$m r_1^2 \omega_1 = m r_2^2 \omega_2$

$\omega_2 = \left(\frac{r_1}{r_2}\right)^2 \omega_1$

$\boxed{\omega_2 = 7\ rad/s}$

c) $\Delta E_k = ?$

$E_{k1} = \frac{1}{2} J_1 \omega_1^2$

$E_{k2} = \frac{1}{2} J_2 \omega_2^2$

$\Delta E_k = E_{k2} - E_{k1}$

$\Delta E_k = \frac{1}{2} m \left(r_2^2 \omega_2^2 - r_1^2 \omega_1^2\right)$

$\boxed{\Delta E_k = 0{,}0103\ J}$

d) $A = \Delta E_k$

$\Rightarrow \boxed{A = 0{,}0103\ J}$

10.46) $l = 1{,}00\ m$

$h = 2\ m$

$m_v = 40\ kg$

$m_b = 0{,}5\ kg$

$v_0 = 12\ m/s$

$\omega = ?$

$J = ?$

$\omega = \frac{L_b}{J}$

$L_b = J_B \omega$

$L_b = J_B \frac{v_0}{0{,}5 l}$

$J_B = m_b \left(\frac{l}{2}\right)^2$

$L_b = m_b \left(\frac{l}{2}\right)^2 \cdot \frac{v_0}{\frac{l}{2}} = m_b v_0 \frac{l}{2} \Rightarrow \boxed{L_b = 3}$

$J = J_B + J_v = m_b \left(\frac{l}{2}\right)^2 + \frac{1}{3} m_v l^2$

$\boxed{J = 13{,}458\overline{3}}$

$\Rightarrow \omega = \frac{L_B}{J}$

$\boxed{\omega = 0{,}2229\ \frac{rad}{s}}$

10.59) $R_k = 0{,}52\ m \Rightarrow \boxed{r_k = 0{,}26\ m}$

$m_k = 50\ kg$

$\omega = 850\ °/min \cdot \frac{\pi\ rad}{30°/sec}$

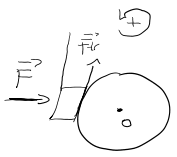
$\boxed{\omega_2 = 89{,}0\ rad/s}$

$F = 160\ N$

$t_1 = 7{,}5\ s$

$\omega(t_1) = 0$

$\mu_k = ?$



$F_{tr} = \mu_k F$

$\omega_2 = \varepsilon_0 t_1 + \omega_0$

$\varepsilon_0 = \frac{\omega_2 - \omega_0}{t_1}$

$\boxed{\varepsilon_0 = -11{,}8\overline{6}\ rad/s^2}$

$\sum M_O^{\vec{F}_i} = J_z \varepsilon_z$

$-F_{tr} r_k = \varepsilon_0 \frac{1}{2} m_k r_k^2$

$-\mu_k F = \varepsilon_0 m_k r_k \frac{1}{2}$

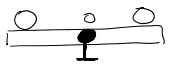
$\mu_k = -\frac{\varepsilon_0 m_k r_k}{2F}$

$\boxed{\mu_k = 0{,}4818}$

10.63) $m_š = 3{,}80\ kg$

$l = 80{,}0\ cm = 0{,}80\ m$

$m_1 = m_2 = m = 2{,}50\ kg$



a) $\varepsilon_0 = ?$

$\sum M_O^{\vec{F}_i} = J_z \varepsilon_0$

$J_š = \frac{1}{12} m_š l^2$

$J_{t_0} = m_t \left(\frac{l}{2}\right)^2$

$M_O^{m_š} = mg\left(\frac{l}{2}\right)$

$mg\left(\frac{l}{2}\right) = \left(\frac{1}{12} m_š l^2 + m_t \left(\frac{l}{2}\right)^2\right) \varepsilon_0$

$\varepsilon_0 = \frac{mg\frac{l}{2}}{\frac{1}{12} m_š l^2 + m_t \left(\frac{l}{2}\right)^2}$

$\boxed{\varepsilon_0 = 16{,}277\ rad/s^2}$

c) $K_1 + \Pi_1 = K_2 + \Pi_2$

$K_1 = 0$

$\Pi_1 = 0$

$\Pi_2 = mg\left(-\frac{l}{2}\right)$

$K_2 = \frac{1}{2}\left(J_š + J_{t_0}\right)\omega^2$

$K_2 + \Pi_2 = 0$

$\Rightarrow \frac{1}{2}\left(\frac{1}{12} m_š l^2 + m_t \left(\frac{l}{2}\right)^2\right)\omega^2 = -mg\left(-\frac{l}{2}\right)$

$$\varepsilon_0 = \frac{mg\frac{l}{2}}{\frac{1}{12}ml^2 + m\left(\frac{l}{2}\right)^2}$$

$\boxed{\varepsilon_0 = 16{,}27\ rad/s^2}$

$$\Rightarrow \frac{1}{2}\left(\frac{1}{12}ml^2 + m\left(\frac{l}{2}\right)^2\right)\omega^2 = -mg\left(-\frac{l}{2}\right)$$

$$\omega = \sqrt{\frac{mgl}{\frac{1}{12}ml^2 + m\left(\frac{l}{2}\right)^2}}$$

$\boxed{\omega = 5{,}70\ rad/s}$

b) neće, štap će se naginjati i ubrzanje će se smanjivati

10.69) $m_r = 16{,}0\,kg$

$r_r = 18{,}0\,cm = 0{,}18\,m$

$J = 0{,}26\,kgm^2$

$\alpha = 30°$

$\mu_D = 0{,}25$

$F = 40{,}0\,N$

a) $F_{os} = ?$

$F_{os}\cos\alpha = F_{tr} + F + Q$

$F_{os}\sin\alpha = n$

$F_{tr} = \mu_D n$

$F_{os}\cos\alpha = \mu_D n + F + Q$

$\mu_d n = F_{os}\cos\alpha - F - Q$

$F_{os}\sin\alpha\,\mu_d = F_{os}\cos\alpha - F - Q$

$F + Q = F_{os}(\cos\alpha - \sin\alpha\,\mu_D)$

$$F_{os} = \frac{F+Q}{\cos\alpha - \sin\alpha\,\mu_d}$$

$\boxed{F_{os} = 265{,}79\,N}$

b) $\varepsilon_p = ?$

$M_0 = (F - F_{tr})r$

$$\varepsilon_p = \frac{(F - F_{tr})r}{J}$$

$F_{tr} = \mu_d n = \mu_d F_{os}\sin\alpha$

$$\varepsilon_p = \frac{(F - \mu_d F_{os}\sin\alpha)r}{J}$$

$\boxed{\varepsilon_p = 4{,}69\ rad/s^2}$

10.70) $m = 5\,kg$

$\alpha = 36{,}9°$

$\mu_D = 0{,}25$

$m_V = 2{,}50\,kg$

$J = 0{,}5\,kgm^2$

$l_{\check{z}} = 0{,}2\,m$

a) $\varepsilon = ?$

$\varepsilon = \frac{M}{J}$

$r_V = l_{\check{z}}$

$T r_V = l_{\check{z}}\varepsilon \qquad \varepsilon = \frac{a}{r} \Rightarrow T r_V = l_{\check{z}}\frac{a}{r}$

$\sum F_y = ma$

$N - mg\cos\alpha = 0$

$N = mg\cos\alpha$

$F_{tr} = \mu_D N = \mu_D mg\cos\alpha$

$\sum F_x = ma$

$mg\sin\alpha - T - F_{tr} = ma$

$mg\sin\alpha - T - mg\mu_D\cos\alpha = ma$

$mg(\sin\alpha - \mu_D\cos\alpha) - T = ma$

$$mg(\sin\alpha - \mu_D\cos\alpha) - \frac{Ja}{r_V^2} = ma$$

$$mg(\sin\alpha - \mu_D\cos\alpha) = ma + \frac{Ja}{r_V^2}$$

$$mg(\sin\alpha - \mu_D\cos\alpha) = a\left(m + \frac{J}{r_V^2}\right)$$

$$a = \frac{mg(\sin\alpha - \mu_D\cos\alpha)}{m + \frac{J}{r_V^2}}$$

$\boxed{a = 1{,}122\ m/s^2}$

b) $T = ?$

$T = mg(\sin\alpha - \cos\alpha\,\mu_D) - ma$

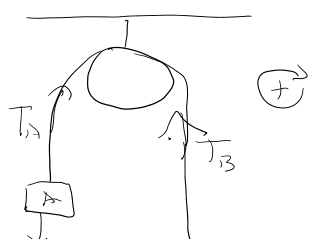
$\boxed{T = 14{,}03\,N}$

! mg se razlaže na x i y komponente

10.73) $Q_1 = 50\,N$

$Q = mkg$

$mk = 5{,}09\,kg$



$m_k = 5{,}05\,kg$

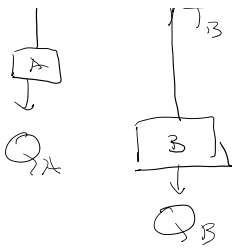
$r_k = 0{,}3\,m$

$Q_A = 75N$

$Q_B = 125N$

$m_a = 7{,}64\,kg$

$m_b = 12{,}74\,kg$



$m_A a = T_A - Q_A \Rightarrow T_A = m_A a + Q_A$

$m_B a = Q_B - T_B \Rightarrow T_B = Q_B - m_B a$

$(T_B - T_A) r_k = \left(\frac{1}{2} m_k r_k^2\right) \varepsilon$

$T_B - T_A = \frac{1}{2} m_k r_k \frac{a}{r_k}$

$T_B - T_A = \frac{1}{2} m_k a$

$Q_B - m_B a - m_A a - Q_A = \frac{1}{2} m_k a$

$Q_B - Q_A = \frac{1}{2} m_k a + a(m_B + m_A)$

$Q_B - Q_A = a\left(\frac{1}{2} m_k + m_B + m_A\right)$

$$a = \frac{Q_B - Q_A}{\frac{1}{2} m_k + m_B + m_A}$$

$a = 2{,}18\,m/s^2$

$F = T_A + T_B + Q_v$

$T_A = 91{,}65N$

$T_B = 97{,}22N$

$F = 238{,}87N$