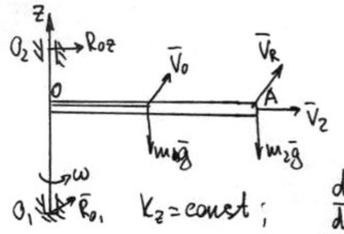


Дано: $OA = 2l$

m_1, m_2

$OB = l,\ \omega = \omega_0$

в кон. пол. $OA = 2l$;

ω - ?

$K_z = const$; $\quad \dfrac{dK_z}{dt} = \sum M_z(\bar{F}_k^{(e)}) = 0$

в нач. пол-ии: $\omega = \omega_0$; $V_0 = \omega_0 l$

$K_{z0} = J_z\omega_0 + mV_0 l = \frac{1}{3}m_1(2l)^2\omega_0 + m_2\omega_0 l^2 =$

$= \left(\frac{4}{3}m_1 + m_2\right)l^2\omega_0$

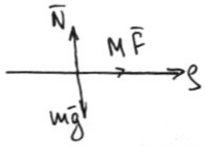
в кон. пол-ии $\quad \omega,\ V_2 = \omega\cdot 2l$

$K_z = J_z\omega + m\cdot V_e\cdot 2l = \frac{4}{3}m_1 l^2\omega + m_2\omega\cdot 4l^2 =$

$= \left(\frac{4}{3}m_1 + 4m_2\right)l^2\omega_0$

$\left(\frac{4}{3}m_1 + m_2\right)l^2\omega_0 = \left(\frac{4}{3}m_1 + 4m_2\right)l^2\omega$

$$\omega = \frac{4/3\, m_1 + m_2}{4/3\, m_1 + 4m_2}\cdot\omega_0$$



Дано: $m,\ V_0 = 0,\ F = F_0\left(1 - \frac{S}{l}\right)$

при $S - l$ - ?

$m\bar{a} = m\bar{g} + \bar{N} + \bar{F}$; в проекции S

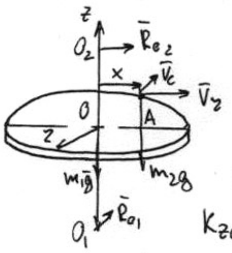
$m\dfrac{dV}{dt} = F = F_0\left(1 - \dfrac{S}{l}\right)$; $\dfrac{dV}{dt} = \dfrac{F_0}{m}\left(1 - \dfrac{S}{l}\right)$

$\dfrac{dV}{dt}\cdot\dfrac{dS}{dS} = \dfrac{dS}{dt}\cdot\dfrac{dV}{dS} = V\dfrac{dV}{dS} = \dfrac{F_0}{m}\left(1 - \dfrac{S}{l}\right)$

$VdV = \dfrac{F_0}{m}\left(1 - \dfrac{S}{l}\right)dS$

$\dfrac{V^2}{2} = \dfrac{F_0}{m}\left(S - \dfrac{S^2}{2l}\right) + C_1$; н.у. $S = 0,\ V = 0,\ C_1 = 0$

$V^2 = \dfrac{2F_0}{m}\left(S - \dfrac{S^2}{2l}\right)$; при $S = l$; $V = \sqrt{\dfrac{F_0}{m}l}$



Дано: m_1, r, ω_0, m_2

$\omega = \omega(x)$ - ?

$\dfrac{dK_z}{dt} = \sum M_z(\bar{F}_k^{(e)}) = 0$

$K_z = const$

$K_{z0} = J_z\omega_0 = \dfrac{m_1 r^2}{2}\omega_0$

$K_z = J_z\omega + mV_e\cdot x$; $V_e = \omega x$

$K_z = \dfrac{m_1 r^2}{2}\omega + mx^2\omega$; $K_{z0} = K_z$

$$\omega = \frac{m_1 r^2}{m_1 r^2 + 2m_2 r^2}\cdot\omega_0$$

Дано: $m, r, \omega_0, M_c = \alpha\omega$

$\omega = \frac{\omega_0}{2}$, время T - ?

$J\varepsilon = \sum M_z(\bar{F}_k^{(e)}) = -M_c = -\alpha\omega$

$\varepsilon = \dfrac{d\omega}{dt} = -\dfrac{\alpha}{J}\omega$

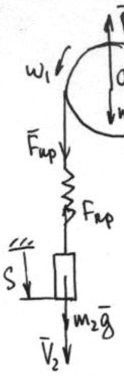
$\dfrac{d\omega}{\omega} = -\dfrac{\alpha}{J}dt$, интегрируем

$\ln\omega = -\dfrac{\alpha}{J}t + C_1$; нач. усл. $t = 0,\ \omega = \omega_0$

$\ln\omega_0 = C_1$; $\ln\omega = -\dfrac{\alpha}{J}t + \ln\omega_0$; $t = \dfrac{J}{\alpha}\ln\dfrac{\omega_0}{\omega}$

$t = T$; $\omega = \dfrac{\omega_0}{2}$; $T = \dfrac{J}{\alpha}\ln 2$; $J = \dfrac{mr^2}{2}$

$$T = \frac{mr^2}{2\alpha}\cdot\ln 2$$



Дано: $m_1, r, m_2, M=M_0\sin pt, c$

T-? Q_S-? Q_φ-?

$\sum F_{kS}=0;\ m_2 g-F_{ст}=0,$

$m_2 g=F_{ст}=c\Delta_{ст};\ \omega_1=\dot\varphi;\ V_2=\dot S$

$\Delta_{ст}=\frac{m_2 g}{c};\ F_{уп}=c\Delta,\ \Delta=\Delta_{ст}+S-r\varphi$

$T=T_1+T_2;\ T_1=\frac12 J_{oz}\omega_1^2=\frac12\frac{m_1 r^2}{2}\dot\varphi^2$

$T_2=\frac12 m_2 V_2^2=\frac12 m_2\dot S^2$

$T=\frac14 m_1 r_1^2\dot\varphi^2+\frac12 m_2\dot S^2$

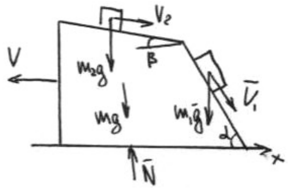
$Q_\varphi=\frac{\sum(\delta A(\bar F_k))_\varphi}{\delta\varphi};\ \delta S>0,\ \delta\varphi=0;\ Q_\varphi=\frac{M\delta\varphi+F_{уп}\cdot r\delta\varphi}{\delta\varphi}=$

$=M+F_{уп}\cdot r=M+c(\Delta_{ст}+S-r\varphi)$

$Q_S=\frac{\sum(\delta A(\bar F_k))_S}{\delta S};\ \delta\varphi=0,\ \delta S=0;\ Q_S=\frac{m_1 g\delta S-F_{уп}\delta S}{\delta S}=$

$=m_2 g-F_{уп}=$

$=m_2 g-c(\Delta_{ст}+S-r\varphi)=-c(S-r\varphi)$



Дано: m, m_1, m_2

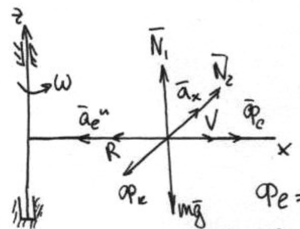
V_1, V_2, V

$\frac{dQ_x}{dt}=\sum F_{kx}^{(e)}=0$

$Q_x=const=Q_{x_0}=0$

$Q_x=-(m+m_2+m_1)V+m_1V_1\cos\alpha+m_2V_2\cos\beta=0$

$V=\frac{m_1V_1\cos\alpha+m_2V_2\cos\beta}{m_1+m_2+m}$



Дано: $\omega=const;\ R=\mu V$

$t=0, V=0, x=l$

Найти $x=x(t)$

$\bar\Phi_e=-m\bar a_e^n;\ \bar a_e^n=\omega^2 x$

$\Phi_e=m\omega^2 x;\ \bar\Phi_k=-m\bar a_k$

$a_k=2\omega V_2=2\omega\dot x\Rightarrow\Phi_k=2m\omega\dot x$

$m\bar a_r=m\bar g+\bar N_1+\bar N_2+\bar R+\Phi_e+\Phi_k$

т. x: $m\ddot x=\sum f_{kx}=\Phi_e-R=m\omega^2 x-\mu\dot x;\ \ddot x+\frac{\mu}{m}\dot x-\omega^2 x=0$

Характ. ур-ие: $\lambda^2+\frac{\mu}{m}\lambda-\omega^2=0;\ \lambda_{1,2}=-\frac{\mu}{2m}\pm\sqrt{\left(\frac{\mu}{2m}\right)^2+\omega^2}$

$x=C_1e^{\lambda_1 t}+C_2e^{\lambda_2 t};\ \dot x=\lambda_1C_1e^{\lambda_1 t}+\lambda_2C_2e^{\lambda_2 t}$

Н.у. $t=0, x=l, \dot x=0;\ l=C_1+C_2;\ C_2=l-C_1$

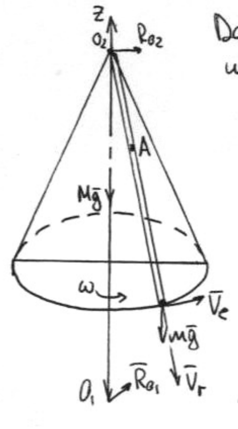
$\lambda_1=-\frac{\mu}{2m}+\sqrt{\left(\frac{\mu}{2m}\right)^2+\omega^2};\ \lambda_1C_1+\lambda_2C_2=0$

$\lambda_2=-\frac{\mu}{2m}-\sqrt{\left(\frac{\mu}{2m}\right)^2+\omega^2};\ \lambda_1C_1+\lambda_2(l-C_1)=0$

$\lambda_1C_1+\lambda_2 l-\lambda_2C_1=0$

$C_1=\frac{\lambda_2 l}{\lambda_2-\lambda_1}=\frac{-\frac{\mu}{2m}-\sqrt{\left(\frac{\mu}{2m}\right)^2+\omega^2}}{-\frac{\mu}{2m}-\sqrt{\left(\frac{\mu}{2m}\right)^2+\omega^2}+\frac{\mu}{2m}-\sqrt{\left(\frac{\mu}{2m}\right)^2+\omega^2}}\,l$

$C_2=l-C_1=l\left(1-\frac{\frac{\mu}{2m}+\sqrt{\left(\frac{m}{2\mu}\right)^2+\omega^2}}{2\sqrt{\left(\frac{\mu}{2m}\right)^2+\omega^2}}\right)$



Дано: $m, J_z=3mr^2, \omega=\omega_0$

шарик внизу ω-? для конуса

$\frac{dK_z}{dt}=\sum M_z(\bar F_k^{(e)})=0;\ K_z=const$

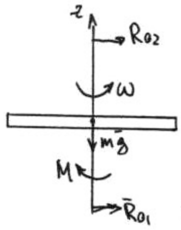
$K_{z0}=J_z\omega_0=3mr^2\omega_0$

$K_z=J_z\omega+mV_e\cdot r;\ V_e=\omega r$

$K_z=J_z\omega+mr^2\omega=4mr^2\omega$

$3mr^2\omega_0=4mr^2\omega$

$\omega=\frac34\omega_0$



$J_z \varepsilon = \sum M_z(\bar F_k^{(e)})$

Дано: $m, l, \omega_0, M = \alpha l m \omega$

$\varphi = \varphi(t) - ?$

$J_z\ddot\varphi = \sum M_z(\bar F_k^{(e)}) = -M = -\alpha l m \dot\varphi$

$\frac{ml^2}{12}\cdot\ddot\varphi = -\alpha l m\dot\varphi$; $\ddot\varphi + \frac{12\alpha}{l}\dot\varphi = 0$

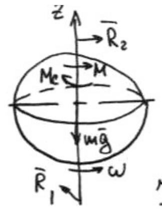
$\lambda^2 + \frac{12\alpha}{l}\lambda = 0$; $\varphi = C_1 + C_2 e^{-\frac{12\alpha}{l}t}$

$\lambda_1 = 0$; $\lambda_2 = -\frac{12\alpha}{l}$; $\dot\varphi = -\frac{12\alpha}{l}C_2 e^{-\frac{12\alpha}{l}t}$

Н.у. $t=0$, $\varphi=0$, $\dot\varphi = \omega_0$

$C_1 + C_2 = 0$; $\omega_0 = -\frac{12\alpha}{l}C_2$; $C_2 = -\frac{\omega_0 l}{12\alpha} = -C_1$

$\varphi = \frac{\omega_0 l}{12\alpha}\left(1 - e^{-\frac{12\alpha}{l}t}\right)$



Дано: $m, R, J = \frac{2}{5}mR^2$

$M = const$, $M_z = \alpha\omega$, $t=0, \varphi=0$, $\omega=0$

$\varphi = \varphi(t) - ?$

$J\ddot\varphi = \sum M_z(\bar F_k^{(e)}) = M - M_1 = M - \alpha\dot\varphi$

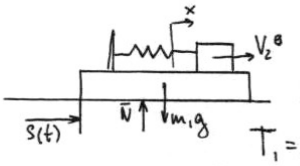
$\ddot\varphi + \frac{\alpha}{J}\dot\varphi = \frac{M}{J}$; $\varphi = \varphi_{oo} + \varphi_{чн}$; $\lambda^2 + \frac{\alpha}{J}\lambda = 0$ $\lambda_1 = 0$, $\lambda_2 = -\frac{\alpha}{J}$

$\varphi_{oo} = C_1 + C_2 e^{-\frac{\alpha}{J}t}$; $\varphi_{чн} = Bt$

$0 + \frac{\alpha}{J}B = \frac{M}{J}$; $B = \frac{M}{J}$; $\varphi = C_1 + C_2 e^{-\frac{\alpha}{J}t} + \frac{M}{\alpha}t$ | Н.у. $t>0$, $\varphi=0$, $\dot\varphi=0$

$0 = C_1 + C_2$; $0 = -\frac{\alpha}{J}C_2 + \frac{M}{\alpha}$ | $\dot\varphi = -\frac{\alpha}{J}C_2 e^{-\frac{\alpha}{J}t} + \frac{M}{\alpha}$

$\varphi = \frac{MJ}{\alpha^2}\left(e^{-\frac{\alpha}{J}t} - 1\right) + \frac{M}{\alpha}t$, $J = \frac{2}{3}mR^2$



Дано: m_1, m_2, c

$S(t) = S_0 \sin pt$

$F_{пр} = cx$

$V_1 = \dot S = V_2^e$; $V_2^r = \dot x$

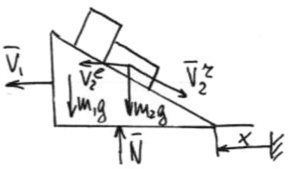
$T_1 = \frac12 m_1 V_1^2 = \frac12 m\dot S^2$

$T_2 = \frac12 m_2 V_2^2 = \frac12 m_1(\dot x + \dot S)^2$

$T = \frac12(m_1+m_2)\dot S^2 + m_1\dot x\dot S + \frac12 m_2\dot x^2$; $\dot S = S_0 p\cos pt$

$Q_S = \frac{\sum(\delta A(\bar F_k))_S}{\delta S} = 0$; $Q_x = \frac{\sum(\delta A(\bar F_k))_x}{\delta x} = -\frac{F_{пр}\delta x}{\delta x} =$

$= -cx$



Дано: m_1, m_2, α

$T - ?$, $Q_x - ?$, $Q_S - ?$

$V_1 = \dot x = V_2^e$, $V_2^r = \dot S$

$T_1 = \frac12 m_1 V_1^2 = \frac12 m_1\dot x^2$

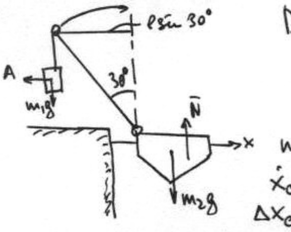
$T_2 = \frac12 m_2 V_2^2 =$

$= \frac12 m_2(\dot x^2 + \dot S^2 - 2\dot x\dot S\cos\alpha)$

$T = \frac12(m_1+m_2)\dot x^2 - 2m_2\dot x\dot S\cos\alpha + \frac12 m_2\dot S^2$

$Q_x = \frac{\sum(\delta A(\bar F_k))_x}{\delta x} = 0$; $Q_S = \frac{\sum(\delta A(\bar F_k))_S}{\delta S} =$

$= \frac{m_2 g\sin\alpha\,\delta S}{\delta S} = m_2 g\sin\alpha$



Дано: $m_1=2т$, $m_2=20т$

$OA=l=8м$

Решение

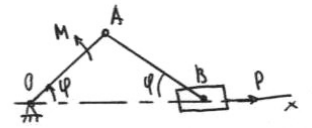
$m\ddot{x}_c=\sum F_{kx}^{(e)}=0$, $\ddot{x}_c=0$

$\dot{x}_c=const$, $x_c=const$

$\Delta x_c=0$

$$\Delta x_c=\frac{-(m_1+m_2)\Delta+m_1 l\sin 30^\circ}{m_1+m_2}=0$$

$$\Delta=\frac{m_1\frac{l}{2}}{m_1+m_2}$$



Дано: $OA=BA=l,\ \varphi,\ P$

$M-?$

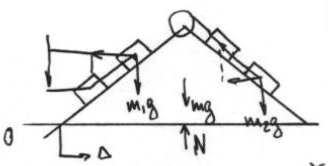
принцип возм. перемещ.

$\sum \bar{F}_k\delta\bar{r}_k=0$ $\quad M\delta\varphi+P\delta x_B=0$

$x_B=2l\cos\varphi$, $\delta x_B=\frac{\partial x_B}{\partial\varphi}\delta\varphi=-2l\sin\varphi\,\delta\varphi$

$M\delta\varphi-P\cdot 2l\sin\delta\varphi=0$

$M=2Pl\sin\varphi$



Дано: $m=4m_2$, искомое

$h=10см$; $\Delta-?$

Решение

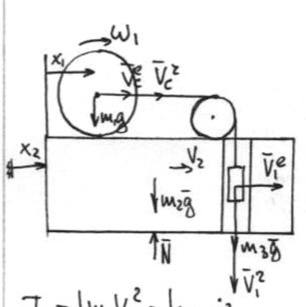
$M\ddot{x}_c=\sum F_{kx}^{(e)}=0$; $\ddot{x}_c=0$

$\dot{x}_c=const=\dot{x}_{c0}=0$

$x_c=const$

$$\Delta x_c=0=\frac{(m_1+m_2+m)\Delta-m_2h\sqrt{3}-m_2h}{m_1+m_2+m}$$

$$\Delta=\frac{m_1\sqrt{3}+m_2}{m+m_1+m_2}\cdot h$$



$V_1=\dot{x}_2=V_c^e=V_1^e$

$V_c^r=\dot{x}_1=V_1^r$, $\omega_1=\frac{V_c^r}{r}=\frac{\dot{x}_1}{r}$

$T_1=\frac{1}{2}m_1V_c^2+\frac{1}{2}J_{1z}\omega_1^2=$

$=\frac{1}{2}m_1(\dot{x}_1+\dot{x}_2)^2+$

$+\frac{1}{2}\frac{m_1r^2}{2}\left(\frac{\dot{x}_1}{r}\right)^2$

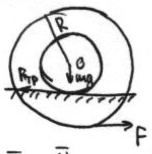
$T_2=\frac{1}{2}m_2V_1^2=\frac{1}{2}m_2\dot{x}_2^2$

$T_3=\frac{1}{2}m_3V_3^2=\frac{1}{2}m_3(\dot{x}_1^2+\dot{x}_2^2)$

$T=\frac{1}{2}\left(\frac{3}{2}m_1+m_2\right)\dot{x}_1^2+m_1\dot{x}_1\dot{x}_2+\frac{1}{2}(m_1+m_2+m_3)\dot{x}_2^2$

$Q_{x_1}=\frac{\sum(\delta A(\bar{F}_k))_{x_1}}{\delta x_1}$; $\delta x_1\neq0$, $\delta x_2=0$, $\delta y_3=\delta x_1$

$Q_{x_1}=\frac{m_3g\,\delta y_3}{\delta x_1}=m_3g$; $Q_{x_2}=\frac{\sum[\delta A(\bar{F}_k)]_{x_2}}{\delta x_2}=0$



Дано: m, R, r, F, ρ, f(к.тр.)

Какому условию должна удовл F чтобы не было скольжение?

$m\bar{a}_0 = \bar{N} + mg + \bar{F} + \bar{F}_{тр}$

$y: 0 = N - mg \to N = mg$

$x: ma_0 = F_{тр} - F \to a_0 = \frac{fmg - F}{m}$

$F_{тр} = fN$

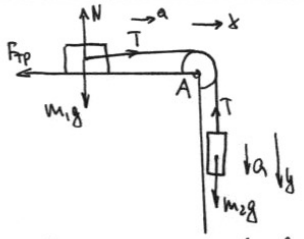
$J_{O_z}\ddot{\varphi} = FR - F_{тр}r$; $m\rho^2\frac{a_0}{r} = FR - fmgr$

$m\rho^2\frac{fmg - F}{mr} = FR - fmgr$

$\rho^2 fmg - F\rho^2 = FRr - fmgr^2$

$F(\rho^2 + Rr) = fmg(\rho^2 + r^2)$

$F = fmg\frac{\rho^2 + r^2}{\rho^2 + Rr}$; $F \le fmg\frac{\rho^2 + r^2}{\rho^2 + Rr}$



Дано: m_1, m_2, a

Найти: f-?

1. Рассмотрим равновесие груза 2:

$m_2\bar{a} = \bar{T} + m_2\bar{g}$

$y: m_2 a = m_2 g - T \to T = m_2(g - a)$

2. Рассм рав-ие груза 1:

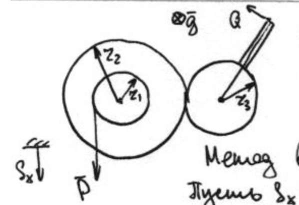
$m_1\bar{a} = T + m\bar{g} + \bar{N} + F_{тр}$

$y: 0 = m_1 g - N \to N = m_1 g$

$x: m_1 a = T - F_{тр}$

$m_1 g = m_2(g - a) - f(m_1 g$

$f = \frac{(m_2(g - a) - m_1 g)}{m_1 g} = \frac{m_2}{m_1}\left(1 - \frac{a}{g}\right) - 1$



Дано: P, r_1, r_2, r_3, r_4

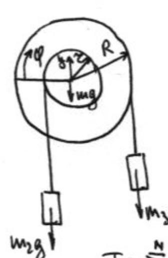
Q-для равновесие-?

Метод возможных перемещ.

Пусть $\delta_x > 0$

$P\delta_x - Q\frac{\delta x_1 r_2 \cdot r_4}{r_1 \cdot r_3} = 0$

$Q = P\frac{r_1 r_3}{r_2 r_4}$



Дано: m, r, R, ρ

$t = 0 \Rightarrow V = 0, V = 0$, Найти $\omega(\varphi)$-?

$T = \frac{m_2\dot{\varphi}^2 r^2}{2} + \frac{m_3\dot{\varphi}^2 R^2}{2} + \frac{m\rho^2\dot{\varphi}^2}{4}$

$T_0 = 0$ $\quad T - \cancel{T_0} = \sum_{k=1}^{N} A_k^{(e)} + \cancel{\sum_{k=1}^{n} A_k^{(i)}}$

$T = \sum_{k=1}^{N} A_k^{(e)}$

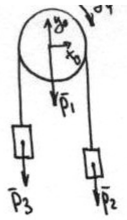
$dA(m_2 g) = -m_2 g r d\varphi$

$dA(m_1 g) = m_3 g R d\varphi$

$\sum_{k=1}^{n} A_k^{(e)} = m_3 g R\varphi - m_2 g r\varphi$

$\dot{\varphi}^2\left(\frac{m_2 r^2}{2} + \frac{m_3 R^2}{2} + \frac{m\rho^2}{4}\right) = \varphi(m_3 g R - m_2 g r)$

$\dot{\varphi} = \sqrt{2\varphi\frac{m_3 R - m_2 r}{m_2 r^2 + m_3 R^2 + \frac{m\rho^2}{2}}g}$



$$\frac{dK_{Oz}}{dt} = \sum_k M_{Oz}(\bar F_k^{(e)})$$

$$\sum_k M_{Oz}(\bar F_k^{(e)}) = P_2 \cdot r - P_3 \cdot r = m_2 g r - m_3 g r$$

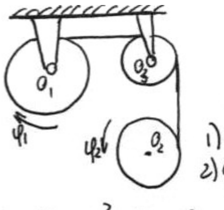
$$K_{Oz} = K_{Oz}^{(1)} + K_{Oz}^{(2)} + K_{Oz}^{(3)} = \dot\varphi(m_1\rho^2 + m_2 r^2 + m_3 r^2)$$

$$K_{Oz}^{(1)} = J_{Oz}^{(1)}\dot\varphi = m_1\rho^2\dot\varphi$$

$$J_{Oz}^{(1)} = m_1\rho^2$$

$$K_{Oz}^{(2)} = m_2 r^2\dot\varphi, \quad K_{Oz}^{(3)} = m_3 r^2\dot\varphi$$

$$\ddot\varphi(m_1\rho^2 + m_2 r^2 + m_3 r^2) = g r (m_2 - m_3)$$



Дано: $R_1; R_2; m_1 = m_2 = m$

Найти T и Q - ?

Решение

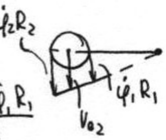
1) $q_1 = \varphi_1$

2) $q_2 = \varphi_2$

$$\frac{d}{dt}\left(\frac{\partial T}{\partial \dot\varphi_1}\right) - \frac{\partial T}{\partial \varphi_1} = Q_{\varphi_1}$$

$$\frac{d}{dt}\left(\frac{\partial T}{\partial \dot\varphi_2}\right) - \frac{\partial T}{\partial \varphi_2} = Q_{\varphi_2}$$

$$T = \frac{J_{1c}\cdot\omega_1^2}{2} + \frac{J_3\omega_3^2}{2} + \frac{J_2\omega_2^2}{2} + \frac{m_2 V_2^2}{2}$$

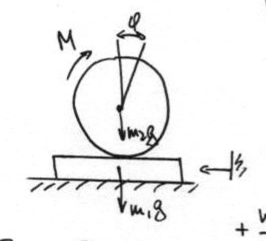


$$V_{O_2} = \frac{\dot\varphi R_2 + \dot\varphi_1 R_1}{2}$$

$\omega_1 = \dot\varphi_1$

$\omega_2 = \dot\varphi_2$

$\omega_3 = \frac{\dot\varphi_1 \cdot R_1}{R_3}$



Дано: m_1, m_2, r_2, M

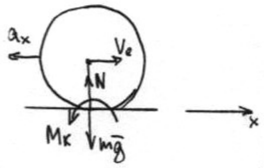
Найти: T_1, Q_φ, Q_x - ?

$q_1 = x; \dot q_1 = \dot x$, $q_2 = \varphi, \dot q_2 = \dot\varphi$

$$T = \frac{m_1\dot x^2}{2} + \frac{m_2 r_1^2\dot\varphi^2}{4} + \frac{m_2(\dot x - \dot\varphi r_2)^2}{2}$$

$\delta x = 0;\ \delta\varphi = 0$

$Q_\varphi = \frac{M\delta\varphi}{\delta\varphi} = M;\ \delta x \neq 0;\ \delta\varphi = 0;\ Q_x = 0$



Дано: m, R, V_0, δ

Найти S

$m\bar a = m\bar g + \bar N$

$0 = m\ddot y = mg - N \to N = mg$

$M_K = \delta m g$

$J_{Pz}\ddot\varphi = -M_K$

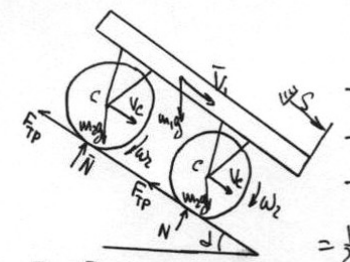
$$J_{Pz} = \frac{mr^2}{2} + mr^2 = \frac{3}{2}mr^2$$

$$\frac{3}{2}mr^2\ddot\varphi = -\delta m g;\ \ddot\varphi = -2\delta g/3R^2 \to a_x = -\frac{2\delta g}{3R}$$

$$V = V_0 + a_x t \to t_0 = \frac{V_0}{-a_x} = \frac{3RV_0}{2\delta g}$$

$$S = V_0 t + \frac{at^2}{2}$$

$$S = V_0\frac{3RV_0}{2\delta g} + \frac{V_0^2}{2a_x} = \frac{3RV_0^2}{2\delta g} - \frac{V_0^2 3R}{4\delta g} = \frac{3}{4}\frac{V_0^2 R}{\delta g}$$



Дано: m_1, m_2, α

$V_1 = V_1(S)$, a_1 – ?

$T - \cancel{T_0} = \sum A(\bar{F}_k^{(e)}) + \cancel{\sum A(\bar{F}_x^{(i)})}$

$T_1 = \frac{1}{2} m_1 V_1^2$

$T_2 = \frac{1}{2} m_2 V_C^2 + \frac{1}{2} J_{Cz} \omega_2^2 =$

$= \frac{1}{2} m_2 V_1^2 + \frac{1}{2} \frac{m_2 r^2}{2} \left(\frac{V_1}{2}\right)^2$

$T = T_1 + 4T_2 = \frac{1}{2}(m_1 + 6m_2) V_1^2$; $\sum A(\bar{F}_k^{(e)}) = (m_1 + 4m_2) g \sin\alpha \cdot S$

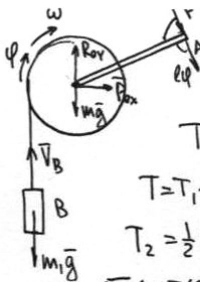
$\frac{1}{2}(m_1 + 6m_2) V_1^2 = (m_1 + 4m_2) g \sin\alpha\, S$;

$V_1 = \sqrt{\frac{2(m_1 + 4m_2) g \sin\alpha\, S}{m_1 + 6m_2}}$; $dT = \sum dA(\bar{F}_x^{(e)}) + \sum dA(\bar{F}_x^{(i)})$

$dT = (m_1 + 6m_2) a_1 dS$; $(m_1 + 4m_2) g \sin\alpha\, dS = \sum dA(\bar{F}_x^{(e)})$

$(m_1 + 6m_2) a_1 dS = (m_1 + 4m_2) g \sin\alpha \cdot dS$

$$a_1 = \frac{(m_1 + 4m_2)\sin\alpha}{m_1 + 6m_2} g$$



Дано: $m_1, r, m_2, l = OA$

$F = const$; $T_0 = 0$

$\omega = \omega(\varphi)$ – ?

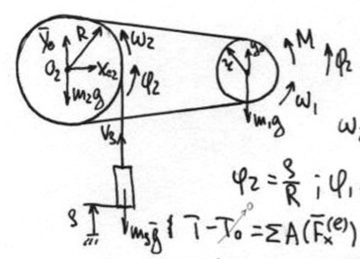
$T - \cancel{T_0} = \sum A(\bar{F}_x^{(e)}) + \cancel{\sum A(\bar{F}_x^{(i)})}$

$T = T_1 + T_2$; $T_1 = \frac{1}{2} m_1 V_B^2 = \frac{1}{2} m_1 r^2 \omega^2$

$T_2 = \frac{1}{2} J_{Oz} \omega^2 = \frac{1}{2} \frac{m_1 r^2}{2} \omega^2$

$\sum A(\bar{F}_k^{(e)}) = Fl\varphi - m_1 g \cdot r\varphi$; $\frac{2m_1 + m_2}{4} r^2 \omega^2 = (Fl - m_1 g r)\varphi$

$$\omega = \sqrt{\frac{4(Fl - m_1 g r)\varphi}{(2m_1 + m_2) r^2}}$$



Дано: m_1, m_2, m_3, $R, r, M = const$

$V_3 = V_1(S)$ – ?

$\omega_2 = \frac{V_3}{R}$; $\omega_1 = \frac{V_3}{R}$

$\varphi_2 = \frac{S}{R}$; $\varphi_1 = \frac{S}{r}$

$T - \cancel{T_0} = \sum A(\bar{F}_x^{(e)}) + \cancel{\sum A(\bar{F}_k^{(i)})}$

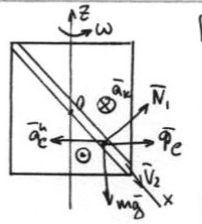
$T_1 = \frac{1}{2} J_1 \omega_1^2 = \frac{1}{2} \frac{m_1 r^2}{2} \left(\frac{V_3}{r}\right)^2$

$T_2 = \frac{1}{2} J_2 \omega_2^2 = \frac{1}{2} \frac{m_2 R^2}{2} \left(\frac{V_3}{R}\right)^2$; $T_3 = \frac{1}{2} m_3 V_3^2$;

$T = \frac{m_1 + m_2 + m_3}{4} V_3^2$; $\sum_k A(\bar{F}_k^{(e)}) = M\varphi_2 - m_1 g S =$

$= M\frac{S}{r} - m_3 g S$

$\frac{m_1 + m_2 + 2m_3}{4} V_3^2 = \left(\frac{M}{r} - m_3 g\right) S$; $V_3 = \sqrt{\frac{4\left(\frac{M}{r} - m_3 g\right) S}{m_1 + m_2 + 2m_3}}$



Дано: $m, \alpha, t = 0, x_0 = l, \dot{x}_0 = 0$

$\omega = const$

$x = x(t)$ – ?

$\bar{\Phi}_e = -m\bar{a}_e$; $a_e = a_e^n = \omega^2 x \cos\alpha$

$\Phi_e = m\omega^2 x \cos\alpha$

$\bar{\Phi}_k = -m\bar{a}_k$; $\bar{a}_k = 2(\bar{\omega} \times \bar{V}_2)$

$a_k = 2\omega V_2 \sin(\widehat{\omega V_2}) = 2\omega V_2 \cos\alpha = 2\omega \dot{x} \cos\alpha$

$\Phi_k = 2m\omega\dot{x}\cos\alpha$

$m\bar{a}_2 = m\bar{g} + \bar{N}_1 + \bar{N}_2 + \bar{\Phi}_e + \bar{\Phi}_k$, в проекции на ось x

$m\ddot{x} = \sum F_{kx} = mg\sin\alpha + \Phi_e\cos\alpha = mg\sin\alpha + m\omega^2 x\cos^2\alpha$

$\omega\cos\alpha = \omega_1$

$\ddot{x} = g\sin\alpha + \omega_1^2 x$; $\ddot{x} - \omega_1^2 x = g\sin\alpha$; $x = x_{oo} + x_{чн}$

$u^2 - \omega_1^2 = 0$ $u_{1,2} = \pm\omega_1$, $x_{oo} = C_1 e^{\omega_1 t} + C_2 e^{-\omega_1 t}$

$x_{чн} = B = const$; $0 = \omega_2^2 B = g\sin\alpha$, $B = -\frac{g\sin\alpha}{\omega_1^2}$

Н.у $t = 0, x_0 = l, \dot{x}_0 = 0$

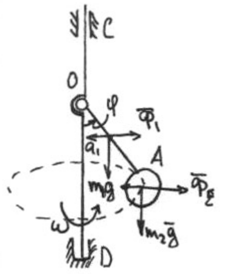
$x = C_1 e^{\omega_2 t} + C_2 e^{-\omega_1 t} - \frac{g\sin\alpha}{\omega_2^2}$

$\dot{x} = \omega_1(C_1 e^{\omega_1 t} - C_2 e^{-\omega_2 t})$

$l = C_1 + C_2 - \frac{g\sin\alpha}{\omega_1^2}$; $0 = \omega_1(C_1 - C_2)$; $C_1 = C_2 = \frac{l}{2} + \frac{g\sin\alpha}{2\omega_1^2}$

$x = \left(l + \frac{g\sin\alpha}{\omega_1^2}\right) \cdot \frac{e^{\omega_1 t} + e^{-\omega_1 t}}{2} - \frac{g\sin\alpha}{\omega_1^2} =$

$= \left(l + \frac{g\sin\alpha}{\omega_1^2}\right) ch(\omega_1 t) - \frac{g\sin\alpha}{\omega_1^2}$



Дано: $l, m_1, m_2, \angle AOD = const$

$\omega - ?$

$\Phi_1 = m_1 a_1$; $a_1 = \omega^2 R_1$

$\Phi_2 = m_2 a_2$; $a_2 = \omega^2 R_2$

$R_1 = \frac{1}{2} l \sin\varphi$; $R_2 = l \sin\varphi$

$\Phi_1 = m_1 \omega^2 \frac{l}{2} \cdot \sin\varphi$

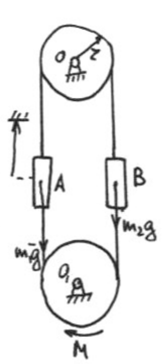
$\Phi_2 = m_2 \omega^2 \cdot l \sin\varphi$

$M(m_1 g) = -\frac{l}{2} m_1 g \sin\varphi$; $M(\Phi_1) = \frac{2}{3} l m_1 \omega^2 \cdot \frac{1}{2} l \sin\varphi \cos\varphi$

$M(m_2 g) = -l m_2 g \sin\varphi$; $M(\Phi_2) = l m_2 \omega^2 l \sin\varphi \cos\varphi$

$-\frac{l}{2} m_1 g - l m_2 g + \frac{1}{3} l m_1 \omega^2 \cdot l \cos\varphi + l m_2 \omega^2 l \cos\varphi = 0$

$\omega^2 = \frac{3g(m_1 + 2m_2)}{l\cos\varphi(m_1 + 3m_2)}$



Дано: $m_A = m_1$; $V_0 = 0$

$m_B = m_2$; $m_0 = m_{0_1} = m_3$; ρ

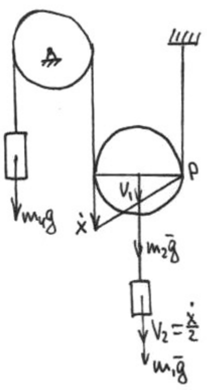
$V_A - ?$

$T - T_0 = \sum A^{(e)} + \sum A^{(i)}$

$T = \frac{m_1 \dot{x}^2}{2} + \frac{m_2 \dot{x}^2}{2} + \frac{2 \cdot J_0 \cdot \omega^2}{2}$

$A = -m_1 g x + M\varphi + m_2 g x$

$\omega = \frac{\dot{x}}{z}$; $\varphi = \frac{x}{z}$; $J_0 = M_3 \rho^2$



Дано: $m_1; m_2; r_2; r_4$

$m_3 = 0$

Найти: $T - ?$ $Q_x - ?$

$q_1 = x$; $\dot{q}_1 = \dot{x}$

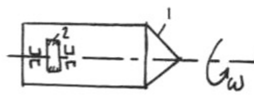
$T = \frac{m_4 \dot{x}^2}{2} + \frac{m_2 r_2^2 \dot{x}^2}{4 \cdot 4 r_2^2} + \frac{m_2 \dot{x}^2}{2 \cdot 4} + \frac{m_1 \dot{x}^2}{2 \cdot 4}$

$T = \dot{x}^2 \left(\frac{m_4}{2} + \frac{3m_2}{16} + \frac{m_1}{8} \right)$

Пусть $\delta x_1 > 0$

$Q_x = \frac{-m_4 g \delta x + m_2 g \frac{\delta x}{2} + m_1 g \frac{\delta x}{2}}{\delta x} =$

$= \left(\frac{m_2 + m_1}{2} - m_4 \right) g$



Дано: $J_{2z} = 0{,}01 J_{1z}$

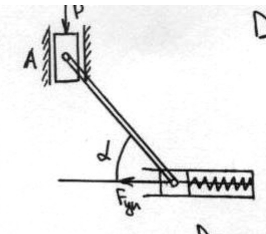
$\frac{dK_z}{dt} = 0$; $L = 0$

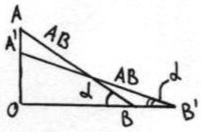
$K_z = const$

$K_0 = K$

$K_0 = J_1 \omega_0$; $\bar{K} = J_1 \bar{\omega}_1^2 + J_2 \bar{\omega}_2^2$

Oz: $J_1 \omega_0 = J_1 \frac{\omega_0}{2} + J_2 \omega_2'$





Дано: $m_{AB}=0,\ \alpha,\ \Delta,\ c$

Найти: P

Решение

1) Пусть AB = l, тогда

$x = l\sin\alpha - l\sin(\alpha - d\alpha) = l(\sin\alpha - \sin(\alpha - d\alpha)) =$

$= l(\sin\alpha - \sin\alpha\cos d\alpha + \cos\alpha\sin d\alpha$

$\cos d\alpha \approx 1$; $\sin d\alpha \sim d\alpha$

$x = l(\sin\alpha - \sin\alpha + \cos\alpha\, d\alpha) = l\cos\alpha\, d\alpha$

2) $y = l\cos(\alpha - d\alpha) - l\cos\alpha$

$y = l(\cos\alpha\cos d\alpha + \sin\alpha\sin d\alpha - \cos\alpha)$

$\cos d\alpha = 1$; $\sin d\alpha \sim d\alpha$

$y = l(\cos\alpha - \cos\alpha + \sin\alpha\cdot d\alpha) = l\sin\alpha\cdot d\alpha$

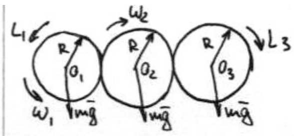
3) $\sum_{k=1}^{n} A_k^{(e)} = 0$ (равновесие)

$P\cdot x - F_{уп}\cdot y = 0$

$P\cdot l\cos\alpha\cdot d\alpha - F_{упр}\cdot l\sin\alpha\cdot d\alpha = 0$

$P\cos\alpha - F_{уп}\sin\alpha = 0 \Rightarrow P = F_{уп}\,\mathrm{tg}\,\alpha$

$P = c\Delta\,\mathrm{tg}\,\alpha$



Дано: L_1, L_3 − const

m, r

$\omega = \omega(\varphi)$ − ?

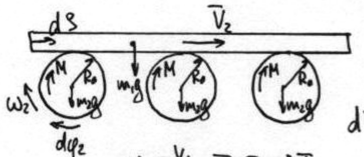
$T - T_0 = \sum A(\bar{F}_k^{(e)}) + \sum A(\bar{F}_k^{(i)})$

$\omega_1 = \omega_2 = \omega_3 = \omega$

$T = \frac{1}{2} J_{O_1}\omega^2\cdot 3 = \frac{1}{2}\frac{m r^2}{2}\cdot\omega^2\cdot 3 = \frac{3}{4} m r^2\omega^2$

$\sum A(\bar{F}_k^{(e)}) = L_1\varphi_1 - L_3\varphi_3 = (L_1 - L_3)\varphi$;

$\frac{3}{4} m r^2\omega^2 = (L_1 - L_3)\varphi$; $\omega = \sqrt{\frac{4(L_1 - L_3)\varphi}{3 m r^2}}$



Дано: m_1, m_2, r

M

a_1 − ?

$dT = \sum dA(\bar{F}_x^{(e)}) + \sum dA(\bar{F}_x^{(i)})$

$\omega_2 = \frac{V_1}{2}$; $T = T_1 + 3T_2$

$T_1 = \frac{1}{2} m_1 V_1^2$; $T_2 = \frac{1}{2} J_{Oz}\omega_2^2 = \frac{1}{2}\frac{m_2 r^2}{2}\cdot\left(\frac{V_1}{2}\right)^2$

$T = \frac{1}{2}(m_1 + \frac{3}{2} m_2)V_1^2$; $dT = (m_1 + \frac{3}{2} m_2)a_1\cdot dS$,

$\sum dA(\bar{F}_k^{(e)}) = 3M\cdot d\varphi_2 = 3M\frac{dS}{2}$

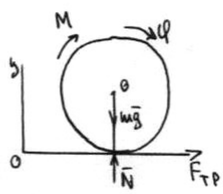
$(m_1 + \frac{3}{2} m_2)a_1\, dS = 3M\frac{dS}{2}$; $a_1 = \frac{3M/2}{m_1 + \frac{3}{2} m_2}$

Скорость балки

$T - T_0 = \sum A(\bar{F}_x^{(e)}) + \sum A(\bar{F}_x^{(i)})$

$\frac{1}{2}(m_1 + \frac{3}{2} m_2)V_1^2 = 3M\varphi$; $\frac{2m_1 + 3m_2}{4} V_1^2 = 3M\varphi$

$V_1 = \sqrt{\frac{12M\varphi}{2m_1 + 3m_2}}$



Дано: $m = 20$ кг, $M = 30$ Н·м

$R = 0{,}2$ м

Найти $F_{тр}$ − ?

$m\ddot{x}_c = \sum F_{xx}^{(e)}$; $m\ddot{y}_c = \sum F_{xy}^{(e)}$

$J_{Oz}\,\varepsilon = \sum M_{Oz}(\bar{F}_x^{(e)})$

$m\ddot{x}_c = \sum F_{xx}^{(e)} = F_{тр}$; $m\ddot{y}_c = \sum F_{xy}^{(e)} = N - mg = 0$ $(y_c = R)$

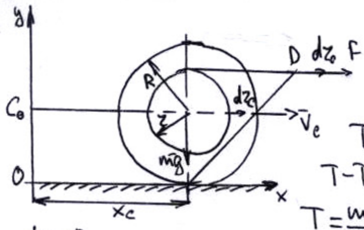
$J_{Oz}\,\varepsilon = \sum M_{Oz}(\bar{F}_x^{(e)}) = M - F_{тр}R$; $J_{Oz} = \frac{mR^2}{2}$; $\omega = \frac{V_c}{R}$

$\varepsilon = \frac{a_c}{R} = \frac{\ddot{x}_c}{R}$; $\frac{mR^2}{2}\cdot\frac{\ddot{x}_c}{R} = M - F_{тр}\cdot R$, $m\ddot{x}_c = 2\frac{M}{R} - 2F_{тр}$ (2)

$-\begin{cases} m\ddot{x}_c = F_{тр} \\ m\ddot{x}_c = 2\frac{M}{R} - 2F_{тр} \end{cases}$

$F_{тр} - 2\frac{M}{R} + 2F_{тр} = 0$

$F_{тр} = \frac{2}{3}\frac{M}{R} = \frac{2}{3}\cdot\frac{30}{0{,}2} = 100$ Н



Дано: r, $R=2r$, m

$\bar F = const$, $\rho = \sqrt{3Rr}$

$V_c(x_c)$ - ?

$T_0 = 0$

$T - T_0 = \Sigma A_k^{(e)} + \Sigma A_k^{(i)}$

$T = \frac{m\dot x_c^2}{2} + \frac{J\omega^2}{2}$

$\dot x = \omega R$

$T = \frac{m\dot x_c^2}{2} + \frac{m\rho^2 \dot x_c^2}{2R^2}$

$2\delta r_e = 3\delta r_D$

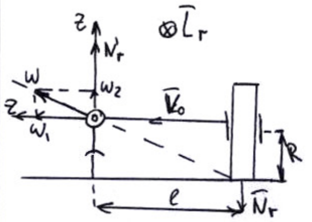
$\delta r_0 = \frac{2}{3}\delta r_e$

$T = \frac{m\dot x_c^2}{2} + \frac{m3Rr\dot x_c^2}{2R^2} = \frac{m\dot x_c^2}{2} + \frac{3mr\dot x_c^2}{2R}$

$A(m\bar g) = 0$

$A(F) = F\cdot\frac{3}{2}x_c$

$\dot x_c^2\left(\frac{m}{2} + \frac{3mr}{2R}\right) = \frac{3}{2}Fx_c$



Дано: $m = 1200$ кг

$\rho = 0{,}4$ м, $n = 60$ об/мин

$R = 0{,}5$ м

бегун-гироскоп

Определить силу давления бегунка на гориз. пл-ть.

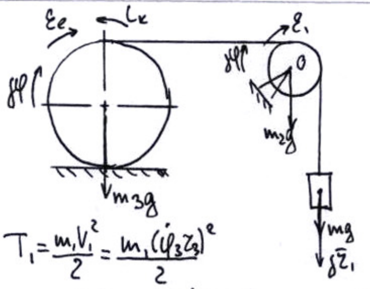
$\omega_2 = \frac{2\pi n}{60} = \frac{2\pi 60}{60} = 2\pi$ рад/с

$\frac{\omega_2}{\omega_1} = \frac{R}{\ell}$; $\omega_1 = \omega_2\frac{\ell}{R}$; $K_0 = J_z\omega_1 = m\rho^2\omega_1 = m\rho^2\omega_2\frac{\ell}{R}$

$L_r = -\bar\omega_2 \times \bar K_0 = K_0 \times \omega_2$ $\quad \theta = \frac{\pi}{2}$

$L_r = N_r\cdot\ell \Rightarrow N_r = \frac{m\rho^2\omega_2\cdot\frac{\ell}{R}\omega_2}{\ell} = \ldots$

$F_{дав} = N_r + mg \approx 26900$ Н



Дано: $m_1, m_2, m_3,$ r_2, r_3, f_k

$\dot x = \dot\varphi\cdot 2R_3$

$\dot\varphi_A\cdot r_2 = \dot\varphi_3 2r_3$

$\delta r_1 = \delta\varphi\cdot 2R_3$

$\delta\varphi_2 = \frac{2\delta\varphi_3 r_3}{r_2}$

$m\ddot y = N - m_3\bar g$

$N = m_3 g$

$T_1 = \frac{m_1V_1^2}{2} = \frac{m_1(\dot\varphi_3 r_3)^2}{2}$

$T_2 = \frac{J\omega^2}{2} = \frac{m r_2^2\dot\varphi_3^2 4r_3^2}{2\cdot 2r_2^2}$

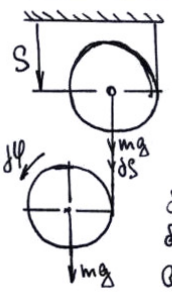
$T_3 = \frac{m_3\dot\varphi_3^2 r_3^2}{2} + m_3R_3^2\cdot\frac{\dot\varphi_3^2}{2}$

$\delta A(L_k) = -f_k m_3 g\,\delta\varphi_3$

$dA(m_1 g) = m_1 g\cdot 2r_3\delta\varphi_3$; $\quad \delta A(m_3 g) = 0$

$\delta A(m_2 g) = m_2 g\cdot\frac{2r_3}{r_2}\delta\varphi_3$;

$Q = 2m_1 g r_3 + m_2 g\frac{2r_3}{r_2} - f_k m_3 g$



Дано: M, R

$\dot s = \omega R \Rightarrow \omega = \frac{\dot s}{R}$

$T_1 = \frac{m\dot s^2}{2} + \frac{mR^2}{2}\cdot\frac{\dot s^2}{R^2}$

$T_2 = \frac{m(\dot s + \dot\varphi R)^2}{2} + \frac{mR^2\dot\varphi^2}{2}$

$\delta A(m_1 g) = 0$

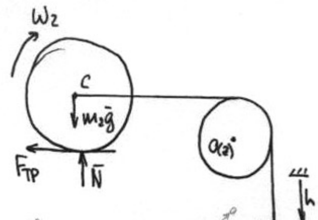
$\delta A(m_2 g) = mgR\delta\varphi$

$Q_\varphi = mgR$

$\delta A(m_1 g) = m_1 g\delta S$

$\delta A(m_2 g) = m_1 g\delta S$

$Q_S = 2mg$



Дано: m_1, m_2, R

$T_0=0$, h

V_1 - ?

груз 1 - поступат. движение

каток 2 - плоское движение

$T-T_0=\sum A(\bar F_k^{(e)})+\sum A(\bar F_k^{(i)})$

$T_1=\frac12 m_1V_1^2$; $T=T_1+T_2$

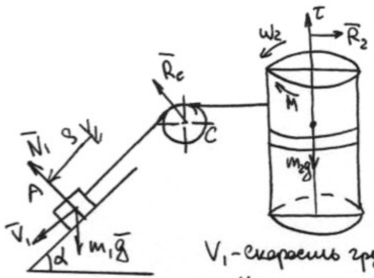
$\omega_2=\frac{V_C}{R}=\frac{V_1}{R}$ - угл.ск.кат.

$T_2=\frac12 m_2V_C^2+\frac12 J_{C2}\omega_2^2=$

$=\frac12 m_2V_1^2+\frac12\frac{m_2R^2}{2}\cdot\left(\frac{V_1}{R}\right)^2=\frac34 m_2V_1^2$

$T=\left(\frac{m_1}{2}+\frac34 m_2\right)V_1^2$; Раб. вн. сил $\sum A(\bar F_k^{(e)})=m_1gh$

$\left(\frac{m_1}{2}+\frac34 m_2\right)V_1^2=m_1gh \Rightarrow V_1=\sqrt{\frac{m_1gh}{\frac{m_1}{2}+\frac34 m_2}}$



Дано: m_2, r,

M - мом. сопр.

$V_A=V_A(S)$ - ?

груз 1 - поступ. движение

V_1 - скорость груза; бараб 2 - вр. дв.

$\omega_2=\frac{V_1}{r}$

$T-T_0=\sum A(\bar F_k^{(e)})+\sum A(\bar F_k^{(i)})$; $T_0=0$; $\sum A(\bar F_k^{(i)})=0$

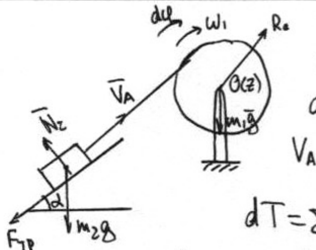
$T_1=T_1+T_2$, $T_1=\frac12 m_1V_1^2$; $T_2=\frac12 J_z\omega_2^2=\frac12\frac{m_2r^2}{2}\left(\frac{V_1}{r}\right)^2$

$T=\left(\frac{m_1}{2}+\frac{m_2}{4}\right)V_1^2$; $\sum_k A(\bar F_k^{(e)})=m_1g\sin\alpha\, S-M\varphi$

$\varphi=\frac{S}{r}$; $\sum A(\bar F_k^{(e)})=m_1g\sin\alpha\, S-M\frac{1}{r}$

$\left(\frac{m_1}{2}+\frac{m_2}{4}\right)V_1^2=\left(m_1g\sin\alpha-\frac{M}{r}\right)S$

$V_1=\sqrt{\frac{m_1g\sin\alpha-M/r}{\frac{m_1}{2}+\frac{m_2}{4}}}$



Дано: $m_1, r, M=const$

m_2, α, f

a_A - ?

V_A, $\omega_1=\frac{V_A}{r}$; d_{1A}, $d\varphi=\frac{dS_A}{r}$

$dT=\sum dA(\bar F_k^{(e)})+\sum dA(\bar F_k^{(i)})$

$T=T_1+T_2$; $T_1=\frac12 J_{O2}\omega_1^2=\frac12\frac{m_1r^2}{2}\cdot\left(\frac{V_A}{r}\right)^2$

$T_2=\frac12 m_2V_A^2$; $T=\frac12\left(\frac{m_1}{2}+m_2\right)V_A^2$

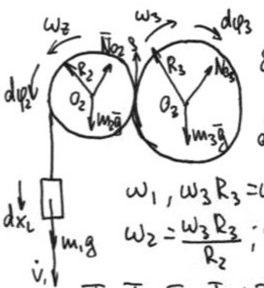
$dT=\left(\frac{m_1}{2}+m_2\right)a_A\,dS_A$; $\sum dA(\bar F_k^{(e)})=Md\varphi_1-$

$-m_2g\sin\alpha\cdot dS_A-F_{тр}\cdot dS_A=M\frac{dS_A}{r}-m_2g\sin\alpha\, dS_A-$

$-fm_2g\cos\alpha\, dS_A$

$\left(\frac{m_1}{2}+m_2\right)a_A\cdot dS_A=\left[\frac{M}{r}-m_2g(\sin\alpha+f\cos\alpha)\right]dS_A$

$a_A=\frac{M/r-m_1g(\sin\alpha+f\cos\alpha)}{\frac{m_1}{2}+m_2}$



Дано: m_1, m_2, R_2, m_3, R_3

ε_3 - ? сила в точке зацепки S - ?

$dT=\sum dA(\bar F_k^{(e)})+\sum dA(\bar F_k^{(i)})$

ω_1, $\omega_3R_3=\omega_2R_2=V_1$

$\omega_2=\frac{\omega_3R_3}{R_2}$; $V_1=\omega_3R_3$; $dx_1=R_3d\varphi_3$

$T=T_1+T_2+T_3$; $T_1=\frac12 m_1V_1^2=\frac12 m_1(R_3\omega_3)^2$

$T_2=\frac12 J_2\omega_2^2=\frac12 m_2R_2^2\left(\frac{\omega_3R_3}{R_2}\right)$

$T_3=\frac12 J_3\omega_3^2=\frac12 m_3R_3^2\omega_3^2$; $T=\frac12(m_1+m_2+m_3)R_3^2\omega_3^2$

$dT=(m_1+m_2+m_3)R_3^2\varepsilon_3d\varphi_3$; $\sum dA(\bar F_k^{(e)})=m_1g\,dx_1=$

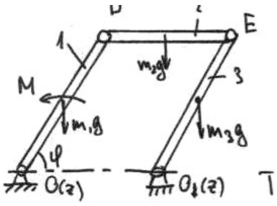
$=m_1gR_3d\varphi_3$

$(m_1+m_2+m_3)R_3^2\varepsilon_3d\varphi_3=m_1gR_3d\varphi_3$

$\varepsilon_3=\frac{m_1g}{(m_1+m_2+m_3)R_3}$; $J_3\varepsilon_3=\sum M_{O_3}(\bar F_k^{(e)})=SR_3$

$m_3R_3^2\cdot\frac{m_1g}{(m_1+m_2+m_3)R_3}=SR_3$

$S=\frac{m_1m_3}{m_1+m_2+m_3}\cdot g$



Дано: $OD = O_1E = \ell$

$m_1 = m_3 = m$; $m_2 = 2m$

$\dot\varphi$ – ?

$T - T_0 = \sum A^{(e)} + \sum A^{(i)}$

$T - T_0 = T = \frac{J\dot\varphi^2}{2} + \frac{mV^2}{2} + \frac{J\dot\varphi^2}{2} \ominus$

$\ominus \frac{m\ell^2\dot\varphi^2}{3} + \frac{m\dot\varphi^2\ell^2}{2} = \frac{5}{6} m\ell^2\dot\varphi^2$

$dT = \frac{5}{6} m\ell^2 \cdot 2\dot\varphi d\dot\varphi$

$dA = dA(M) + dA(m_1 g) + dA(m_2 g) + dA(m_3 g) = M d\varphi + m_1 g \frac{\ell}{2} \cos\varphi d\varphi +$

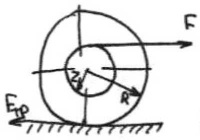
$+ m_2 g \ell \cos\varphi d\varphi + m_3 g \frac{\ell}{2} \cos\varphi d\varphi = M d\varphi + 3mg\ell\cos\varphi d\varphi +$

$+ \frac{5}{3} m\ell^2 \dot\varphi d\dot\varphi = M d\varphi + 3mg\ell\cos\varphi d\varphi$

$\frac{5}{3} m\ell^2 \frac{\dot\varphi^2}{2} = M\varphi + 3mg\ell\sin\varphi + C \Rightarrow \dot\varphi = \sqrt{\frac{(M\varphi + 3mg\ell\sin\varphi)6}{5m\ell^2}}$

$\ddot\varphi = \frac{1}{2}\sqrt{\frac{6}{5m\ell^2}} (M\varphi + 3mg\ell\sin\varphi)^{-1/2} \cdot (M\dot\varphi + 3mg\ell\cos\varphi\dot\varphi)$

$\ddot\varphi = \frac{\sqrt{6}(M + 3mg\ell\cos\varphi) \cdot \sqrt{\frac{(M\varphi + 3mg\ell\sin\varphi)6}{5m\ell^2}}}{2\sqrt{5m\ell^2} \cdot \sqrt{M\varphi + 3mg\ell\sin\varphi}}$



Дано: m, R, z, F, ρ

F

ρ – ?

$\dot\varphi R = \dot x_c$; $\ddot\varphi R = \ddot x_c$

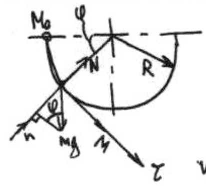
$m\ddot x_c = \sum F_{kx}^{(e)} = F$

$\frac{dK}{dt} = L_c^{(e)}$; $\frac{dk}{dt} = m\rho^2\ddot\varphi$

$L_c^{(e)} = Fz$; $m\rho^2\ddot\varphi = Fz \Rightarrow \ddot\varphi = \frac{Fz}{m\rho^2}$

$\frac{Fz}{m\rho^2} \cdot R = \ddot x_c \Rightarrow \frac{Fz}{m\rho^2} \cdot R = \frac{F}{m} \Rightarrow \frac{Rz}{\rho^2} = 1$

$\rho^2 = Rz$; $\rho = \sqrt{Rz}$



Дано: $m, R, \varphi = 60°$

N – ?, V_M – ?

$m\ddot S = \sum F_\tau$; $\sum F_\tau = mg\cos\varphi$

$m\frac{\dot S^2}{R} = \sum F_n$; $\sum F_n = -mg\sin\varphi + N$

$m\ddot S = mg\cos\varphi$; $\frac{d\dot\varphi}{dt} \cdot \frac{dS}{dS} = \frac{d\dot\varphi}{dS} \cdot \frac{dS}{dt} = \frac{d\dot\varphi}{dS} \cdot V = \frac{d\dot\varphi}{R d\varphi} \cdot \dot\varphi R$

$m\frac{\dot S^2}{R} = -mg\sin\varphi + N$;

$\ddot S = \varepsilon R = \frac{d\dot\varphi}{dt} \cdot R = \frac{\dot\varphi d\dot\varphi}{d\varphi} \cdot R$; $mR\frac{\dot\varphi d\dot\varphi}{d\varphi} = mg\cos\varphi$

$mR\dot\varphi d\dot\varphi = mg\cos\varphi d\varphi$

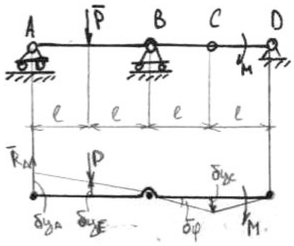
$R\frac{\dot\varphi^2}{2} = g\sin\varphi + C$; н.у. $\varphi = 0 \Rightarrow C = 0$

$\dot\varphi = \sqrt{\frac{2g\sin\varphi}{R}}$; $V = R\dot\varphi = R\dot\varphi = \sqrt{2gR\sin\varphi}$

$m2gR\sin\varphi = mg\cos\varphi$

$N = m2g\sin\varphi + mg\sin\varphi$

$N = 3mg \cdot \sin\varphi$



Дано: $P, \ell, M = P\ell$

$\bar R_A$ – ?

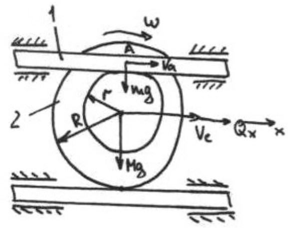
$\delta y_A = 2\delta y_C$

$\delta\varphi = \frac{\delta y_C}{\ell}$

$R_A \cdot \delta y_A - P\delta y_E - M\delta\varphi = 0$

$R_A = \delta y_A - P \cdot \frac{\delta y_A}{2} - M \cdot \frac{\delta y_A}{2\ell} = 0$

$R_A = \frac{P\ell + M}{2\ell}$



Дано: $m, M, R=2r$

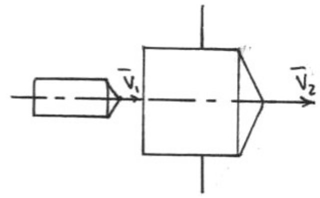
$Q_x - ?$

$$\frac{dQ_x}{dt}=\sum F_x^{(e)}; \sum F^{(e)}=0$$

$$\frac{dQ_x}{dt}=0$$

$V_c=\omega R=\omega 2r$; $V_A=\omega 3r$; $\omega=\frac{V_c}{2r}$, $\omega=\frac{V_A}{3r}$ $\Rightarrow \frac{V_c}{2r}=\frac{V_A}{3r}$, $V_c=\frac{2}{3}V_A$

$$Q_x=\sum m_i V_{ix}=mV_A+MV_c=mV_A+M\tfrac{2}{3}V_A=V_A\left(m+\tfrac{2}{3}M\right)$$



Дано: m_1, m_2, U

$m_1=4000$ кг, $m_2=12000$ кг

$U=0{,}4$ м/с

$V_2 - ?$

$\frac{dQ}{dt}=0$; $Q=const$

$Q_0=m_2V_2+m_1(V_2+U)$

$Q=(m_1+m_2)V'$

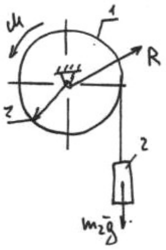
$m_2V_2+m_1(V_2+U)=(m_1+m_2)V'$

$m_2V_2+m_1V_2+m_1U=m_1V'+m_2V'$

$(m_1+m_2)V_2+m_1U=(m_1+m_2)V'$

$m_1U=(m_1+m_2)(V'-V_2)$

$V'-V_2=\frac{m_1U}{m_1+m_2}$



Дано: $M, m_1, r, m_2, m_1=2m$

$m_2=m$, $M=10mgr$

$\frac{dK_e}{dt}=L^e$; $K=J\omega=\frac{m_1 r^2}{2}\omega$

$K_2=mV_1\cdot r=m_2\omega r^2$

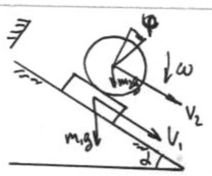
$L=M-mgr$

$L=10mgr-mgr=9mgr$

$K=\frac{mr^2\omega}{2}+mr^2\omega=\frac{3}{2}mr^2\omega=\frac{3}{2}J\omega$

$\frac{dK}{dt}=\frac{3}{2}mr^2\varepsilon \Rightarrow \frac{3}{2}mr^2\varepsilon=mgr \Rightarrow \varepsilon=\frac{G}{r}$

$a_2=\varepsilon r=\frac{2}{3}\frac{(M-m_2gr)}{mr}$; $\bar{\Phi}_2=-m_2\bar{a}_2$;



m_1, α, m_2, R, f

Q - ? сила - ?

$T_1=\frac{m\dot{x}^2}{2}$

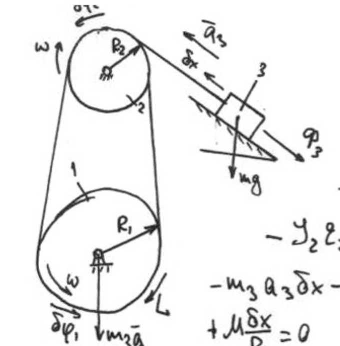
$T_2=\frac{mR^2\dot{\varphi}^2}{4}+\frac{m(\dot{x}+\omega R)^2}{2}$

$$Q_x=\frac{\delta A(\text{при } x=0, \varphi=0, \delta x\neq 0)}{\delta x}=$$

$$=\frac{\delta x\sin\alpha\cdot m_1g+\delta x\sin\alpha + m_2g-fm_1g\cos\alpha\,\delta x}{\delta x}=$$

$$=m_1g\sin\alpha+m_2g\sin\alpha-fm_1g\cos\alpha$$

$$Q_y=\frac{\delta A(\text{при } x=0; \varphi=0; \delta x=0; \delta\varphi\neq 0)}{\delta\varphi}=m_2gR\sin\alpha$$



$\Phi_3 = m_3 a_3 ; \ \delta x$

$\delta\varphi_2 = \dfrac{\delta x}{R_2}$

$\delta\varphi_1 = \dfrac{\delta x}{R_1}$

$-m_3 a_3 \delta x - m_3 g \sin\alpha \cdot \delta x -$

$- J_2 \varepsilon_2 \delta\varphi_2 - J_1 \varepsilon_1 \delta\varphi_1 + M\delta\varphi_1 = 0$

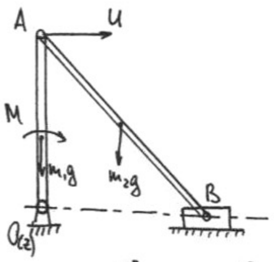
$-m_3 a_3 \delta x - m_3 g \sin\alpha\, \delta x - \dfrac{m_2 R_2^2}{2} \cdot \dfrac{a_3 \delta x}{R_2 R_1} +$

$+ M\dfrac{\delta x}{R_1} = 0$

$\varepsilon_1 A_1 = \varepsilon_2 A_2 ; \varepsilon_2 R_2 = a_3$

$-m_3 a_3 - m_3 g \sin\alpha - \dfrac{m_2 a_2}{2} - \dfrac{m_1 a_3}{2} + \dfrac{M}{R_1} = 0$

$\varepsilon_1 = \dfrac{a_3}{R_1} ; \varepsilon_2 = \dfrac{a_3}{R_2}$



Дано: $\angle AOB = 90^\circ, \bar{u}$

$m_1 = m, \ m_2 = 2m$

$\bar{V}_A - ?$

$T - T_0 = \sum A_k^{(e)} + \sum A_k^{(i)}$

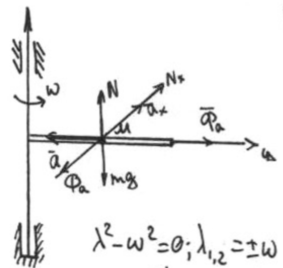
$T_0 = T_{01} + T_{02} = T_{10} = \dfrac{m\ell^2}{3 \cdot 2} \cdot \dfrac{u^2}{\ell^2} =$

$= \dfrac{m u^2}{6}$

$T_{02} = \dfrac{m_2 u^2}{2} ; \ T_1 = \dfrac{m\ell^2}{3} \cdot \dfrac{u_A^2}{2\ell_2^2} = \dfrac{m_2 V_A^2}{6}$

$A(M) = M \cdot \dfrac{\pi}{2}$

$\dfrac{m_1 V_A^2}{6} + \dfrac{m_2 V_A^2}{6} - \dfrac{m_1 u^2}{6} - \dfrac{m_2 u^2}{2} = M \cdot \dfrac{\pi}{2}$



Дано: $2\ell, \omega, m$

$t - ?$

$m\bar{a}^2 = \bar{F} + \bar{\Phi}_e + \bar{\Phi}_1$

$y: \ m a_{r_y} = \Phi_{e_y}$

$\Phi_{e_y} = m a_{e_y}$

$m a_r = m a_e$

$\lambda^2 - \omega^2 = 0 ; \lambda_{1,2} = \pm\omega ; \ a_r = a_e ; \ \ddot{y} = \omega^2 y$

$y = C_1 e^{\omega t} + C_2 e^{-\omega t}$

$\dot{y} = C_1 \omega e^{\omega t} + C_2(-\omega) e^{-\omega t} ; \ t=0, y = \ell : \ \ell = C_1 + C_2$

$0 = C_1\omega - C_2\omega$

$y = \dfrac{\ell}{2} e^{\omega t} + \dfrac{\ell}{2} e^{-\omega t}$

$C_1 = C_2 \Rightarrow C_1 = C_2 = \dfrac{\ell}{2}$

$2\ell = \dfrac{\ell}{2}(e^{\omega t} + e^{-\omega t}) \Rightarrow 4 = e^{\omega t} + e^{-\omega t}$

$4 e^{\omega t} = e^{2\omega t} + 1$

$4 e^{2\omega t} - 4 e^{\omega t} + 1 = 0 \Rightarrow e^{\omega t}_{1,2} = 2 \pm \sqrt{3}$

$\omega t = \ln(2 \pm \sqrt{3})$, но $\ln(2 - \sqrt{3}) < 0 \Rightarrow t = \dfrac{\ln(2+\sqrt{3})}{\omega}$

Дано: M, R_1, m_1, R_2, m_2

m_3

$\varepsilon_1 R_1 = \varepsilon_2 R_2 = \bar{a}_3$

$\delta\varphi_1 R_1 = \delta\varphi_2 R_2 = \delta\bar{r}_3$

$\delta r_3 \neq 0$

$dA(m\bar{g}) = -mg\delta r_3$

$dA(L_2^{(u)}) = -J\varepsilon_2 \delta\varphi_2$

$(\sum F_k + \sum \Phi_k)\delta r_k = 0$

$dA(L_1^{(\varphi)}) = -J\varepsilon_1 \delta\varphi_1$

$\Phi_3 = m a_3$

$dA(M) = M\delta\varphi_1$

$dA(\Phi_3) = -m a_1 \delta r_3$

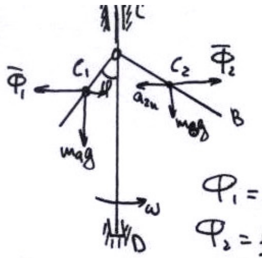
$-mg\, d r_3 - J_2 \dfrac{\varepsilon_1 R_1}{R_2} \cdot \dfrac{\delta r_3}{R_2} - J_1 \varepsilon_1 \dfrac{\delta r_3}{R_1} + M\dfrac{\delta r_3}{R_1} = 0$

$-mg - \dfrac{m R_2^2 \varepsilon_1 R_1}{R_2^2} - \dfrac{m R_1^2}{2 R_1}\varepsilon_1 + \dfrac{M}{R_1} - m a_3 = 0$

$-mg - m\varepsilon_1 R_1 - \dfrac{m R_1}{2}\varepsilon_1 + \dfrac{M}{R_1} - m\varepsilon_1 R_1 = 0$

$\varepsilon_1 \left(m R_1 + \dfrac{m R_1}{2} + m R_1\right) = \dfrac{M}{R_1} - mg$

$\varepsilon_1 = \dfrac{(M - R_1 mg)2}{R_1 \cdot m R_1 \cdot 5} = \dfrac{2(M - R_1 mg)}{5 m R_1^2}$



Дано: $AO=a$, $BO=b$, ω

$\omega(\varphi)$ -?

$m(AO)=a\rho$; $a_{n1}=\frac{\omega^2 a}{2}\sin\varphi$

$m(BO)=b\rho$; $a_{n2}=\frac{\omega^2 b}{2}\cos\varphi$

$\Phi_1=\rho a\cdot\frac{\omega^2 a}{2}\sin\varphi$

$\Phi_2=\rho b\cdot\frac{\omega^2 b}{2}\cos\varphi$

Ур-ие моментов, относ. т. O

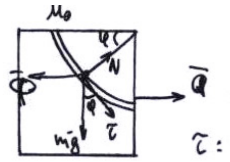
$-\Phi_1\cdot\frac{2a}{3}\cos\varphi+\rho a g\frac{a}{2}\sin\varphi+\Phi_2\cdot\frac{ab}{3}\sin\varphi-\rho b g\frac{b}{2}\cos\varphi=0$

$-a\frac{\omega^2 a}{2}\sin\varphi\cdot\frac{2a}{3}\cos\varphi+ag\frac{a}{2}\sin\varphi+b\frac{\omega^2 b}{2}\cos\varphi\frac{2b}{3}\sin\varphi-bg\frac{b}{2}\cos\varphi=0$

$\omega^2\left(-\frac{a^3}{3}\sin\varphi\cdot\cos\varphi+\frac{b^3}{3}\sin\varphi\cos\varphi\right)+\frac{a^2 g\sin\varphi}{2}-\frac{b^2 g\cos\varphi}{2}$

$\omega^2=\left(\frac{b^2 g\cos\varphi}{2}-\frac{a^2 g\sin\varphi}{2}\right):\left(-\frac{a^3}{3}+\frac{b^3}{3}\right)\cdot\frac{\sin 2\varphi}{2}$

$\omega^2=\frac{3g(b^2\cos\varphi-a^2\sin\varphi)}{\sin 2\varphi(b^3-a^3)}$



Дано: a, m, $\varphi=60°$

a-? N-?

$F_k+\overline{\Phi}_k=0$

τ: $mg\cos\varphi-\Phi_k\sin\varphi=0$

$mg\cos\varphi-ma\sin\varphi=0$

$a=\frac{g\cos\varphi}{\sin\varphi}=g\,ctg\varphi$

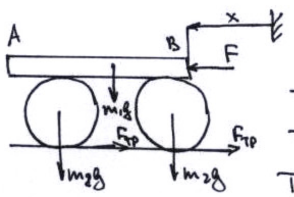
n: $-mg\sin\varphi-\Phi\cos\varphi+N=0$

$-mg\sin\varphi-mg\,ctg\varphi\cos\varphi+N=0$

$N=mg(\sin\varphi+ctg\varphi\cos\varphi)$

$N=mg\sin\varphi\underbrace{(1+ctg^2\varphi)}_{=\frac{1}{\sin^2\varphi}}$

$N=\frac{mg}{\sin\varphi}$



Дано: m_1, m_2, F

a_1-?

$T=T_1+T_2+T_3$

$T_1=m_1\frac{\dot{x}^2}{2}$

$T_1=T_3=\frac{J\omega^2}{2}+\frac{m\dot{x}^2}{8}$

$T_2=T_3=\frac{1}{2}\cdot\frac{m_2R^2}{2}\cdot\frac{\dot{x}^2}{4R^2}+\frac{m_2\dot{x}^2}{8}=\frac{m_2\dot{x}^2}{16}+\frac{m_2\dot{x}^2}{8}=\frac{3}{16}m_2\dot{x}^2$

$T=m_1\frac{\dot{x}^2}{2}+\frac{3}{8}m_2\dot{x}^2=\dot{x}^2\left(\frac{m_1}{2}+\frac{3m_2}{8}\right)$

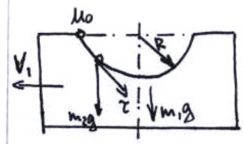
$dT=2\dot{x}\ddot{x}\left(\frac{m_1}{2}+\frac{3m_2}{8}\right)$

$dT=\sum F_k dx_k=Fdx$

$\int\dot{x}d\dot{x}\left(m_1+\frac{3m_2}{4}\right)=\int Fdx$

$(m_1+\frac{3}{4}m_2)\frac{\dot{x}^2}{2}=Fx+C \Rightarrow (m_1+\frac{3}{4}m_2)\frac{1}{2}\cdot 2\dot{x}\ddot{x}=F\dot{x}$

$\ddot{x}=\frac{F}{(m_1+\frac{3}{4}m_2)}$



Дано: m_1, R_1, m_2

$m_1=20$кг, $m_2=5$кг, $R=0,5$м

V_1-?

$E=T+\Pi$ $\quad E=const$

$T+\Pi=T_0+\Pi_0$

$\Pi_0=m_2gR$ $\quad \Pi=0$

$T_0=0$ $\quad T=\frac{m_1V_1^2}{2}+\frac{m_2V_2^2}{2}$

$\frac{dQ}{dt}=\sum F_k^{(e)}$; $\sum F_k^{(e)}=0$; $Q=const$; $Q_0=0$

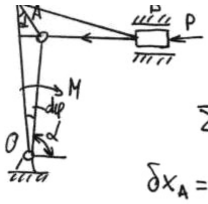
$Q_k=m_1\overline{V}_1+m_2\overline{V}_2$; $m_1V_1-m_2V_2=0$

$Q_{kx}=m_1V_1-m_2V_2$; $V_2=\frac{m_1V_1}{m_2}$

$\frac{m_1V_1^2}{2}+\frac{m_2V_2^2}{2}=mgR$

$\frac{m_1V_1^2}{2}+m_2\left(\frac{m_1V_1}{m_2}\right)^2=m_2gR$

$\Rightarrow$ выражаем V_1



Дано: P, $OA = \ell$, $AB = 2\ell$, $\alpha = 45^\circ$

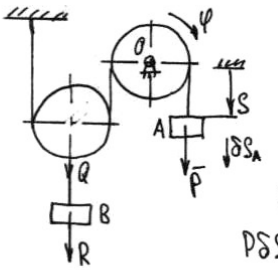
M - ?

$$\sum \bar{F}_k \delta r_k = 0$$

$$\delta x_A = \ell \delta\varphi \sin\alpha \quad \delta x_A \approx \delta x_B$$

$$P\delta\varphi \ell \sin\alpha - M\delta\varphi = 0$$

$$M = P\ell \sin\alpha$$



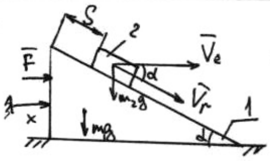
Дано: P, Q

R - ?

$$\delta S_B = \delta S_D = \frac{\delta S_A}{2}$$

$$P\delta S_A - Q\frac{\delta S_A}{2} - R \cdot \frac{\delta S_A}{2} = 0$$

$$R = 2P - Q$$



Дано: m_1, m_2, α, F

T-?, Q_x-?, Q_S-?

$$q_1 = x, \quad q_2 = S$$

$$T_1 = \frac{m_2\dot{x}^2}{2}; \quad T_2 = \frac{m_1 V_c^2}{2}$$

$$\bar{V}_c = \bar{V}_e + \bar{V}_z$$

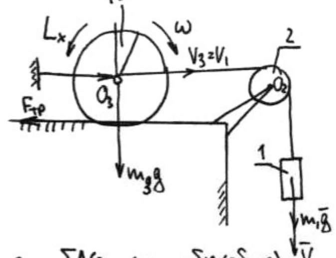
$$\dot{V}_c^2 = V_c^2 + V_z^2 - 2V_e V_z \cos\alpha \quad ; \quad V_e = \dot{x}, \ V_z = \dot{S}$$

$$T = \frac{m_1(\dot{x}^2 + \dot{S}^2 + 2\dot{x}\dot{S}\cos\alpha)}{2}$$

$$Q_x = \frac{\delta A(\text{при } S \neq 0, A \neq 0, \delta S \neq 0, \delta\varphi \neq 0)}{\delta x}$$

$$\delta A(F) = F\delta x \quad ; \quad Q_x = F \ ; \quad Q_S = \frac{\delta A(\text{при } S = 0, x = 0, \delta S \neq 0, \delta x = 0)}{\delta S}$$

$$Q_S = \frac{m_2 g \delta S \sin\alpha}{\delta S} = m_2 g \sin\alpha$$



Дано: m_1, m_3, r_3, f - коэф. тр., f_k

Q-? силы-?

$$T_1 = \frac{mV_1^2}{2} = \frac{m\dot{x}^2}{2}$$

$$T_3 = \frac{mV_c^2}{2} + \frac{J\omega^2}{2} = \frac{m\dot{x}^2}{2} + \frac{m \cdot r^2\dot{\varphi}^2}{4}$$

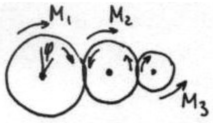
$$Q_\varphi = \frac{\delta A(\text{при } \varphi = 0, x = 0, \delta\varphi \neq 0, \delta x = 0)}{\delta\varphi}$$

$$Q_\varphi = \frac{-f_k m_3 g + f m_3 g r_3 \delta\varphi}{\delta\varphi} = -f_k m_3 g + f m_3 g$$

Найдем L_k:

$$L_k = f_k N; \ m\ddot{y} = N - mg, \ N = mg, \ L = f_k m_3 g$$

$$Q_x = \frac{m_1 g\delta x - F_{тр}\delta x}{\delta x} = m_1 g - F_{тр}$$



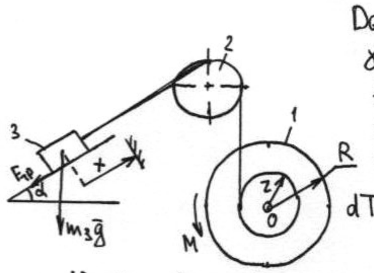
$$T = \frac{m_1 r_1^2}{4}\dot{\varphi}^2 + \frac{m_2 r_2^2}{4}\cdot\frac{\dot{\varphi}^2 r_1^2}{r_2^2} + \frac{m_3 r_3^2}{4}\frac{\dot{\varphi}^2 r_1^2}{r_3^2}$$

$$T = \frac{\dot{\varphi}^2}{4} r_1^2 (m_1+m_2+m_3)$$

$$Q_\varphi = \frac{M_1\delta\varphi - M_2\frac{\delta\varphi R_1}{R_2} - M_3\frac{\delta\varphi R_1}{R_3}}{\delta\varphi}$$

$$Q_\varphi = M_1 - M_2\frac{r_1}{r_2} - M_3\frac{r_1}{r_3};\quad \frac{\partial T}{\partial\varphi}=0;\quad \frac{d}{dt}\left(\frac{\partial T}{\partial\dot{\varphi}}\right) = \ddot{\varphi}\frac{r_1^2}{2}(m_1+m_2+m_3)$$

$$\ddot{\varphi} = 2\,\frac{M_1 - M_2\frac{r_1}{r_2} - M_3\frac{r_1}{r_3}}{r_1^2(m_1+m_2+m_3)}$$



Дано: m_1, m_3

γ - коэф. тр.; $R=2r$

$\rho = 0{,}6R$

$x(0)=0$

Найти: $\dot{x}(x)$ - ?

$$dT = \sum_{k=1}^{n} dA_k^{(e)} + \sum_{k=1}^{n} dA_k^{(i)}$$

$$T = \frac{m_3\dot{x}^2}{2} + \frac{J_{1O}\,\omega_1^2}{2};\quad \omega_1 = \frac{\dot{x}}{r};\quad J_{1O} = m_1\rho^2 \Rightarrow T = \frac{\dot{x}^2}{2}\left[m_3 + m_1\left(\frac{\rho}{r}\right)^2\right]$$

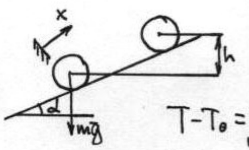
$$dA = -m_3 g\sin\alpha\cdot dx - F_{тр}dx + M d\varphi;\quad F_{тр} = m_3 g\cos\alpha\cdot\gamma$$

$$d\varphi = \frac{dx}{r}$$

$$dT = \left[m_3 + m_1\left(\frac{\rho}{r}\right)^2\right]\frac{2\dot{x}}{2}d\dot{x};\quad dT = dA$$

$$\dot{x}d\dot{x}\left[m_3 + m_1\left(\frac{\rho}{r}\right)^2\right] = dx\left[\frac{M}{r} - m_3 g(\sin\alpha + \cos\alpha\cdot\gamma)\right]$$

$$\int \dot{x}d\dot{x}[\;] = \int dx[\;] \Rightarrow \dot{x} = \sqrt{\;}$$



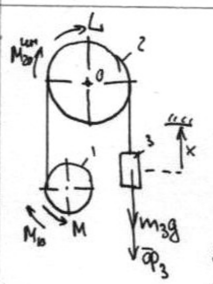
Дано: R, ω_0

Найти h

$$T - T_0 = \sum_{k=1}^{n} A_k^{(e)} + \sum_{k=1}^{n} A_k^{(i)}$$

$$-\frac{3m\omega_0^2 R^2}{4} = -mgh$$

$$h = \frac{3\omega_0^2 R^2}{4g}$$



Дано: $m_1, m_2, r_1, r_2; L, M$

$a_{гр}$ - ?

Решение

$$\sum\delta A^{акт} + \sum\delta A^{ин} = 0$$

1) $\bar{\Phi}_3^{ин} = -m_3\bar{a}_{гр};\ \Phi_3^{ин} = m_3 a_{гр}$

2) $\bar{M}_{20}^{ин} = -J_{20}\varepsilon_2;\ M_{20}^{ин} = J_{20}\varepsilon_2$

3) $\bar{M}_{10}^{ин} = -J_{10}\varepsilon_1;\ M_{10}^{ин} = J_{10}\varepsilon_1$

$$-m_3 g\cdot\delta x - \Phi_3^{ин}\cdot\delta x - M_{20}^{ин}\cdot\delta\varphi_2 - L\cdot\delta\varphi_2 - M_{10}^{ин}\cdot\delta\varphi_1 + M\delta\varphi_1 = 0$$

$\delta\varphi_2 = \frac{\delta x}{r_2}$	$\varepsilon_2 = \frac{a_{гр}}{r_2}$	$J_{20} = \frac{m_2 r_2^2}{2}$
$\delta\varphi_1 = \frac{\delta x}{r_1}$	$\varepsilon_1 = \frac{a_{гр}}{r_1}$	$J_{10} = \frac{m_1 r_1^2}{2}$