PREMO GIBANJE

$v = \frac{s_2 - s_1}{t_2 - t_1} = \frac{\Delta s}{\Delta t}$

$a = \frac{v_2 - v_1}{t_2 - t_1} = \frac{\Delta v}{\Delta t}$

- enakomerno

$s = vt + s_0$

$v = konst.$

$a = 0$

- enakomerno pospešeno

$\Delta s = v_0 t \pm \frac{1}{2} a t^2 + s_0$

$\Delta s = \frac{v_k^2 - v_2}{2a}$

$\Delta v = v_0 + at$

$v^2 = v_0^2 \pm 2as$ (zveza)

$v(t) = \dot{s} = \frac{ds}{dt}$

$a(t) = \dot{v} = \frac{dv}{dt} = \ddot{s} = \frac{d^2 s}{dt^2}$

$s(t) = s(t_0) + \int_{t_0}^{t} v(t)\,dt$

$v(t) = v(t_0) + \int_{t_0}^{t} a(t')\,dt$

- prosti pad

$v = v_0 + gt$

$h = \frac{1}{2} g t^2 = h_0 + v_0 t$

$v = \sqrt{2gh}$

- navpični met

$v = v_0 - gt$

$h = v_0 t - \frac{1}{2} g t^2 + h_0$

$v^2 = v_0^2 - 2gh$

$t = \sqrt{\frac{2h}{g}}$

$v = \sqrt{2gh}$

$h_{max} = \frac{v_0^2}{2g}$

$v(t) = \dot{h}$

- kroženje

$\nu = \frac{1}{t_0} = \frac{\omega_0}{2\pi}$ [Hz]

$\theta = \theta_0 + \omega t = \frac{\omega_k^2 - \omega_z^2}{2\alpha}$

$\omega = \frac{\theta}{t} = \frac{2\pi}{t_0} = 2\pi\nu$ [Hz] $= \frac{d\theta}{dt} = \dot{\theta}$

$v = \frac{s}{t} = \frac{2\pi r}{t_0} = 2\pi r \nu = r\omega$ [m/s]

$a_r = \omega v = \omega^2 r = \frac{v^2}{r}$

$R = r \cdot \theta = \frac{v_k^2 - v_z^2}{2at}$

$a_t = \alpha \cdot r$

$\alpha = \frac{d\omega}{dt}$

$\theta(t) = \theta_0 + \omega_0 t + \frac{\alpha t^2}{2}$; $\omega = \dot{\theta}$; $\alpha = \dot{\omega}$

$l(l) = l_0 + v_0 t = \frac{a_t t^2}{2}$; $v = \dot{l}$; $a_t = \dot{v}$

θ = pot, ω = kotna hitrost, α = kotni posp.

- vodoravni met

$x = v_x t$, $v_x = konst.$

$y = y_0 - \frac{1}{2} g t^2$, $v_y = gt$

- poševni met

$x_{max} = \frac{v_0^2 \cdot \sin(2\alpha)}{g}$

$y_{max} = \frac{v_0^2 \cdot \sin^2 \alpha}{2g}$

$x = (v_0 \cos\alpha) \cdot t$

$y = (v_0 \cdot \sin\alpha) \cdot t - \frac{1}{2} g t^2$

SILE

$F_c = m \cdot a_r = m \frac{v^2}{r} = m \cdot \omega^2 \cdot R$

$\Sigma F = m \cdot a$

$F_{tr} = F_N \cdot k_t$

$F_t = F_N \cdot k_t$

$k_t > k_t$

$F_y = F \sin\theta$

$F_x = F \cos\theta$

$\sin\theta = \frac{a}{c}$

$\cos\theta = \frac{b}{c}$

- gravitacija

$F_g = G \frac{m_1 m_2}{r^2} = m \cdot a$

$W_g = -G \frac{m_1 m_2}{r}$

$A = \frac{1}{2} m v^2$

$g_0 = \frac{GM}{R^2}$

- kotaljenje

$v_t = \omega \cdot R$

$W_k = \frac{1}{2} \left(m + \frac{J}{r^2}\right) \cdot v_r^2$

- energija

$A = \Delta W = \Delta W_k + \Delta W_p + \Delta W_{pr} = \Delta W_{meh}$

$W_k = \frac{1}{2} m v^2$

$W_{pr} = \frac{1}{2} k x$

$W_p = mgh$

$\Delta W_{meh} = W_k - W_2$

ohranitev mehanične energije: $\Delta W_{meh} = 0$, $W_{pred} = W_{po}$ (prožni trk)

- navor

$M = F_\perp r = F r_\perp = F r \sin\theta$

$\vec{M} = J \cdot \vec{\alpha} = J \frac{d\omega}{dt}$ (kot)

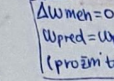
$A = M \cdot \theta = \int \vec{M} \cdot d\theta$ (delo po zasuku)

$P = \vec{M} \cdot \vec{\omega}$

$A = \vec{M} d\vec{\theta} = \vec{M} \vec{\omega} dt$

$M_1 = M_2$

$F_{r_1} = F_2 r_2$



- gibalna količina

$\vec{G} = m\vec{v}$

$\Delta G = m\vec{v}_{po} - m\vec{v}_{pred} = F\Delta t = \int_{t_0}^{t} \vec{F}\,dt$

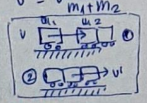
↳ ohranitev gib. količine: $\Delta G = 0$ oz. $G_{pred} = G_{po}$

↳ neprožni trk

$G_{pred} = G_{po}$

$G_{po} = (m_1 + m_2) v'$

$v' = v \frac{m_1}{m_1 + m_2}$

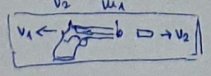


↳ eksplozija

$G_{pred} = 0$

$G_{po} = m_1 v_1 - m_2 v_2$

$\frac{v_1}{v_2} = \frac{m_2}{m_1}$



↳ prožni trk

$G_{pred} = m_1 v$

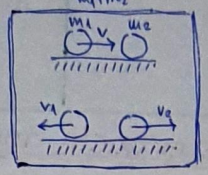
$W_{kpred} = \frac{1}{2} m_1 v^2$

$G_{po} = m_1 v_1 - m_2 v_2$

$W_{kpo} = \frac{1}{2} m_1 v_1^2 + \frac{1}{2} m_2 v_2^2$

$v_1 = \frac{m_1 - m_2}{m_1 + m_2} v$

$v_2 = \frac{2m}{m_1 + m_2} v$



- vztrajnostni momenti

- valj, $J = m \cdot r^2$ točkasto telo, obroč.
- $J = \frac{mr^2}{2}$ palica na koncu
- $J = \frac{mr^2}{2}$ disk / valj $W_k = \frac{1}{2} J \cdot \omega^2$
- $J = \frac{2mR^2}{5}$ polna krogla
- $J = \frac{2mR^2}{3}$ tanka krogla lupina
- $J = \frac{mR^2}{4} + \frac{mh^2}{12}$
- $J = \frac{3mR^2}{10}$
- $J = \frac{1}{12} m R^2$
- $J = \frac{2}{5} mR^2$
- STEINER

$J = J_* + mr_*^2$

- delo

$A = F \cdot s = F \cdot s \cdot \cos\theta$

$A_g = -F_g \Delta h$

$P = \frac{A}{t} = F \cdot v$

$A = Pdt = M\,d\theta$

$\Rightarrow P = M \frac{d\theta}{dt}$

- vrtilna količina

$\Psi = J \cdot \omega_{kon}$

$\vec{\Psi} = \vec{G} \times \vec{r} = m \cdot v \cdot r \cdot \sin\theta$

$\Delta\vec{J} = \int M dt = \vec{J}_k - \vec{J}_z$

NIHANJE

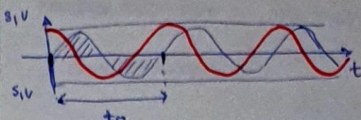
$\nu = \frac{N}{t} = \frac{1}{t}$ [Hz]

$x(t) = A \sin\left(\left(\frac{2\pi}{t_0}\right) t + \delta\right) = A \sin(\omega t + \delta)$

(A = amplituda nihanja)

$v(t) = v_0 \cos\left(\frac{2\pi}{t_0}\right) t = \omega x \cos(\omega t)$

(v_0 = amplituda hitrosti)



$a(t) = -a_0 \sin\left(\frac{2\pi}{t_0}\right)^2 t = -\omega^2 x_0 \sin(\omega t)$

$t_0 = 2\pi\sqrt{\frac{m}{k}} = \omega^{-1}$

$t_0 = 2\pi\sqrt{\frac{l}{g}} = \omega$

$t_0 = \frac{2\pi}{\omega}$

$\omega = \sqrt{\frac{k}{m}}$ krožna frekvenca

$x(t) = x_0 e^{-\beta t} \sin\omega t$ dušeno nihanje

$\beta = -\frac{\ln \frac{x_t}{x_0}}{\Delta t}$ koef. dušenja

$W = W_0 e^{-2\beta}$ energija dušenega nihanja

$\ddot{x} + \omega^2 x = 0$ harmonično nihanje

$W = \frac{1}{2} k A^2$ vzmetna energija

VZBUJANJE

$\ddot{x} + 2\beta\dot{x} + \omega^2 x = F(t)/m$

$F(t)_{zun} = F_0 \sin(\Omega t)$ ... Ω frekvenca vzb.

Če je $\Omega = \omega_1$ dobimo rezonanco.

ELEKTROSTATIKA

$F_e = \frac{e_1 e_2}{4\pi\varepsilon_0 r^2}$ $\quad e_1 e_2 < 0$ $\quad e_1 e_2 > 0$ ⇐ Električni naboj (Coulomb)

b) električno polje

$k = \frac{1}{4\pi\varepsilon_0}$

$W_{el} = \frac{e_1 e_2}{4\pi\varepsilon_0 |r_1 - r_2|}$

- $E = \frac{1}{4\pi\varepsilon_0} \cdot \frac{e}{r^2}$ $\left[\frac{N}{As}\right]\left[\frac{V}{m}\right]$

- $E = \frac{\sigma}{2\varepsilon_0} = \frac{e}{2S\varepsilon_0}$

- $E = \frac{e}{S\varepsilon_0}$

$E = \frac{U}{d}$

$\sigma = \frac{e}{S}$ ploskovna gostota naboja

$\vec{F}_e = e \cdot \vec{E}$, $U = Ed$

$A = -F_e x = -eEx$ ... x premik vzdolž silnice

$A = Ue$

$U = \frac{Ae}{e}$ $\left[\frac{J}{As}\right]$ [V]

$\Delta W_{ep} = eU = e(V_1 - V_2) = e\Delta V$

$U = V_1 - V_2$ (razlika potencialov med dvema točkama polja)

$W_{ed} = eEh$

$\varphi_e = \frac{W_e}{e_t}$ $\left[\frac{Nm}{As}\right] = \left[\frac{J}{A_s}\right]$

Kondenzator

$C = \frac{e}{U} \Rightarrow e = U \cdot C$ ↑ Farad $[\frac{As}{V}]$

$E = \frac{e}{\varepsilon_0 S}$

$C = \varepsilon_0 \frac{S}{d}$ → površina plošče, → razmik med ploščama, ← infl. koustanta

$e = \varepsilon_0 S \frac{U}{d}$

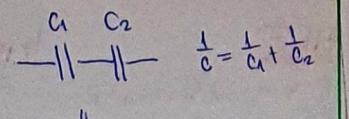
$A_e = \frac{e^2}{2C}$

$W_e = \frac{e^2}{2C} = \frac{1}{2} C U^2 = \frac{1}{2} \varepsilon_0 E^2 V$ ← prostornina kon.

$W_e = \frac{1}{2} \varepsilon_0 E^2$ gostota ener.

Kapaciteto povečamo, če med plošči vstavimo dielektrik $C = \varepsilon_0 \varepsilon \frac{S}{d}$ ↳ dielektričnost snovi

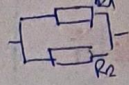
$W_e = \frac{1}{2} \varepsilon_0 \varepsilon E^2$



$\frac{1}{C} = \frac{1}{C_1} + \frac{1}{C_2}$

$C = C_1 + C_2$

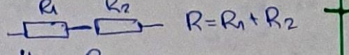
KONDENZATORJI



$\frac{1}{R} = \frac{1}{R_1} + \frac{1}{R_2}$

$\frac{I_1}{I_2} = \frac{R_2}{R_1}$ $U_1 = U_2$

UPORNIKI



$R = R_1 + R_2$

$\frac{U_1}{U_2} = \frac{R_1}{R_2}$ $I_1 = I_2$

ELEKTRIČNO DELO IN MOČ

$A_e = U_e = UIt = RI^2 t = \frac{U^2}{R} t$

$P_e = \frac{A_e}{t} = UI = RI^2 = \frac{U^2}{R}$

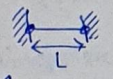
VALOVANJE

$t_0 = \frac{1}{\nu_0}$

$c = \nu_0 \lambda \Rightarrow \lambda = \frac{c}{\nu}$

$k = \frac{2\pi}{\lambda}$

$c = \sqrt{\frac{F}{\mu}} = \sqrt{\frac{Fw}{\ell}}$ hitrost trauzverzalnih valov in dolžiuska gostota

$\nu = \frac{c}{2\ell} = \frac{c}{\lambda}$  vrvica in piščal

$\nu = \frac{c}{4\ell}$  vrvica in piščal

interferenca

$\sin\theta = \frac{N\lambda}{d}$ pasi ojačitev

$\sin\theta = \frac{(N+\frac{1}{2})\lambda}{d}$ pasi oslabitev

dopplerjev pojav

$\nu = \frac{\nu_0}{1 \pm \frac{v}{c}}$ sprejemnik miruje

$\nu = \nu_0 (1 \pm \frac{v}{c})$ izvir miruje

\+ približevanje − oddaljevanje

$\sin\alpha = \frac{v}{c} = \frac{1}{M}$ kot Machovega stožca 2α

gostota energijskega toka

$j = \frac{W}{St} = \frac{P}{S}$ $[\frac{W}{m^2}]$

ELEKTRIČNI TOK

$I = \frac{e}{t}$ $[A]$ = amper

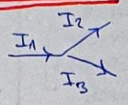
$U_{12} = \phi_2 - \phi_1$ el. napetost/ razlika el. potencijalov $[\frac{J}{As}][V]$

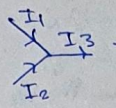
$R = \frac{U}{I}$ $[\frac{V}{A}][\Omega]$

$R = \varrho \frac{\ell}{S}$ ℓ dolžina vodnika, S presek vodnika, ϱ specifični upor

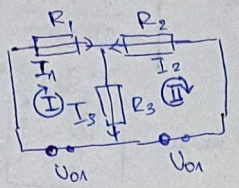
ELEKTRIČNA VEJA

$I_1 = I_2 + I_3$





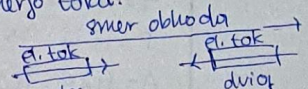
$I_1 + I_2 = I_3$



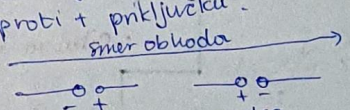
Ⓘ $U_{01} = I_1 R + I_3 R_3$

Ⓘⓘ $U_{02} = -I_3 R_1 + I_2 R_2$

Na porabniku je padec napetosti, kadar se smer obhoda ujema s smerjo toka.



Na izviru je dvig napetosti, kadar je smer obhoda od- proti + priključku.



Srednji polmer Zemlje	$r_z = 6370\,km$
Težni pospešek	$g = 9{,}81\ \frac{m}{s^2}$
Hitrost svetlobe	$c = 3{,}00 \cdot 10^8\ \frac{m}{s}$
Osnovni naboj	$e_0 = 1{,}60 \cdot 10^{-19} As$
Električna (infl.) koustanta	$\varepsilon_0 = 8{,}85 \cdot 10^{-12} As/Vm$
Stefanova koustanta	$\sigma = 5{,}67 \cdot 10^{-8} W/m^2 K^4$