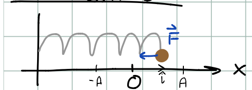
Svängningar



$\vec{F} = -kx\hat{i}$
$\vec{F} = m\vec{a}$
$\vec{a} = \frac{d^2x}{dt^2}\hat{i}$

$$-kx\hat{i} = m\cdot\frac{d^2x}{dt^2}\cdot\hat{i} \Rightarrow m\frac{d^2x}{dt^2} = -kx \Rightarrow \frac{d^2x}{dt^2} + \frac{k}{m}x = 0$$

Allm. Lösning: $X(t) = A\cdot\cos\left[\sqrt{\frac{k}{m}}\cdot t + \varnothing\right]$ $\varnothing$: faskonstant, A: amplitud

$\omega = \sqrt{\frac{k}{m}}$: Vinkelhastighet $\left[\frac{rad}{s}, s^{-1}\right]$,

$\omega = 2\pi f$

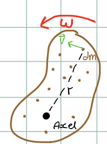
$T = \frac{1}{f} = \frac{2\pi}{\omega}$, periodtid

$X(t) = A\cos(\omega t + \varnothing)$

Varianter: $X(t) = A\cdot\sin(\omega t)$: $X=0$ när $t=0$ och $\vec{v}$ går åt höger

$X(t) = -A\cdot\sin(\omega t)$: — " — och $\vec{v}$ går åt vänster

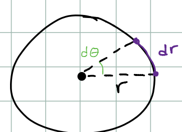
Rotationsrörelse Av STEL kropp runt FIX axel



Rörelseenergi: $dK_R = \frac{1}{2}dm\cdot v^2 = \frac{1}{2}dm(r\omega)^2$

Totala: $K_R = \int_{\text{hela kroppen}} dK_R = \int_{\text{hel. kr.}} \frac{1}{2}dm\, r^2\omega^2 = \frac{1}{2}\omega^2 \int_{\text{h.k}} r^2\cdot dm$ Jfr med partikel: $K = \frac{1}{2}v^2 m$

Kropp/axel har ett tröghetsmoment: $I = \int_{\text{hela kr.}} r^2\cdot dm$



$dr = r\cdot d\theta$

$\frac{dr}{dt} = r\frac{d\theta}{dt} \Rightarrow V = r\cdot\omega$

Translation

Läge: x

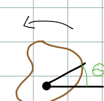
Hastighet: $\vec{V} = \frac{d\vec{x}}{dt}$

Acceleration: $\vec{a} = \frac{d\vec{V}}{dt}$

$x_f - x_i = V_0 t + \frac{1}{2}at^2$

$V_f^2 - V_i^2 = 2as$

Rotation



Läge: θ

Hastighet: $\omega = \frac{d\theta}{dt}$

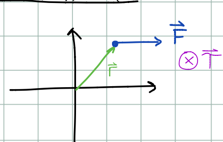
Acceleration: $\alpha = \frac{d\omega}{dt}$

$\theta_f - \theta_i = \omega_0\cdot t + \frac{1}{2}\alpha t^2$

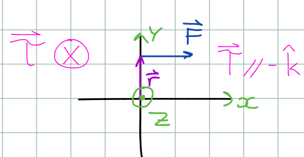
$\omega_f^2 - \omega_i^2 = 2\alpha\Delta\theta$

Vridande moment: $\vec{\tau}$

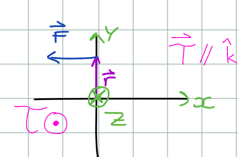
$\vec{\tau} = \vec{r}\times\vec{F}$



Riktningen för $\vec{\tau}$ sammanfaller inte med rotationen.



Medurs



Moturs

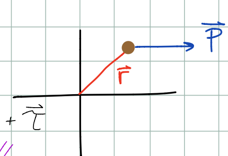
Rörelsemängdsmoment: $\vec{L}$

$\vec{L} = \vec{r}\times\vec{P} = \vec{r}\times(m\vec{v})$

$\frac{d\vec{L}}{dt} = \frac{d}{dt}(\vec{r}\times\vec{P}) = \frac{d\vec{r}}{dt}\times\vec{P} + \vec{r}\times\frac{d\vec{P}}{dt} =$

$\frac{d\vec{r}}{dt}\times m\vec{v} + \vec{r}\times\vec{F} = \frac{d\vec{r}}{dt}\times m\vec{v} + \vec{\tau} \Leftrightarrow \underbrace{\vec{v}\times m\vec{v}}_{=0 \text{ ty } //} + \vec{\tau}$

$\vec{\tau} = \frac{d\vec{L}}{dt}$



Partiklar: $\vec{F} = \frac{d\vec{P}}{dt}$

To be continued.