Sammanfattning - Mekanik I

Statik

$\bar{M}_0 = \bar{r}_{oa} \times \bar{F}$	Kraftmoment
$\bar{M}_a = M_b + \bar{r}_{ab} \times \bar{F}$	Moment map en axel
$M_\lambda = \bar{M}_p \times \bar{e}_\lambda$	Sambandsformel
$\bar{F} \cdot \bar{M}_a = 0; (\bar{F} \neq \bar{0})$	Enkraftresultant
$\bar{r}_g = \frac{\sum_{k=1}^{n} m_k \bar{r}_k}{m}$	Masscentrum
$A = 2\pi\, y_g\, l; V = 2\pi\, y_g\, A$	Pappus regel
$\begin{cases} \bar{F} = \bar{0} \\ \bar{M}_a = \bar{0} \end{cases}$	Kraftekv.

$y_g = \frac{r\sin(\alpha)}{\alpha}$	Cirkelbåge
$y_g = \frac{2}{3}\frac{r\sin(\alpha)}{\alpha}$	Cirkelsektor
$y_g = \frac{h}{3}$	Triangel skiva
$y_g = \frac{3r}{8}$	Halvklot
$y_g = \frac{h}{4}$	Kon
$F = \mu\, N$	Friktionsvilkor glidning

Massa M, Längd L, Tid T

Dynamik

$\bar{v} = \dot{x}\bar{e}_x + \dot{y}\bar{e}_y + \dot{z}\,\bar{e}_z$	Kartetiska kord.
$\bar{a} = \ddot{x}\bar{e}_x + \ddot{y}\bar{e}_y + \ddot{z}\,\bar{e}_z$	Kartetiska kord.
$\bar{v} = \dot{s}\,\bar{e}_t$	Naturliga kord.
$\bar{a} = \dot{v}\,\bar{e}_t + \frac{v^2}{\rho}\bar{e}_n$	Naturliga kord.
$\rho = \frac{\lvert s'^3 \rvert}{\lvert \bar{r}' \times \bar{r}'' \rvert} = \frac{(1+y'^2)^{3/2}}{\lvert y'' \rvert}$	Krökningsradie
$\bar{v} = \dot{r}\bar{e}_r + r\dot{\theta}\bar{e}_\theta + \dot{z}\bar{e}_z$	Cylinder kord.
$\bar{a} = (\ddot{r} - r\dot{\theta}^2)\bar{e}_r + (r\ddot{\theta} + 2\dot{r}\dot{\theta})\bar{e}_\theta + \ddot{z}\,\bar{e}_z$	
$\bar{p} = m\bar{v}$	Rörelsemängd
$\dot{\bar{p}} = \bar{F}$	Rör.mängdslagen
$U_{1-2} = \int_{\bar{r}_1}^{\bar{r}_2} \bar{F} \cdot d\bar{r}$	Arbetet
$P = \bar{F} \cdot \bar{v}$	Effekt
$\Delta p = \int_{t_1}^{t_2} \bar{F} dt$	Kraftimpulslag.
$\Delta\bar{H}_0 = \int_{t_1}^{t_2} \bar{M}_o dt$	Momentimpulslag.
$e = \frac{v'_{2x} - v'_{1x}}{v_{1x} - v_{2x}}$	Studstal
$\Delta p = \bar{p}' - \bar{p} = \bar{0}$	Bevarande av $\bar{p}$
$\dot{A} = \frac{1}{2} r^2 \theta = konst$	Sektorhastghet

$P = \int_{t_1}^{t_2} P\, dt$	Lagen om effekt
$T = \frac{1}{2} m v^2$	Kinetisk energi
$U_{1-2} = T_2 - T_1$	Lagen om kin. Ene.
$V(\bar{r}) = -\int_{\bar{r}_1}^{\bar{r}} \bar{F} \cdot d\bar{r}$	Potentiell energi
$V = mgz + C$	Pot. tyngdkraft
$V(r) = -G\frac{mM}{r}$	Pot. Grav.kraft
$V = \frac{1}{2} k (\Delta l)^2$	Pot. fjäderkraft
$U_{1-2} = V_1 - V_2$	Arbete kons.kraf
$T + V = E$	Mek. energi lagen
$\bar{H}_o = \bar{r} \times m\bar{v}$	Rörelsemängdlag
$\dot{\bar{H}} = \bar{M}_0$	Momentekv.
$a_r = -h^2 u^2 \left(\frac{d^2 u}{d\theta^2} + u\right)$	Binets formel
$r = \frac{(1-e^2)a}{1+e\,cos(\theta)}$	Radie i eliptiskbana
$\tau = 2\pi \frac{a^{\frac{3}{2}}}{\sqrt{GM}} = 2\pi \frac{a^{\frac{3}{2}}}{R\sqrt{g}}$	Kepllers III lag
$v = R\sqrt{2g\left(\frac{1}{r} - \frac{1}{2a}\right)}$	Hastighet i en elips

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$\omega_n^2 = \frac{k}{m}$ $\quad 2\zeta\omega_n = \frac{c}{m}$

$\ddot{x} + \omega_n^2 x = 0$ Fri odämpad svängning

$$x(t) = Asin(\omega_n t) + Bcos(\omega_n t) = C \sin(\omega_n t + \alpha)$$

$\tau_n = \frac{2\pi}{\omega_n}$ $\quad C = \sqrt{A^2 + B^2}$ $\quad \tan(\alpha) = \frac{A}{B}$

$\ddot{x} + 2\zeta\omega_n\dot{x} + \omega_n^2 x = 0$ Fri dämpad svängning

$$\lambda_{1,2} = -\zeta\omega_n \pm \omega_n\sqrt{\zeta^2 - 1}$$

$\zeta > 1$ Stark dämpning $\quad x(t) = e^{\left(-\zeta-\sqrt{\zeta^2-1}\right)\omega_n t}\left[A_1 + A_2 e^{2\sqrt{\zeta^2-1}\,\omega_n t}\right]$

$\zeta = 1$ Kritisk dämpning $\quad x(t) = (A + B\,t)e^{-\omega_n t}$

$\zeta < 1$ Svag dämpning $\quad x(t) = e^{-\zeta\omega_n t}(Asin(\omega_d t) + Bcos(\omega_d t))$

$\tau_d = \frac{2\pi}{\omega_d}$ $\quad \delta = \ln(\frac{x_1}{x_2})$ $\quad \zeta = \frac{\delta}{\sqrt{4\pi^2+\delta^2}}$ $\quad \omega_d = \omega_n\sqrt{1-\zeta^2}$

$\ddot{x} + \omega_n^2 x = F_0 \sin(\omega\, t)$ Påtvingad odämpad svävning

$$x_p(t) = \frac{F_0/k}{1-\left(\frac{\omega}{\omega_n}\right)^2}\sin(\omega t)$$

$M = \frac{1}{1-\left(\frac{\omega}{\omega_n}\right)^2}$ Förstornings faktor

$\ddot{x} + 2\zeta\omega_n\dot{x} + \omega_n^2 x = F_0 \sin(\omega\, t)$ Påtvingad dämpad svävning