

Kinematikk og dynamikk (translatorisk og rotasjon)

Posisjon, hastighet/vinkelhastighet og akselerasjon/vinkelakselerasjon:

$$\begin{aligned}\vec{v} &= \frac{\Delta \vec{r}}{\Delta t}, & \vec{v} &= \frac{d\vec{r}}{dt}, & \vec{a} &= \frac{\Delta \vec{v}}{\Delta t}, & \vec{a} &= \frac{d\vec{v}}{dt}, \\ \vec{v}(t) &= \vec{v}_0 + \int_0^t \vec{a}(t) dt, & \vec{r}(t) &= \vec{r}_0 + \int_0^t \vec{v}(t) dt \\ \vec{\omega} &= \frac{\Delta \vec{\theta}}{\Delta t}, & \vec{\omega} &= \frac{d\vec{\theta}}{dt}, & \vec{\alpha} &= \frac{\Delta \vec{\omega}}{\Delta t}, & \vec{\alpha} &= \frac{d\vec{\omega}}{dt}, \\ \vec{\omega}(t) &= \vec{\omega}_0 + \int_0^t \vec{\alpha}(t) dt, & \vec{\theta}(t) &= \vec{\theta}_0 + \int_0^t \vec{\omega}(t) dt\end{aligned}$$

Konstant akselerasjon (x-retning) / konstant vinkelakselerasjon:

$$\begin{aligned}v_x &= v_{0x} + a_x t, & x &= x_0 + v_{0x} t + \frac{1}{2} a_x t^2, \\ v_x^2 - v_{0x}^2 &= 2a_x(x - x_0), & x - x_0 &= \frac{1}{2}(v_{0x} + v_x)t, \\ \omega &= \omega_0 + \alpha t, & \theta &= \theta_0 + \omega_0 t + \frac{1}{2} \alpha t^2, \\ \omega^2 - \omega_0^2 &= 2\alpha(\theta - \theta_0), & \theta - \theta_0 &= \frac{1}{2}(\omega_0 + \omega)t\end{aligned}$$

Sirkelbevegelse:

$$\begin{aligned}a_{\text{rad}} &= \frac{v^2}{R}, & a_{\text{tan}} &= \frac{d|\vec{v}|}{dt}, & T &= \frac{2\pi R}{v}, \\ s &= R\theta, & v_{\text{tan}} &= R\omega, & a_{\text{tan}} &= R\alpha\end{aligned}$$

Krefter, kraftmoment, bevegelsesmengde, kraftimpuls og angulært moment:

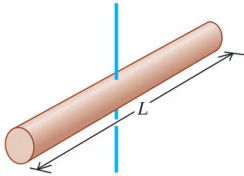
$$\begin{aligned}G &= mg, & R &= \mu N, & F_{\text{fjær}} &= kx, \\ \Sigma \vec{F} &= m\vec{a} = \frac{d\vec{p}}{dt}, & \vec{p} &= m\vec{v}, & \vec{J} &= \int_{t_1}^{t_2} \Sigma \vec{F} dt = \Delta \vec{p}, \\ \vec{\tau} &= \vec{r} \times \vec{F}, & \Sigma \tau &= I\vec{\alpha} = \frac{d\vec{L}}{dt}, & \vec{L} &= \vec{r} \times \vec{p} = I\vec{\omega}\end{aligned}$$

Massesenter og treghetsmoment:

$$\vec{r}_{\text{cm}} = \frac{\Sigma m_i \vec{r}_i}{\Sigma m_i}, \quad I = \Sigma m_i r_i^2, \quad I_P = I_{\text{cm}} + M d^2$$

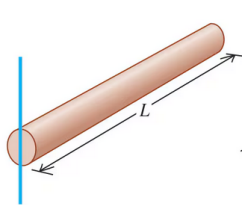
(a) Slender rod,
axis through center

$$I = \frac{1}{12}ML^2$$



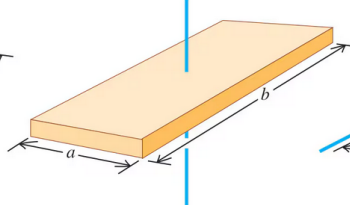
(b) Slender rod,
axis through one end

$$I = \frac{1}{3}ML^2$$



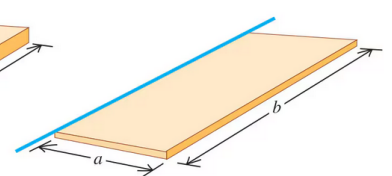
(c) Rectangular plate,
axis through center

$$I = \frac{1}{12}M(a^2 + b^2)$$



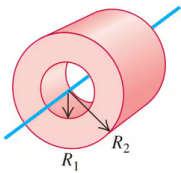
(d) Thin rectangular plate,
axis along edge

$$I = \frac{1}{3}Ma^2$$



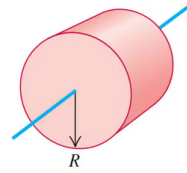
(e) Hollow cylinder

$$I = \frac{1}{2}M(R_1^2 + R_2^2)$$



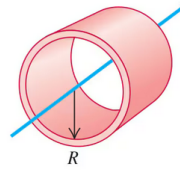
(f) Solid cylinder

$$I = \frac{1}{2}MR^2$$



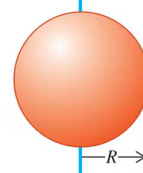
(g) Thin-walled hollow
cylinder

$$I = MR^2$$



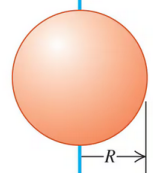
(h) Solid sphere

$$I = \frac{2}{5}MR^2$$



(i) Thin-walled hollow
sphere

$$I = \frac{2}{3}MR^2$$



Arbeid og energi

$$W = \int \vec{F} \cdot d\vec{s}, \quad P = \frac{dW}{dt} = \vec{F} \cdot \vec{v}, \quad E_K = \frac{1}{2}mv^2, \quad E_P = mgh,$$

$$E_{el} = \frac{1}{2}kx^2, \quad W_{\Sigma F} = \Delta E_K, \quad W_G = -\Delta E_P, \quad W_{el} = -\Delta E_{el},$$

$$W_{andre} = \Delta E, \quad W = \int \vec{\tau} \cdot d\vec{\theta}, \quad P = \vec{\tau} \cdot \vec{\omega}, \quad E_K = \frac{1}{2}I\omega^2$$

Elektrisitet og magnetisme

Elektriske felt:

$$\begin{aligned} F &= \frac{1}{4\pi\epsilon_0} \frac{|q_1 q_2|}{r^2}, & \vec{E} &= \frac{\vec{F}_0}{q_0}, & \vec{E} &= \frac{1}{4\pi\epsilon_0} \frac{q}{r^2} \hat{r}, \\ E_P &= \frac{1}{4\pi\epsilon_0} \frac{q_1 q_2}{r}, & V &= \frac{E_P}{q_0}, & V &= \frac{1}{4\pi\epsilon_0} \frac{q}{r}, \end{aligned}$$

Kapasitans og dielektrikum:

$$\begin{aligned} C &= \frac{Q}{V_{ab}}, & C_{\text{plate}} &= \epsilon \frac{A}{d}, & \frac{1}{C_s} &= \frac{1}{C_1} + \frac{1}{C_2} + \cdots, \\ C_p &= C_1 + C_2 + \cdots, & E_{\text{kond}} &= \frac{Q^2}{2C}, & u &= \frac{1}{2} \epsilon E^2, & K &= \frac{C}{C_0} = \frac{\epsilon}{\epsilon_0}, \end{aligned}$$

Strøm og elektriske kretser:

$$\begin{aligned} I &= \frac{\Delta Q}{\Delta t}, & R &= \frac{V_{ab}}{I}, & V_{\text{pol}} &= R_y I = \mathcal{E} - r_i I, & P &= V_{ab} I, \\ R_s &= R_1 + R_2 + \cdots, & \frac{1}{R_p} &= \frac{1}{R_1} + \frac{1}{R_2} + \cdots, \end{aligned}$$

Magnetiske krefter og magnetfelt:

$$\begin{aligned} \vec{F} &= q\vec{v} \times \vec{B} = I\vec{l} \times \vec{B}, & \Phi_B &= B_{\perp} A, & \vec{B} &= \frac{\mu_0}{4\pi} \frac{q\vec{v} \times \hat{r}}{r^2} = \frac{\mu_0}{4\pi} \int \frac{Id\vec{l} \times \hat{r}}{r^2}, \\ B_{\text{rett leder}} &= \frac{\mu_0 I}{2\pi r}, & \frac{F}{L} &= \frac{\mu_0 I I'}{2\pi r}, & (B_x)_{\text{coil}} &= \frac{\mu_0 N I a^2}{2(x^2 + a^2)^{3/2}}, \end{aligned}$$

Elektromagnetisk induksjon:

$$\mathcal{E} = -\frac{d\Phi_B}{dt}, \quad \mathcal{E} = vBL,$$

Sammenheng mellom enheter

$$1 \text{ N} = 1 \text{ kg m/s}^2$$

$$1 \text{ J} = 1 \text{ Nm} = 1 \text{ kg m}^2/\text{s}^2$$

$$1 \text{ W} = 1 \text{ J/s}$$

$$1 \text{ V} = 1 \text{ J/C}$$

$$1 \text{ eV} = 1,602 \cdot 10^{-19} \text{ J}$$

$$1 \text{ F} = 1 \text{ C/V}$$

$$1 \text{ A} = 1 \text{ C/s}$$

$$1 \Omega = 1 \text{ V/A}$$

$$1 \text{ T} = 1 \text{ N/(A} \cdot \text{m)}$$

$$1 \text{ Wb} = 1 \text{ T} \cdot \text{m}^2$$

Fysiske konstanter

$$g = 9,81 \text{ m/s}^2$$

$$e = 1,602 \cdot 10^{-19} \text{ C}$$

$$\epsilon_0 = 8,854 \cdot 10^{-12} \text{ C}^2/(\text{N} \cdot \text{m}^2)$$

$$\frac{1}{4\pi\epsilon_0} = 8,988 \times 10^9 \text{ N} \cdot \text{m}^2/\text{C}^2$$

$$m_e = 9,109 \cdot 10^{-31} \text{ kg}$$

$$m_p = 1,673 \cdot 10^{-27} \text{ kg}$$

$$m_n = 1,675 \cdot 10^{-27} \text{ kg}$$

$$\mu_0 = 4\pi \times 10^{-7} \text{ Wb/A} \cdot \text{m}$$

SI-prefikser

femto	f	10^{-15}
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piko	p	10^{-12}
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nano	n	10^{-9}
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mikro	μ	10^{-6}
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milli	m	10^{-3}
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centi	c	10^{-2}
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kilo	k	10^3
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mega	M	10^6
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giga	G	10^9
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tera	T	10^{12}
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