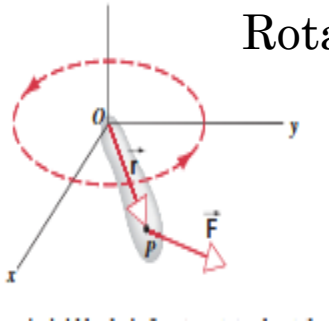
MEHANIKA KRUTOG TIJELA

dr Mira Vučeljić

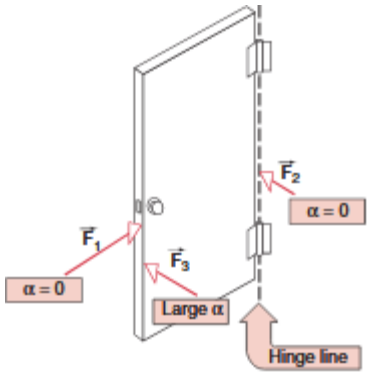
TRANSLATORNO –SVE TACKE TIJELA IMAJU ISTU BRZINU I UBRZANJEI (MODEL MATERIJALNE TACKE)

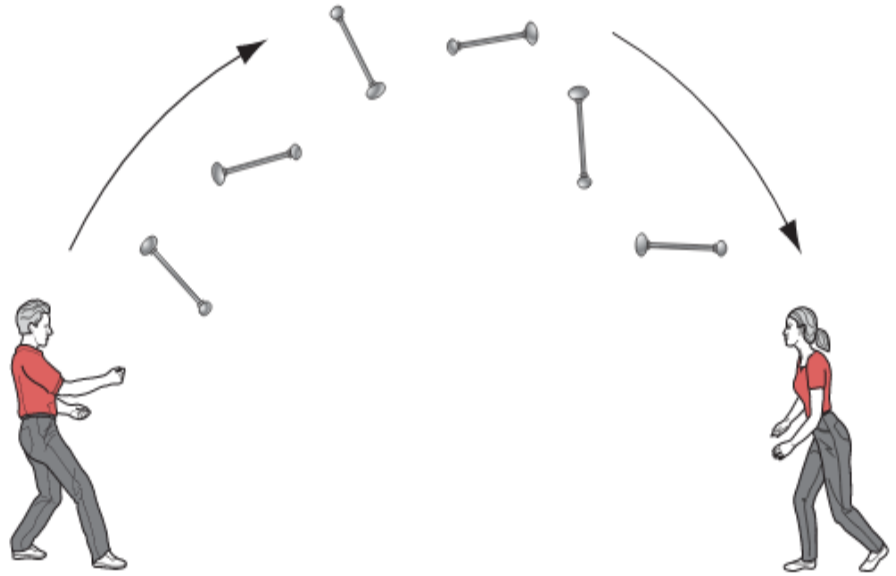
ROTACIONO KRETANJE- TACKE NEMAJU ISTU BRZINU I UBRZANJE, ALI IMAJU ISTU UGAONU BRZINU I UGAONO UBRZANJE

MODEL APSOLUTNO CVRSTO TIJELO-TIJELO KOJE SE POD DEJSTVOM SPOLJASNJIH SILA NE DEFORMISE



Rotacija oko nepokretne ose

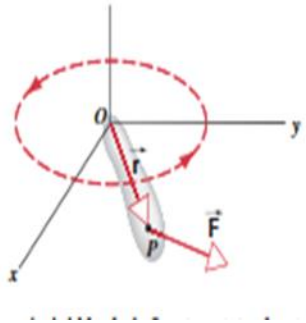


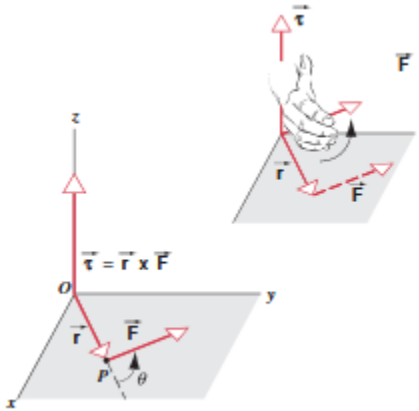


Moment sile

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

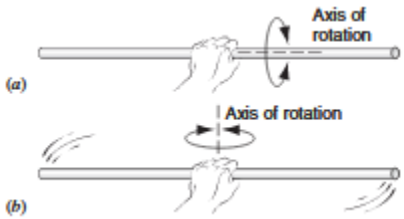
$$M = rF\sin\theta$$

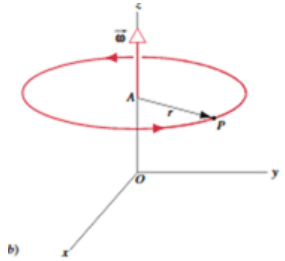




Moment sile je nula kada je r paralelno sa F ili kada je napadna tacka sile na osi, tada je r jednako 0.

Moment inercije



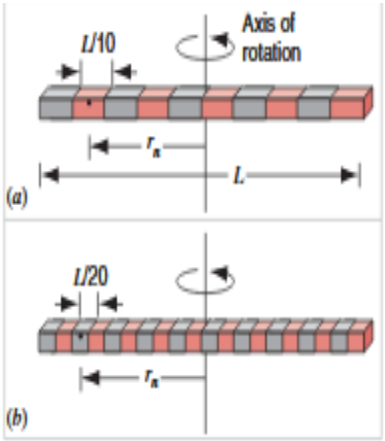


$$I = mr^2$$

Moment inercije materijalne tacke mase m koja kruzi po kruznici poluprecnika r

Moment inercije krutog tijela

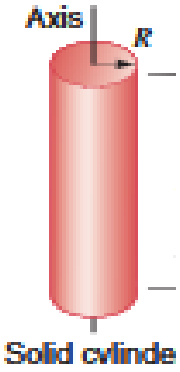
$$I = \sum_{i=1}^{n} \Delta m_i r_i^2 = \int r^2 dm = \int \rho r^2 dV$$

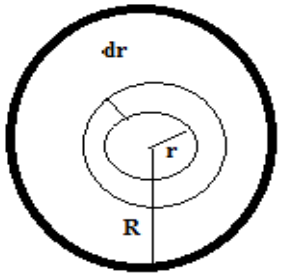


Odredimo moment inercije valjka mase m, poluprecnika R oko ose prikazane na slici..

$$dV = dB \cdot H = 2r\pi dr H$$

$$I = \int \rho 2r\pi dr \cdot r^2 H = 2\pi\rho H \int_0^R r^3 dr = 2\pi\rho H \frac{R^4}{4} = \frac{mR^2}{2}$$

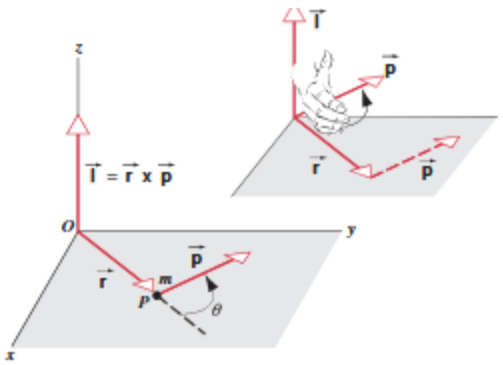




Njegova vrijednost zavisi od izbora ose rotacije.

Moment kolicine kretanja

$$\vec{l} = \vec{r} \times \vec{p}.$$



$$l = rp\sin\theta,$$

Ako se cestica krece po kruznici, r i v su medjusobno normalni i tada l ima oblik

$$l = rmwr = mr^2 w = Iw$$

Za kruto tijelo koje rotira oko neke ose mmoment kol kretanja oko te ose L dobijamo na sledeci nacin:

$$L = \sum L_i = \sum I_i w = w\sum I_i = Iw$$

I je moment inercije krutog tijela a w njegova ugaona brzina

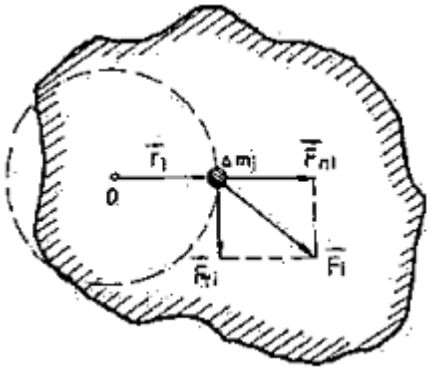
Osnovni zakon dinamike krutog tijela

$$\vec{F}_{\tau i} = \Delta m_i \vec{a}_{\tau i}$$

$$M_i = \Delta m_i r_i a_{\tau i}$$

$$M_i = \Delta m_i r_i^2 \alpha$$

$$M = \sum M_i = \alpha \sum \Delta m_i r_i^2$$



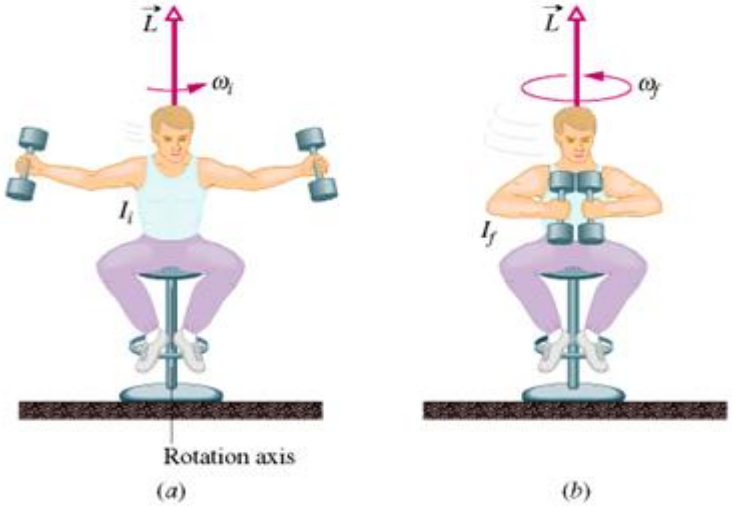
$$M = I\alpha$$

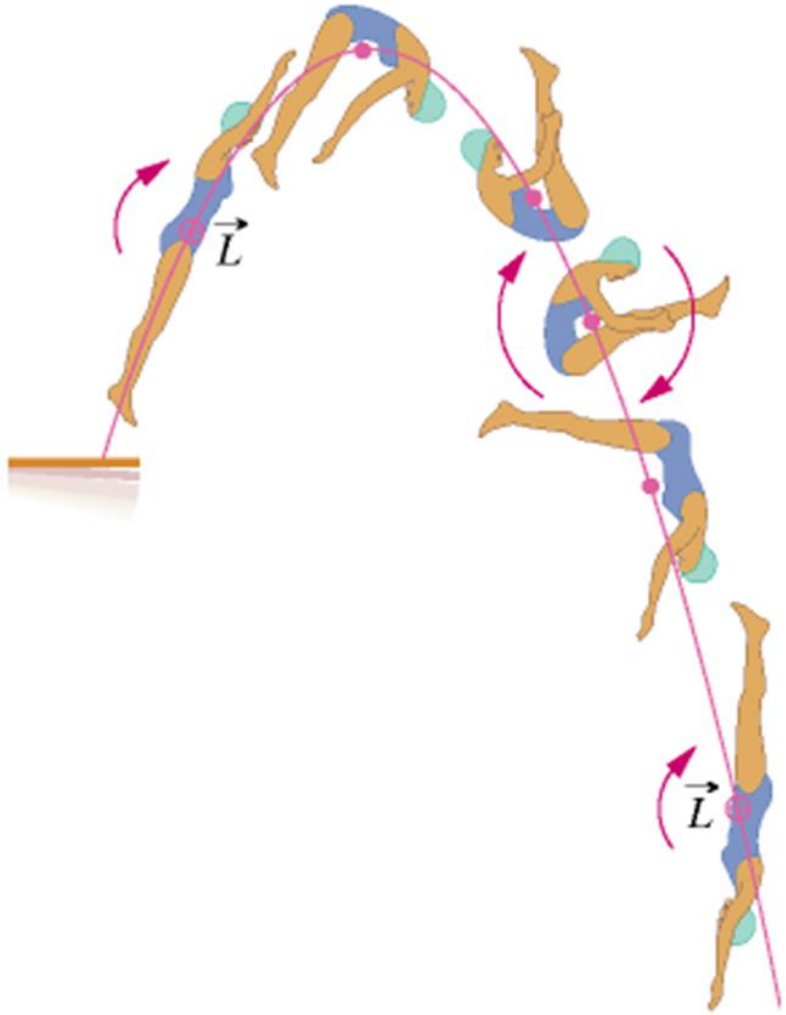
Osnovni zakon dinamike krutog tijela

$$M = I\alpha = I\frac{dw}{dt} = \frac{d(Iw)}{dt} = \frac{dL}{dt}$$

Zakon o odrzanju momenta kolicine kretanja

$$M = \frac{dL}{dt} = 0 \Rightarrow L = const = Iw = const$$




$\vec{L}$
$\vec{L}$