Moment of inertia(MI) = mass x perpendicular distance from axis

MI depends on mass, shape and size of body and axis of rotation

MI of ring perpendicular = MR^2

MI along diameter of ring = (MR^2)/2

MI of axis perpendicular to disc = (MR^2)/2

MI along diameter of disc = (MR^2)/4

MI about axis along center of solid cylinder = (MR^2)/2

MI about axis perpendicular to center of solid cylinder = (MR^2)/4 + (ML^2)/(12)

MI about axis along center of hollow cylinder = MR^2

MI about axis perpendicular to thin rectangular plate(same for cuboid) = M/(12) (a^2 + b^2)

MI about axis perpendicular to square plate = (Ma^2)/6

MI about diagonal axis of square plate = (Ma^2)/(12)

MI about axis perpendicular to thin rod = (ML^2)/12

MI of axis perpendicular to one end of rod = (ML^2)/3

MI of uniform rod about an axis passing through one end making angle`alpha` with axis of rotation

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α

I = (ML^2(sin)^2alpha)/3

MI of solid sphere = 2/2MR^2

MI of hollow sphere = 2/3MR^2

Torque is the roitational analog of force

`Tau = vec r\_{bot} xx vec F = rFsintheta`

Direction can be obtained by right thumb rule

Translational eqbm F\_{net} = 0

Rotational equilibrium `tau\_{net} = 0`

For rigid boddy to be in equilibrium it needs to satisfy both rotational and translational equilibrium

`F\_{net} = 0` and `tau\_{net} = 0`

Analogy

Translational rotational

Linear displacement (s) angular displacement (`theta`)

Linear velocity(v) sangular velocity(`omega`)

`v =(ds)/(dt) v =r`omega` `omega(dtheta)/(dt)`

Linear /tangential acceleration angular acceleration(`alpha`)

A\_{t} = (dv)/(dt) a\_{t} = ralpha alpha = (domega)/(dt)

Mass(inertia factor) moment of inertia

Linear momentum p = mv angular momentum L = Iomega

Newton second law newtons second law

F\_{ext} = (dp)/(dt) =ma tau\_{ext} = (dL)/(dt) = Ialpha

K.E = 1/2mv^2 K.E = 1/2Iomega^2

Linear impulse = FDeltat rotational impulse = tauDeltat

= change in linear momentum = change in angular impulse

Work = F\*s work = tau\*theta

Conservation of linear momentum conservation of angular momentum

F\_{ext} = 0 (dp)/(dt) = 0 tau\_{ext} = 0 (dL)/(dt) = 0

P\_{total} = constant L\_{total} =constant

a=(vdv)/(ds) alpha(omegadomega)/(dtheta)

v =u +at omega = omega\_{0} +alphat

s = ut +1/2at^2 theta = omega\_{0}t + 1/2alphat^2

v^2 –u^2 = 2as omega^2-omega\_{0}^2 = 2alphatheta

s\_{n} = u + a/2(2n-1) theta\_{n} = omega\_{0} + alpha/2(2n -1 )

(distance traveled in nth second)

Linear impulse `xx` distance(bot) = angular impulse =change in angular momentum

Theorms of moment of inertia

Parallel axis theorm