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October 5, 2020

1.a Center of suspension: The intersection of the axis of rotation of a pendulum with a plane perpendicular to the axis that passes through the center of mass.

1.b Poinsot's central axis: A line through a rigid body which is parallel to the vector sum **F** of a system of forces acting on the body, and which is located so that the system of forces is equivalent to the force **F** applied anywhere along the line, plus a couple whose torque is equal to the component of the total torque **T** exerted by the system in the direction **F**.

1.c Wrench: A wrench is a force and couple system in which the force and couple are parallel.

1.d Routh's Rule: The principal moments of inertia for the "simple" bodies in the following table can be given by

$$I = \frac{Ms^2}{n}$$

where s^2 is the sum of squares of the semimajor axes of the other principal moments and $n = 3$ for rectangle and rectangular parallelepiped, 4 for ellipse 5 for ellipsoid

(2.b)

We know that $X^2 + Y^2 + Z^2$ is the square of the resultant force R corresponding to the Central Axis and is therefore invariant.

Again, if (l, m, n) are the direction cosines of the resultant force and (l_1, m_1, n_1) those of the axis of the resultant couple, then

$$\begin{aligned}\frac{X}{R}\frac{L}{G} + \frac{Y}{R}\frac{M}{G} + \frac{Z}{R}\frac{N}{G} &= ll_1 + mm_1 + nn_1 \\ &= cos\theta\end{aligned}$$

Therefore

$$LX + MY + NZ = R.Gcos\theta = R.K$$

where K is the moment of the couple about the Central Axis

Hence $I = LX + MY + NZ$ is an invariant.

(2.h)

Equimomental Systems: Two systems are said to be equimomental if they have equal M.I. about every line in space.

The necessary and sufficient condition for two systems to be equimomental are :

(i) They have same total mass.

(ii) They have same centroid.

(iii) They have same principal axes.

2.c Fig shows a simple pendulum of length *L with a bob of* mass *m*.

The restoring force is

$$F = -mg\sin\theta$$

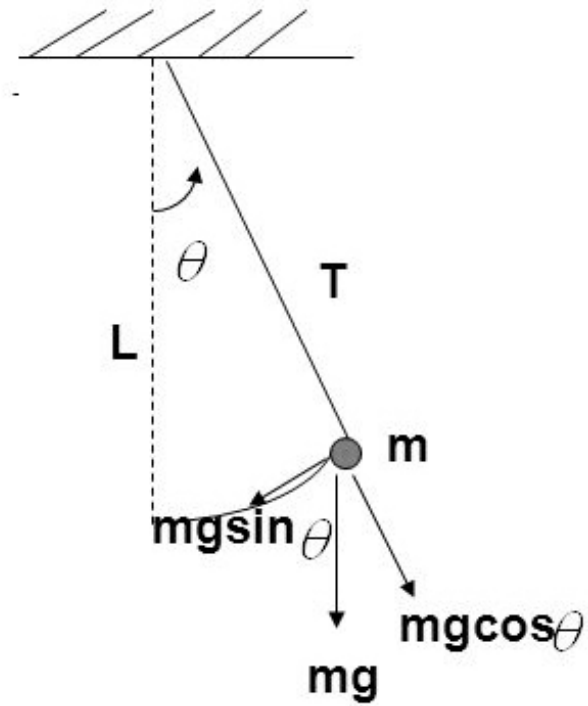
If the θ is small, $\sin\theta \approx \theta$

$$F = -mg\theta = -mg\frac{x}{L}$$

$F\alpha - x$ (AS L m,g are consants)

,

Thus simple pendulum performs S.H.M



2.d

(i) about the axis of symmetry or about an axis of passes through circular faces or about axis of cylinder:

Let us divide the hollow cylinder into elementary similar rings each of mass dm.

Moment of inertia of any elementary ring about the given axis, $= dMR^2$

~~∴ MOI~~

Moment of Inertia of hollow cylinder about its axis,

$$I = \sum dMR^2$$

$$I = R^2 \sum dM$$

$$\boxed{I = MR^2}$$