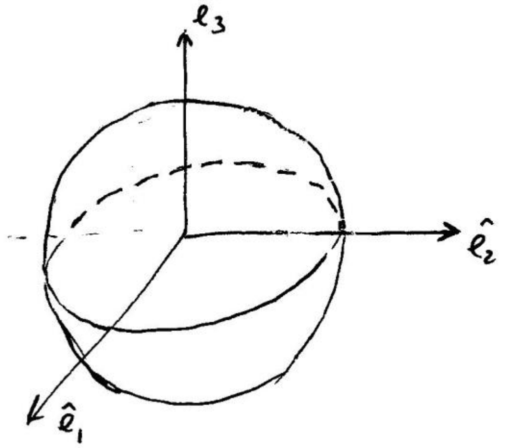
MOMENTS OF INERTIA OF HOMOGENEOUS BODIES

All moments of inertia are with respect to the center of mass, which coincides with the center of symmetry for the body because mass density per volume unit, ρ, is assumed as constant. The latter assumption means that the body is homogeneous. Its overall mass is M.

(a) SPHERE

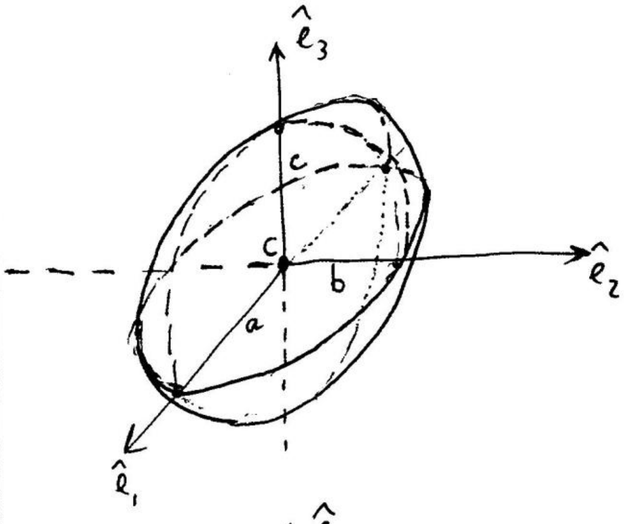
$$I_c^{(E)} = \begin{bmatrix} \frac{2}{5}MR^2 & 0 & 0 \\ 0 & \frac{2}{5}MR^2 & 0 \\ 0 & 0 & \frac{2}{5}MR^2 \end{bmatrix}$$



(b) ELLIPSOID

with semiaxes a, b, c

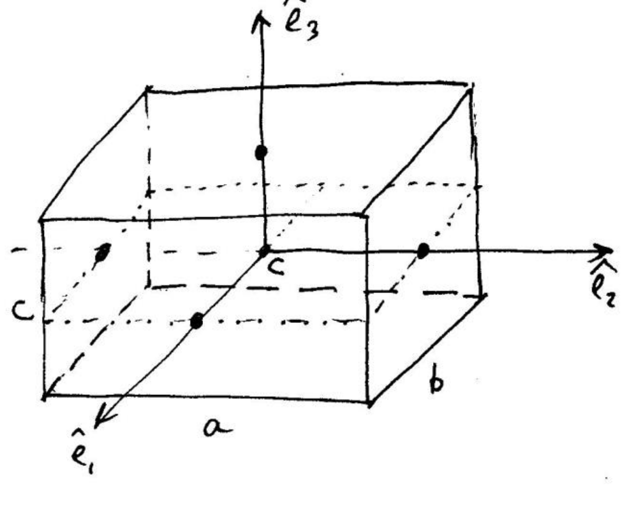
$$I_c^{(E)} = \begin{bmatrix} \frac{1}{5}M(b^2+c^2) & 0 & 0 \\ 0 & \frac{1}{5}M(a^2+c^2) & 0 \\ 0 & 0 & \frac{1}{5}M(a^2+b^2) \end{bmatrix}$$



(c) CUBOID (RIGHT PARALLELEPIPED)

with sides a, b, c

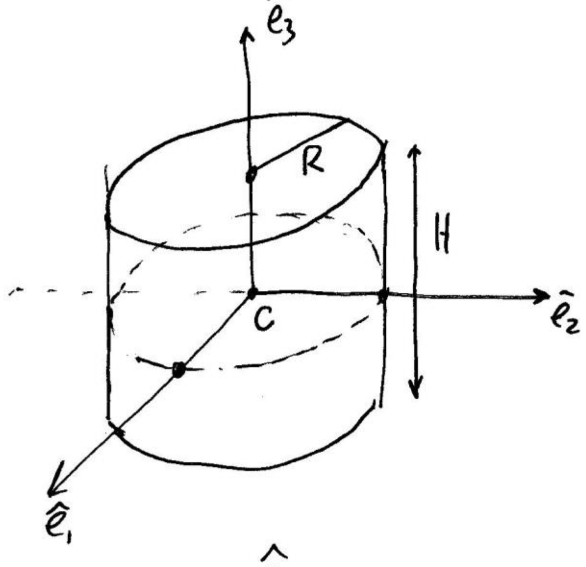
$$I_c^{(E)} = \begin{bmatrix} \frac{M}{12}(b^2+c^2) & 0 & 0 \\ 0 & \frac{M}{12}(a^2+c^2) & 0 \\ 0 & 0 & \frac{M}{12}(a^2+b^2) \end{bmatrix}$$



(d) CYLINDER

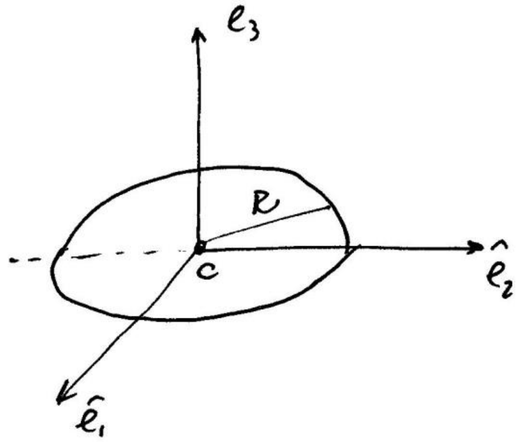
with radius R and height H

$$I_c^{(E)} = \begin{bmatrix} \frac{M}{12}\left(3R^2+H^2\right) & 0 & 0 \\ 0 & \frac{M}{12}\left(3R^2+H^2\right) & 0 \\ 0 & 0 & \frac{MR^2}{2} \end{bmatrix}$$



(e) DISK of radius R (case (d) as $H \to 0$)

$$I_c^{(E)} = \begin{bmatrix} \frac{MR^2}{4} & 0 & 0 \\ 0 & \frac{MR^2}{4} & 0 \\ 0 & 0 & \frac{MR^2}{2} \end{bmatrix}$$



(f) ROD (case (d) as $R \to 0$)

$$I_c^{(E)} = \begin{bmatrix} \frac{MH^2}{12} & 0 & 0 \\ 0 & \frac{MH^2}{12} & 0 \\ 0 & 0 & 0 \end{bmatrix}$$