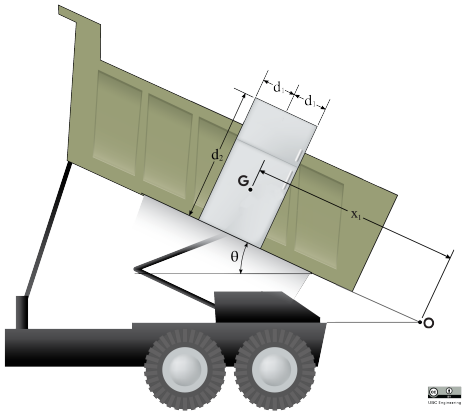
21-R-KIN-SS-57



Find the moment of inertia of the fridge being tipped by the dump truck about the ICZV labeled O in the figure, $x_1 = 1.5$ m from the center of mass of the fridge. The fridge can be approximated as a uniform cuboid with width, $d_1 = 1$ m, height, $d_2 = 0.8$ m depth, $d_3 = 1$ m and a mass, $m = 80$ kg (G is located at the centroid of the fridge).

Find the mass moment of inertia about O.

Solution

The moment of inertia of the fridge is calculated by the formula for a cuboid's moment of inertia.

$$I_G = \tfrac{1}{12} m(l^2 + w^2)$$

$$= \tfrac{1}{12}(80)(2^2 + 0.8^2) = 30.93 \ \ [\text{kg}\cdot\text{m}^2]$$

Next, calculating the distance from G to O, we have

$$r_{OG}^2 = x_1^2 + (\tfrac{d_2}{2})^2$$

$$= 1.5^2 + (\tfrac{0.8}{2})^2 = 2.41 \ \ [\text{m}]$$

Then by the parallel axis theorem, we can find the mass moment of inertia about O.

$$I_O = I_G + m r_{OG}^2$$

$$= 30.93 + 80(2.41) = 223.73 \ \ [\text{kg}\cdot\text{m}^2]$$