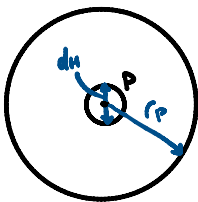


20-R-KIN-DK-1 Beginner Composite Bodies Video

Inspiration: Hibbeler pg. 416

What is the moment of inertia about an axis passing through point P of the plate? The plate has constant density 8950 kg/m^3 and a radius of $r_P = 50 \text{ mm}$. The hole has a diameter $d_H = 10 \text{ mm}$. The thickness of the plate is given as $t = 1 \text{ cm}$.



Disk: For a disk with about the z -axis at its center of gravity $I_{zz} = \frac{1}{2} m r^2$

$$m_D = \rho V_D = \rho \pi r^2 t = 8950 \frac{\text{kg}}{\text{m}^3} (\pi (0.05 \text{ m})^2 (0.01 \text{ m}))$$

$$= \frac{179\pi}{800} \approx 0.70293 \text{ kg}$$

$$I_{PD} = \frac{1}{2} \left(\frac{179\pi}{800} \right) (0.05)^2 \approx 0.000879664 \text{ kg}\cdot\text{m}^2$$

Hole: The hole is also a disk-shape $I_{zz} = \frac{1}{2} m r^2$

$$m_H = \rho V_H = \rho \pi r_h^2 t = 8950 \frac{\text{kg}}{\text{m}^3} (\pi (0.005)^2 (0.01 \text{ m}))$$

$$\approx 0.007029313 \text{ kg}$$

$$I_{PH} = \frac{1}{2} m r^2 = \frac{1}{2} (0.007029313) (0.005)^2 \approx 8.7 \times 10^{-8} \text{ kg}\cdot\text{m}^2$$

$$I_P = I_{PD} - I_{PH} = 8.79 \times 10^{-4} - 8.7 \times 10^{-8} = \boxed{8.79 \times 10^{-4} \text{ kg}\cdot\text{m}^2}$$