

Chapter 9 Homework Solutions

9-45: Mass = 8 Kg Find I_A

Table 9-2 Slender Rod $I_y = 1/12 * m * l^2$

$$I_y = 0.24 \text{ Kg-m}^2$$

$$I_A = I_y + md^2 = 0.24 \text{ Kg-m}^2 + (8\text{Kg})(0.14\text{m})^2 = 0.397 \text{ Kg-m}^2$$

9-47

Flywheel consists of a thin disk and a rim (cylinder)

Add separate mass moments together since they rotate about the same axis

Table 9-2 Thin disk Use $I_x = \frac{1}{2} mr^2 = \frac{1}{2} (64.4/32.2)(1)^2 = 1 \text{ ft-lb-sec}^2$

Outer Rim, same table but for cylinder where $r_1 = 1.25 \text{ ft}$ and $r_2 = 1.0 \text{ ft}$

$$I_x = \frac{1}{2} m (r_1^2 + r_2^2) = \frac{1}{2} (322/32.2)(1.25^2 + 1.0^2) = 12.8125 \text{ ft-lb-s}^2$$

$$\text{Total } I = 13.81 \text{ ft-lb-s}^2$$

9-50

1. Determine mass of blades and shaft separately
2. Determine I for common blades x 4 blades
3. Determine I for shaft
4. Add I 's about the rotating axis (shaft axis)

$$\text{Material Density} = 8000 \text{ Kg/m}^3$$

Mass = density x volume: for blades, $m = 1.12 \text{ Kg}$ each.

For shaft, subtract 4 blade thicknesses first

$$\text{Shaft } m = 8000 (\pi * d^2)/4 \text{ times } .96 \text{ meters} = 9.65 \text{ Kg}$$

I for a single blade:

$$I_y = 1/12 (m)(a^2 + l^2) = 0.0042$$

$$\text{But blades rotate about an offset axis so } I = I_y + md^2 = 0.0042 + 1.12(.065)^2 = 0.0089$$

$$I_x \text{ for the shaft: } = \frac{1}{2} mr^2 = \frac{1}{2} (9.65)(.020)^2 = 0.0193$$

$$\text{Total } I = \text{shaft plus 4 blades} = 0.0193 + 4(.0089) = 0.0377 \text{ Kg-m}^2$$