

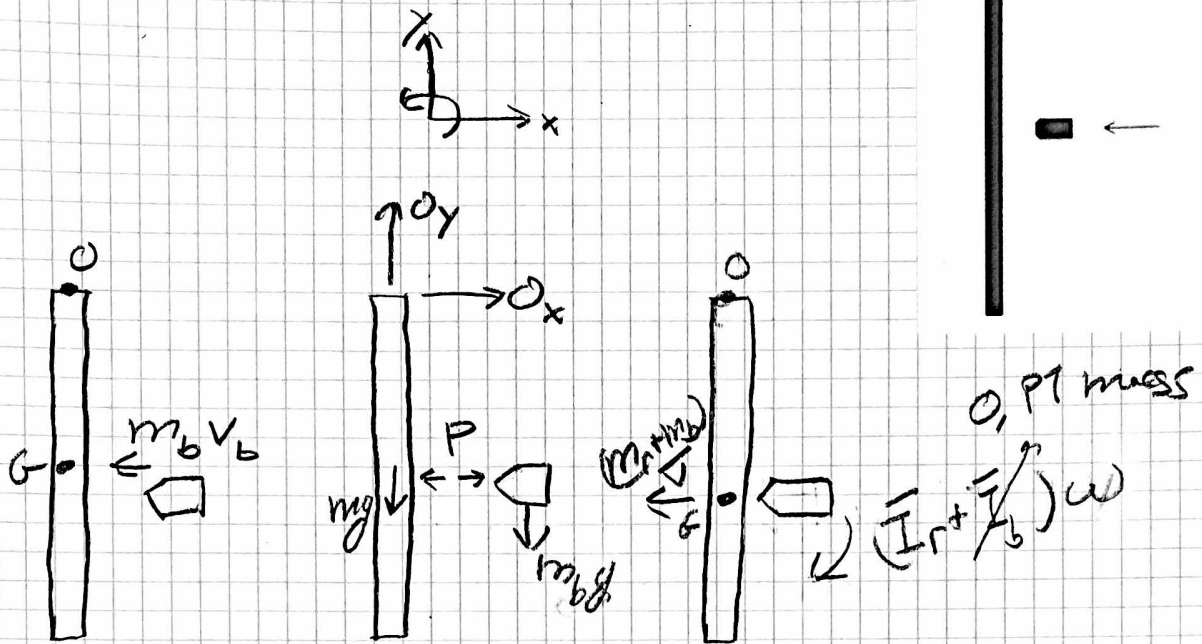
Lect15-16. Example

S.6

The 2-oz jacketed hollow point bullet has a horizontal velocity of 1500 ft/s as it strikes the midpoint of the 20-lb, 30 inch slender bar OA, which is suspended from point O and is initially at rest. After striking the bar, the bullet becomes embedded in the bar. Find the angular velocity of the bar/bullet immediately after the impact.

Given: $W_{\text{bullet}} = 2 \text{ oz}$, $v_{\text{bullet}} = 1500 \text{ ft/s}$, $l_{\text{bar}} = 30 \text{ in}$, $W_{\text{bar}} = 20 \text{ lb}$

Find: ω after impact



$$H_{O1} + \int M_O dt = H_{O2}$$

$$\vec{r}_{G/O} \times m_b \vec{v}_b = \vec{r}_{G/O} \times (m_r + m_b) \vec{v} + \bar{I}_r \omega$$

$$m_b = 0.00389 \text{ slug}$$

$$m_r = 0.6216 \text{ slug}$$

$$m_b v_b \frac{e}{2} = \bar{I}_r \omega + (m_b + m_r) \bar{v} \left(\frac{e}{2} \right)$$

$$\bar{v} = \omega \frac{e}{2}$$

$$m_b v_b \frac{e}{2} = \bar{I}_r \omega + (m_b + m_r) \omega \frac{e}{2} \left(\frac{e}{2} \right)$$

$$\omega = \frac{m_b v_b \frac{e}{2}}{\left(\frac{1}{12} m_r l^2 \right) + (m_b + m_r) \frac{e^2}{4}} = 0.467 \frac{\text{rad}}{\text{s}}$$