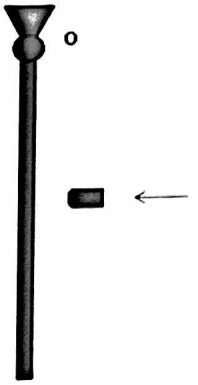
Lect15-16. Example

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

Find: ω after impact



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

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

$m_b = 0.00389$ slug

$m_b = 0.6216$ slug

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

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

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

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