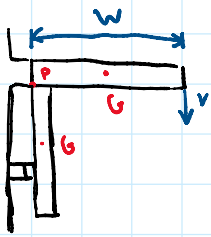


Beginner Eccentric Impact

Inspiration: None



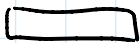
If a door with width $w = 0.75 \text{ m}$ is pushed such that one end is given a velocity $v = 1 \text{ m/s}$, determine its velocity at its center of gravity immediately after hitting the door stopper. The coefficient of restitution is $e = 0.4$ and the stopper is located $\frac{3}{4}w$ from P.

Notes for graphic artist:

Top view, before and after shot

The door is hinged at P

State 1



State 2



Just before

$$\vec{T}_1 + \cancel{V_1} = \vec{T}_2 + \cancel{V_2} \quad V_1 = V_2$$

$$e = \frac{V_{\text{stopper}_3} - V_{\text{door}_3}}{V_{\text{door}_2} - V_{\text{stopper}_2}}$$

$$0.4 = \frac{0 - V_{\text{door}_3}}{V_{\text{door}_2} - 0}$$

State 3



Just after

State 4



V_{door} is along the line of impact thus where the stopper is located

$$V_{\text{door}_2} = w \left(\frac{3}{4}w \right)$$

$$V = w w \quad l = w(0.75) \quad w = \frac{4}{3}$$

$$V_{\text{door}_1} = \frac{4}{3} \left(\frac{3}{4} \cdot \frac{3}{4} \right) = 0.75 \text{ m/s}$$

$$0.75(0.4) = 0.3 = V_{\text{door}_3}$$

$$0.3 = w \left(\frac{3}{4} \cdot \frac{3}{4} \right)$$

$$w = \frac{8}{15} \quad V_G = \frac{8}{15} \cdot \frac{0.75}{2} = 0.2 \text{ m/s}$$