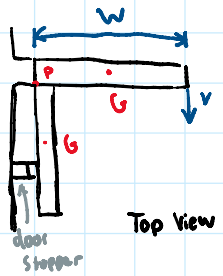
20-R-IM-DK-22

July 15, 2020 11:25 AM

Beginner Eccentric Impact

Inspiration: None



If a door with width ***w = 0.75 m*** is pushed such that the far end is given a velocity ***v = 1 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 ***3/4 w*** from P.

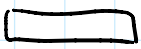
Notes for graphic artist:

Top view, before and after shot

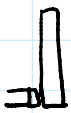
The door is hinged at P

$T_1 + V_1 = T_2 + V_2 \qquad V_1 = V_2$

State 1

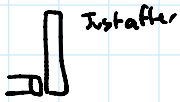


State 2 Just before



$$e = \frac{v_{stopper_2} - v_{door_2}}{v_{door_1} - v_{stopper_1}} \qquad 0.4 = \frac{0 - v_{door_2}}{v_{door_1} - 0}$$

State 3 Just after



State 4

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

$v_{door_2} = w\left(\frac{3}{4}w\right) \qquad v = w\,w \qquad 1 = w(0.75) \qquad w = \frac{4}{3}$

$v_{door_1} = \frac{4}{3}\left(\frac{3}{4}\cdot\frac{3}{4}\right)$

$= 0.75$ m/s

$0.75(0.4) = 0.3 = v_{door_2}$

$0.3 = w\left(\frac{3}{4}\cdot\frac{3}{4}\right) \qquad w = \frac{8}{15} \qquad v_G = \frac{8}{15}\cdot\frac{0.75}{2}$

$= 0.2$ m/s