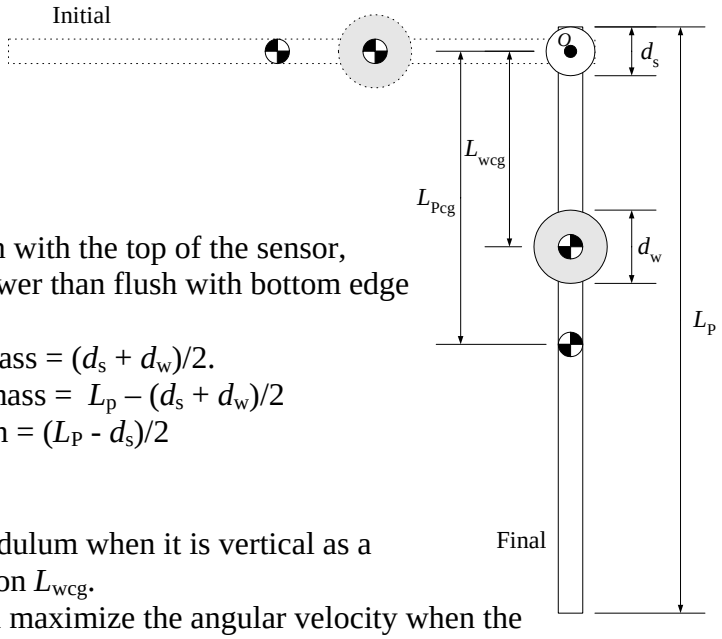
Problem 11.2

A pendulum (slender bar) of mass m_p is pinned at point *O* and a mass m_w with an adjustable fixed position is attached to the pendulum as shown. The system is released from rest in the horizontal position and a massless frictionless sensor is attached to the top of the pendulum to measure its angular position. The system has the following nominal parameter values:

m_p = pendulum mass = 68.5 g
m_w = moveable weight = 88 g
L_p = pendulum length = 43.2 cm
d_s = sensor diameter = 2.5 cm
d_w = moveable weight diameter = 5 cm



Assuming the pendulum rod is mounted flush with the top of the sensor, and the moveable weight is not positioned lower than flush with bottom edge of pendulum rod, we would observe that.
L_{wcg_min} = minimum location for moveable mass = $(d_s + d_w)/2$.
L_{wcg_max} = maximum location for moveable mass = $L_p - (d_s + d_w)/2$
L_{Pcg} = pendulum center of gravity location = $(L_P - d_s)/2$

Determine:

a) Plot the angular velocity ω of the pendulum when it is vertical as a function of the adjustable mass location L_{wcg}.
b) Determine the location, L_{wcg}, that will maximize the angular velocity when the bar is vertical.