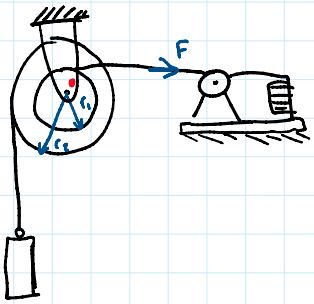
20-R-IM-DK-4

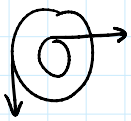
July 2, 2020 2:00 PM

Beginner Principle of Impulse and Momentum

Inspiration: Hibbeler 19.7



An engineering student sets up an experiment to record data such that she may apply her findings to a prototype. Specifically, she is curious about the velocity of an attached load to a motor. If the pulley consists of two wheels rigidly attached to another, with a radius of gyration of $k_0 = 0.110\ m$ and a mass of $m = 15\ kg$, determine the velocity of a $40\ kg$ cylinder if it is pulled with a force of $F = 2000N$ after $t = 3$ seconds. The cylinder is originally at rest and take $r_1 = 0.075\ m$ and $r_2 = 0.2\ m$



$I_G = mk_G^2 = 15(0.11^2) = 0.1815 \qquad v = \omega r \qquad \omega = \frac{v}{r} = \frac{v}{0.2} = 5v$

$$(\Sigma \vec{H}_{O\,sys})_{t_1} + \left(\sum \int_{t_1}^{t_2} M_{O\,ext}\, dt\right) = (\Sigma H_{O\,sys})_{t_2}$$

$H_{G\,cylinder} + r_{G/O} \times m\vec{v}$

$$0 + 40(9.81)(0.2)(3) - (2000)(0.075)(3) = -0.1815(\omega) + H_{O\,cylinder}$$

$$-214.56 = -0.1815(5v) + 0 + (-0.2\hat{i}) \times (40v\hat{j})$$

$$-214.56 = -0.1815(5v) - 0.2(40)v$$

$$\boxed{v = 24.087566\ m/s}$$