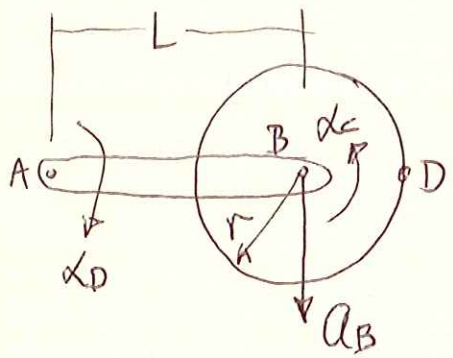
PROB. 16-110

$W_C = 10^{LB}$, $K_C = \frac{3}{12}$ ft, $W_L = 6^{LB}$, $\omega_D = 0$,

$L = \left(\frac{10}{12}\right)$ ft, $r = \frac{5}{12}$ ft, FIND α_C, a_B

KINEMATICS

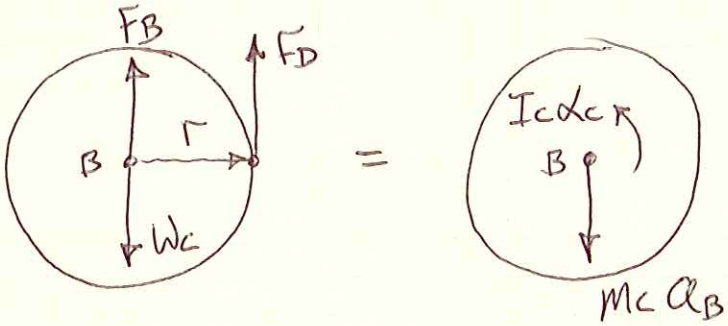


$a_B = L\alpha_L$

$a_B = r\alpha_C$

$L\alpha_L = r\alpha_C$ OR $\alpha_C = \left(\frac{L}{r}\right)\alpha_L$

KINETICS



$\Sigma F_y = m a_y$: $F_B + F_D - W_C = -m_C a_B = -\left(\frac{W_C}{g}\right)L\alpha_L$

$F_B = W_C - \left(\frac{W_C}{g}\right)L\alpha_L - F_D$

$\Sigma M_B = \Sigma (M_B)_{EFF}$ +↺: $r F_D = I_C \alpha_C$

$I_C = m_C K_C^2 = \left(\frac{W_C}{g}\right)K_C^2$,

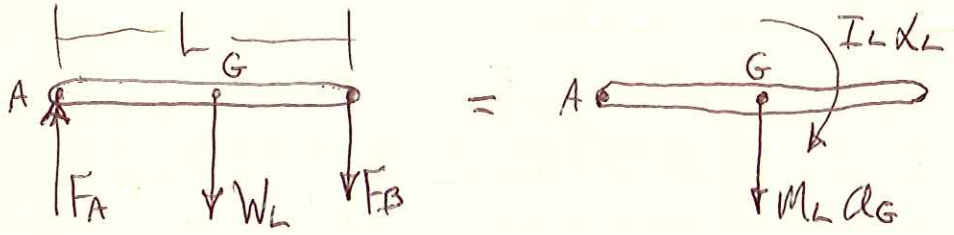
$F_D = \frac{1}{r}\left[\left(\frac{W_C}{g}\right)K_C^2\right]\cdot\left[\left(\frac{L}{r}\right)\alpha_L\right] = L\left(\frac{W_C}{g}\right)\left(\frac{K_C}{r}\right)^2\alpha_L$

PROB. 16-110 CONT.

$$F_B = W_C - \left(\frac{W_C}{g}\right) L \alpha_L - L\left(\frac{W_C}{g}\right)\left(\frac{K_C}{r}\right)^2 \alpha_L$$

$$\boxed{F_B = W_C - L\left(\frac{W_C}{g}\right)\alpha_L \left[1 + \left(\frac{K_C}{r}\right)^2\right]}$$

LINK



$$\Sigma M_A = \Sigma (M_A)_{EFF} \; \circlearrowleft: \; -\left(\frac{L}{2}\right) W_L - L F_B = -\left(\frac{L}{2}\right) M_L a_G - I_L \alpha_L$$

$$\left(\frac{L}{2}\right) W_L + L F_B = \left(\frac{L}{2}\right)\left(\frac{W_L}{g}\right)\left(\frac{L}{2}\right)\alpha_L + \frac{1}{12}\left(\frac{W_L}{g}\right) L^2 \alpha_L$$

$$\frac{1}{2} W_L + F_B = \frac{L}{4}\left(\frac{W_L}{g}\right)\alpha_L + \frac{L}{12}\left(\frac{W_L}{g}\right)\alpha_L$$

$$\frac{1}{2} W_L + F_B = \frac{L}{3}\left(\frac{W_L}{g}\right)\alpha_L$$

$$\frac{1}{2} W_L + W_C - L\left(\frac{W_C}{g}\right)\alpha_L \left[1 + \left(\frac{K_C}{r}\right)^2\right] = \frac{L}{3}\left(\frac{W_L}{g}\right)\alpha_L$$

$$\alpha_L \left(\frac{L}{g}\right)\left\{\frac{1}{3} W_L + W_C \left[1 + \left(\frac{K_C}{r}\right)^2\right]\right\} = \frac{1}{2} W_L + W_C$$

$$\alpha_L = \frac{g\left(\frac{1}{2} W_L + W_C\right)}{L\left\{\frac{1}{3} W_L + W_C \left[1 + \left(\frac{K_C}{r}\right)^2\right]\right\}}$$

PROB. 16-110 CONT.

$$\alpha_L = \frac{\left(32.2 \frac{ft}{s^2}\right)\left[\frac{1}{2}(6^{LB}) + (10^{LB})\right]}{\left(\frac{10}{12} ft\right)\left\{\frac{1}{3}(6^{LB}) + (10^{LB})\left[\left(\frac{3}{5}\right)^2 + 1\right]\right\}} = 32.2 \frac{RAD}{s^2} \curvearrowright$$

$$\alpha_C = \frac{\left(\frac{10}{12} ft\right)}{\left(\frac{5}{12} ft\right)} \cdot \left(32.2 \frac{ft}{s^2}\right) = 64.4 \frac{RAD}{s^2} \curvearrowleft$$

$$a_B = L\alpha_L = \left(\frac{10}{12} ft\right)\left(32.2 \frac{RAD}{s^2}\right) = 26.83 \frac{ft}{s^2} \downarrow$$