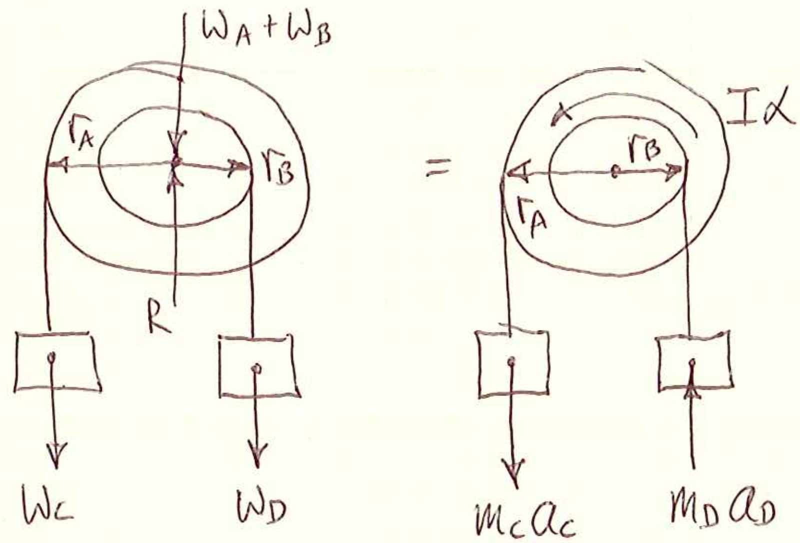
PROB. 16-37



$W_A = 20^{LB}$, $W_B = 12^{LB}$

$W_C = 15^{LB}$, $W_D = 18^{LB}$

$r_A = 8^{IN}$, $r_B = 6^{IN}$

$v_{C,0} = v_{D,0} = 0$

FIND a_C, a_D

$\sum \vec{M}_G = \sum (\vec{M}_G)_{EFF}$:

$$r_A W_C - r_B W_D = r_A m_C a_C + r_B m_D a_D + I\alpha$$

TANGENTIAL ACCELERATION:

$$a_C = r_A \alpha \downarrow, \quad a_D = r_B \alpha \uparrow$$

$$r_A W_C - r_B W_D = r_A m_C (r_A \alpha) + r_B m_D (r_B \alpha) + I\alpha$$

$$\alpha (m_C r_A^2 + m_D r_B^2 + I) = (r_A W_C - r_B W_D)$$

$$\alpha = \frac{(r_A W_C - r_B W_D)}{\left[\left(\frac{W_C}{g}\right) r_A^2 + \left(\frac{W_D}{g}\right) r_B^2 + I\right]}$$

MASS MOMENT OF INERTIA OF COMBINED DISKS:

$$I = \frac{1}{2} m_A r_A^2 + \frac{1}{2} m_B r_B^2 = \frac{1}{2}\left[\left(\frac{W_A}{g}\right) r_A^2 + \left(\frac{W_B}{g}\right) r_B^2\right]$$

$$I = \left(\frac{1}{2g}\right)(W_A r_A^2 + W_B r_B^2)$$

PROB. 16-37 CONT.

$$\alpha = \frac{(r_A W_C - r_B W_D)}{\left(\frac{1}{g}\right)\left[W_C r_A^2 + W_D r_B^2 + \frac{1}{2}\left(W_A r_A^2 + W_B r_B^2\right)\right]}$$

$$\alpha = \frac{g(r_A W_C - r_B W_D)}{\left[W_C r_A^2 + W_D r_B^2 + \frac{1}{2}\left(W_A r_A^2 + W_B r_B^2\right)\right]}$$

$$\alpha = \frac{\left(32.2\ \frac{ft}{s^2}\right)\left[(8^{IN})(15^{LB}) - (6^{IN})(18^{LB})\right]}{\left[(15^{LB})(8^{IN})^2 + (18^{LB})(6^{IN})^2 + \frac{1}{2}\left\{(20^{LB})(8^{IN})^2 + (12^{LB})(6^{IN})^2\right\}\right]} \cdot \left(\frac{12^{IN}}{ft}\right)$$

$$\alpha = 1.882\ \frac{RAD}{s^2} \circlearrowright$$

$$a_C = r_A \alpha = \left(\frac{8}{12}\ ft\right)\left(1.882\ \frac{RAD}{s^2}\right) \boxed{= 1.254\ \frac{ft}{s^2} \downarrow}$$

$$a_D = r_B \alpha = \left(\frac{6}{12}\ ft\right)\left(1.882\ \frac{RAD}{s^2}\right) \boxed{= 0.9409\ \frac{ft}{s^2} \uparrow}$$