

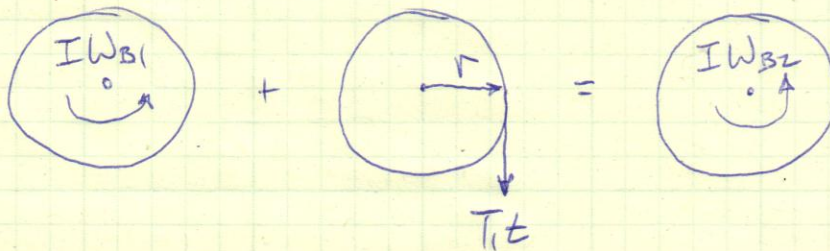
17-75

①

$$M_A = M_B = 6 \text{ kg}, \quad r = 0.125 \text{ m}, \quad \omega_{B1} = 30 \frac{\text{RAD}}{\text{s}} \uparrow$$

$$\text{FIND } t \text{ FOR } \omega_{B2} = 5 \frac{\text{RAD}}{\text{s}} \uparrow, \quad T$$

CYLINDER B:



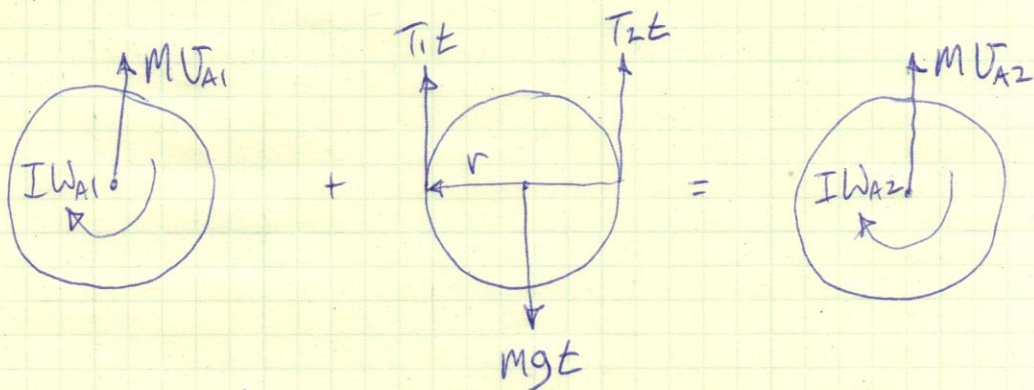
$$I\omega_{B1} - T_1 t \cdot r = I\omega_{B2}$$

$$T_1 t = \frac{1}{r} \cdot I(\omega_{B1} - \omega_{B2})$$

$$I = \frac{1}{2} m r^2$$

$$T_1 t = \frac{1}{2} m r (\omega_{B1} - \omega_{B2}) \quad \text{①}$$

CYLINDER A:

Y-DIR. MOM.  $\uparrow +$ :

$$M U_{A1} + T_1 t + T_2 t - m g t = M U_{A2}$$

$$T_1 t = -T_2 t + mg t + m v_{A2} - m v_{A1} \quad (2)$$

ANG. MOMENTUM  $\uparrow$ :

$$-I \omega_{A1} - T_1 t \cdot r + T_2 t \cdot r = -I \omega_{A2}$$

$$T_1 t = T_2 t + \frac{I}{r} (\omega_{A2} - \omega_{A1})$$

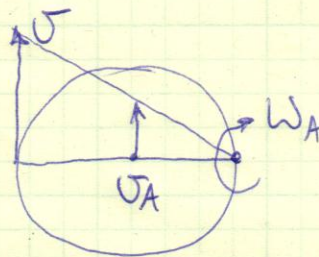
$$I = \frac{1}{2} m r^2$$

$$T_1 t = T_2 t + \frac{1}{2} m r (\omega_{A2} - \omega_{A1}) \quad (3)$$

KINEMATICS:



$$v = r \omega_B$$



$$v = 2r \omega_A$$

$$v_A = \frac{1}{2} v = r \omega_A$$

$$r \omega_B = 2r \omega_A$$

$$\omega_A = \frac{1}{2} \omega_B$$

$$v_A = r \omega_A = \frac{1}{2} r \omega_B$$

$$T_1 t = \frac{1}{2} m r (\omega_{B1} - \omega_{B2}) \quad (1)$$

$$T_1 t = -T_2 t + m g t + m \left( \frac{1}{2} r \omega_{B2} \right) - m \left( \frac{1}{2} r \omega_{B1} \right)$$

$$T_1 t = -T_2 t + m g t + \frac{1}{2} m r (\omega_{B2} - \omega_{B1}) \quad (2)$$

$$T_1 t = T_2 t + \frac{1}{2} m r \left[ \left( \frac{1}{2} \omega_{B2} \right) - \left( \frac{1}{2} \omega_{B1} \right) \right]$$

$$T_1 t = T_2 t + \frac{1}{4} m r (\omega_{B2} - \omega_{B1}) \quad (3)$$

$$(2) + (3):$$

$$2T_1 t = m g t + \frac{1}{2} m r (\omega_{B2} - \omega_{B1}) + \frac{1}{4} m r (\omega_{B2} - \omega_{B1})$$

$$T_1 t = \frac{1}{2} m g t + \frac{3}{8} m r (\omega_{B2} - \omega_{B1}) \quad (4)$$

$$(1) = (4):$$

$$\frac{1}{2} m r (\omega_{B1} - \omega_{B2}) = \frac{1}{2} m g t + \frac{3}{8} m r (\omega_{B2} - \omega_{B1})$$

$$t = \frac{7}{4} \cdot \frac{r}{g} (\omega_{B1} - \omega_{B2})$$

$$t = \frac{7}{4} \cdot \frac{(0.125 \text{ m})}{(9.81 \frac{\text{m}}{\text{s}^2})} \cdot \left[ (30) - (5) \frac{\text{RAD}}{\text{s}} \right]$$

$$t = 0.5575 \text{ s}$$

17-75 CONT.

4

EQN. ①:

$$T_1 = \frac{1}{2} \cdot \frac{mv^2}{E} \cdot (\omega_{B1} - \omega_{B2})$$

$$T_1 = \frac{1}{2} \cdot \frac{(6 \text{ kg}) (0.125 \text{ m})}{(0.5575 \text{ s})} \cdot \left[ (30) - (5) \frac{\text{RAD}}{\text{s}} \right] \cdot \left( \frac{\text{N} \cdot \text{s}^2}{\text{kg} \cdot \text{cm}} \right)$$

$$T_1 = 16.82 \text{ N}$$