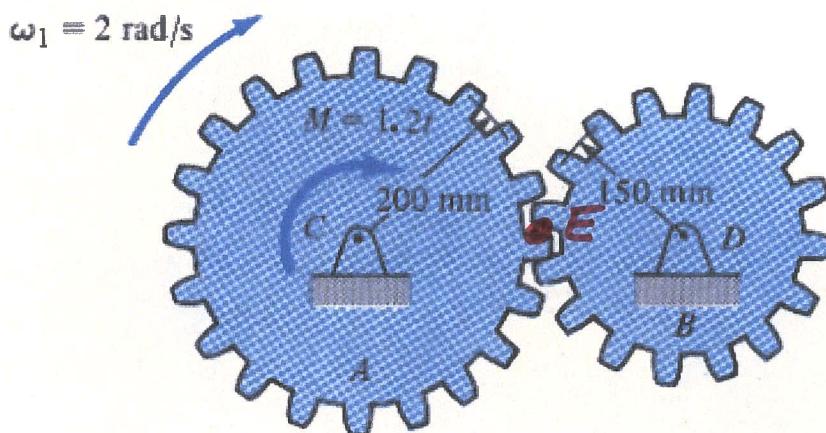


Problem 2: Impulse Momentum II

The flywheel A has a mass of 60 kg and a radius of gyration $k_C = 160$ mm. Gear B has a mass of 25 kg and a radius of gyration $k_D = 125$ mm. If the motor supplies a clockwise torque having a magnitude $M = (1.2t)$ Nm, where t is in seconds, to the flywheel, determine the angular velocity of the gear in 3 seconds. Initially the flywheel is rotating at $\omega_1 = 2$ rad/s.



CLASSIFY MOTION

BOTH R.A.F.A

PROPERTIES

$$I_A = 60(0.16)^2 = 1.536 \text{ kg}\cdot\text{m}^2$$

$$I_B = 25(0.125)^2 = 0.3906 \text{ kg}\cdot\text{m}^2$$

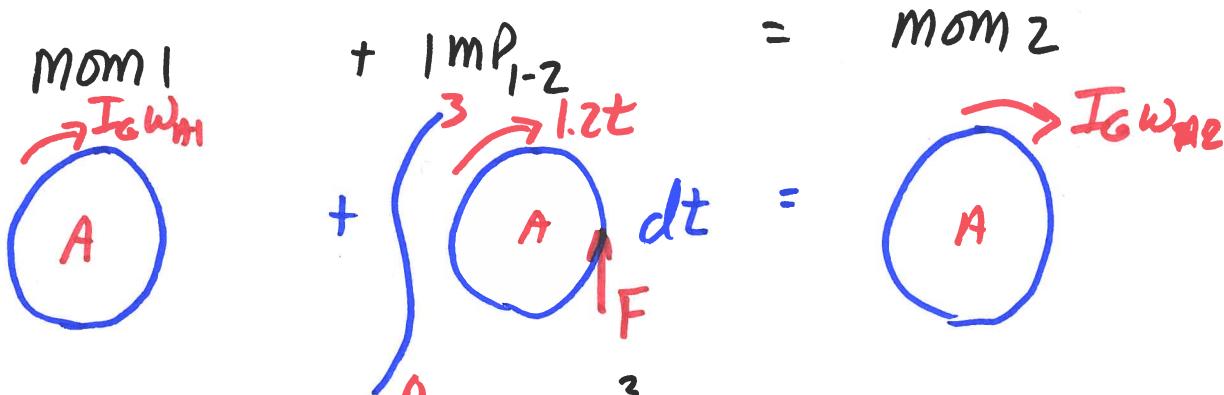
$$V_{E1} = \omega_{A1} r_A = 2(0.2) = 0.4 \text{ m/s}$$

$$V_{E1} = \omega_{B1} r_B \\ 0.4 = \omega_{B1}(0.15) \quad \underline{\omega_{B1} = 2.667 \text{ rad/s}}$$

$$V_{E2} = \omega_{A2} r_A = \omega_{B2} r_B$$

$$\omega_{A2}(0.2) = \omega_{B2}(0.15)$$

$$\underline{\omega_{A2} = 0.75 \omega_{B2}}$$



$$\sum M_G \quad 1.536(2) + \int_0^3 1.2t dt - \int_0^3 0.2F dt = 1.536 \omega_{A2}$$

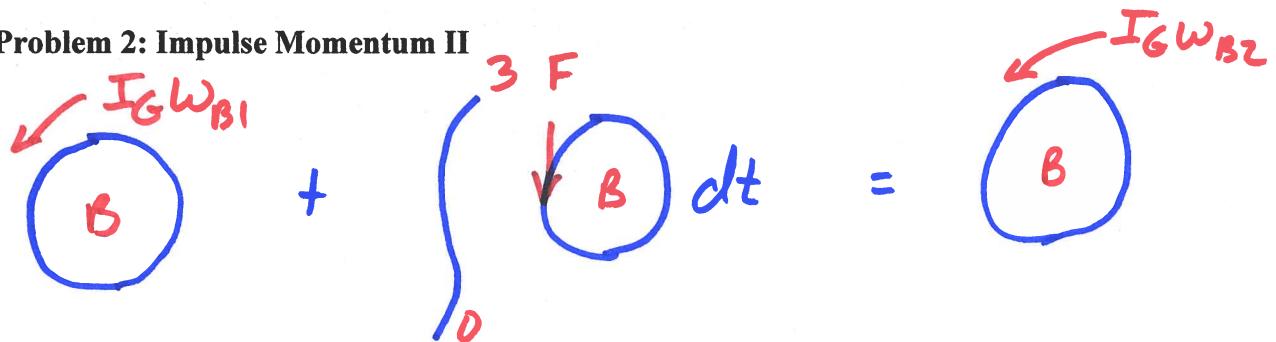
$$3.072 + 5.4 - 0.6F = 1.536 \omega_{A2}$$

$$0.6F + 1.536 \omega_{A2} = 8.47 \quad (1)$$

$$1.152 \omega_{B2}$$

$$= 0.75 \omega_{B2}$$

Problem 2: Impulse Momentum II



$$\begin{aligned} \sum M_G - 0.3906(2.667) - 0.45F &= -0.3906 w_{B2} \\ -1.64 - 0.45F &= -0.3906 w_{B2} \\ -0.45F + 0.3906 w_{B2} &= 1.04 \quad \textcircled{2} \end{aligned}$$

$$0.6F + 1.152 w_{B2} = 0.47 \quad \textcircled{1}$$

$$-0.45F + 0.3906 w_{B2} = 1.04 \quad \textcircled{2}$$

$$\begin{bmatrix} 0.6 & 1.152 \\ -0.45 & 0.3906 \end{bmatrix} \begin{Bmatrix} F \\ w_{B2} \end{Bmatrix} = \begin{Bmatrix} 0.47 \\ 1.04 \end{Bmatrix}$$

SOLVE $F = 2.8$

$$w_{B2} = 5.89 \text{ rad/s}$$

$$w_{A2} = 0.75 w_{B2} = 4.42 \text{ rad/s}$$