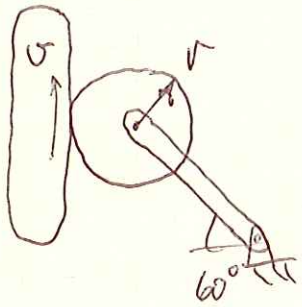
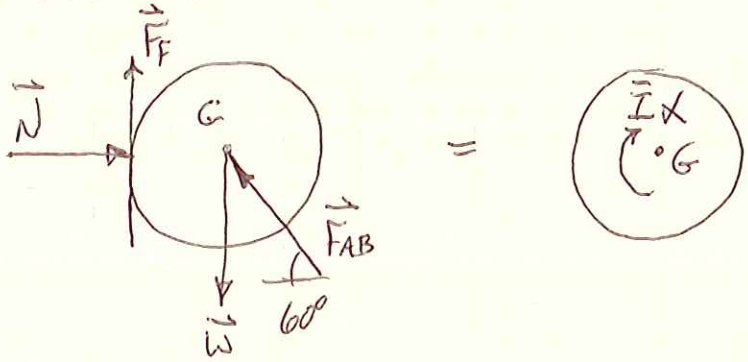
PROB. 16-27

$r = 0.18^m$, $\mu_K = 0.4$, FIND $\alpha$




FBD OF WHEEL:




$$\vec{F}_{AB} = F_{AB}\left[(-\cos 60^\circ)\hat{i} + (\sin 60^\circ)\hat{j}\right]$$

$$\vec{F}_{AB} = (-0.5 F_{AB})\hat{i} + (0.866 F_{AB})\hat{j}\ N$$

$$\Sigma F_x = m\bar{a}_x : \quad N - 0.5 F_{AB} = 0 \Rightarrow N = 0.5 F_{AB}$$

$$\Sigma F_y = m\bar{a}_y : \quad F_F - mg + 0.866 F_{AB} = 0$$

$$\mu N - mg + 0.866 F_{AB} = 0$$

$$\mu(0.5 F_{AB}) - mg + 0.866 F_{AB} = 0$$

$$F_{AB}(0.5\mu + 0.866) = mg$$

$$F_{AB} = \frac{mg}{(0.5\mu + 0.866)} = \frac{(9.81\ \frac{m}{s^2})}{(0.5)(0.4) + (0.866)} \cdot m$$

$$F_{AB} = 9.203 \cdot m$$

$$N = 0.5(9.203\ m) = 4.601 \cdot m$$

PROB. 16-27 CONT.

$$F_F = \mu N = (0.4)(4.601 \cdot m) = 1.84 \cdot m$$

$$\Sigma \vec{M}_G = \Sigma (\vec{M}_G)_{EFF} \quad +\circlearrowleft:$$

$$-r F_F = \bar{I} \alpha$$

$$\alpha = -\frac{r F_F}{\bar{I}} = -\frac{r(1.84\,m)}{\left(\frac{1}{2} m r^2\right)} = -\frac{2(1.84)}{r}$$

$$\alpha = -\frac{2(1.84)}{(0.18^m)} \boxed{= -20.45 \ \frac{RAD}{S^2} \ \circlearrowright}$$