PROB. 17-5

$M = 300^{kg}$, $K = 0.6^{m}$, $U_{1-2} = -2500^{J}$

a) $W_0 = \left(300 \frac{REV}{MIN}\right)\left(\frac{MIN}{60\ s}\right)\left(\frac{2\pi}{REV}\right) = 10\pi \frac{RAD}{s}$

FIND W_F

WORK AND ENERGY: $T_1 + U_{1-2} = T_2$

KINETIC ENERGY: $T = \frac{1}{2} m \bar{v}^2 + \frac{1}{2} I \omega^2$

$T_1 = \frac{1}{2} I W_0^2$, $T_2 = \frac{1}{2} I W_F^2$

$\frac{1}{2} I W_0^2 + U_{1-2} = \frac{1}{2} I W_F^2$

$$W_F = \sqrt{W_0^2 + \frac{2U_{1-2}}{I}} = \sqrt{W_0^2 + \frac{2U_{1-2}}{K^2 m}}$$

$$W_F = \sqrt{\left(10\pi \frac{RAD}{s}\right)^2 + \frac{2(-2500\ N\cdot m)}{(0.6^m)^2(300\ kg)}}$$

$$W_F = \left(30.67 \frac{RAD}{s}\right)\left(\frac{60\ s}{MIN}\right)\left(\frac{REV}{2\pi\ RAD}\right) = 292.9\ RPM$$

b) $M = 25^{N\cdot m}$, FIND $\Delta\theta$ FOR $W_F = 300^{RPM} = 10\pi \frac{RAD}{s}$

$W_0 = 30.67 \frac{RAD}{s}$

$T_1 + U_{1-2} = T_2$

$U_{1-2} = \int_{\theta_1}^{\theta_2} M\, d\theta = M \cdot \Delta\theta$

$\frac{1}{2} I W_0^2 + M \cdot \Delta\theta = \frac{1}{2} I W_F^2$

$\Delta\theta = \frac{I}{2M}$

PROB. 17-5 CONT.

$$\Delta\theta = \frac{I}{2M}\left(\omega_F^2 - \omega_0^2\right) = \frac{K^2 M}{2M}\left(\omega_F^2 - \omega_0^2\right)$$

$$\Delta\theta = \frac{(0.6^m)^2(300\ kg)}{2(25\ N\cdot m)} \cdot \left[\left(10\pi\ \frac{RAD}{s}\right)^2 - \left(30.67\ \frac{RAD}{s}\right)^2\right]$$

$$\Delta\theta = (100\ RAD)\left(\frac{REV}{2\pi\ RAD}\right) = 15.92\ REV$$