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$$\frac{2\pi f_f}{60} = 840\ rpm \times \frac{2\pi\ rad}{1\ rev} \times \frac{1\ min}{60 sec} = 28\pi \frac{rad}{s} = 87.96 \frac{rad}{s}$$

$rpm \longrightarrow \frac{rad}{s}$

$eW_0/2 = 3\ lb\text{-}in$ ; $\times 2 = 6 \frac{lb\text{-}in}{} = eW_0$ ; $mg = 200\ lb$

when $x=0$ rotating mass form $\measuredangle$ of $90°$ to horizontal $x_p = X_{ss,RU} \sin(\omega_f t - \psi)$

$\therefore\ \omega_f t - \psi = 0$ & $\psi = 90°$ $\tan\psi = \infty = \frac{2\zeta r}{1-r^2} \Rightarrow r = 1$ namely $\omega_f = \omega_n = 87.96 \frac{rad}{s}$

when $\omega_f = \omega_n$ $X_{ss,RU} = 0.75 in = \frac{m_0 e}{m} \frac{r^2}{\sqrt{(1-r^2)^2 + (2\zeta r)^2}} = \frac{W_0 e}{W} \frac{\cancel{r^2}\ 1}{2\zeta \cancel{r}\ 1} = \frac{6\ lbin}{200\ lb} \cdot \frac{1}{2\zeta}$

now $\zeta = \frac{6}{200} \cdot \frac{1}{2(0.75)} = .02$

$F_{trans,max,RU} = \frac{m_0 e}{m} \frac{k r^2 \sqrt{1+(2\zeta r)^2}}{\sqrt{(1-r^2)^2 + (2\zeta r)^2}}$

$\omega_n = 87.96 = \sqrt{\frac{k}{m}}$ $m = \frac{W}{g} = \frac{200}{32.2} =$ & $k = m\omega_n^2$

for $2^{nd}$ part $f_f = 1260\ rpm \Rightarrow \omega_f = 1.5(87.96) = 131.94 \frac{rad}{s} \Rightarrow r = \frac{\omega_f}{\omega_n} = \frac{131.94}{87.96} = 1.5$

everything else not change $W_0 e = 6\ lbin$ $W = 200\ lb$ $\zeta = 0.02$

$$X_{ss,RU} = \frac{W_0 e}{W} \frac{r^2}{\sqrt{(1-r^2)^2 + (2\zeta r)^2}}$$

and $\psi = \tan^{-1}\left(\frac{2\zeta r}{1-r^2}\right)$ since $\omega_f t$ represents angle rot. mass makes with horiz