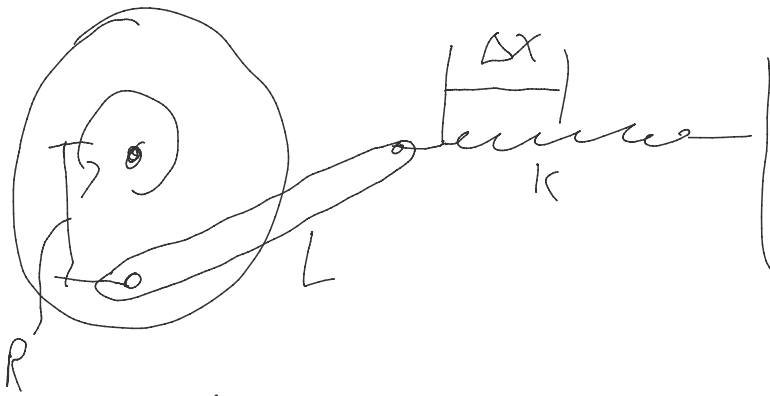


Power requirements

Wednesday, October 9, 2019 22:04



Find power needed to compress spring

Assume L is infinite length

$$\Delta x = R \sin(\theta) \quad \left(\begin{array}{l} \text{spring fully compressed @ } \theta = 90^\circ \\ \text{spring @ free length @ } \theta = 0^\circ \end{array} \right)$$

$$F = -k \Delta x$$

$$k = \frac{50 \text{ lb}}{R} \Rightarrow \text{Guarantees that spring will exert } 50 \text{ lb when compressed}$$

$$\frac{\partial \Delta x}{\partial t} = R \cos(\theta) \frac{\partial \theta}{\partial t} \quad \left\{ \begin{array}{l} \text{Angular velocity} \\ 100 \text{ Hz} = 2\pi \cdot 100 \frac{\text{rad}}{\text{s}} \end{array} \right.$$

$$F \cdot \frac{\partial \Delta x}{\partial t} = \text{Power} = -\frac{50 \text{ lb}}{R} R \sin(\theta) R \cos(\theta) \cdot 2\pi \cdot 100 \text{ rad/s}$$

$$= 50 \text{ lb} \cdot R \cdot \frac{\sin(2\theta)}{2} \cdot 2\pi \cdot 100 \text{ rad/s}$$

$$\text{Max @ } \theta = 45^\circ \Rightarrow 5000 \pi R \frac{\text{in} \cdot \text{lb}}{\text{sec}} \quad \text{Assuming } R \text{ is inches}$$

@ $R = 1''$
Need 2.38 hp
motor

$$P = \frac{5000 \pi R \text{ hp}}{6600} \leftarrow R \text{ in inches}$$

= 1775 watts!!!

Implausible??

