Pendulums

$$l\ddot{\theta} + g\sin\theta = 0$$

$$l\ddot{\theta} = -g\sin\theta$$

$$\ddot{\theta} = \frac{-g\sin\theta}{l}$$

$$\phi = \dot{\theta}$$

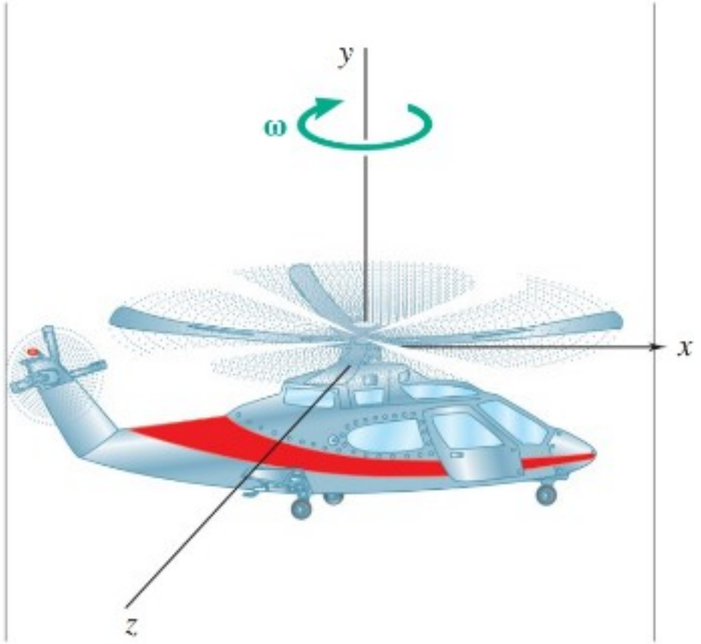
$$\ddot{\theta} = \dot{\phi} = \frac{-g\sin\theta}{l}$$

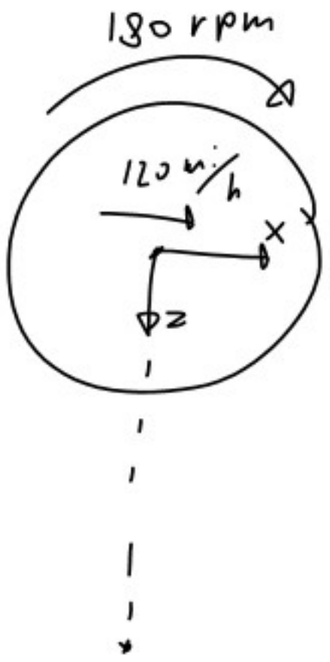
$$\begin{bmatrix} \dot{\theta} \\ \dot{\phi} \end{bmatrix} = \begin{bmatrix} \phi \\ -g\sin\theta/l \end{bmatrix}$$

$$f\left(\begin{bmatrix} \theta \\ \phi \end{bmatrix}\right) = \begin{bmatrix} \dot{\theta} \\ \dot{\phi} \end{bmatrix} = \begin{bmatrix} \phi \\ -g\sin\theta/l \end{bmatrix}$$

$$f\left(\begin{bmatrix} 0 \\ 1 \end{bmatrix}\right) = \begin{bmatrix} 1 \\ -g\sin(0)/l \end{bmatrix} = \begin{bmatrix} 1 \\ 0 \end{bmatrix}$$

15.75 A helicopter moves horizontally in the x direction at a speed of 120 mi/h. Knowing that the main blades rotate clockwise when viewed from above with an angular velocity of 180 rpm, determine the instantaneous axis of rotation of the main blades.





$$V = \ell \omega$$

$$\frac{V}{\omega} = \ell$$

$$\frac{120 \text{ mi/h}}{180 \text{ rev/min}} \cdot \frac{1 \text{ rev}}{2\pi \text{ rad}} \cdot \frac{1 \text{ h}}{60 \text{ min}} \cdot \frac{5280 \text{ ft}}{1 \text{ mi}} = 9.34 \text{ ft}$$