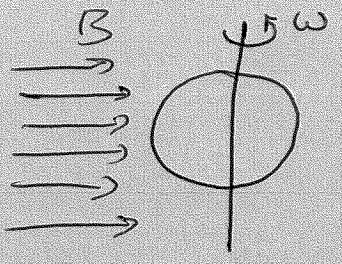
Ch. 13 Prob. 70

$r = 10\,cm$

$\omega = 5\ \frac{cycles}{s}$

$B = 2\,G$



a) Find a time-dependent expression for flux

$$\Phi = \vec{B}\cdot\vec{A} = BA\cos\theta$$

now $\theta = \omega t$ - convert ω into rad/s

$$\omega = \frac{5\,cycles}{s}\left(\frac{2\pi\,rad}{1\,cycle}\right) = 10\pi\ \frac{rad}{s}$$

$$\theta = 10\pi \cdot t$$

convert B into Tesla

$$B = 2\,G\left(\frac{1\,T}{10{,}000\,G}\right) = 2\times10^{-4}\,T$$

Find area (circle)

$$A = \pi r^2 = \pi\,(0.10\,m)^2 = 3.14\times10^{-2}\,m^2$$

$$\therefore\ \Phi = (2\times10^{-4}\,T)(3.14\times10^{-2}\,m^2)\cos(10\pi\cdot t)$$

$$\boxed{\Phi = 6.28\times10^{-6}\,Wb\cos(10\pi\cdot t)}$$

b) Determine the current function if $R = 10\,\Omega$

First $\mathcal{E} = -\frac{d\Phi}{dt} = -\frac{d}{dt}\left(6.28\times10^{-6}\,Wb\right)\cos(10\pi\cdot t)$

$$= (6.28\times10^{-6})(10\pi)\sin(10\pi\cdot t)$$

$$\mathcal{E} = 1.97\times10^{-4}\,V\sin(10\pi t)$$

By Ohm's Law

$$I = \frac{\mathcal{E}}{R} = \frac{1.97\times10^{-4}\,V}{10\,\Omega}\sin(10\pi t) = \boxed{1.97\times10^{-5}\,A\sin(10\pi t)}$$