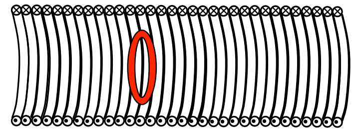
$n_{solenoid} = 400$ turns/meter

$N_{coil} = 250$ turns, $R_{coil} = .06$ m



$I = 30\left(1 - e^{-1.6t}\right)$

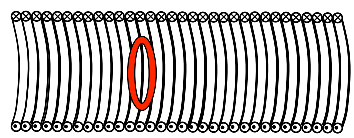
Problem 31.14

With Faraday's Law problems (i.e., Induction problems), you always want to determine the magnetic field, then the magnetic flux, then take the derivative. The solenoid generates a magnetic field of:

$$\begin{aligned} B_{solenoid} &= (\mu_o n I) \\ &= \left(4\pi x10^{-7}\ T\bullet m/A\right)(400\ turns/m)\left[30\left(1 - e^{1.6t}\right)A\right] \\ &= 1.5x10^{-2}\left(1 - e^{1.6t}\right)\ T \end{aligned}$$

$n_{solenoid} = 400$ turns/meter

$N_{coil} = 250$ turns, $R_{coil} = .06$ m



$I = 30\left(1 - e^{-1.6t}\right)$

The magnetic flux through the coil is a function of the cross-sectional area of the coil, so:

$$\begin{aligned} \Phi_B &= \vec{B} \bullet \vec{A} \\ &= [\mu_o n I]\left(\pi R_{coil}^2\right) \\ &= \left[1.5x10^{-2}\left(1 - e^{1.6t}\right)\right]\left(\pi(.06\ m)^2\right) \\ &= 1.7x10^{-4}\left(1 - e^{1.6t}\right)\ Webers \end{aligned}$$

And the EMF is:

$$\begin{aligned} \varepsilon_{induced} &= -N_{coil}\frac{d\Phi_B}{dt} \\ &= -(250)\left[\frac{d\left(1.7x10^{-4}\left(1 - e^{1.6t}\right)\ Webers\right)}{dt}\right] \\ &= -(250)\left(1.7x10^{-4}\right)(-1.6)e^{1.6t}\ V \\ &= 6.8x10^{-2}e^{1.6t}\ V \end{aligned}$$