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67. A coil with 150 turns, a radius of 5.0 cm, and a resistance of 12 Ω surrounds a solenoid with 230 turns/cm and a radius of 4.5 cm; see Fig. 29–50. The current in the solenoid changes at a constant rate from 0 to 2.0 A in 0.10 s. Calculate the magnitude and direction of the induced current in the 150-turn coil.

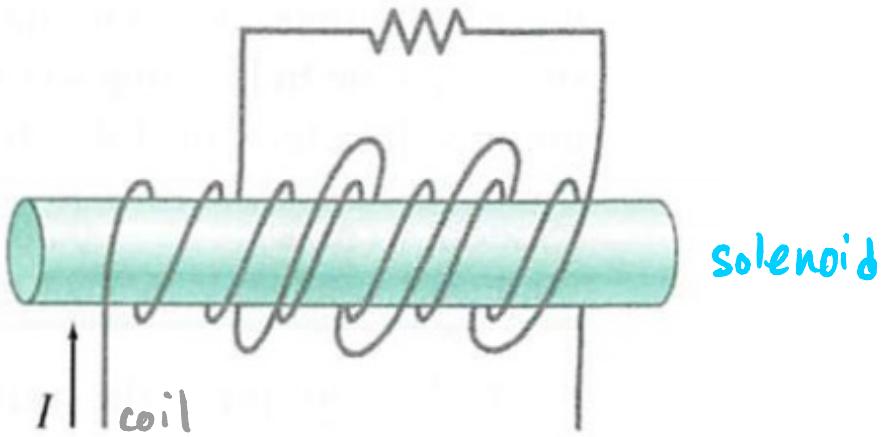

FIGURE 29–50
Problem 67.

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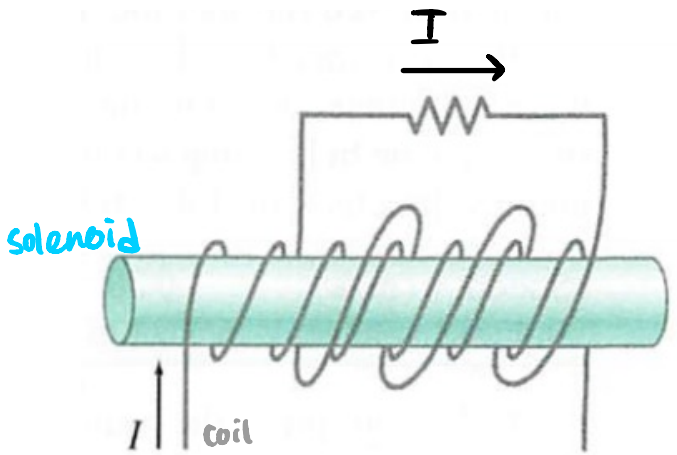

$$I = \frac{\mathcal{E}_{ind}}{R}$$

$$|\mathcal{E}_{ind}| = N_{coil}\frac{d\Phi}{dt} = N_{coil}A_{solenoid}\frac{dB_{solenoid}}{dt}$$

$$B_{sol} = \mu_0 \frac{N_{sol}I_{sol}}{\ell_{sol}}$$

$$I = \frac{N_{coil}\,A_{sol}\,\frac{d}{dt}\left(\mu_0\frac{N_{sol}I_{sol}}{\ell_{sol}}\right)}{R} = \frac{N_c A_s \mu_0 \frac{N_s}{\ell_s}}{R}\cdot\frac{dI_{sol}}{dt}$$

$$\frac{(150)\pi(0.05\,m)^2\left(4\pi\times10^{-7}\,T\cdot m/A\right)\left(\frac{230\,T}{0.01\,m}\right)\left(\frac{2\,A}{0.1\,s}\right)}{12\,\Omega} = 5.7\times10^{-2}\,A$$