Example 33.1 **What Is the rms Current?**

The voltage output of an AC source is given by the expression $\Delta v = (200 \text{ V}) \sin \omega t$. Find the rms current in the circuit when this source is connected to a 100-Ω resistor.

$$\Delta V_{\text{rms}} = \frac{\Delta V_{\text{max}}}{\sqrt{2}} = \frac{200 \text{ V}}{\sqrt{2}} = 141 \text{ V}$$

$$I_{\text{rms}} = \frac{\Delta V_{\text{rms}}}{R} = \frac{141 \text{ V}}{100\ \Omega} = 1.41 \text{ A}$$

Example 33.2 **A Purely Inductive AC Circuit**

In a purely inductive AC circuit, *L = 25.0 mH* and the rms voltage is 150 V. Calculate the inductive reactance and rms current in the circuit if the frequency is 60.0 Hz.

$$X_L = \omega L = 2\pi f L = 2\pi(60.0\text{ Hz})(25.0 \times 10^{-3}\text{ H})$$
$$= 9.42\ \Omega$$

$$I_{\text{rms}} = \frac{\Delta V_{L,\text{rms}}}{X_L} = \frac{150\text{ V}}{9.42\ \Omega} = 15.9\text{ A}$$

Example 33.3 **A Purely Capacitive AC Circuit**

An 8.00-μF capacitor is connected to the terminals of a 60.0-Hz AC source whose rms voltage is 150 V. Find the capacitive reactance and the rms current in the circuit.

$\omega = 2\pi f = 377\ \mathrm{s}^{-1}$

$$X_C = \frac{1}{\omega C} = \frac{1}{(377\ \mathrm{s}^{-1})(8.00 \times 10^{-6}\ \mathrm{F})} = 332\ \Omega$$

$$I_{\mathrm{rms}} = \frac{\Delta V_{\mathrm{rms}}}{X_C} = \frac{150\ \mathrm{V}}{332\ \Omega} = 0.452\ \mathrm{A}$$