

41. The amplitude of the voltage across the inductor in an RLC series circuit is given by $V_L = IX_L = I\omega_d L$. At resonance, the driving angular frequency equals the natural angular frequency: $\omega_d = \omega = 1/\sqrt{LC}$. For the given circuit

$$X_L = \frac{L}{\sqrt{LC}} = \frac{1.0 \text{ H}}{\sqrt{(1.0 \text{ H})(1.0 \times 10^{-6} \text{ F})}} = 1000 \, \Omega .$$

At resonance the capacitive reactance has this same value, and the impedance reduces simply: $Z = R$. Consequently,

$$I = \frac{\mathcal{E}_m}{Z} \Big|_{\text{resonance}} = \frac{\mathcal{E}_m}{R} = \frac{10 \text{ V}}{10 \, \Omega} = 1.0 \text{ A} .$$

The voltage amplitude across the inductor is therefore

$$V_L = IX_L = (1.0 \text{ A})(1000 \, \Omega) = 1000 \text{ V}$$

which is much larger than the amplitude of the generator emf.