Practice Problems Section 13 Solutions

1. An alternating series LRC circuit consists of a resistor with resistance 1.2 kΩ, an inductor with inductance 90 mH, and a capacitor with capacitance 6.0 µF. The amplitude of the AC voltage source is 25.0 V. For all parts explain and/or show your work.
2. What is the resonant angular frequency of the circuit? **Show your work!**

The resonant frequency occurs when , which means

1. What is the amplitude of the current in the circuit at the resonant frequency? **Show your work!**

At the resonant frequency, the reactances of the capacitor and inductor are equal, so the impedance is simply equal to the resistance in the circuit. Thus,

1. Write an expression for the voltage across the inductor as a function of time at the resonant frequency. (The only variable in the expression should be time, everything else should be a numerical quantity). **Show your work!**

To write the voltage as a function of time, we note that

Using the known values of and we find

Thus, the inductor is ¼ of a cycle ahead of the current, and the maximum voltage across the inductor in this circuit is 2.55 V. Note that this is much less than the AC voltage amplitude. Because the circuit is at resonance, most of the voltage will be across the resistor, not across the capacitor or inductor.