Electronics
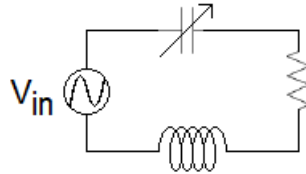
AC circuits

Problem 1.- An RLC circuit consists of the devices shown in the figure, with values R = 10kΩ, L = 15mH, and C a variable capacitance. The AC voltage source supplies a signal with amplitude of 2 volts and angular frequency 1,500 radians per second. For what value of C is the amplitude of the current maximum?

Solution: The maximum current corresponds to the resonance point, which will happen when the capacitor and inductor impedances are equal in magnitude:

$$\frac{1}{\omega C} = \omega L \rightarrow C = \frac{1}{\omega^2 L} = \frac{1}{(1,500 rad / s)^2 (15 \times 10^{-3} H)} = \textbf{30 μF}$$

Problem 2.- A fixed capacitance of 66nF is used together with a variable inductor in the tuning section of a radio. What inductance tunes the circuit into the signal from a radio station broadcasting at 575 kHz?

Solution: Angular frequency: $\omega = 2\pi f = 2(3.1416)(575 \times 10^3 Hz) = 3.61 \times 10^6 rad / s$

Since $\omega = \frac{1}{\sqrt{CL}} \rightarrow L = \frac{1}{\omega^2 C} = \frac{1}{(3.61 \times 10^6 rad / s)^2 (0.066 \times 10^{-6} F)} = \textbf{1.16 μH}$