

Answer on Question#56082 - Physics - Electromagnetism

Consider a series RLC circuit where $R = 447\Omega$ and $C = 3.25\mu\text{F}$. However, the inductance L of the inductor is unknown. To find its value, you decide to perform some simple measurements. You apply an ac voltage that peaks at 84.0V and observe, using an oscilloscope, that the resonance angular frequency occurs at $f = 27500\text{s}^{-1}$ (recall that $\omega = 2\pi f$).

What is the inductance of the inductor in millihenrys?

Solution:

The resonance in such circuit occurs when the frequency of the source coincides with the frequency of corresponding LC circuit:

$$\omega = \frac{1}{\sqrt{LC}}$$

Therefore

$$L = \frac{1}{\omega^2 C} = \frac{1}{4\pi^2 f^2 C} = \frac{1}{4\pi^2 (27500\text{s}^{-1})^2 3.25\mu\text{F}} = 0.01\text{mH}$$

Answer: 0.01mH.