

Answer on Question #81601 Physics / Other

A capacitor of capacitance $C = 10^{-4}$ F and a coil of resistance $R = 50$ Ohm and inductance $L = 0.5$ H are connected in series with a $V = 110$ V, $f = 50$ Hz AC source. Find the RMS value of the current.

Solution:

The Ohm's law states

$$I = \frac{V}{Z}$$

where the impedance is defined as

$$\begin{aligned} Z &= \sqrt{R^2 + (X_L - X_C)^2} = \sqrt{R^2 + \left(2\pi fL - \frac{1}{2\pi fC}\right)^2} \\ &= \sqrt{50^2 + \left(2\pi \times 50 \times 0.5 - \frac{1}{2\pi \times 50 \times 10^{-4}}\right)^2} = 135 \text{ Ohm} \end{aligned}$$

Therefore

$$I = \frac{110}{135} = 0.82 \text{ A}$$

Answer: 0.82 A

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