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

$$Z = \sqrt{R^2 + (X_L - X_C)^2} = \sqrt{R^2 + \left(2\pi f L - \frac{1}{2\pi f C}\right)^2}$$

$$= \sqrt{50^2 + \left(2\pi \times 50 \times 0.5 - \frac{1}{2\pi \times 50 \times 10^{-4}}\right)^2} = 135 \text{ Ohm}$$

Therefore

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

Answer: 0.82 A