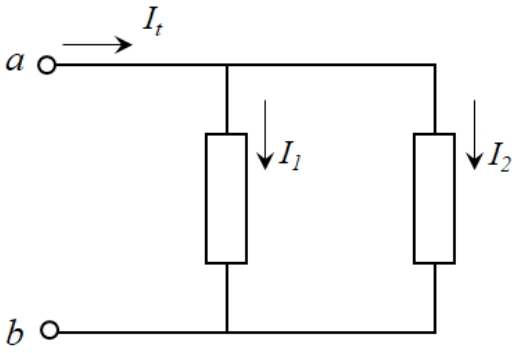
1 In the following circuit, currents i_1 and i_2 are given as:



$$i_1(t) = 2.4\sin(\omega t + 10°) \quad A$$
$$i_2(t) = 3.6\sin(\omega t - 15°) \quad A$$

Find the current at the input terminal.

Solution:

$$\boldsymbol{I_1} = 2.4 < 10° \qquad \boldsymbol{I_2} = 3.6 < -15°$$

A KCL equation at the top node gives:

$$\boldsymbol{I_T} = \boldsymbol{I_1} + \boldsymbol{I_2} = 2.4 < 10° + 3.6 < -15°$$

$$\boldsymbol{I_T} = (2.36 + \text{j}0.416) + (3.48 - \text{j}0.931) = 5.84 - \text{j}0.515$$

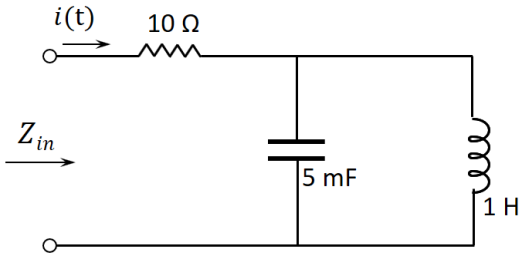
$$\boldsymbol{I_T} = 5.86 < -5.02°$$

And finally the total current in time domain:

$$i_T(t) = 5.86\sin(\omega t - 5.02°) \quad A$$

2 The following circuit is operating at angular frequency of ω=10 rad/sec.

Find the input impedance. If the circuit is supplied through a voltage source with *rms* value of 120 V, find phasor of the input current.

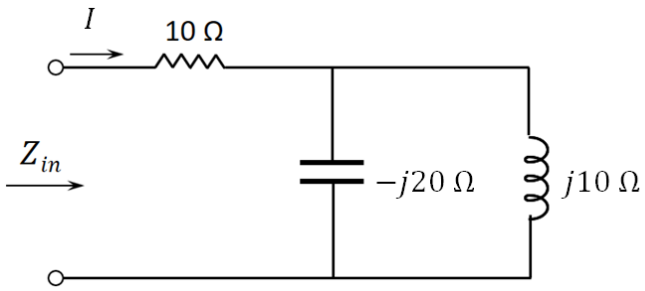


Solution:

First we need to convert the circuit to phasor domain with the given angular frequency:

$$X_L = j\omega L = j10 \times 1 = j10\ \Omega$$

$$X_c = -j\frac{1}{\omega C} = -j\frac{1}{10 \times 5 \times 10^{-3}} = -j20\ \Omega$$



From this circuit the total input impedance is:

$$\boldsymbol{Z_{in}} = 10 + (-j20 \,||\, j10) = 10 + \frac{(-j20 \times j10)}{(-j20 + j10)}$$

$$\boldsymbol{Z_{in}} = 10 + j20\ \ \Omega$$

And finally current can be calculated as:

$$\boldsymbol{I} = \frac{120 < 0°}{10 + j20} = 5.367 < -63.43° \quad A$$

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