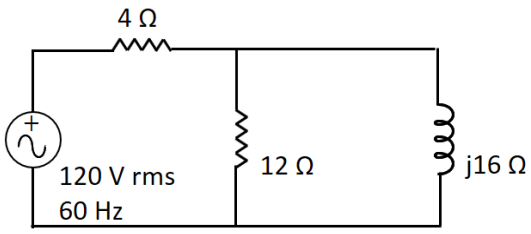
1 Consider the following circuit:

a) Find phasor of the current of the voltage source
b) Find the complex power of the voltage source



Solution:

a) To find the current, first we need to find the total impedance of the circuit from the terminal of the voltage source:

$$\boldsymbol{Z}_t = 4 + (12 \,||\, j16) = 4 + \frac{12 \times j16}{12 + J16} = 11.68 + j5.76 \quad \Omega$$

And hence the total current is:

$$\boldsymbol{I}_s = \frac{120 < 0°}{11.68 + j5.76} = 9.21 < -26.25° \quad A$$

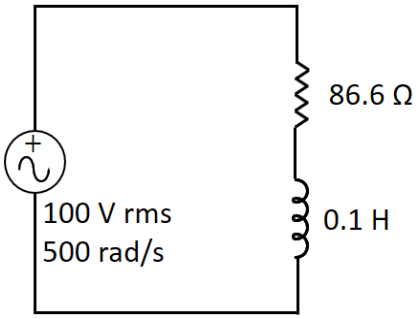
b) Complex power of the voltage source:

$$\boldsymbol{S} = \boldsymbol{V}\,\boldsymbol{I}^* = 120 < 0° \times 9.21 < 26.25° = 1105.2 < 26.25 \quad VA$$

$$\boldsymbol{S} = 991.22 + j488.82 \quad VA$$

2 The following circuit operates at ω=500 rad/s and *rms* voltage of 100 V.

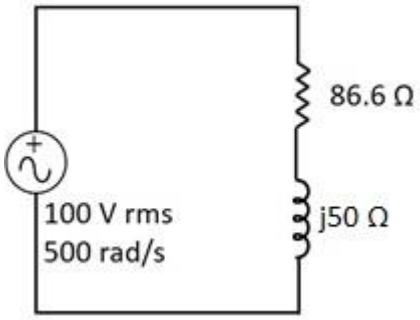
a) Find the complex power delivered to this load
b) Find the required capacitive reactive power to correct power factor to 0.94 lagging



Solution:

a) To analyse this circuit, first we need to transfer it into phasor domain:

$$X_L = j\omega L = j500 \times 0.1 = j50\ \Omega$$



And total current of the circuit is:

$$\boldsymbol{I}_s = \frac{100 < 0°}{86.6 + j50} = 1.0 < -30°\ \ A$$

Therefore, complex power of the source is:

$$\boldsymbol{S} = \boldsymbol{V}\,\boldsymbol{I}^* = 100 < 0° \times 1.0 < 30° = 100 < 30 \quad VA$$

$$\boldsymbol{S} = 86.6 + j50 \quad VA$$

b) Capacitive reactive power is calculated by:

$$Q_c = P_L(\tan\varphi_1 - \tan\varphi_2)$$

The initial phase angle is $\varphi_1 = 30°$ and phase angle after compensation is $\varphi_2 = \cos^{-1}(0.94) = 19.95°$. And hence:

$$Q_c = 86.6(\tan 30° - \tan 19.95°) = 18.53\ VA$$

Hamed Bahmani

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