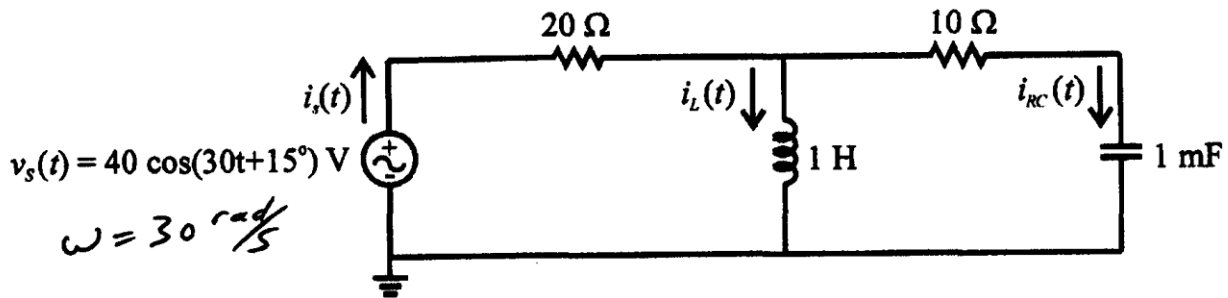
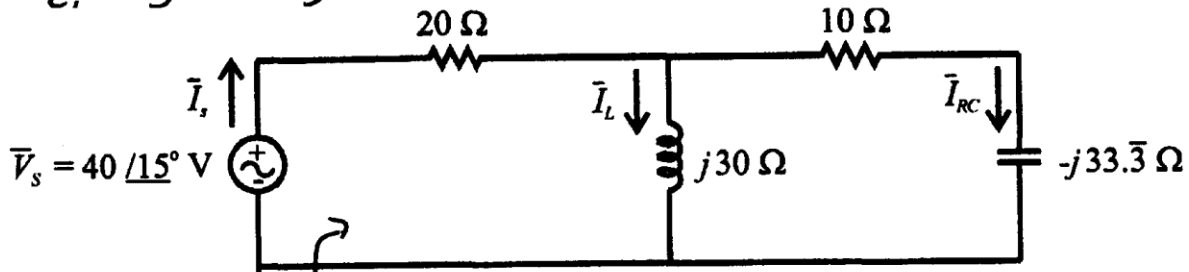


Example- Determine the power factor (as seen by source) & complex powers for the circuit.



Determine phasor equivalent circuit.

$$\bar{Z}_L = j\omega L = j30(1) = j30\Omega \quad \bar{Z}_C = \frac{1}{j\omega C} = \frac{1}{j30(10^{-3})} = -j33.3\Omega$$



$$\bar{Z}_{eq} = 10 + j57\Omega = 115.974 \angle 29.4385^\circ \Omega$$

$$\bar{I}_S = 0.3449 \angle -14.4385^\circ \text{ A} \quad \bar{I}_{RC} = 0.9816 \angle 93.99645^\circ \text{ A}$$

$$\bar{I}_L = 1.1387 \angle -69.30431^\circ \text{ A}$$

$$pf = \cos(\theta_V - \theta_I) = \cos(15^\circ - (-14.4385^\circ)) = \cos(29.4385^\circ)$$

Apparent power

$pf = 0.8709$ lagging

$\theta_Z > 0$ or
 \bar{I}_S lags \bar{V}_S

$$S_{source} = \frac{1}{2} |\bar{V}_S| |\bar{I}_S| = \frac{1}{2} (40) (0.3449) = \underline{\underline{6.898 \text{ VA}}}$$

Complex power

$$\bar{S}_{source} = \frac{1}{2} \bar{V}_S \bar{I}_S^* = \frac{1}{2} (40 \angle 15^\circ) (0.3449 \angle +14.4385^\circ)$$

$$\bar{S}_{source} = \underline{\underline{6.0074 + j3.3903 \text{ VA}}}$$

$$\bar{S}_{source} = \underline{\underline{6.898 \angle 29.4385^\circ \text{ VA}}}$$

ex. cont.

$$P_{\text{source}} = \text{Re} \{ \bar{S}_{\text{source}} \} = \underline{6.0074 \text{ W}}$$

$$Q_{\text{source}} = \text{Im} \{ \bar{S}_{\text{source}} \} = \underline{3.3903 \text{ VAR}}$$

$$\bar{S}_{20} = \frac{1}{2} |\bar{I}_S|^2 (20) = \frac{1}{2} (0.3449)^2 20 = \underline{1.18956 \text{ VA (or W)}}$$

$$\bar{S}_L = \frac{1}{2} |\bar{I}_L|^2 (j30) = \frac{1}{2} (1.1387)^2 (j30) = +j19.4496 \text{ VA (or VAR)}$$

$$\bar{S}_{RC} = \frac{1}{2} |\bar{I}_{RC}|^2 (10 - j33.3) = \frac{1}{2} (0.9816)^2 (10 - j33.3)$$

$$\underline{\underline{\bar{S}_{RC} = 4.8177 - j16.0590 \text{ VA}}}$$

Check - Has complex power been conserved?

$$\sum \bar{S}_{\text{source}} = \sum \bar{S}_{\text{loads}}$$

$$\bar{S}_{\text{source}} \stackrel{?}{=} \bar{S}_{20} + \bar{S}_L + \bar{S}_{RC}$$

$$(6.0074 + j3.3903) \stackrel{?}{=} 1.18956 + j19.4496 + (4.8177 - j16.059)$$

$$6.0074 + j3.3903 = 6.0073 + j3.3906 \quad \therefore$$

⇒ OK (to within rounding error)