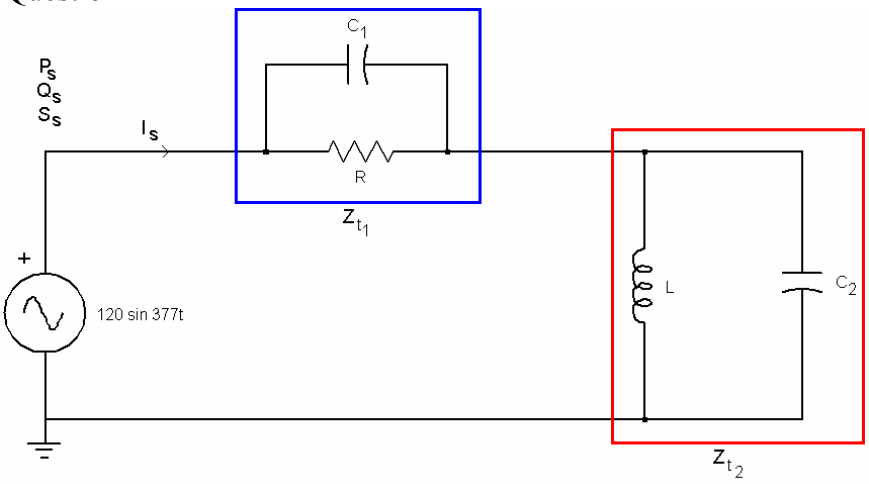
Question



Given:
L = 10mH
R = 10Ω
C_1 = 100μF
C_2 = 50μF

1. Calculate: I_S, P_S, Q_S, and S_S?
2. What is the power factor?
3. Sketch the phasor diagram?

Answer

1.

$$Z_{t_1} = Z_{c_2} // Z_l$$

$$Z_{t_1} = \frac{\left[\frac{1}{j(377)(50)(10^{-6})} \times j(377)(10)(10^{-3})\right]}{\left[\frac{1}{j(377)(50)(10^{-6})} + j(377)(10)(10^{-3})\right]} = \frac{200}{-j50} = j4$$

$$Z_{t_2} = Z_{c_1} // Z_R$$

$$Z_{t_2} = \frac{\left[\frac{1}{j(377)(100)(10^{-6})} \times (10)\right]}{\left[\frac{1}{j(377)(100)(10^{-6})} + (10)\right]} = \frac{-j265.252}{10 - j26.5252} = 8.755 - j3.3$$

$$Z_t = Z_{t_1} + Z_{t_2} = j4 + 8.755 - j3.3 = 8.755 + j0.7 = 8.783\angle 4.57^o$$

$$I_S \angle \theta^o = \frac{V_S}{Z_t} = \frac{120\angle 0^o}{8.783\angle 4.57^o} = 13.66\angle -4.57^o$$

$P_S = |V_S|.|I_S|.\cos\theta = 120 \times 13.66 \times \cos(-4.57) =$ **1634W**
$Q_S = |V_S|.|I_S|.\sin\theta = 120 \times 13.66 \times \sin(-4.57) =$ **-130.67VAR**
$S_S = |V_S|.|I_S| = 120 \times 13.66 =$ **1639VA**

2.P.F. = $\cos\theta = \cos(-4.57) =$ **0.996**

3. Phasor Diagram: