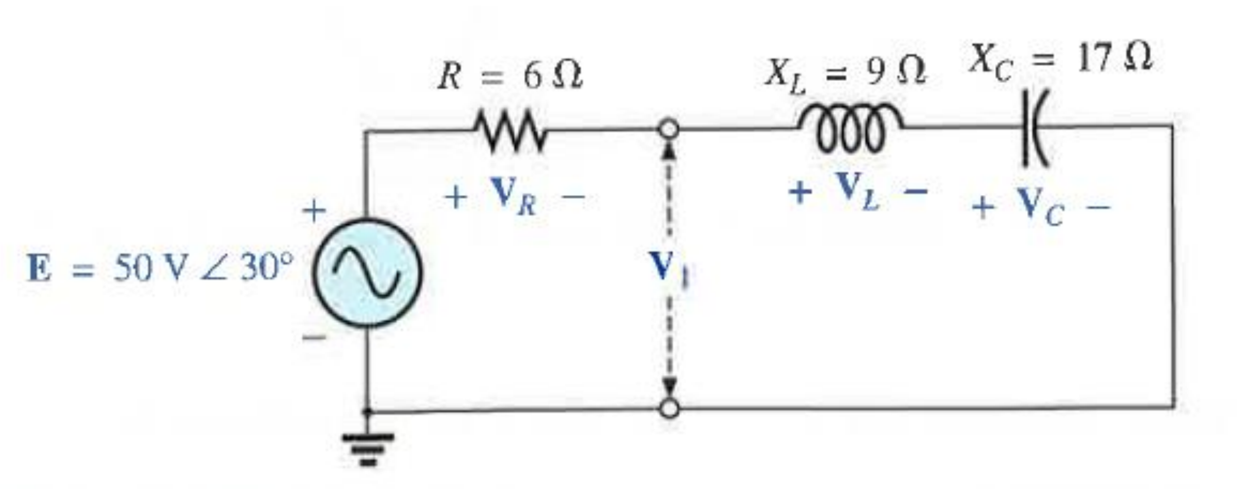
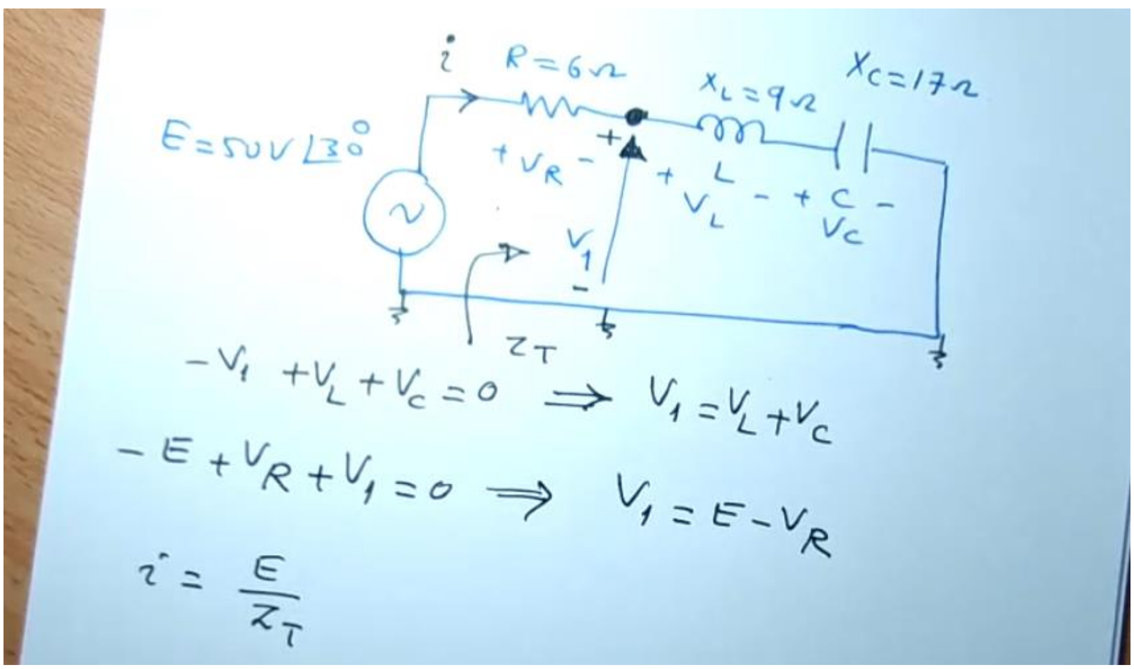
Attribution Nidhal Abdulaziz

Example 7 slide 25

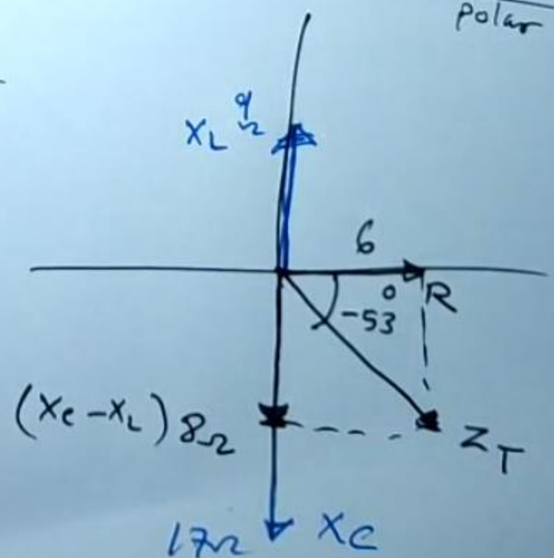




$Z_T = R + j(X_L - X_C)$ Rect

$Z_T = 6 + j(9 - 17) = \underline{6 - j8} = \underline{\sqrt{6^2+8^2}\,\angle \tan^{-1}\frac{-8}{6}}$ polar

$Z_T = 10\,\Omega\,\underline{\angle -53^\circ}$



$$i = \frac{E}{Z_T} = \frac{50V\,\angle 30^\circ}{10\Omega\,\angle -53^\circ} = 5\,A\,\underline{\angle 83^\circ}$$

$$i = 5A \angle 83^\circ$$

$$V_R = i \times R = 5A \angle 83^\circ \times 6\Omega \angle 0^\circ$$

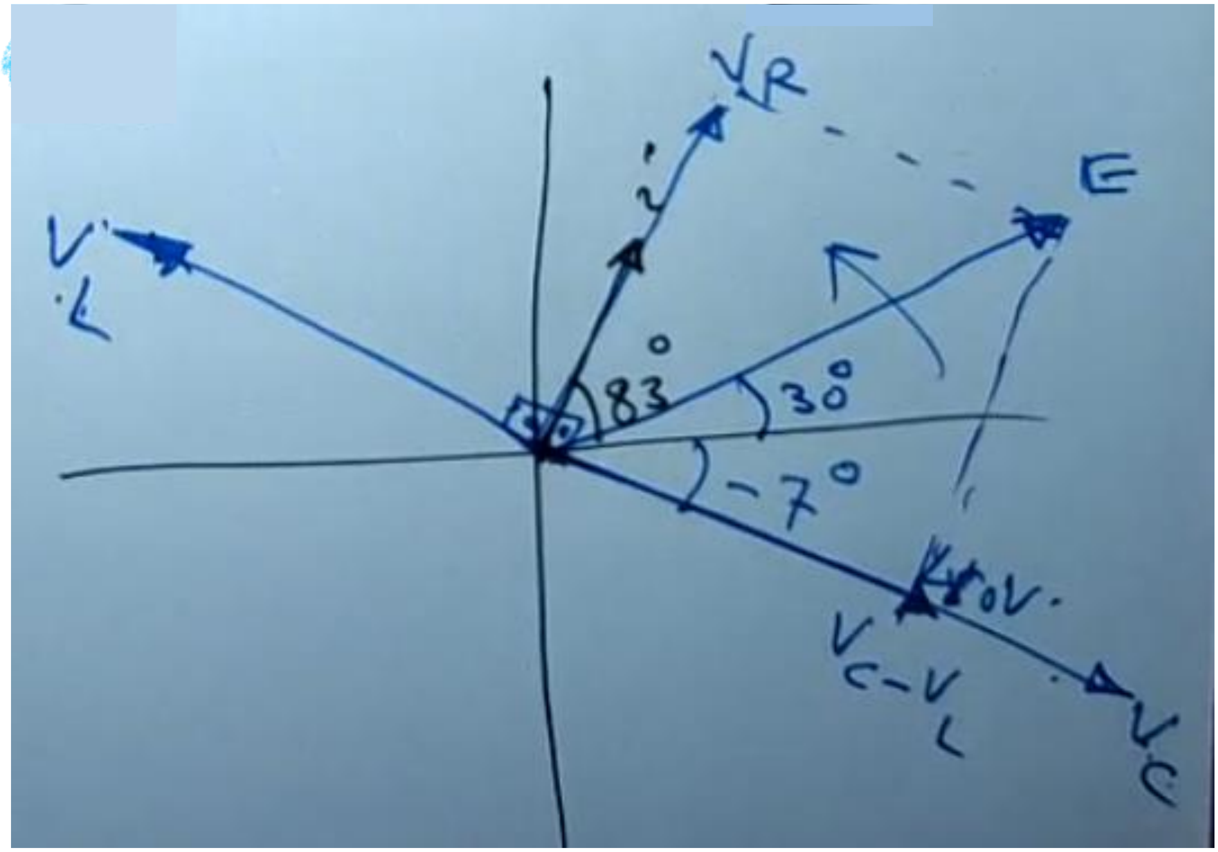
$$V_R = 30V \angle 83^\circ$$

$$V_L = i \times X_L = 5A \angle 83^\circ \times 9\Omega \angle +90^\circ$$

$$V_L = 45V \angle 173^\circ$$

$$V_C = i \times X_C = 5A \angle 83^\circ \times 17 \angle -90^\circ$$

$$V_C = 85V \angle -7^\circ$$



VR
E
i
VL
83°
30°
-7°
40V.
VC-VL
VC

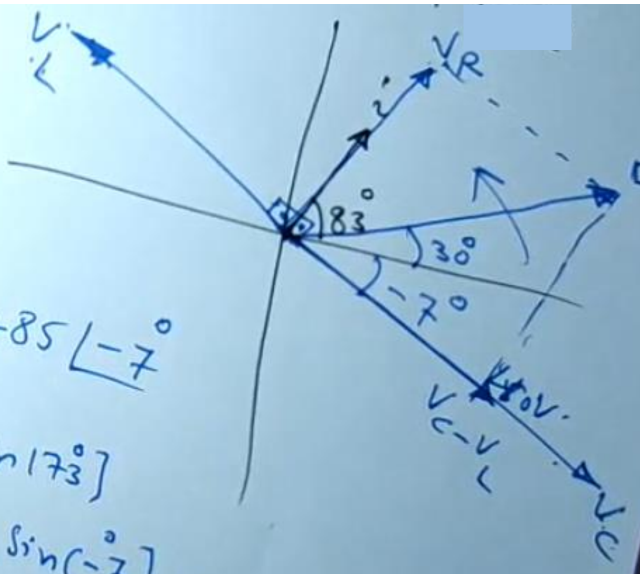
$$V_1 = V_L + V_C$$

$$V_1 = 45\angle 173^\circ + 85\angle -7^\circ$$

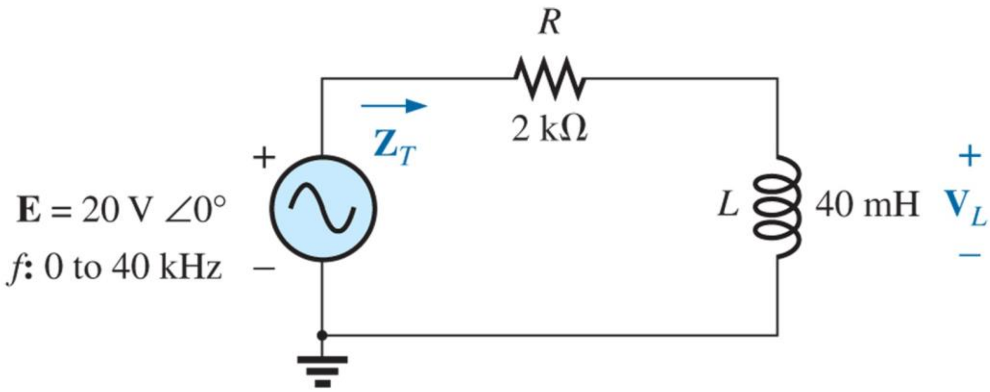
$$V_1 = 45\left[\cos 173^\circ + j\sin 173^\circ\right] + 85\left[\cos(-7^\circ) + j\sin(-7^\circ)\right] =$$

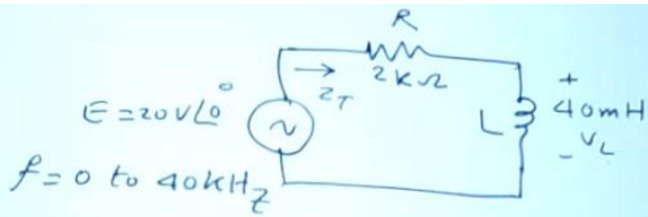
$$V_1 = E - V_R = 50V\angle 30^\circ - 30V\angle 83^\circ$$

$$V_1 = 50\left[\cos 30^\circ + j\sin 30^\circ\right] - 30\left[\cos(83^\circ) + j\sin(83^\circ)\right]$$



Example 15.12 slide 38





$f = 100\,Hz$, $f = 40\,kHz$

$f = ?$ $\quad R = X_L$

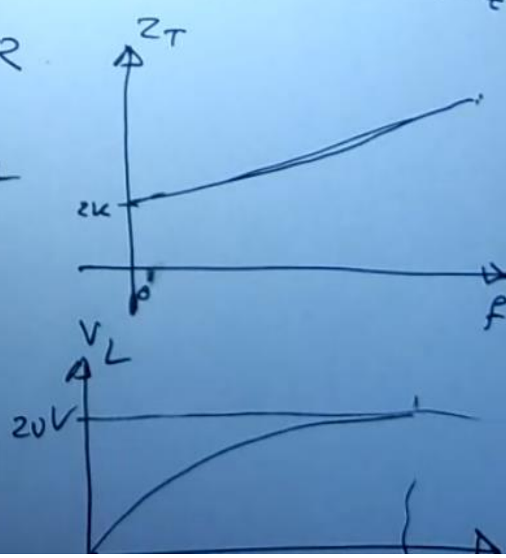
$R = 2\pi f \cdot L$

$2k\Omega = 2\pi \times f \times 40 \times 10^{-3} \Rightarrow f = 79577\,Hz$

at $100Hz$ $\quad Z_T \approx R$

at $40kHz$ $\quad Z_T \approx X_L$

$$V_L = E \times \frac{X_L}{R + jX_L}$$



$f = 1\,kHz$

$$V_L = E \cdot \frac{jX_L}{R + jX_L}$$

$$X_L = 2\pi \times 10^3 \times 40 \times 10^{-3}$$
$$\cong 0.25\,k\Omega \angle +90^\circ$$

$$V_L = \frac{(20V \angle 0^\circ) \times 0.25k \angle +90^\circ}{2k + j\,0.25k}$$

$$V_L = 2.48V \angle 82.87^\circ$$

$5\,kHz$

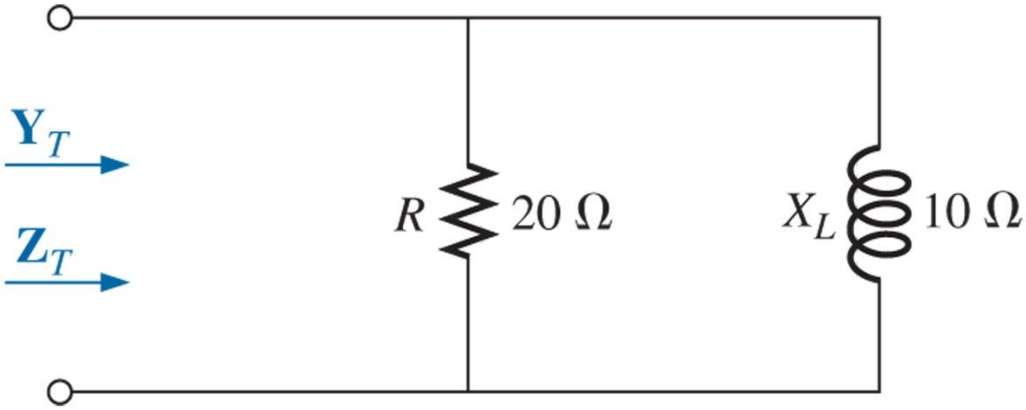
$$X_L = 2\pi f \cdot L = 2\pi \times 5 \times 10^3 \times 40 \times 10^{-3}$$

$$X_L \cong 1.26\,k\Omega$$

$$V_L = E \times \frac{jX_L}{R + jX_L} = \frac{20V\angle 0^\circ \times (1.26k \angle +90^\circ)}{2k + j\,1.26k}$$

$$V_L = 10.68V \angle +57.79^\circ$$

Example 15.13 slide 45



$$Z_T = \frac{Z_1 \cdot Z_2}{Z_1 + Z_2}$$

$$Y_1 = \frac{1}{Z_1} \ ; \ Y_2 = \frac{1}{Z_2} \ ; \ Y_T = Y_1 + Y_2$$

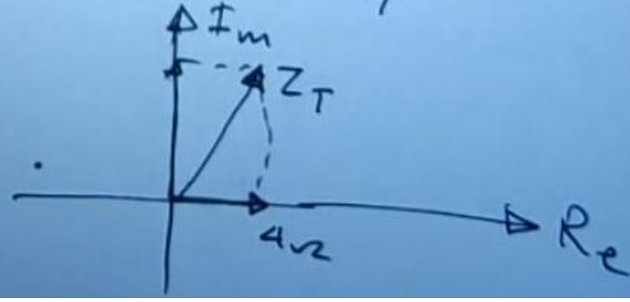
$$Z_T = \frac{1}{Y_T}$$

$$Z_T = \frac{20\Omega\angle 0^\circ \times 10\Omega \angle +90^\circ}{20 + j10} = \frac{200 \angle +90^\circ}{\sqrt{20^2+10^2}\ \angle \tan^{-1} 10/20}$$

$$Z_T = \frac{200\Omega \angle 90^\circ}{22.36 \angle 26.5^\circ} = 8.93\Omega \angle 63.43^\circ$$

$$Z_T = 4.0 + j\,7.95\,\Omega$$

$$Z_T = R_T + j\,X_{L_T}$$



$$Y_1 = \frac{1}{Z_1} = \frac{1}{20\Omega} = 0.05\ S' \angle 0^\circ$$

$$Y_2 = \frac{1}{Z_2} = \frac{1}{10\Omega \angle +90^\circ} = 0.1\ S' \angle -90^\circ$$

$$Y_T = Y_1 + Y_2$$

$$Y_T = 0.05 - j0.1 = \underbrace{0.05}_{Re} - \underbrace{j0.1}_{Im}$$

$$\underline{Y_T = 0.12\ S' \angle -63.43^\circ}$$

$$Z_T = \frac{1}{Y_T} = \frac{1}{0.12} \angle +63.43^\circ$$