

Attribution Nidhal Abdulaziz

Lecture 12 additional solutions

Example 17.12

Slide 22

EXAMPLE 17.12 Determine the voltage across the inductor for the network in Fig. 17.22.

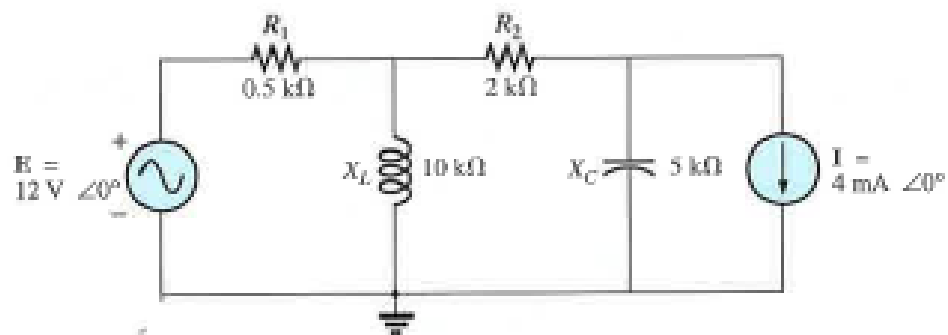
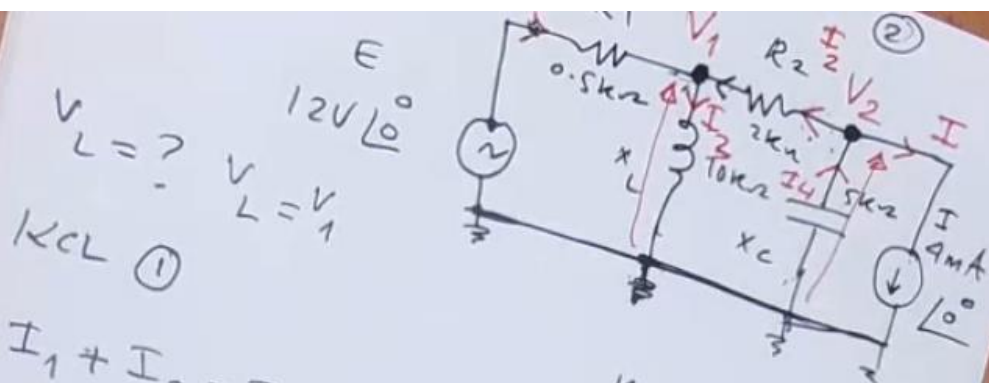


FIG. 17.22

Example 17.12.



$$V_L = ? \quad V_L = V_1$$

KCL ①

$$I_1 + I_2 = I_3 \quad \text{--- ①}$$

KCL ②

$$I_4 = I + I_2 \quad \text{--- ②}$$

$$I_1 = \frac{E - V_1}{R_1} = \frac{12V\angle 0^\circ - V_1}{0.5k\Omega\angle 0^\circ} \quad \text{--- ③}$$

$$I_2 = \frac{V_2 - V_1}{R_2} = \frac{V_2 - V_1}{2k\Omega\angle 0^\circ} \quad \text{--- ④}$$

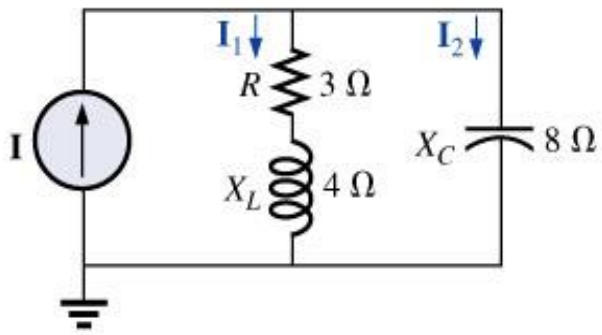
$$I_3 = \frac{V_1 - 0}{jX_L} = \frac{V_1}{j10k} = -j0.1V_1 \times 10^{-3} \quad \text{--- ⑤}$$

$$I_4 = \frac{0 - V_2}{-j5k} = -j0.2V_2 \times 10^{-3} \quad \text{--- ⑥}$$

$$I = 4 \times 10^{-3} \angle 0^\circ \quad \text{--- ⑦}$$

Example 16.2

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$$I_1 = \frac{I \times Z_2}{Z_1 + Z_2}$$

$$Z_1 = R + jX_L$$

$$Z_1 = 3 + j4 = 5 \angle 53^\circ$$

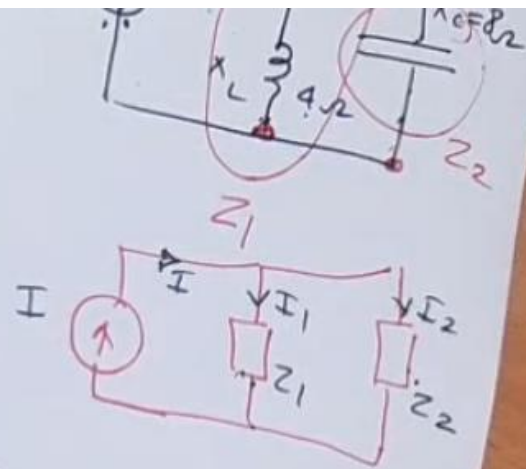
$$Z_2 = -j8 = 8 \angle -90^\circ$$

$$I_1 = \frac{50 \text{ A} \angle 30^\circ \times 8 \angle -90^\circ}{3 + j4 - j8} = \frac{400 \angle -60^\circ}{3 - j4}$$

$$I_1 = \frac{400 \angle -60^\circ}{5 \angle -53^\circ} = 80 \text{ A} \angle -7^\circ$$

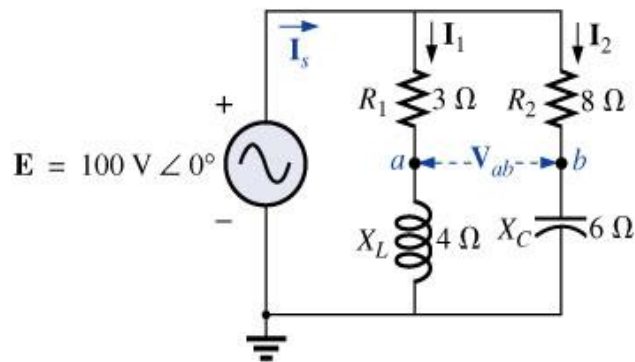
$$I_2 = \frac{I \times Z_1}{Z_1 + Z_2} = \frac{50 \text{ A} \angle 30^\circ \times 5 \angle 53^\circ}{3 + j4 - j8}$$

$$I_2 = \frac{250 \angle 83^\circ}{5 \angle -53^\circ} = 49 \text{ A} \angle 136^\circ$$



Example 16.4

Slide 12



Handwritten calculations and circuit diagrams for Example 16.4:

$Z_1 = R + jX_L$

$Z_1 = 3 + j4 = 5\ \Omega \angle 53^\circ$

$Z_2 = 8 - j6$

$Z_2 = 10\ \Omega \angle -37^\circ$

$I_1 = \frac{E}{Z_1} ; I_2 = \frac{E}{Z_2}$

$I_1 = \frac{100\text{ V} \angle 0^\circ}{5\ \Omega \angle 53^\circ} = 20\text{ A} \angle -53^\circ$

Two circuit diagrams are shown:

- The top diagram is a simplified circuit where the source $E = 100\text{ V} \angle 0^\circ$ is connected in series with Z_1 and Z_2 in parallel.
- The bottom diagram is a simplified circuit where the source $E = 100\text{ V} \angle 0^\circ$ is connected in series with Z_1 and Z_2 in parallel.

$$I_2 = \frac{100V \angle 0^\circ}{10\Omega \angle -37^\circ} = 10A \angle +37^\circ$$

$$I_s = I_1 + I_2 = 20A \angle -53^\circ + 10A \angle +37^\circ$$

$$= 20[\cos(-53^\circ) + j\sin(-53^\circ)] + 10[\cos(37^\circ) + j\sin(37^\circ)]$$

$$i_s = 22.36A \angle -26.56^\circ$$

$I_1 = 20A \angle -53^\circ$
 $I_2 = 10A \angle +37^\circ$

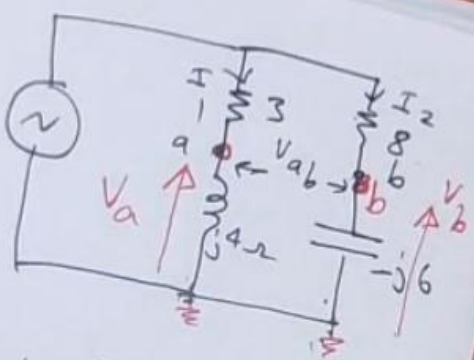
$V_{ab} = V_a - V_b$

$V_a = I_1 \times X_L$

$V_a = 20A \angle -53^\circ \times 4\Omega \angle +90^\circ = 80V \angle 37^\circ$

$V_b = I_2 \times X_C = 10A \angle 37^\circ \times 6 \angle -90^\circ = 60V \angle -53^\circ$

$V_{ab} = 80V \angle 37^\circ - 60V \angle -53^\circ$



$$V_{ab} = 80 \left[\cos 36.87^\circ + j \sin 36.87^\circ \right] \\ - 60V \left[\cos(-53.4^\circ) + j \sin(-53.4^\circ) \right]$$

$$V_{ab} = 28 + j96 = 100V \angle 73.74^\circ$$