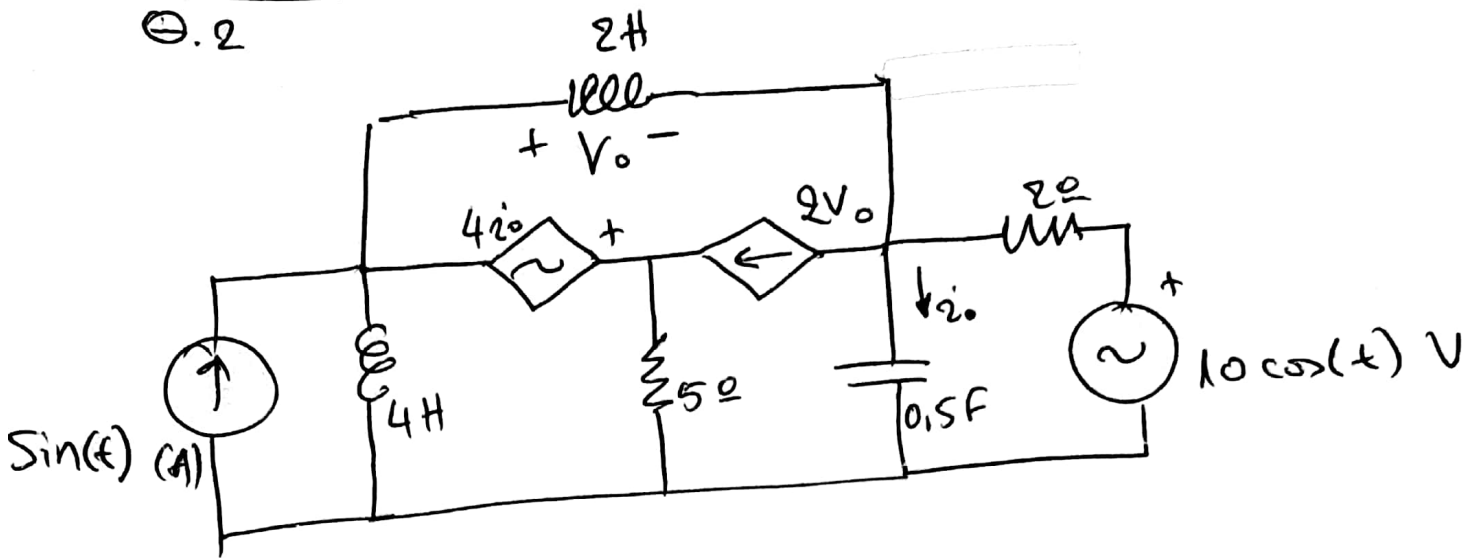


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Q.2

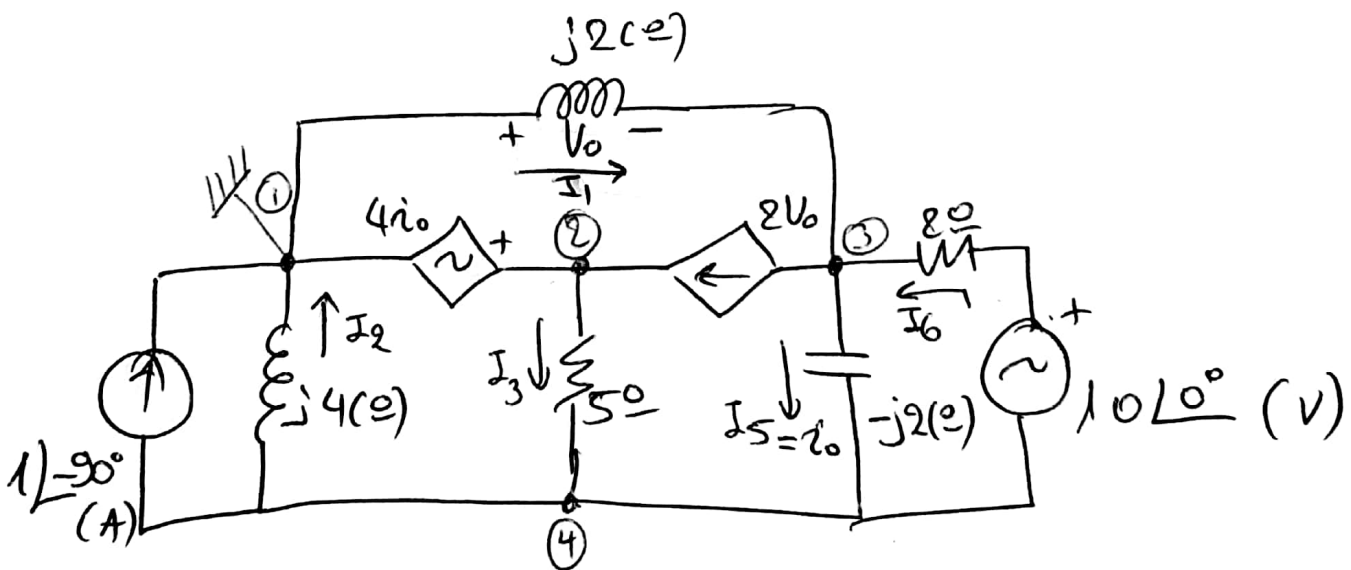


$$I_s = \sin(t) \Rightarrow I_s = 1 \angle -90^\circ \text{ (A)}$$

$$V_s = 10 \angle 0^\circ \text{ (V)}$$

$$Z_{L1} = j2 \cdot 1 = j2 \text{ (}\Omega\text{)} \quad | \quad Z_{L2} = j4 \cdot 1 = j4 \text{ (}\Omega\text{)}$$

$$Z_C = \frac{1}{j0.5 \cdot 1} = -j2 \text{ (}\Omega\text{)}$$



(a) Node ① $V_1 = 0$ (Reference)

(a) Node ② $V_2 = 4i_o$ (V)

(ΣEs. 1)

ⓐ Node ③ (KCL) : $I_6 + I_1 = 2V_0 + I_5 \Rightarrow$

$$\Rightarrow \frac{10 - V_3}{2} + \frac{0 - V_3}{j2} = 2(0 - V_3) + \frac{V_3 - V_4}{-j2} \Rightarrow$$

$$\Rightarrow 5 - \frac{1}{2}V_3 - \frac{1}{j2}V_3 + 2V_3 - \frac{V_3 - V_4}{-j2} = 0 \Rightarrow$$

$$\Rightarrow 5 + (-\frac{1}{2})V_3 + (-\frac{1}{j2})V_3 + (2)V_3 + (-\frac{1}{-j2})V_3 + (\frac{1}{-j2})V_4 = 0$$

$$\Rightarrow V_3 \left(-\frac{1}{2} - \frac{1}{j2} - \frac{1}{-j2} + 2 \right) + \left(\frac{1}{-j2} \right) V_4 = -5 \Rightarrow$$

$$\Rightarrow \boxed{V_3 \left(\frac{3}{2} \right) + V_4 \left(j\frac{1}{2} \right) = -5} \quad \text{①}$$

ⓐ Node ④ (KCL) : $I_3 + I_5 = (1\angle -90^\circ) + I_2 + I_6 \Rightarrow$

$$\Rightarrow \frac{V_2 - V_4}{5} + \frac{V_3 - V_4}{-j2} = (1\angle -90^\circ) + \frac{V_4 - V_3}{j4} + \frac{V_4 + 10 - V_3}{2} \Rightarrow$$

$$\Rightarrow \frac{(4i_0) - V_4}{5} + \frac{V_3 - V_4}{-j2} = (1\angle -90^\circ) + \frac{V_4 - V_3}{j4} + \frac{V_4 + 10 - V_3}{2}$$

$$\Rightarrow \frac{4 \cdot \left(\frac{V_3}{-j2} \right) - V_4}{5} + \frac{V_3 - V_4}{-j2} = (1\angle -90^\circ) + \frac{V_4 - V_3}{j4} + \frac{V_4 + 10 - V_3}{2}$$

=>
Σελ. 2

$$\rightarrow \left(\frac{4}{5(-j2)} + \frac{1}{(-j2)} + \frac{1}{j4} + \frac{1}{2} \right) V_3 + \left(-\frac{1}{5} - \frac{1}{-j2} - \frac{1}{j4} - \frac{1}{2} \right) V_4 =$$

$$= (1 \angle -90^\circ) + \frac{10}{2} \Rightarrow$$

$$\Rightarrow \underbrace{\left(\frac{1}{2} + j\frac{13}{20} \right)}_{(D)} V_3 + \underbrace{\left(-\frac{7}{10} - j\frac{1}{4} \right)}_{(E)} V_4 = \underbrace{(5 - j)}_{(F)}$$

$$V_3 = \frac{\begin{bmatrix} C & B \\ F & E \end{bmatrix}}{\begin{bmatrix} A & B \\ D & E \end{bmatrix}} = \frac{C \cdot E - B \cdot F}{A \cdot E - B \cdot D} = 3,3952 \angle 116,616^\circ \text{ (Volts)}$$

$$V_4 = \frac{\begin{bmatrix} A & C \\ D & F \end{bmatrix}}{\begin{bmatrix} A & B \\ D & E \end{bmatrix}} = \frac{A \cdot F - C \cdot D}{A \cdot E - B \cdot D} = 10,6057 \angle 149,162^\circ \text{ (Volts)}$$

Σ 3