EEE 202 HW#4 SOLUTIONS

8.51

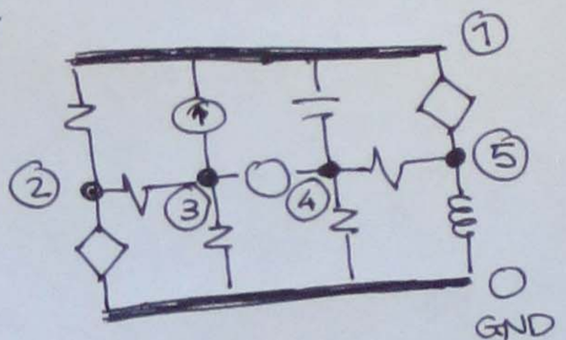
① $\dfrac{12\angle 0 - V_1}{1} - 2\angle 0 - \dfrac{V_1}{1} + \dfrac{V_2 - V_1}{1} = 0$

② $\dfrac{V_1 - V_2}{1} - \dfrac{V_2}{-j} + 4\angle 0 = 0$

$$\Rightarrow \begin{bmatrix} -1-1-1 & 1 \\ 1 & -1+1/j \end{bmatrix} V = \begin{bmatrix} -12+2 \\ -4 \end{bmatrix} \Rightarrow V = \begin{bmatrix} 4.46 - 1.69j \\ 3.38 - 5.08j \end{bmatrix}$$

$$\Rightarrow I_o = \frac{V_1 - 0}{1} = 4.77\angle -20.8^\circ \ (V)$$

8.134



① $\dfrac{V_2 - V_1}{1} + 2\angle 0 + \dfrac{V_4 - V_1}{-j} - 2I_x = 0$; $I_x = \dfrac{V_4}{1}$

$V_x = V_3$

② $V_2 = 2V_x$;

③ $V_4 - V_3 = 12\angle 0$

④ $\dfrac{V_1 - V_4}{-j} + \dfrac{V_5 - V_4}{1} + \dfrac{0 - V_4}{1} + \dfrac{0 - V_3}{1} + \dfrac{V_2 - V_3}{1} + -2\angle 0 = 0$ (supernode)

⑤ $2I_x + \dfrac{V_4 - V_5}{1} + \dfrac{0 - V_5}{j} = 0$

$I_o = \dfrac{V_2 - V_3}{1}$

$$\begin{bmatrix} -1+\frac{1}{j} & 1 & 0 & -\frac{1}{j}-2 & 0 \\ 0 & 1 & -2 & 0 & 0 \\ 0 & 0 & -1 & 1 & 0 \\ -\frac{1}{j} & 1 & -1-1 & \frac{1}{j}-1-1 & 1 \\ 0 & 0 & 0 & 2+1 & -1-\frac{1}{j} \end{bmatrix} V = \begin{bmatrix} -2\angle 0 \\ 0 \\ 12\angle 0 \\ 2\angle 0 \\ 0 \end{bmatrix}$$

$$I_0 = [0, 1, -1, 0, 0]\,V = -13-12j$$

$$= 17.7\angle -137^\circ \text{ (A)}$$

1	2	3
6	5	4

$I_1 - I_2 = -2\angle 0$

$(I_2 - I_3)(-j) + 12\angle 0 + (I_1 - I_6)1 + I_1(1) = 0$

$I_x = I_5 - I_4$

$I_3 = 2I_x$ 5

$(I_4 - I_3)1 + I_4(j) + (I_4 - I_5)1 = 0$

$(I_5 - I_4)1 + (I_5 - I_6)1 - 12\angle 0 = 0$

$V_x = (I_6 - I_5)1$

$(I_6 - I_5)1 + (-2V_x) + (I_6 - I_1)1 = 0$

$I_0 = I_6 - I_1$

$$\begin{bmatrix} 1 & -1 & 0 & 0 & 0 & 0 \\ 1+1 & -j & j & 0 & 0 & -1 \\ 0 & 0 & 1 & 2 & -2 & 0 \\ 0 & 0 & -1 & 1+j+1 & -1 & 0 \\ 0 & 0 & 0 & -1 & 1+1 & -1 \\ -1 & 0 & 0 & 0 & -1+2 & 1-2+1 \end{bmatrix} I = \begin{bmatrix} -2\angle 0 \\ -12\angle 0 \\ 0 \\ 0 \\ 12\angle 0 \\ 0 \end{bmatrix}$$

$$I_o = [-1, 0, 0, 0, 0, 1]\, I = -13-12j$$
$$= 17.7 \angle -137^\circ \text{ (A)}$$

8.135 $\quad I_L = \dfrac{V_2}{j\omega L}$, $\quad I_c = \dfrac{V_2}{(j\omega C)^{-1}+150}$

For $|I_L| = |I_c|$, we need $\left|\dfrac{1}{j\omega L}\right| = \left|\dfrac{1}{(j\omega C)^{-1}+150}\right|$

$$\Leftrightarrow \frac{1}{\omega L} = \frac{\omega C}{\sqrt{150^2 C^2 \omega^2 + 1}} \quad \Leftrightarrow \left(\sqrt{}\right)^2 = (\omega^2 LC)^2$$

$$\Leftrightarrow \omega^4 L^2 C^2 - \omega^2 C^2 150^2 - 1 = 0$$

$$\Leftrightarrow \omega^4 - \omega^2 \frac{150^2}{L^2} - \frac{1}{L^2C^2} = 0$$

Roots of quadratic 2.254 E6, −4.44 E3

$\Rightarrow \omega^2 = 2.254\text{ E}6 \Rightarrow \omega = 1501.5$ (rad/s)
