

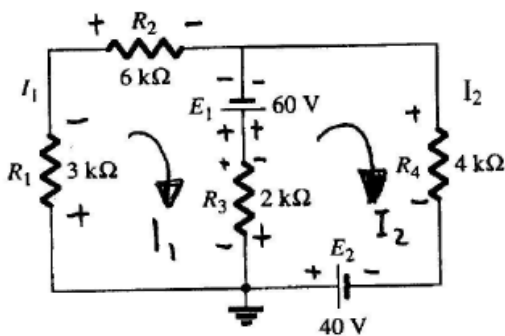
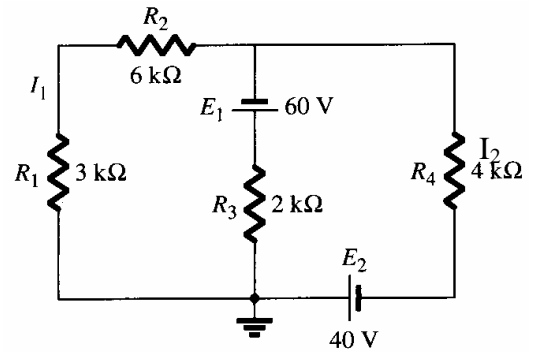
生機系電工學第四次隨堂練習 2011/03/16

學號： _____

姓名： _____

Problem 1 (Mesh analysis)

Using mesh analysis to determine the current I_1 and I_2 for the network as shown. (建議把推算過程有秩序的交待清楚)



Mesh 1

$$-I_1 R_1 - I_1 R_2 + E_1 - (I_1 - I_2) R_3 = 0$$

Mesh 2

$$-(I_2 - I_1) R_3 - E_1 - I_2 R_4 + E_2 = 0$$

$$\Rightarrow I_1 (R_1 + R_2 + R_3) - I_2 R_3 = E_1$$

$$-I_1 R_3 + I_2 (R_3 + R_4) = E_2 - E_1$$

代入

$$11 \text{ k} I_1 - 2 \text{ k} I_2 = 60$$

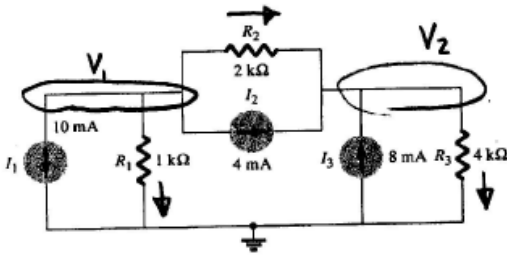
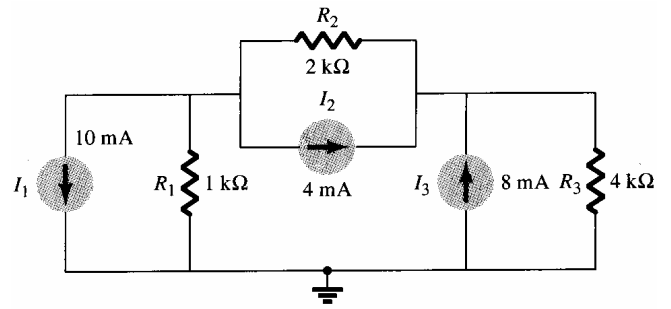
$$-2 \text{ k} I_1 + 6 \text{ k} I_2 = -20$$

$$I_1 = \frac{\begin{vmatrix} 60 & -2\text{k} \\ -20 & 6\text{k} \end{vmatrix}}{\begin{vmatrix} 11\text{k} & -2\text{k} \\ -2\text{k} & 6\text{k} \end{vmatrix}} = 5.161 \text{ mA}$$

$$I_2 = \frac{\begin{vmatrix} 11\text{k} & 60 \\ -2\text{k} & -20 \end{vmatrix}}{\begin{vmatrix} 11\text{k} & -2\text{k} \\ -2\text{k} & 6\text{k} \end{vmatrix}} = -1.613 \text{ mA}$$

Problem 2 (Nodal analysis)

- Using nodal analysis to determine the nodal voltages for the network as shown.
- Using the nodal voltages, determine the current (magnitude and direction) through each resistive element. (建議把推算過程有秩序的交待清楚)



$$\text{Node 1: } -I_1 - \frac{V_1}{R_1} - I_2 - \frac{V_1 - V_2}{R_2} = 0$$

$$\text{Node 2: } \frac{V_1 - V_2}{R_2} + I_2 + I_3 - \frac{V_2}{R_3} = 0$$

$$\Rightarrow -V_1 \left(\frac{1}{R_1} + \frac{1}{R_2} \right) + V_2 \left(\frac{1}{R_2} \right) = I_1 + I_2$$

$$V_1 \left(\frac{1}{R_1} \right) + V_2 \left(\frac{1}{R_2} + \frac{1}{R_3} \right) = I_2 + I_3$$

$$\text{代入 } -1.5 \text{ ms } V_1 + 0.5 \text{ ms } V_2 = 14 \text{ mA}$$

$$-0.5 \text{ ms } V_1 + 0.75 \text{ ms } V_2 = 12 \text{ mA}$$

$$\text{解 } V_1 = \frac{\begin{vmatrix} 14 \text{ mA} & 0.5 \text{ ms} \\ 12 \text{ mA} & 0.75 \text{ ms} \end{vmatrix}}{\begin{vmatrix} -1.5 \text{ ms} & 0.5 \text{ ms} \\ -0.5 \text{ ms} & 0.75 \text{ ms} \end{vmatrix}} = -5.143 \text{ V}$$

$$V_2 = \frac{\begin{vmatrix} -1.5 \text{ ms} & 14 \text{ mA} \\ -0.5 \text{ ms} & 12 \text{ mA} \end{vmatrix}}{\begin{vmatrix} -1.5 \text{ ms} & 0.5 \text{ ms} \\ -0.5 \text{ ms} & 0.75 \text{ ms} \end{vmatrix}} = 12.571 \text{ V}$$

流經 R_1 的電流 = $-5.143 \text{ mA} \downarrow$ (或 $5.143 \text{ mA} \uparrow$)

流經 R_2 的電流 = $-8.857 \text{ mA} \rightarrow$ (或 $8.857 \text{ mA} \leftarrow$)

流經 R_3 的電流 = $3.143 \text{ mA} \downarrow$

注意：數字與方向

