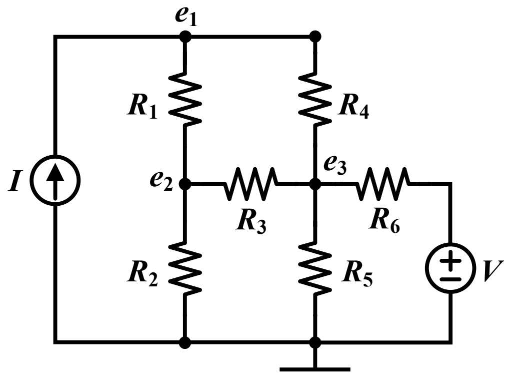
電路學(EE2210)第二次隨堂考

2013年10月2日
時間：15 分鐘
Close Book

學號：______________________________

姓名：______________________________

The network shown below has three nodes with unknown node voltages e_1, e_2 and e_3. (i) Use conductance instead of resistance to write the node equations. (ii) Simplify the equations by collecting terms and arranging them in the “standard” form for n linear equations in n unknowns. (iii) Express these n linear equations in matrix form as shown below. (***Do not solve the equations.***) (100%)



(i) KCL (node) equations:

At node e_1: $I + G_1(e_2 - e_1) + G_4(e_3 - e_1) = 0$

At node e_2: $G_1(e_1 - e_2) + G_2(0 - e_2) + G_3(e_3 - e_2) = 0$

At node e_3: $G_4(e_1 - e_3) + G_3(e_2 - e_3) + G_6(V - e_3) + G_5(0 - e_3) = 0$

(ii) n linear equations:

$$\begin{cases} (G_1 + G_4)e_1 + (-G_1)e_2 + (-G_4)e_3 = I \\ (-G_1)e_1 + (G_1 + G_2 + G_3)e_2 + (-G_3)e_3 = 0 \\ (-G_4)e_1 + (-G_3)e_2 + (G_3 + G_4 + G_5 + G_6)e_3 = G_6 V \end{cases}$$

(iii) Matrix form:

$$\begin{bmatrix} G_{11} & G_{12} & G_{13} \\ G_{21} & G_{22} & G_{23} \\ G_{31} & G_{32} & G_{33} \end{bmatrix} \begin{bmatrix} e_1 \\ e_2 \\ e_3 \end{bmatrix} = \begin{bmatrix} S_1 \\ S_2 \\ S_3 \end{bmatrix} \Rightarrow \begin{bmatrix} (G_1 + G_4) & (-G_1) & (-G_4) \\ (-G_1) & (G_1 + G_2 + G_3) & (-G_3) \\ (-G_4) & (-G_3) & (G_3 + G_4 + G_5 + G_6) \end{bmatrix} \begin{bmatrix} e_1 \\ e_2 \\ e_3 \end{bmatrix} = \begin{bmatrix} I \\ 0 \\ G_6 V \end{bmatrix}$$

G_{11} = G_1+G_4, G_{12} = $-G_1$, G_{13} = $-G_4$,

G_{21} = $-G_1$, G_{22} = $G_1+G_2+G_3$, G_{23} = $-G_3$,

G_{31} = $-G_4$, G_{32} = $-G_3$, G_{33} = $G_3+G_4+G_5+G_6$,

S_1 = I, S_2 = 0, S_3 = G_6V.