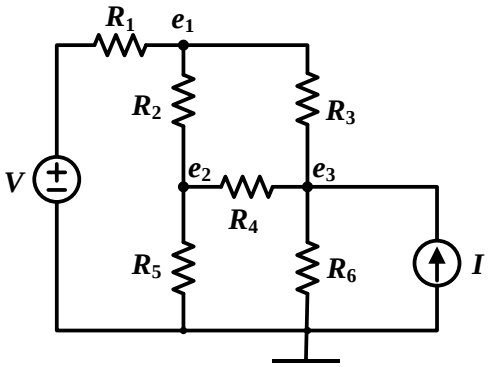
電路學(EE2210)第三次隨堂考

2015年10月7日
時間：10 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. Use conductance instead of resistance to write the node equations. Simplify the equations by collecting terms and arranging them in the "standard" form for n linear equations in *n* unknowns. (*Do not solve the equations.*)



Matrix Form: $\begin{bmatrix} G_{11} & G_{12} & G_{13} \\ G_{21} & G_{22} & G_{23} \\ G_{31} & G_{32} & G_{33} \end{bmatrix} \begin{bmatrix} e_1 \\ e_2 \\ e_3 \end{bmatrix} = \begin{bmatrix} S_1 \\ S_2 \\ S_3 \end{bmatrix}$

G_{11} = $G_1+G_2+G_3$, G_{12} = $-G_2$, G_{13} = $-G_3$,

G_{21} = $-G_2$, G_{22} = $G_2+G_4+G_5$, G_{23} = $-G_4$,

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

S_1 = G_1V, S_2 = 0, S_3 = I,

(i) KCL equations:

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

node e_2: $G_2(e_2 - e_1) + G_5(e_2 - 0) + G_4(e_2 - e_3) = 0$

node e_3: $G_3(e_3 - e_1) + G_4(e_3 - e_2) - I + G_6(e_3 - 0) = 0$

(ii) *n* linear equations:

$$\begin{cases} (G_1 + G_2 + G_3)e_1 + (-G_2)e_2 + (-G_3)e_3 = G_1V \\ (-G_2)e_1 + (G_2 + G_4 + G_5)e_2 + (-G_4)e_3 = 0 \\ (-G_3)e_1 + (-G_4)e_2 + (G_3 + G_4 + G_6)e_3 = I \end{cases}$$

(iii) Matrix form:

$$\begin{bmatrix} G_{11} & G_{12} & G_{13} \\ G_{21} & G_{22} & G_{23} \\ G_{31} & G_{32} & G_{33} \end{bmatrix} \begin{bmatrix} e_1 \\ e_2 \\ e_3 \end{bmatrix} = \begin{bmatrix} S_1 \\ S_2 \\ S_3 \end{bmatrix}$$

$$\Rightarrow \begin{bmatrix} (G_1 + G_2 + G_3) & (-G_2) & (-G_3) \\ (-G_2) & (G_2 + G_4 + G_5) & (-G_4) \\ (-G_3) & (-G_4) & (G_3 + G_4 + G_6) \end{bmatrix} \begin{bmatrix} e_1 \\ e_2 \\ e_3 \end{bmatrix} = \begin{bmatrix} G_1V \\ 0 \\ I \end{bmatrix}$$