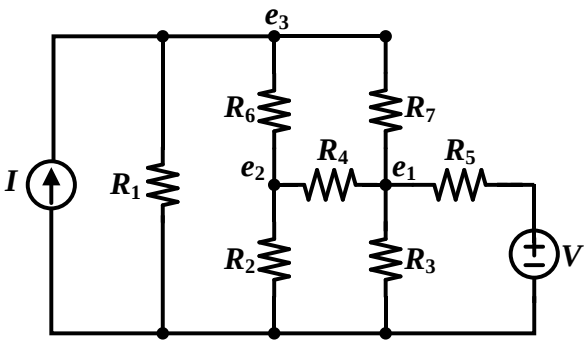
電路學(EE2210)第二次隨堂考

2016年10月5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*.)



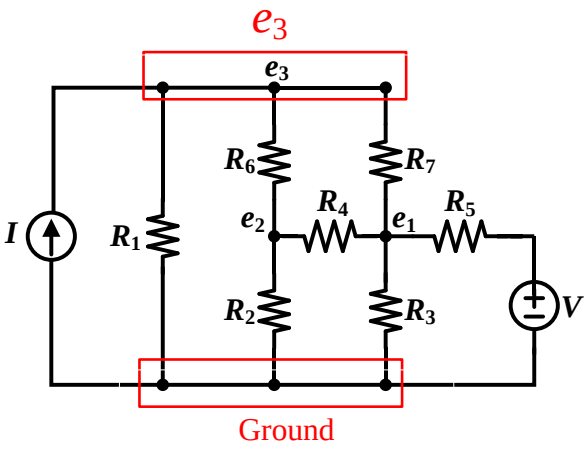
Matrix Form: $\begin{bmatrix} G_{11} & G_{12} & G_{13} \\ G_{21} & G_{22} & G_{23} \\ G_{31} & G_{32} & G_{33} \end{bmatrix} \begin{bmatrix} e_1 \\ e_2 \\ e_3 \end{bmatrix} = \begin{bmatrix} S_1 \\ S_2 \\ S_3 \end{bmatrix}$

G_{11} =_____, G_{12} =_____, G_{13} =_____,

G_{21} =_____, G_{22} =_____, G_{23} =_____,

G_{31} =_____, G_{32} =_____, G_{33} =_____,

S_1 =_____, S_2 =_____, S_3 =_____,



Solutions:

(i) KCL equations:

node e_1: $G_5(V-e_1)+G_3(0-e_1)+G_4(e_2-e_1)+G_7(e_3-e_1)=0$

node e_2: $G_4(e_1-e_2)+G_2(0-e_2)+G_6(e_3-e_2)=0$

node e_3: $G_6(e_2-e_3)+G_7(e_1-e_3)+I+G_1(0-e_3)=0$

(ii) *n* linear equations:

$$\begin{cases}(G_3+G_4+G_5+G_7)e_1+(-G_4)e_2+(-G_7)e_3=G_5V\\(-G_4)e_1+(G_2+G_4+G_6)e_2+(-G_6)e_3=0\\(-G_7)e_1+(-G_6)e_2+(G_1+G_6+G_7)e_3=I\end{cases}$$

(iii) Matrix form:

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

$$\Rightarrow\begin{bmatrix}(G_3+G_4+G_5+G_7)&(-G_4)&(-G_7)\\(-G_4)&(G_2+G_4+G_6)&(-G_6)\\(-G_7)&(-G_6)&(G_1+G_6+G_7)\end{bmatrix}\begin{bmatrix}e_1\\e_2\\e_3\end{bmatrix}=\begin{bmatrix}G_5V\\0\\I\end{bmatrix}$$

or

$$\Rightarrow\begin{bmatrix}-(G_3+G_4+G_5+G_7)&(G_4)&(G_7)\\(G_4)&-(G_2+G_4+G_6)&(G_6)\\(G_7)&(G_6)&-(G_1+G_6+G_7)\end{bmatrix}\begin{bmatrix}e_1\\e_2\\e_3\end{bmatrix}=\begin{bmatrix}-G_5V\\0\\-I\end{bmatrix}$$