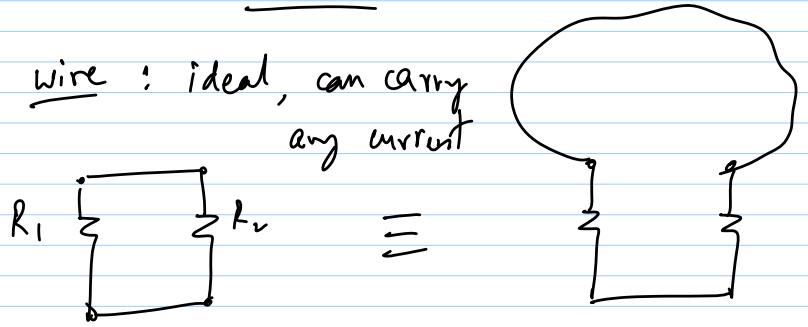
21/1/15

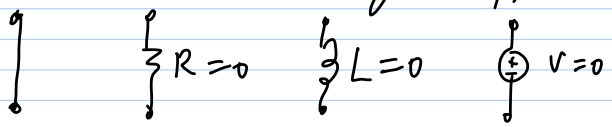
Lec 5

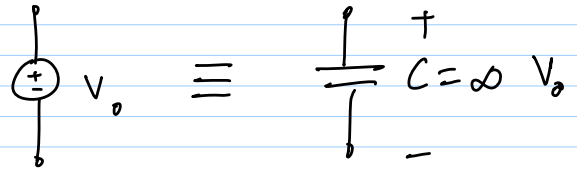
wire : ideal, can carry any current



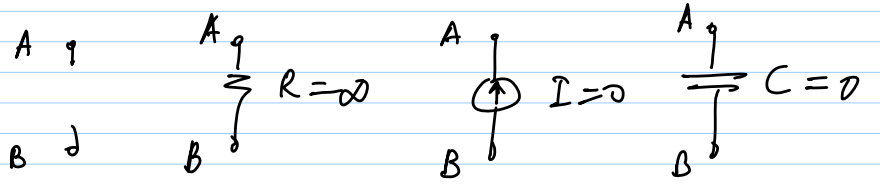
ideal wire ⇒ zero resistance / short circuit

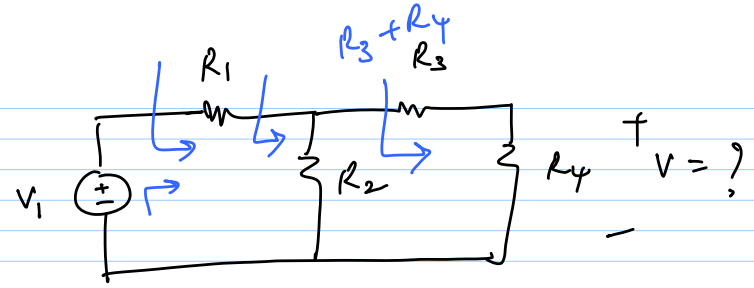
short circuit ⇒ voltage difference = 0

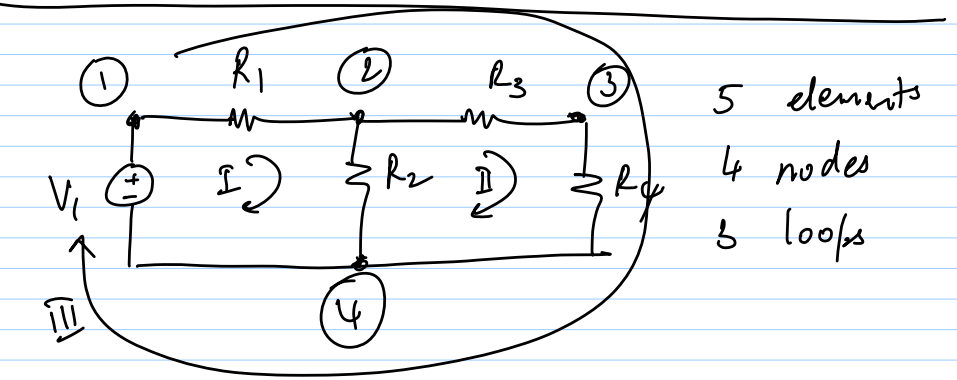




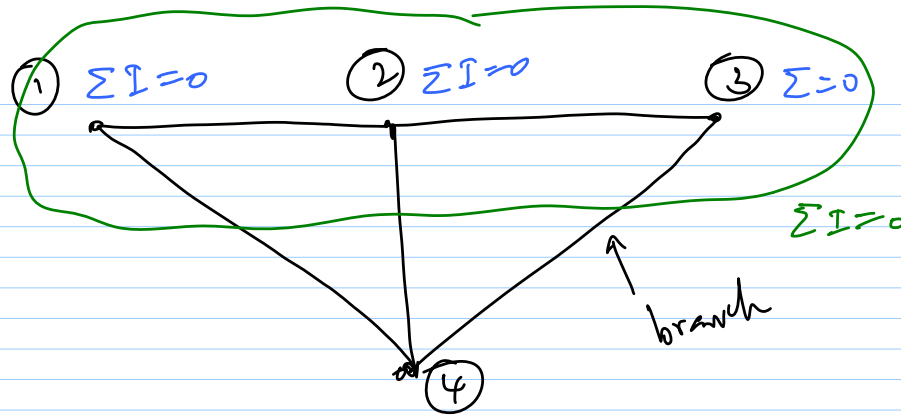
open circuit ≡ (infinite resistance) current = 0







5 elements
4 nodes
3 loops



graph : representation of network retaining node & connection information

branch : connection standing in for the element in the graph

B branches

N nodes

2B variables

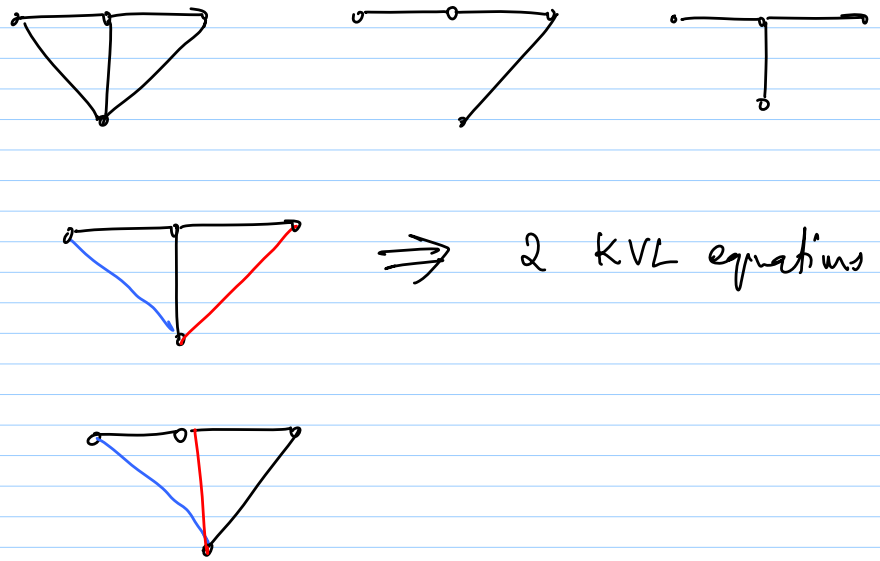
KVL, KCL, V-I relation of each element

$(B-N+1)$ indep eqn.

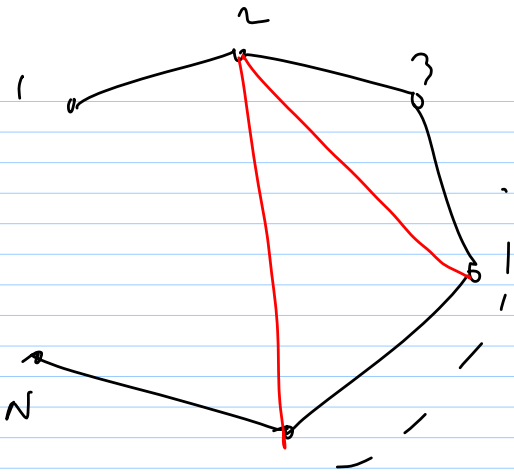
$(N-1)$ indep. equations

B equations

tree: Sub-network of the graph containing all nodes of the original graph, and no loops



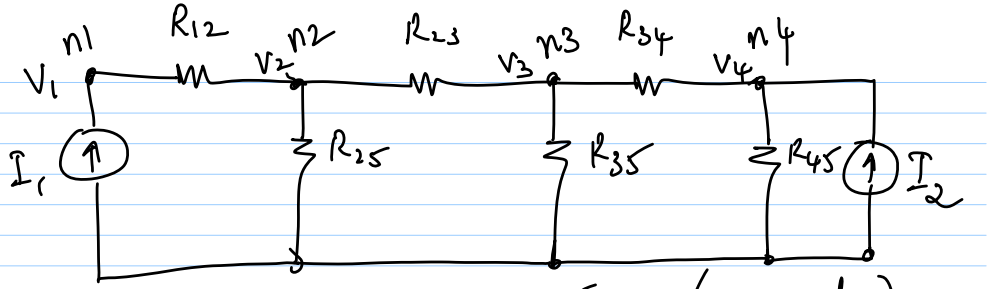
$\Rightarrow$ 2 KVL equations



B branches

N nodes

$(B-N+1)$ KVL equations



Nodal Analysis

KCL – 4 equations ; $\Sigma I_{leaving\ node} = 0$

@ $n_1 \Rightarrow -I_1 + \frac{V_1 - V_2}{R_{12}} = 0$

@ $n_2 \Rightarrow \frac{V_2 - V_1}{R_{12}} + \frac{V_2}{R_{25}} + \frac{V_2 - V_3}{R_{23}} = 0.$

@ $n_3 \Rightarrow \dfrac{V_3 - V_2}{R_{23}} + \dfrac{V_3}{R_{35}} + \dfrac{V_3 - V_4}{R_{34}} = 0$

@ $n_4 \Rightarrow \dfrac{V_4 - V_3}{R_{34}} + \dfrac{V_4}{R_{45}} - I_2 = 0$

$$\begin{bmatrix} \text{Matrix of resistances w conductances} \end{bmatrix} \begin{bmatrix} \text{voltage variables} \end{bmatrix} = \begin{bmatrix} \text{indep. curr sources} \end{bmatrix}$$

$$\begin{bmatrix} & & & \\ & & & \\ & & & \\ & & & \end{bmatrix} \begin{bmatrix} V_1 \\ V_2 \\ V_3 \\ V_4 \end{bmatrix} = \begin{bmatrix} I_1 \\ 0 \\ 0 \\ I_2 \end{bmatrix}$$