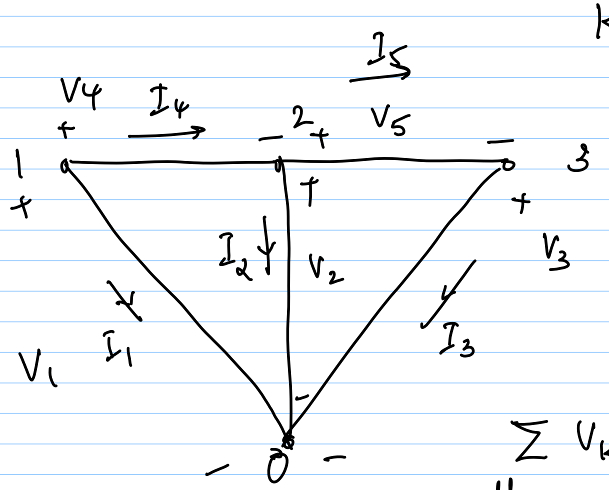
7/2/15

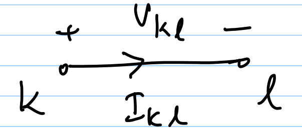
Lec 13

KCL : $\sum_n I_{\text{leaving node}} = 0$



$\sum_{\text{all branches}} V_k I_k$

name nodes $1, 2, 3 \ldots N$



$V_{kl} = V_k - V_l$

current leaving k, entering l

$$\sum_{\substack{\text{all}\\\text{branches}}} V_{kl} \cdot I_{kl} = \sum (V_k - V_l) I_{kl}$$

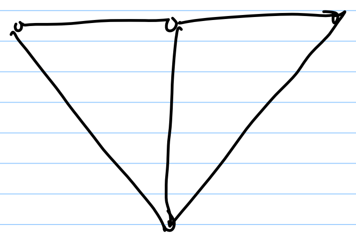
$$= \sum_m \left\{ V_m \underbrace{\sum_k I_{mk}}_{\text{currents leaving } m} \right\} - \left\{ V_m \underbrace{\sum_k I_{km}}_{\text{currents entering } m} \right\} = 0$$

all nodes $m = 1 \ldots N$

Tellegen's theorem

1) $\sum_k V_k I_k = 0$

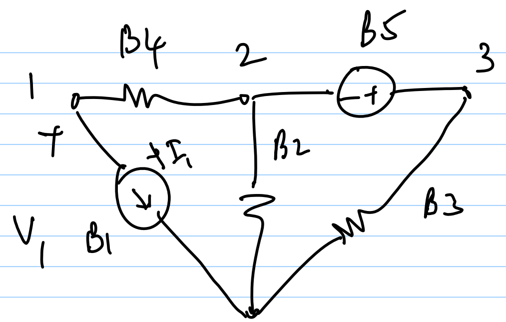
2) $N, \hat{N}$: 2 networks that have same graph



$\sum V_k \hat{I}_k$

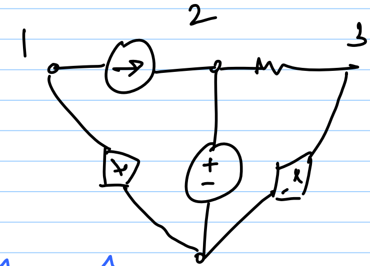
N : V_k , I_k

$\hat{N}$: $\hat{V}_k , \hat{I}_k$



$I_1, I_2 \ldots I_B$ 0

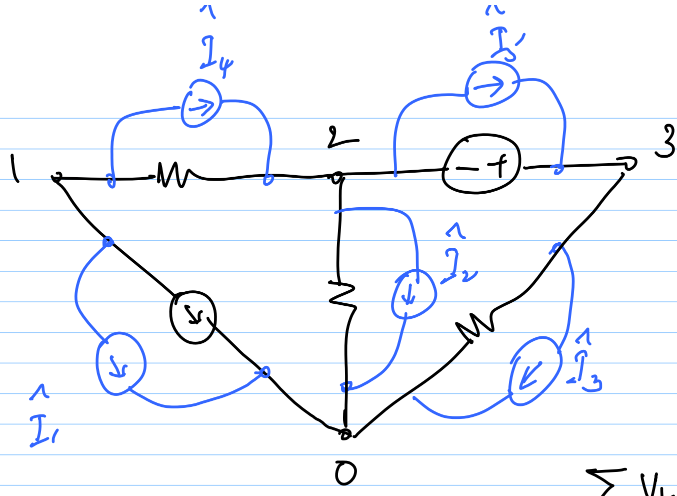
N



$\hat{I}_1, \hat{I}_2 \ldots \hat{I}_B$ 0

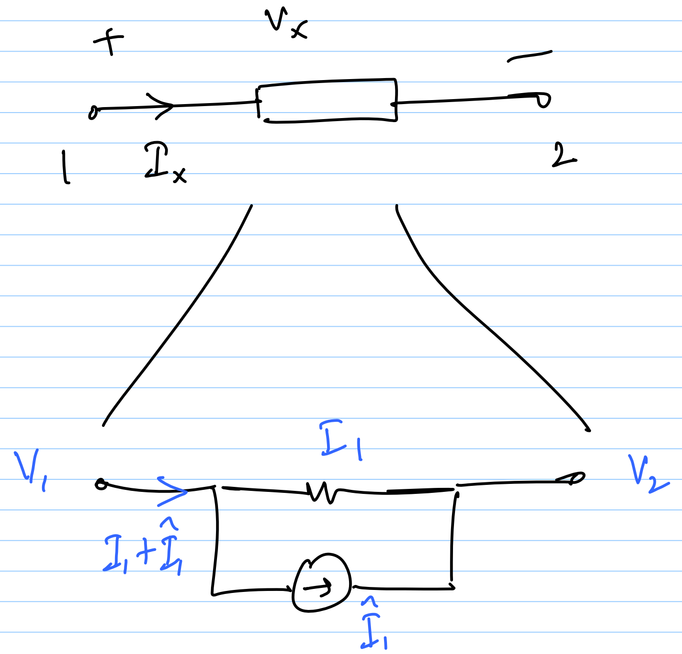
$\hat{N}$

$\sum V_k \hat{I}_k$



$$\sum V_k I_k = 0 \text{ for } N$$

$$\sum_B V_k \left[I_k + \hat{I}_k \right] = 0 \Rightarrow \boxed{\sum_B V_k \hat{I}_k = 0}$$

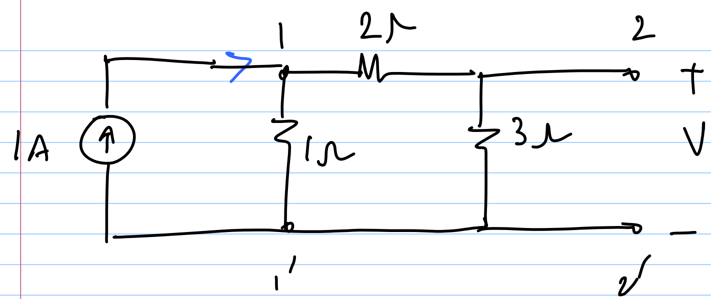


$$\boxed{\begin{array}{c} \sum V_k \hat{I}_k = 0 \\ \sum \hat{V}_k I_k = 0 \end{array}}$$

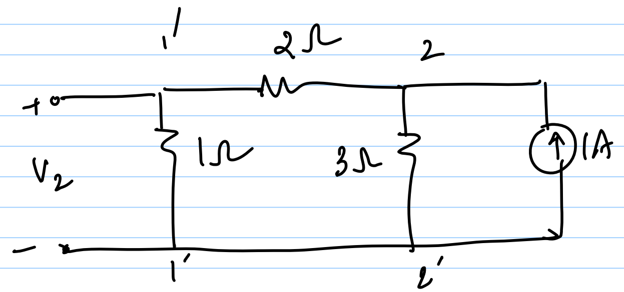
N & $\hat{N}$

V_k, I_k $\quad$ $\hat{V}_k, \hat{I}_k$

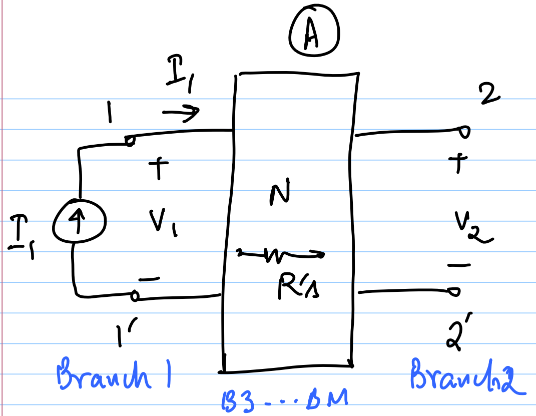
$$\boxed{\sum_B V_k(t_1) \cdot \hat{I}_k(t_2) = 0}$$

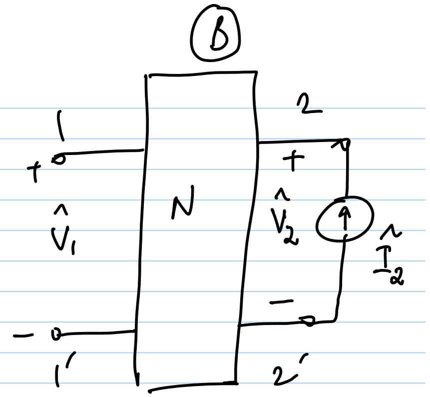


$$V_1 = 1 \cdot \frac{1}{6} \cdot 3 = 1/2\,V$$



$$V_2 = 1 \cdot \frac{1}{2} \cdot 1 = 1/2\,V$$


A
I1
1
2
N
V1
V2
R'1
1'
2'
Branch 1
B3 ··· BM
Branch2


B
1
2
N
V̂1
V̂2
Î2
1'
2'