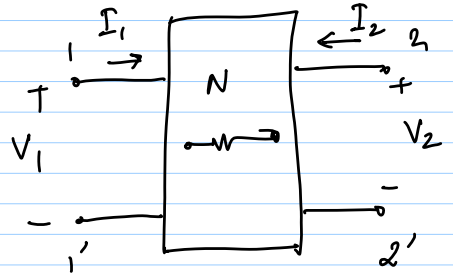
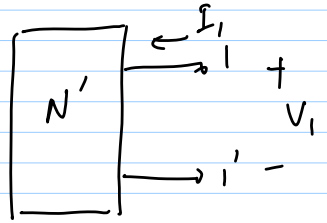
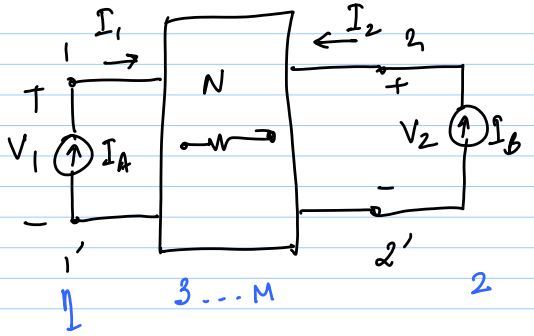
10-2-15

Lec 14

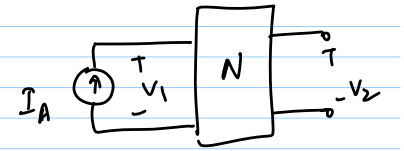
2-port network



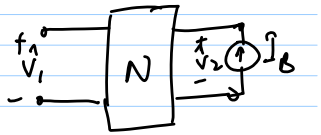




Case 1 $I_B = 0$



Case 2 $I_A = 0$



(1) $\sum V_k \hat{I}_k = 0$

$V_1 (0) + V_2 (-I_B) + \sum_3^M V_k \hat{I}_k = 0$

(2) $\sum \hat{V}_k I_k = 0$

$\hat{V}_1 (-I_A) + \hat{V}_2 (0) + \sum_3^M \hat{V}_k I_k = 0$

(1) $\sum V_k \hat{I}_k = 0$

$V_1 \cdot (0) + V_2 \cdot (-I_B) + \sum_3^M V_k \hat{I}_k = 0$ (A)

(2) $\sum \hat{V}_k I_k = 0$

$\hat{V}_1 \cdot (-I_A) + \hat{V}_2 (0) + \sum_3^M \hat{V}_k I_k = 0$ (B)

(3) N is resistive

$V_k = R_k I_k$

$\hat{V}_k = R_k \hat{I}_k$

(A): $\sum_3^M V_k \hat{I}_k = \sum_3^M R_k I_k \hat{I}_k$

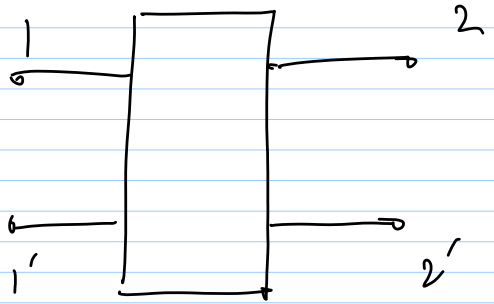
(B): $\sum_3^M \hat{V}_k I_k = \sum_3^M R_k \hat{I}_k I_k$

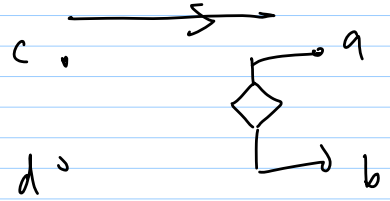
$\therefore V_2 \cdot I_B = \hat{V}_1 \cdot I_A$

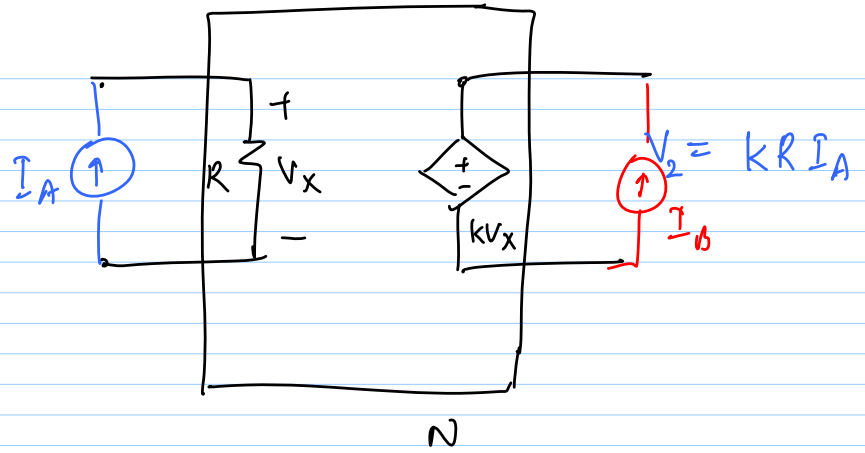
$$\frac{V_2}{I_A} = \frac{\hat{V}_1}{I_B}$$

Reciprocity Theorem

"Reciprocal networks"


1
2
1'
2'


c
d
a
b


I_A
R
+
V_x
−
+
−
kV_x
$V_2 = kRI_A$
I_B
N