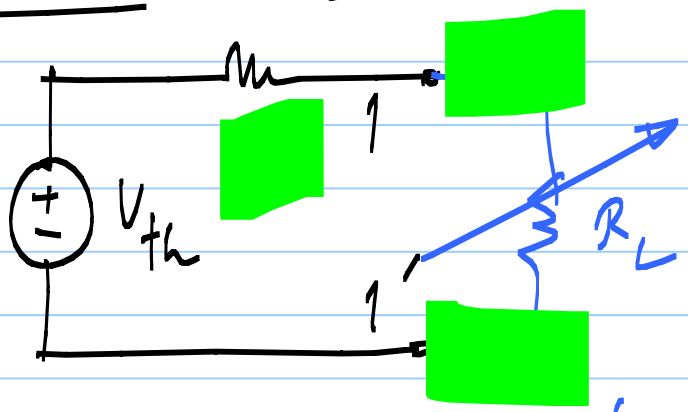
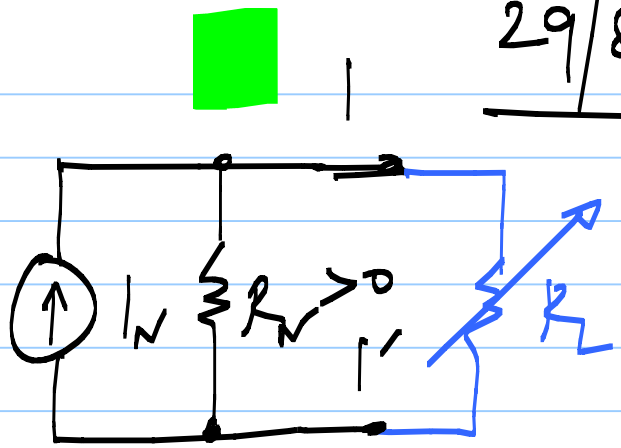
EE 2015 $R_{Th} > 0$ 29/8/2017





Vary R_L such that P_L is maximized

R_L should be equal to R_{Th} to maximize P_L

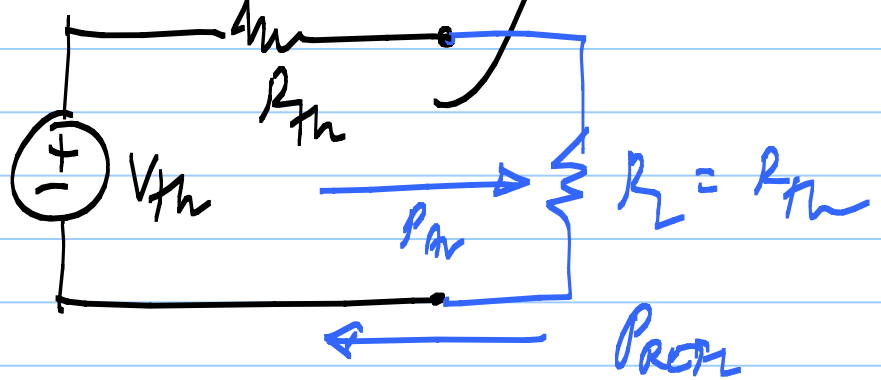
(matching for max. power transfer)

$$P_L = V_{Th}^2 \cdot \frac{R_L}{(R_L + R_{Th})^2}$$

$$P_{L,max} = \frac{V_{Th}^2}{4 \cdot R_{Th}} \quad ; \text{ Available power}$$

$(R_L = R_{Th})$

Power source $\rightarrow$ available power $P_{Av} = \frac{V_{Th}^2}{4 \cdot R_{Th}}$



Perfectly matched load absorbs P_{Av}.

when $R_L \neq R_{th}$

Γ : reflection coefficient

$$P_L = P_{AV} - P_{REFL}$$

Calculate P_{REFL} & Γ

$$= \underbrace{P_{AV}\left(1 - \Gamma^2\right)}$$

$$1 - \Gamma^2 = \frac{4 \cdot R_{th} R_L}{\left(R_L + R_{th}\right)^2}$$

$$V_{th}^2 \cdot \frac{R_L}{\left(R_L + R_{th}\right)^2} = \frac{V_{th}^2}{4R_{th}} \cdot \left(1 - \Gamma^2\right)$$

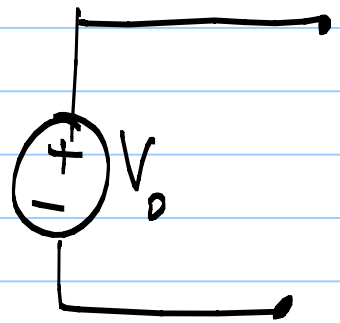
$$\Gamma^2 = 1 - \frac{4 R_{th} R_L}{\left(R_L + R_{th}\right)^2} = \frac{\left(R_L - R_{th}\right)^2}{\left(R_L + R_{th}\right)^2}$$

Refl. coeff: $\Gamma = \left| \frac{R_L - R_{th}}{R_L + R_{th}} \right|$

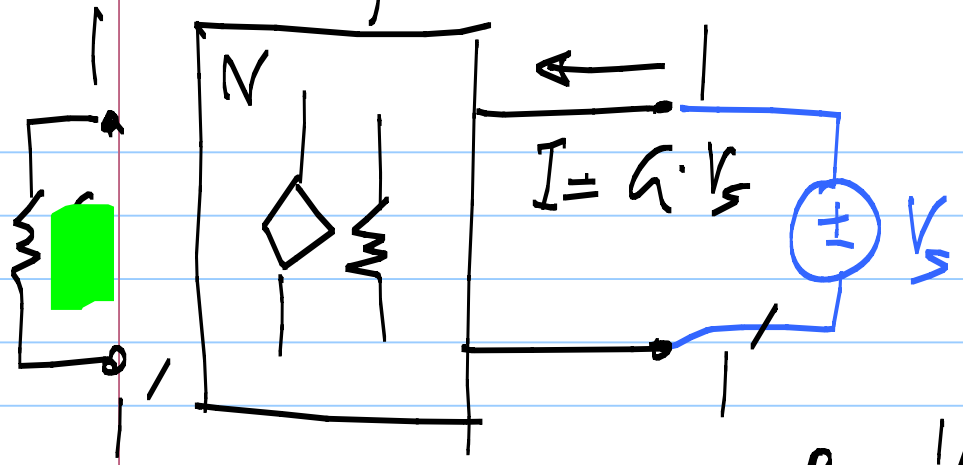
$0 \leq \Gamma \leq 1$

$\Gamma = 0 \Rightarrow R_L = R_{th}$: Perfect matching

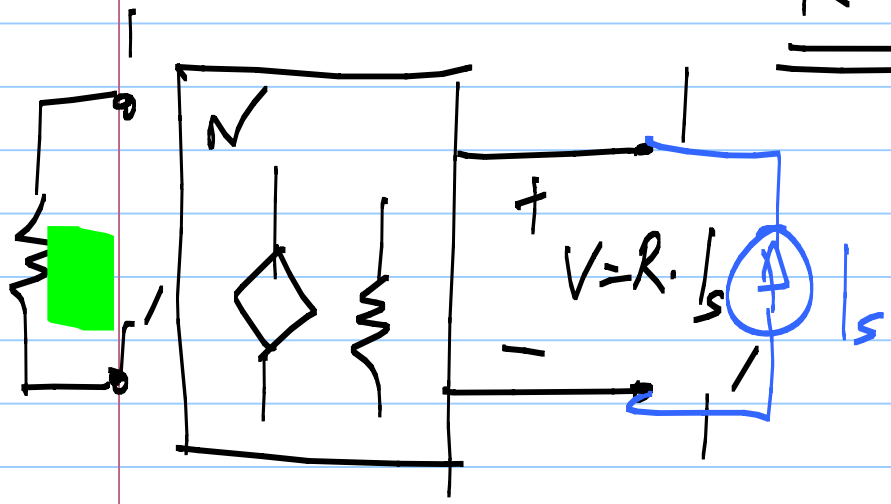
$\Gamma = 1 \Rightarrow R_L = \infty$ or $R_L = 0$:



No independent sources



$R = 1/G$



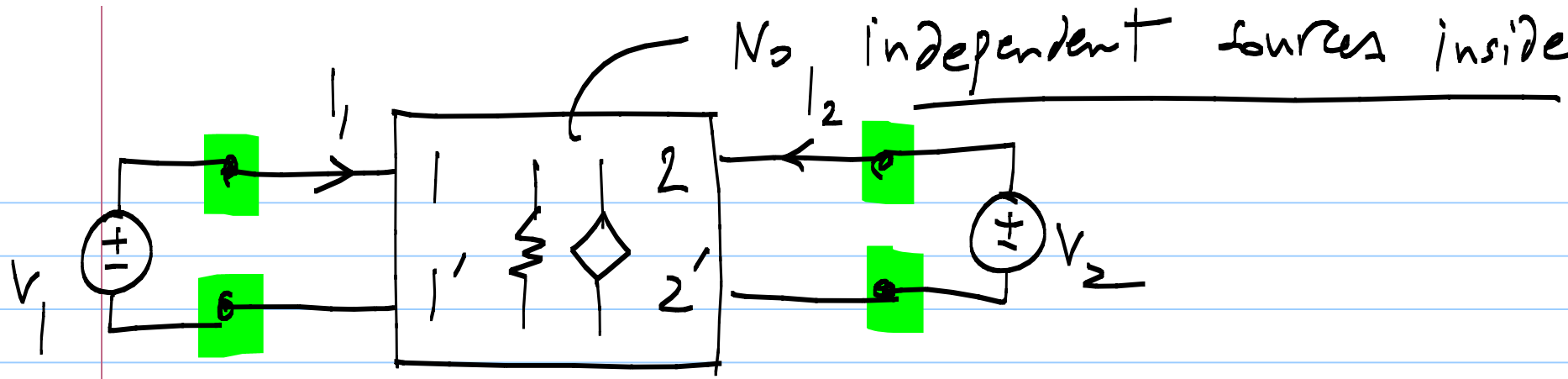
Two-terminal networks

(One port network)

1 - 1'

$$[G]^{-1} \begin{bmatrix} 0 \\ 0 \\ \vdots \\ V_s \\ 0 \end{bmatrix} =$$

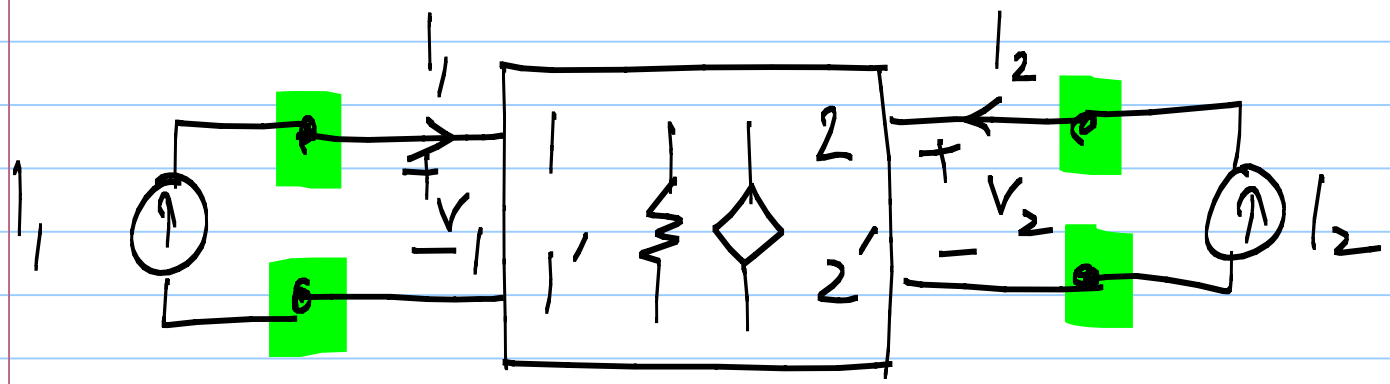
k^{th}



$$I_1 = (\ ) \cdot V_1 + (\ ) \cdot V_2$$

$$I_2 = (\ ) \cdot V_1 + (\ ) \cdot V_2$$

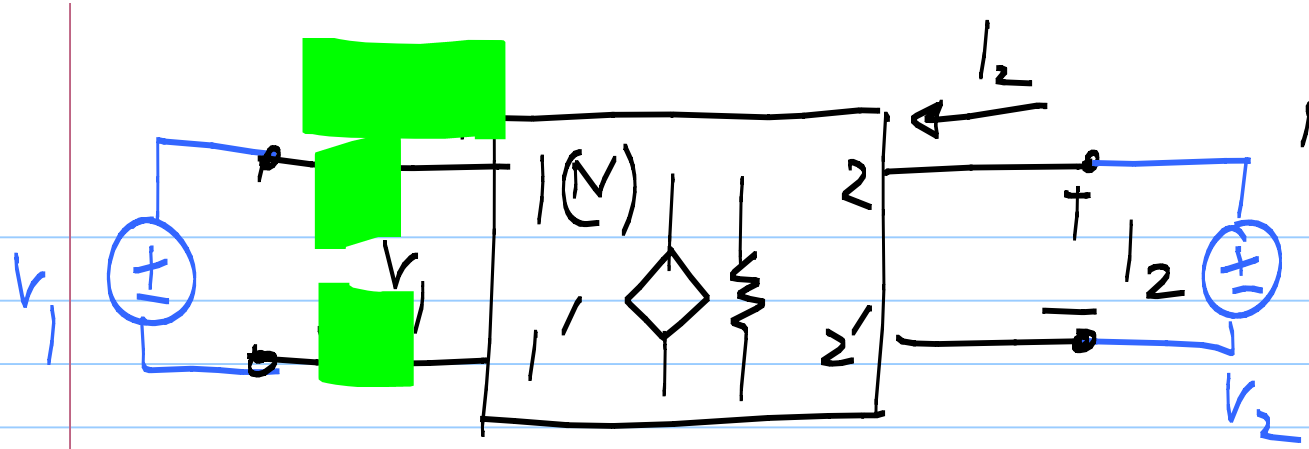
Two-port parameters



$$V_1 = (\ ) \cdot I_1 + (\ ) \cdot I_2$$

$$V_2 = (\ ) \cdot I_1 + (\ ) \cdot I_2$$

Two-port parameters



Relationship between $\{V_1, I_1\}$ & $\{V_2, I_2\}$

2-port parameters

$$I_1 = y_{11} V_1 + y_{12} V_2$$

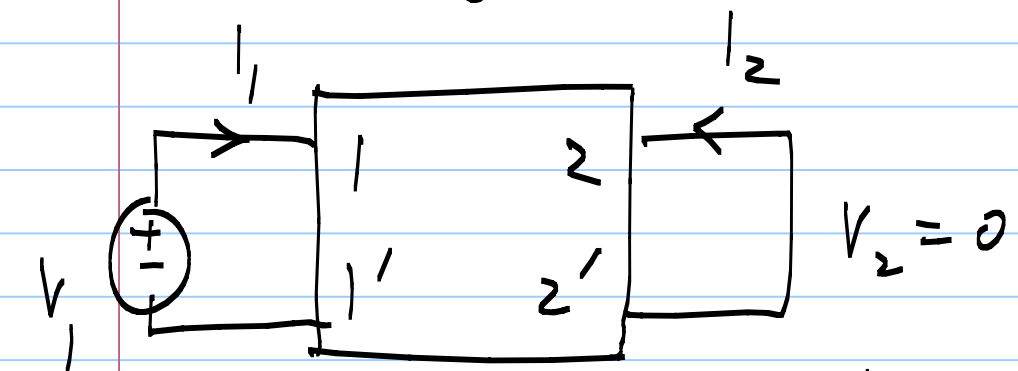
$$I_2 = y_{21} V_1 + y_{22} V_2$$

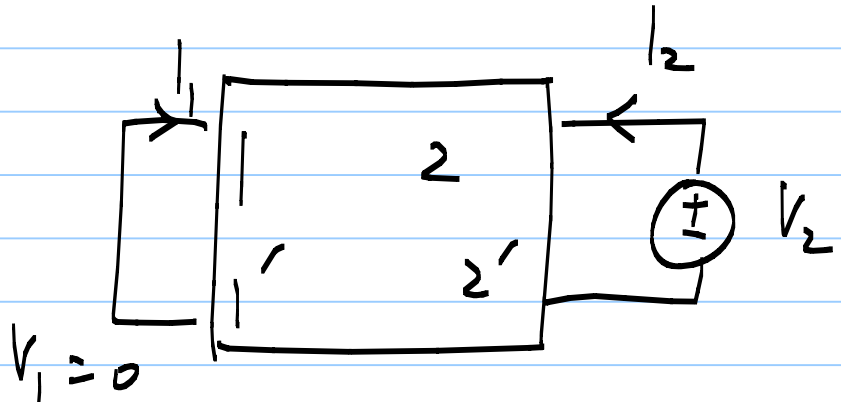
$$\begin{bmatrix} I_1 \\ I_2 \end{bmatrix} = \begin{bmatrix} y_{11} & y_{12} \\ y_{21} & y_{22} \end{bmatrix} \begin{bmatrix} V_1 \\ V_2 \end{bmatrix}$$

effect cause

y-parameters of N

Measuring 2-port parameters



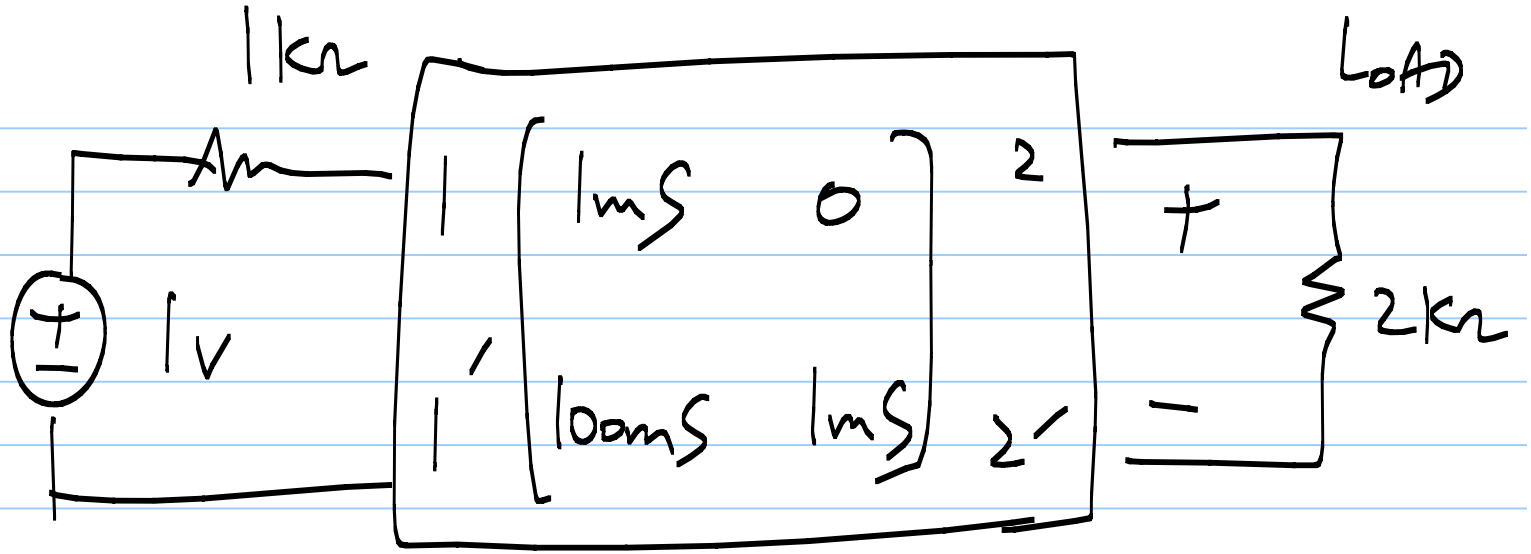


$$y_{11} = \left.\frac{I_1}{V_1}\right|_{V_2=0}$$ ← Conductance looking into 1-1' with 2-2' Shorted

$$y_{12} = \left.\frac{I_1}{V_2}\right|_{V_1=0}$$

$$y_{21} = \left.\frac{I_2}{V_1}\right|_{V_2=0}$$

$$y_{22} = \left.\frac{I_2}{V_2}\right|_{V_1=0}$$


1kΩ
LOAD
1
1mS
0
2
+
2kΩ
1V
1'
100mS
1mS
2'
−