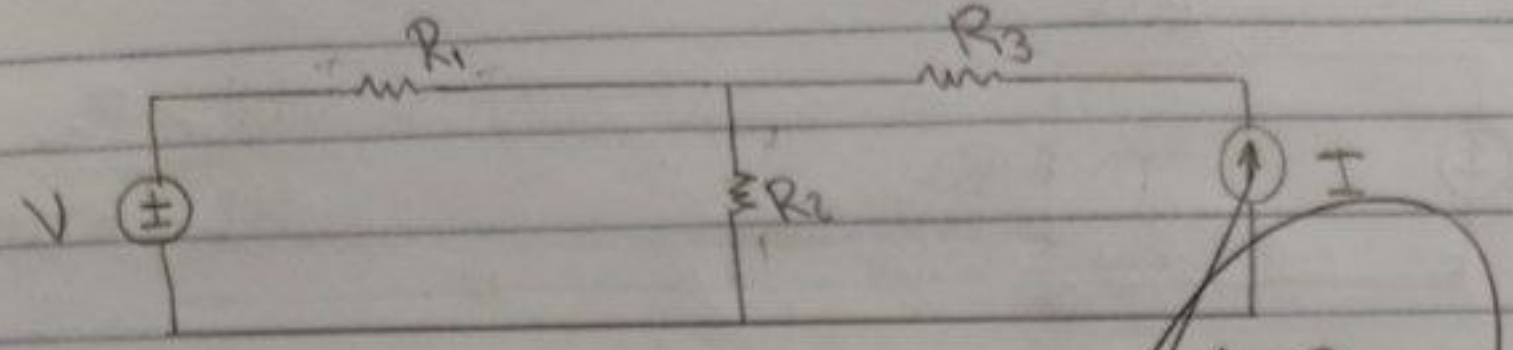
Práctica 2 - Instrumentación José Castro ; Carlos Hurtado

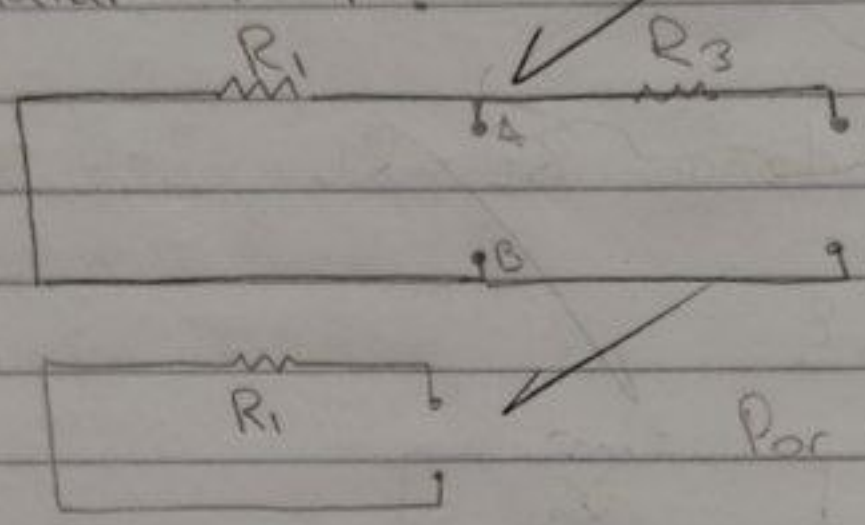


$R_1 = 1000\,\Omega$
$R_2 = 2000\,\Omega$
$R_3 = 3000\,\Omega$
$V = 6\,V$
$I = 2{,}00 \times 10^{-3}\,A$

① Equivalente de thevenin

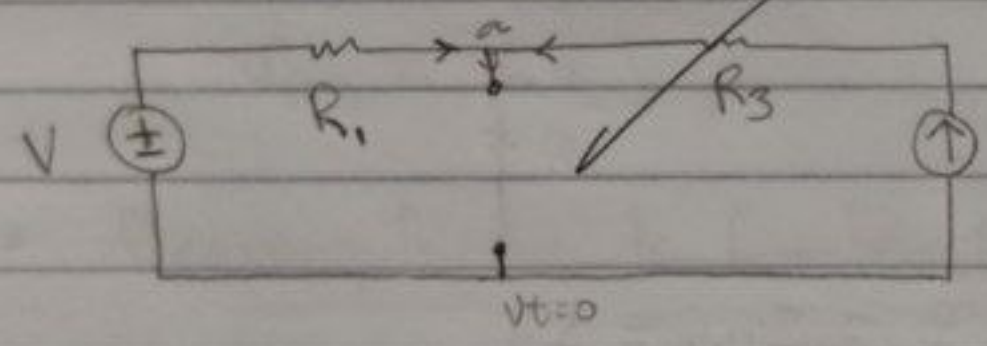
Carga ha usar R_2, entonces $R_2 = R_L$

- * Hallar RtH?



Por tanto $R_{TH} = R_1 = 1000\,\Omega$ //

- * Hallar VtH?



Por Nodos:

Nodo a

$V_t - V_a = -V + V_{R1}$

$V - V_a = V_{R1}$

$I_{R1} + I_{R3} = 0$

$\frac{V - V_a}{R_1} + I = 0$

$V_t - V_a = V_{R1} + V_{R3}$

$V_{R1} - V_a = V_{R3}$

$\frac{V}{R_1} - \frac{V_a}{R_1} + I = 0$

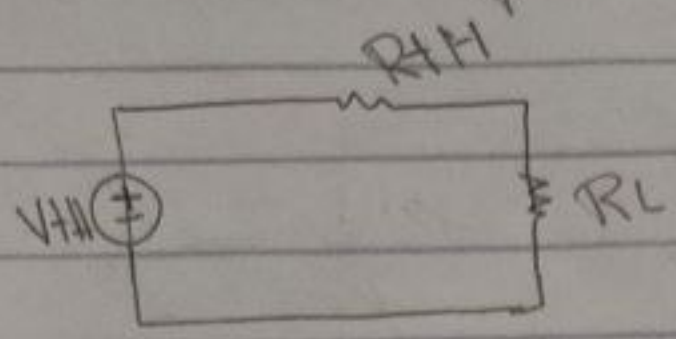
$V_a = V_{TH}$

$I_{R3} = I$

$V_a = \left(\frac{V}{R_1} + I\right) R_1 = 8V$ //

$V_a = V_{TH} = 8V$ //

Entonces el equivalente de Thevenin:



$$V_L = \frac{V_{TH} * R_L}{R_L + R_{TH}} = 5,33\,V$$

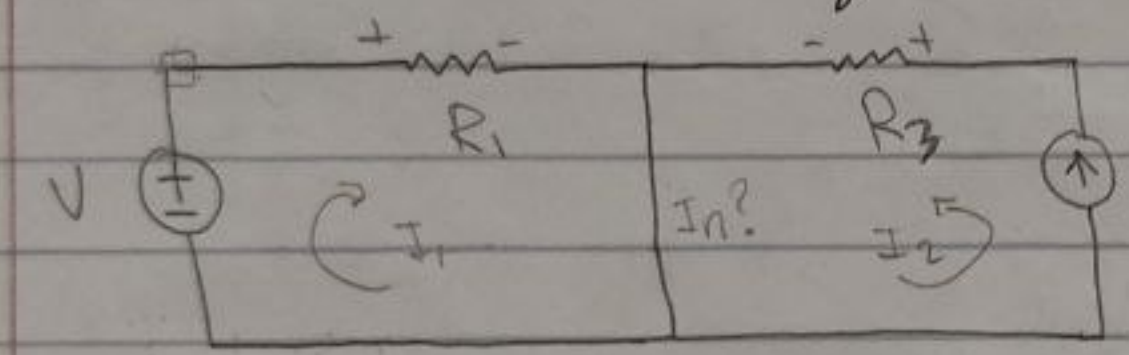
$$\begin{cases} V_L = V_{R2} \\ I_L = I_{R2} \end{cases}$$

$$I_L = \frac{V_{TH}}{R_{TH} + R_L} = 2,69 \times 10^{-3}\,A$$

② Equivalente Norton

Carga R_2 donde $R_2 = R_L$

* Hallar I_n?



Por Mallas:

$I_n = I_1 + I_2$, $I = I_{R3} = I_2$

Malla 1:

$-V + V_{R1} = 0$

$-V + I_1 R_1 = 0$

$I_1 = \frac{V}{R_1} = 6 \times 10^{-3}\,A$

Malla 2:

$-V_{R1} + V_{R3} = 0$

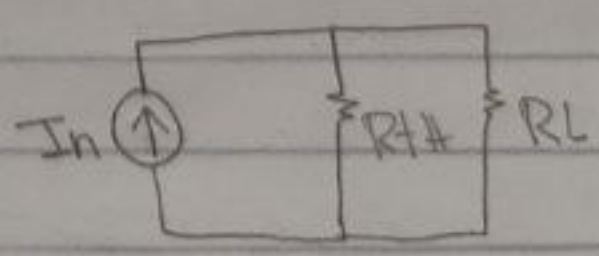
$-V_{R1} + I R_3 = 0$

$V_{R1} = I R_3$

$I_n = (6 \times 10^{-3}\,A + 2 \times 10^{-3}\,A)$

$I_n = 8 \times 10^{-3}\,A$

Entonces el equivalente de Norton:



$$I_L = \frac{I_n * R_{TH}}{R_{TH} + R_L} = 2,67 \times 10^{-3}\,A$$

$V_L = 5,33\,V$

* Entonces Aplicando el principio de Superposición:

$V_{R1} = V'_{R1} - V''_{R1} = -0,67V$ $\quad \pm \sum_{R_1} = V$ $\quad I_{R1} = -I'_{R1} + I''_{R1} = 6,67 \times 10^{-3} A$

$V_{R2} = V'_{R2} + V''_{R2} = 5,33V$ $\quad I_{R2} = I'_{R2} + I''_{R2} = 2,67 \times 10^{-3} A$

$V_{R3} = V'_{R3} = 6V$ $\quad I_3 = I_{R3} = 2 \times 10^{-3} A$

(4) Valores Medidos:

$R_3 = 3,01 k\Omega$ $\quad R_1 = 1,01 K\Omega$

$R_2 = 2,01 K\Omega$ $\quad V) = 6,00 V$

$I = 2,01 \times 10^{-3} A$

Superposición

$V'_{R1} = -1,26 V$, $\quad V''_{R1} = 2V$, $\quad I'_{R1} = -1,32 \times 10^{-3} A$ $\quad I''_{R1} = 2,09 \times 10^{-3} A$

$V'_{R2} = 1,27 V$, $\quad V''_{R2} = 3,99 V$, $\quad I'_{R2} = 6,65 \times 10^{-4} A$ $\quad I''_{R2} = 2,10 \times 10^{-3} A$

$V'_{R3} = -5,70 V$ $\quad V''_{R3} = 0 V$ $\quad I'_{R3} = -2 \times 10^{-3} A$ $\quad I''_{R3} = 0 A$

$V_{R1} = 0,74 V$, $V_{R2} = 5,26 V$, $V_{R3} = 5,70 V$

Norton: $\quad I_{R1} = 6,8 \times 10^{-3} A$, $I_{R2} = 2,76 \times 10^{-3} A$, $I_{R3} = 2 \times 10^{-3} A$

$I_1 = 6,22 \times 10^{-3} A$

$I_2 = 2 \times 10^{-3} A$

$I_n = I_1 + I_2 = 6,22 \times 10^{-3} A + 2 \times 10^{-3} A = 8,22 \times 10^{-3} A$

Thevenin

$R_{TH} = 1010 \Omega$

$V_{TH} = 7,85 V$

(5) Calculando errores:

$\varepsilon V'_{R1} = 5,26\%$ $\quad \varepsilon V''_{R1} = 0\%$ $\quad \varepsilon I'_{R1} = 0,76\%$ $\quad \varepsilon I''_{R1} = 4,5\%$

$\varepsilon V'_{R2} = 4,51\%$ $\quad \varepsilon V''_{R2} = 0,25\%$ $\quad \varepsilon I'_{R2} = 0\%$ $\quad \varepsilon I''_{R2} = 5\%$

$\varepsilon V'_{R3} = 5\%$ $\quad \varepsilon V''_{R3} = 0\%$ $\quad \varepsilon I''_{R3} = 0\%$ $\quad \varepsilon I''_{R3} = 0\%$

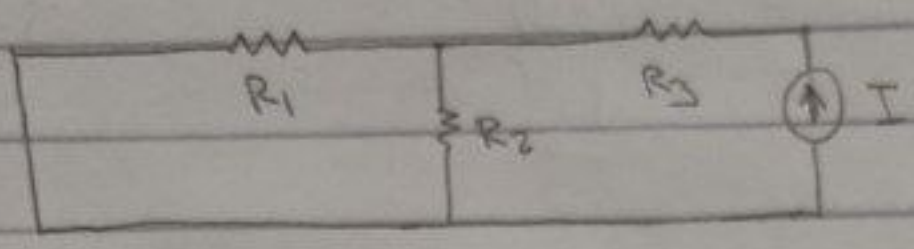
$\varepsilon_{RTH} = 1\%$ $\quad \varepsilon_{VR1} = 10\%$ $\quad \varepsilon_{IR1} = 1,94\%$

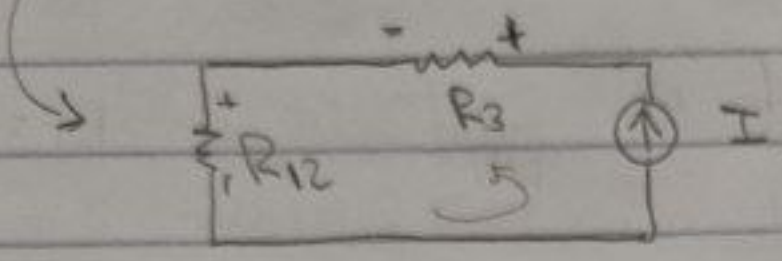
$\varepsilon V_{TH} = 1,87\%$ $\quad \varepsilon_{VR2} = 1,31\%$ $\quad \varepsilon_{IR2} = 1,12\%$

$\varepsilon I_n = 2,75\%$ $\quad \varepsilon_{VR3} = 5\%$ $\quad \varepsilon_{IR3} = 0$

③ Principio de Superposición:

* Apagando la fuente de Voltaje:





$$R_{12} = \left(\frac{1}{R_1} + \frac{1}{R_2}\right)^{-1}$$

$$R_{12} = 666,67\ \Omega$$

Por Mallas:

$$I = I_{R3} = I_{R12}$$

$$-V_{R1} + V'_{R3} + V'_{12} = 0$$

$$-V_{R1} + I R_3 + I R_{12} = 0$$

$$V_{R1} = 7,33\ V$$

$$V_{12} = V_{R1} = V_{R2}$$

$$V'_{R12} = 1,33\ V$$

$$V'_{R1} = 1,33\ V$$

$$V'_{R2} = 1,33\ V$$

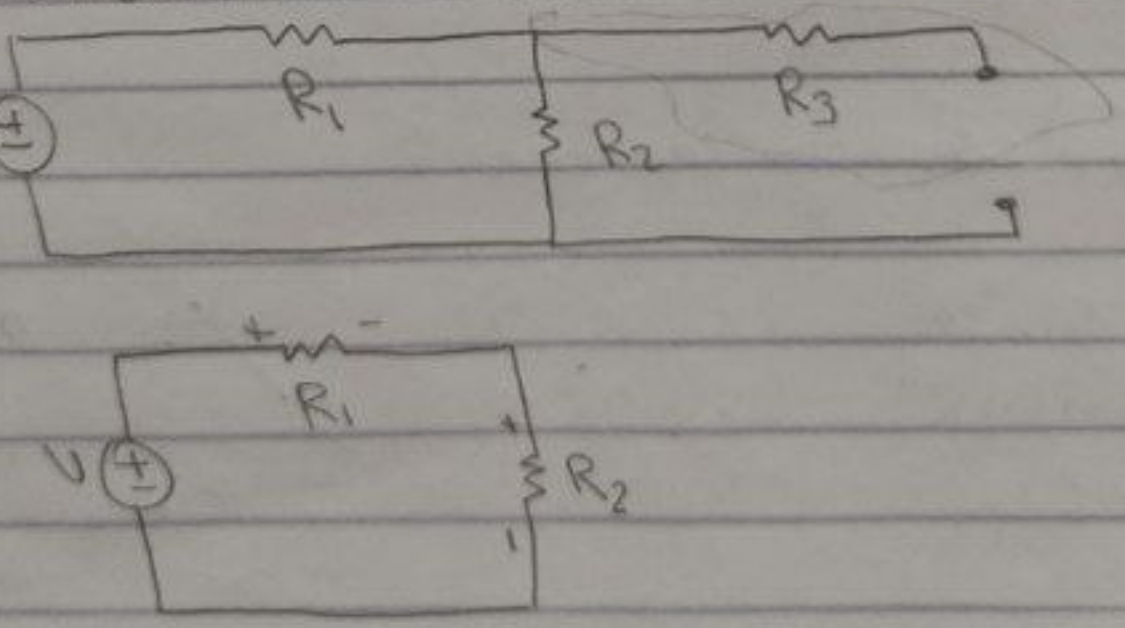
$$V'_{R3} = 6\ V$$

$$I'_{R1} = 1,33 \times 10^{-3}\ A$$

$$I'_{R2} = 6,65 \times 10^{-4}\ A$$

$$I'_{R3} = 2 \times 10^{-3}\ A$$

* Desconectando la fuente de Corriente:



Por divisor de voltaje:

$$V''_{R1} = \frac{V * R_1}{R_1 + R_2} = 2\ V$$

$$V''_{R2} = \frac{V * R_2}{R_1 + R_2} = 4\ V$$

$$V''_{R3} = 0\ V$$

$$I''_{R1} = 2 \times 10^{-3}\ A$$

$$I''_{R2} = 2 \times 10^{-3}\ A$$

$$I''_{R3} = 0\ A$$