Electrical Engineering Technology

ECET 17700 - DAQ & Control Systems

Lecture # 9 – Loading, Thévenin & Norton

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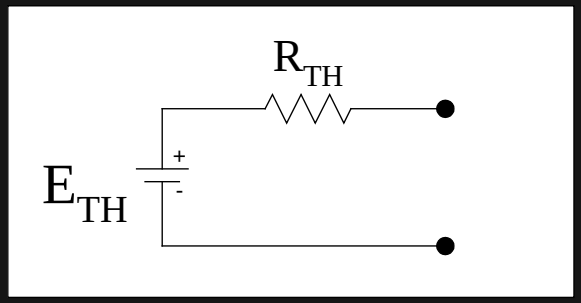
Module 4

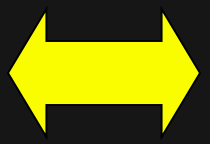
Source Conversion

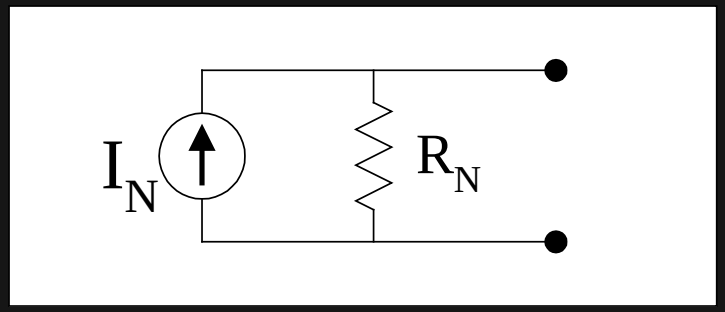
Lecture 9 Modules

1. Circuit Loading
2. Thévenin Circuit Model – *What's in the Box*
3. Norton Circuit Model
4. **Model Conversion**
5. What's in the Box – Practical Measurements

Equivalent Models - *supply conversion*



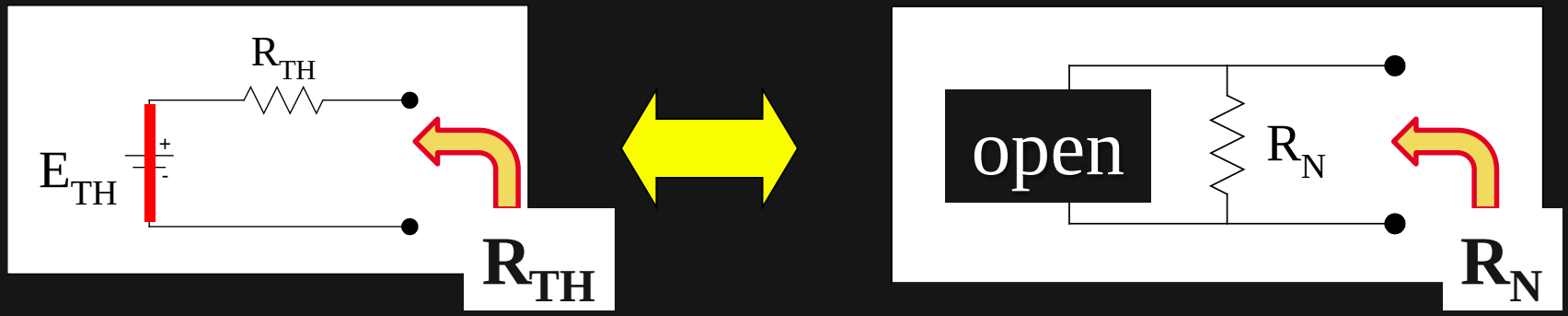




Thévenin model ***Norton model***

Same load results !

R_{TH} & R_N - *supply conversion*

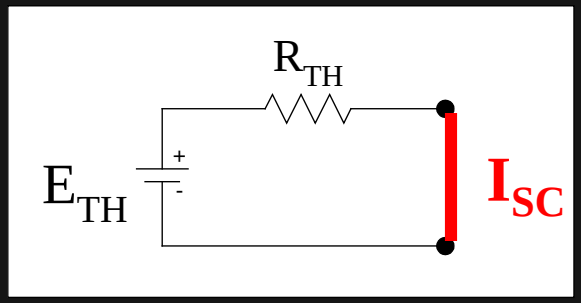


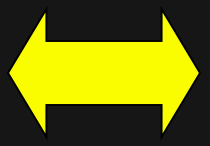
Thevenin model ***Norton model***

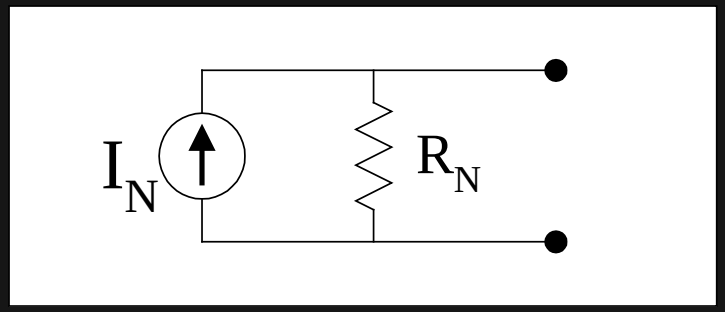
Zero the sources

$$R_{TH} = R_N$$

I_N - *supply conversion*







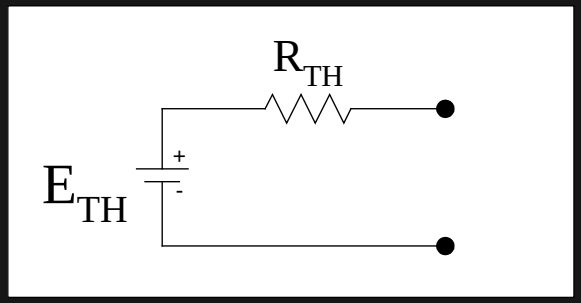
Thevenin model

Norton model

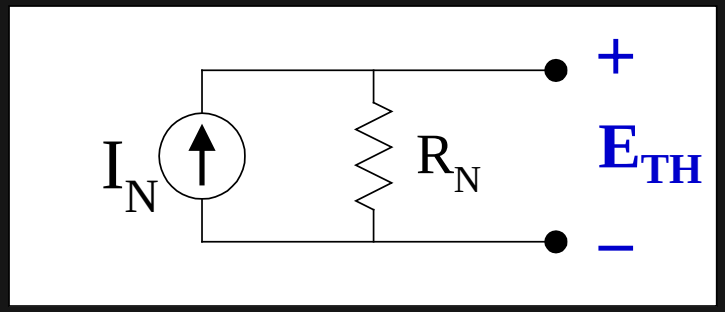
Short Circuit Current

$$I_N = E_{TH} / R_{TH}$$

E_{TH} - *supply conversion*



Thevenin model



Norton model

Open Circuit Voltage

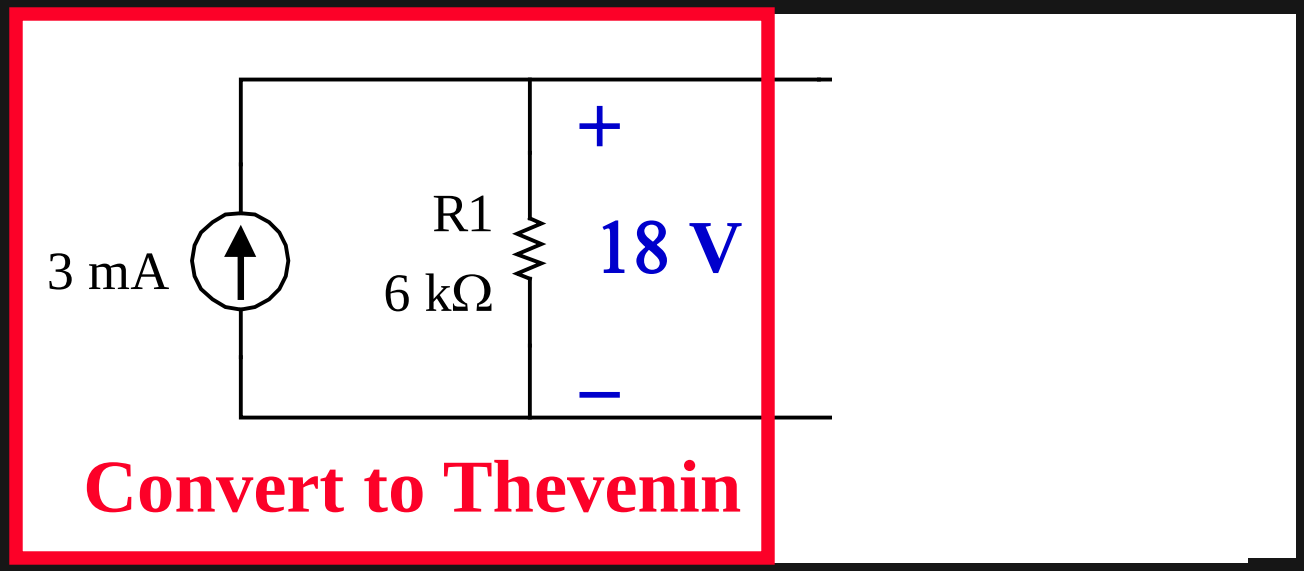
$$E_{TH} = I_N \times R_N$$

Thevenin Resistance

$$R_{TH} = R_N = V_{OC} / I_{SC}$$

Warning *- SHORT can cause smoke or loading !*

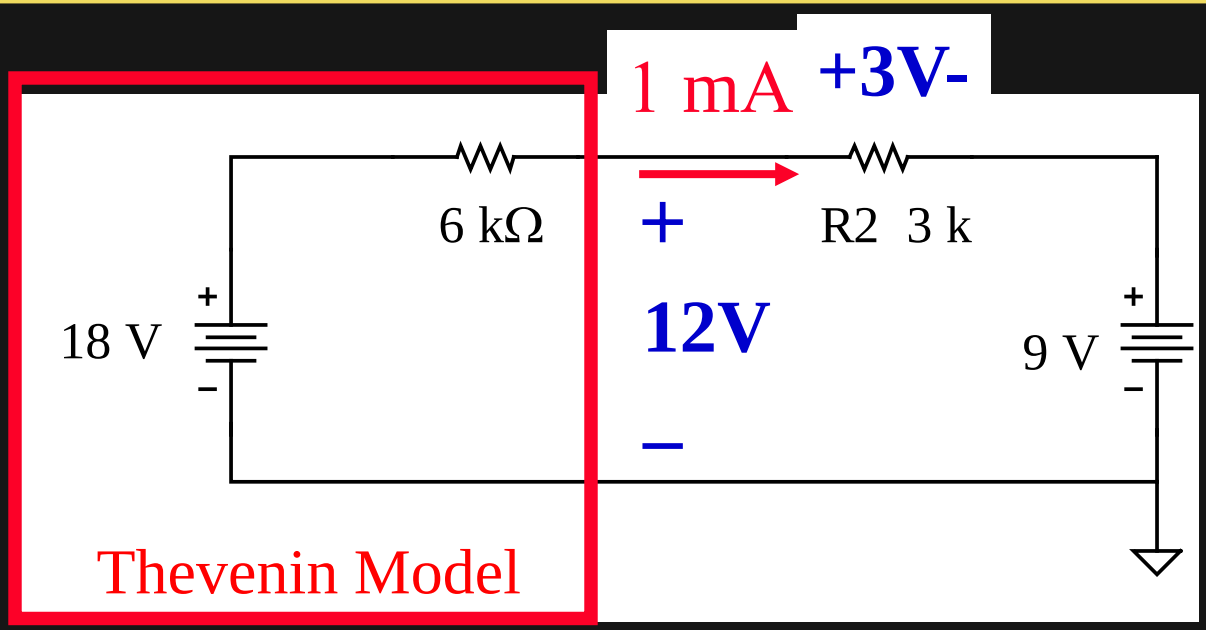
Equivalent Circuit - *source conversion*



$$\mathbf{R_{TH}} = R_N = \mathbf{6\ k\Omega}$$

$$\mathbf{E_{TH}} = 3\text{mA} \times 6\ \text{k}\Omega = \mathbf{18V}$$

Example model - *source conversion*

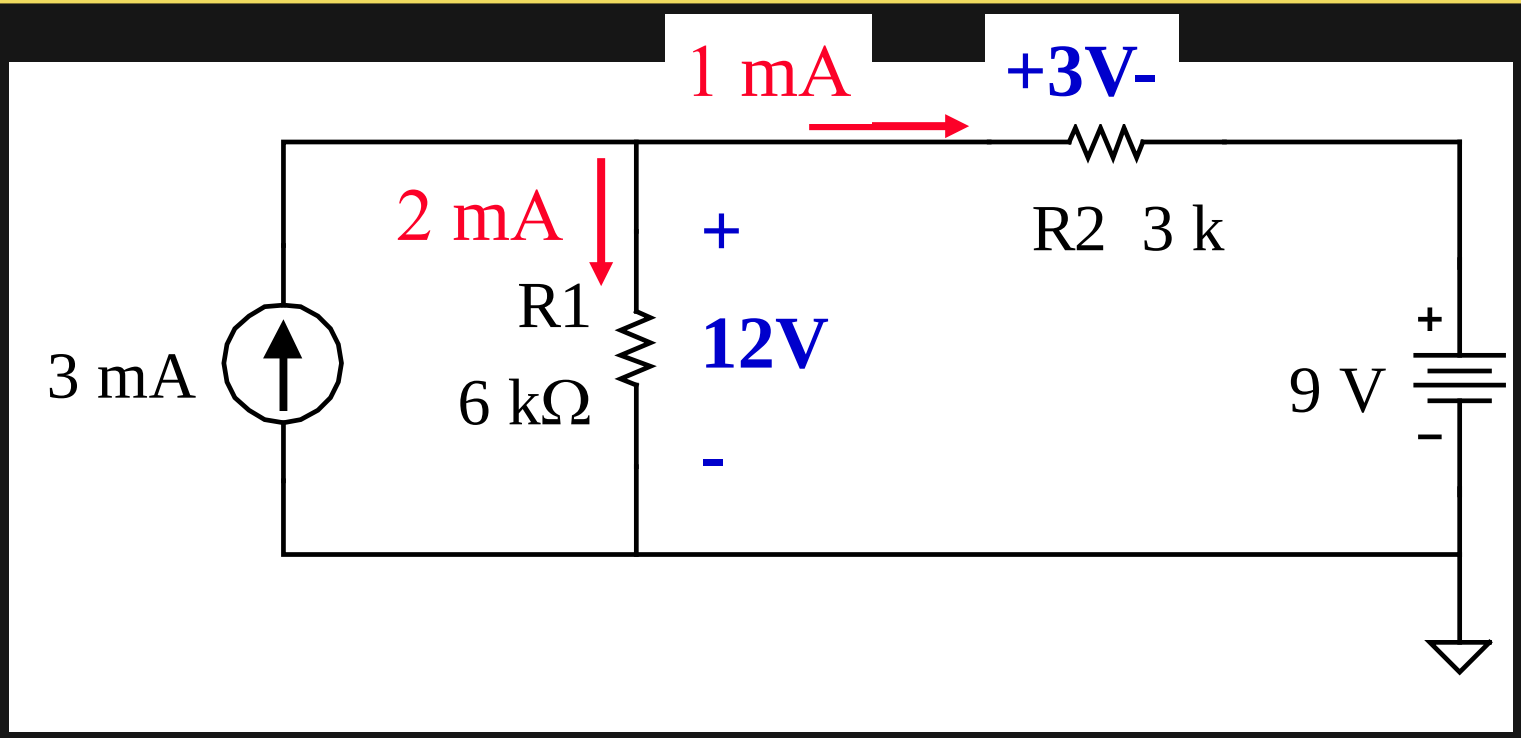


$E_{NET} = 18V - 9V = 9V$

$R_T = 6\ k\Omega + 3\ k\Omega = 9\ k\Omega$

$I_{R2} = 9V / 9k\Omega = 1\ mA$

Switch Back to Original Circuit



I_{R1} = 3 mA - 1mA = 2 mA

$V_{R1} = V_{Isupply}$ = 2mA × 6kΩ = 12V

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