Source Transformation

and

Equivalent Source Theorem

A report By

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Id: 2019380163

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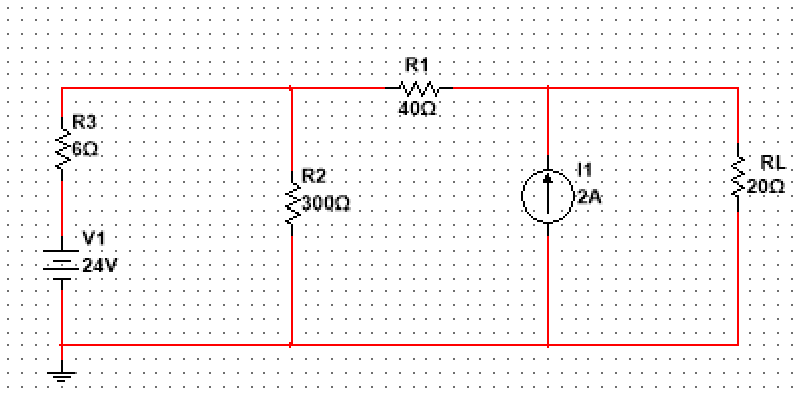
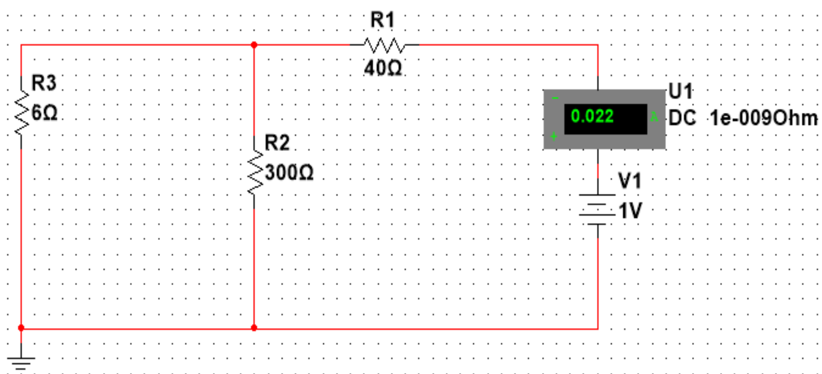
Use Thevenin's theorem to simplify this circuit, calculate the current flowing through R_L, and prove that your simplification is correct.

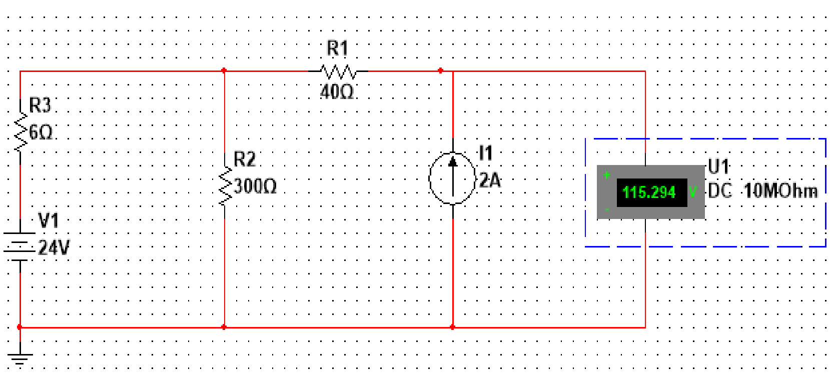


Step 1: Measuring R_{th} by shorting the voltage source and opening the current source.



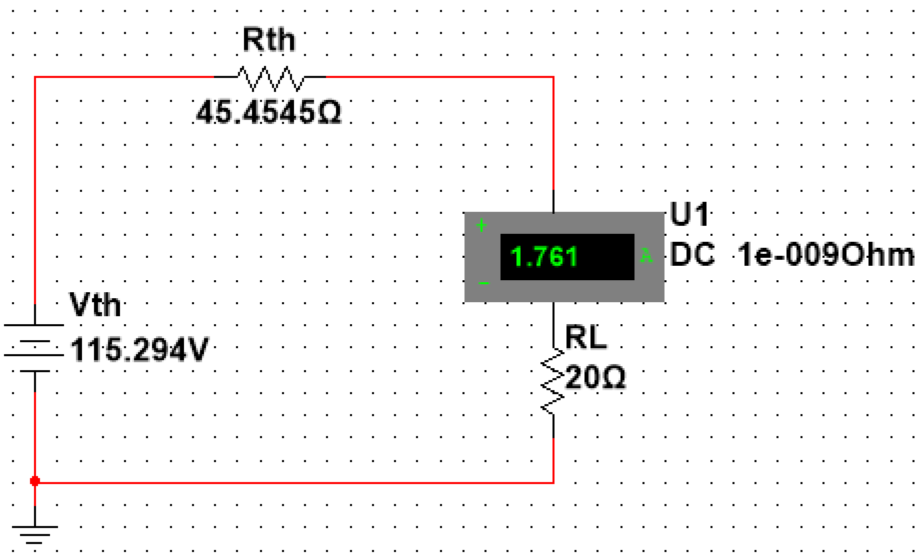
Rth= 1v/0.022A= 45.4545

Step 2: Measure the V_{th} removing R_L.



Vth= 115.294V

Step3: Finding the current I_L through R_L using Thevenin's Equivalent circuit.

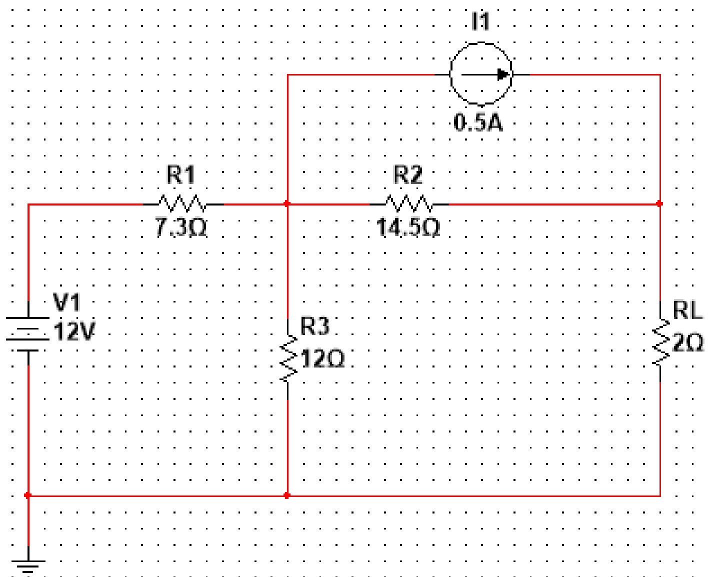


- current through load resistance, I_L= 1.761A

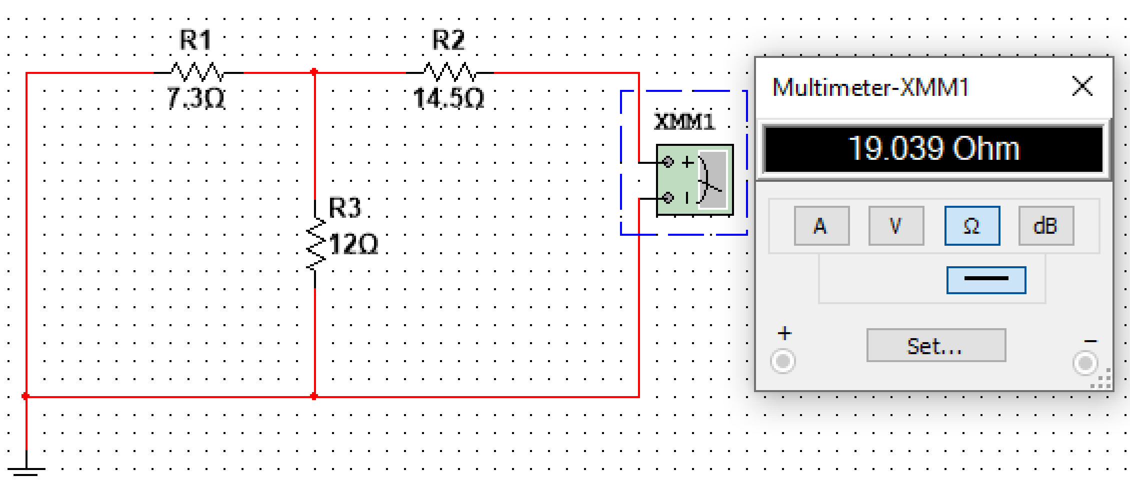
Advantages and disadvantages of open short circuit method, direct measurement method and semi-biased method

	Advantages	**Disadvantages**
Open short circuit method	No external source is required	doesn't work if the circuit has a dependent source
Direct measurement method	No external source is required	doesn't work if the circuit has a dependent source
Semi-biased method	semi biased method works in any condition	Requires external source

Use Norton's theorem to simplify this circuit, and calculate the current flowing through RL.

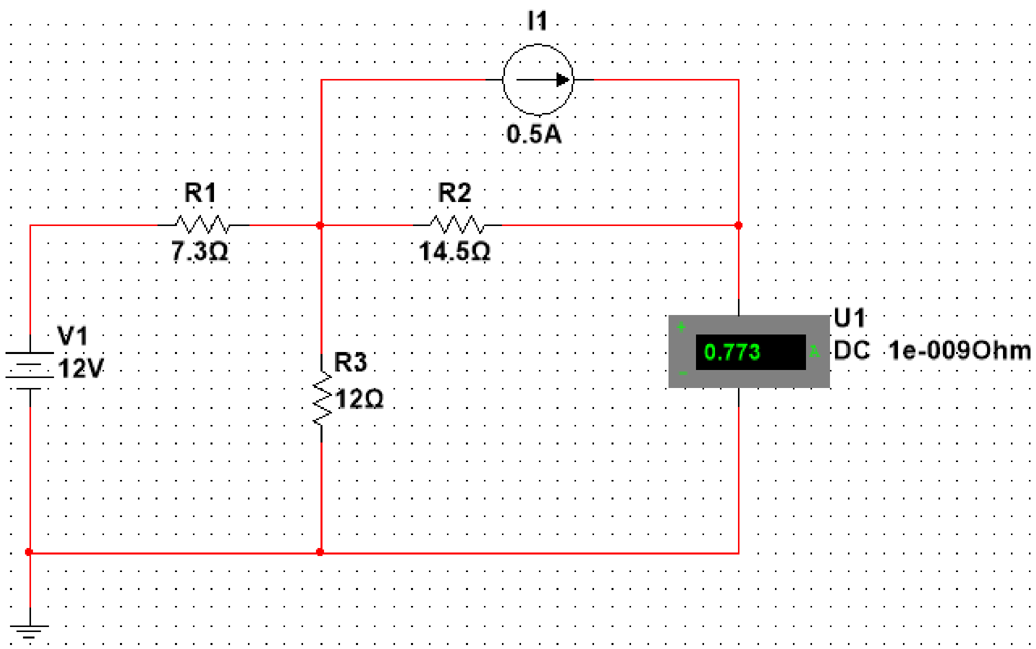


Step 1: Measuring R_N by shorting the voltage source and opening the current source. Which is same as Thevenin's equivalent resistance.



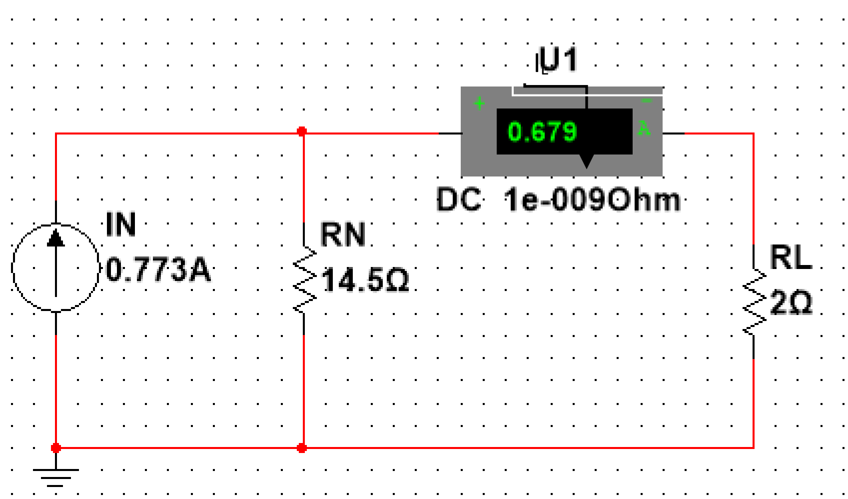
$R_N = R_{Th} = 19.039$ Ohm

Step2: Measure short circuit current I_{sc} by removing Load resistance and shorting the terminals.



$I_{sc} = I_N = 0.773A$

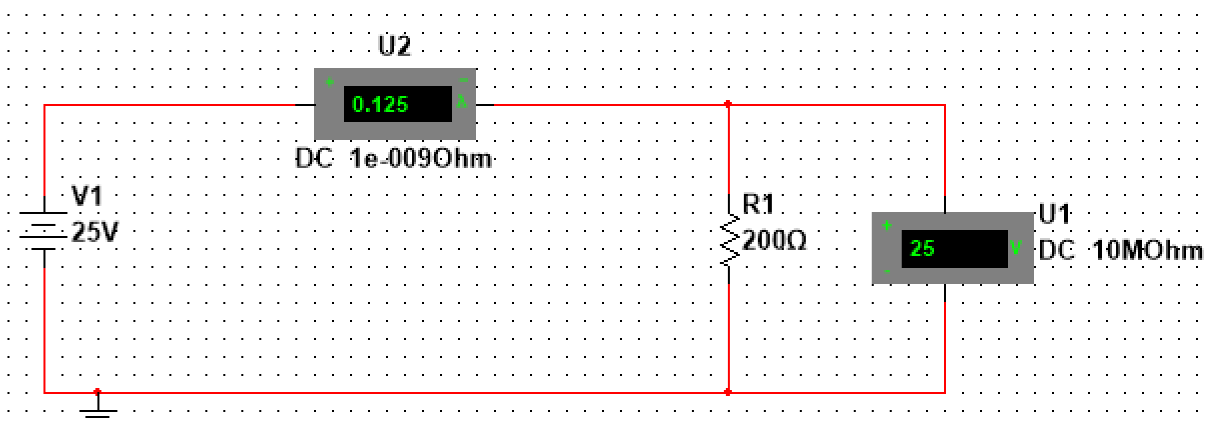
Step3: Finding the current I_L through R_L using Norton's Equivalent circuit.



$I_N = 0.679A$

The internal resistor of ideal voltmeter is infinity, and the internal resistor of ideal ammeter is zero. But practical voltmeter and ammeter is different. Use a practical voltmeter and ammeter to measure the voltage-current characteristic of a linear resistor R=200Ω, the internal resistance of voltmeter is 100 kΩ, and the internal resistance of ammeter is 0.2Ω. How do we connect voltmeter and ammeter so that the error is minimal? Design a circuit and give a description or explanation.

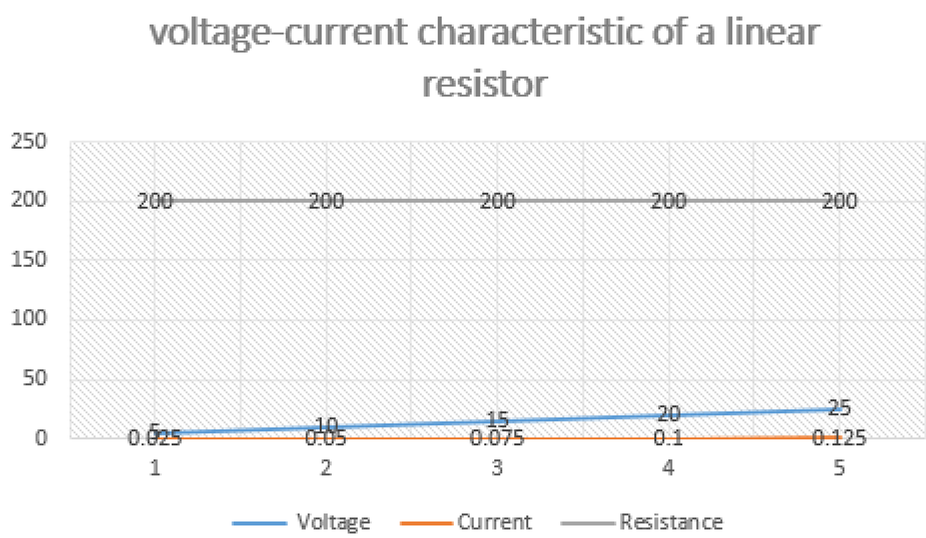
Circuit:



Datasheet:

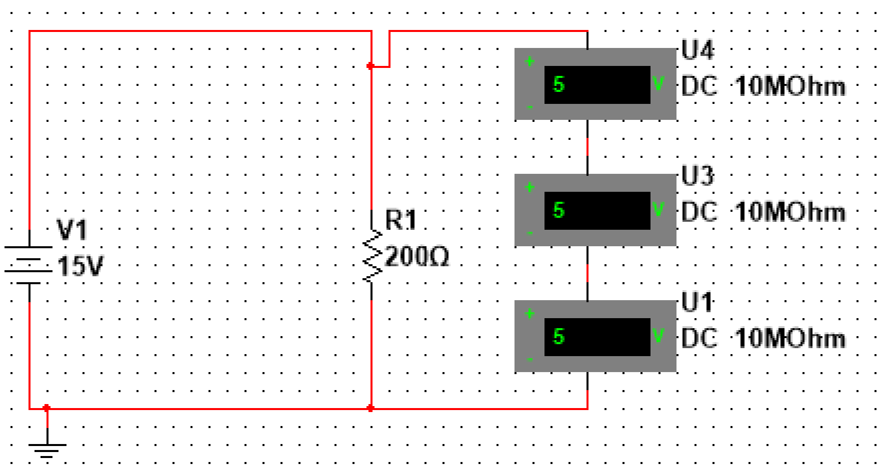
Voltage	5V	10V	15V	20V	25V
Current	0.025A	0.05A	0.075A	0.1A	0.125
Resistance	200Ω	200Ω	200Ω	200Ω	200Ω

Graph:



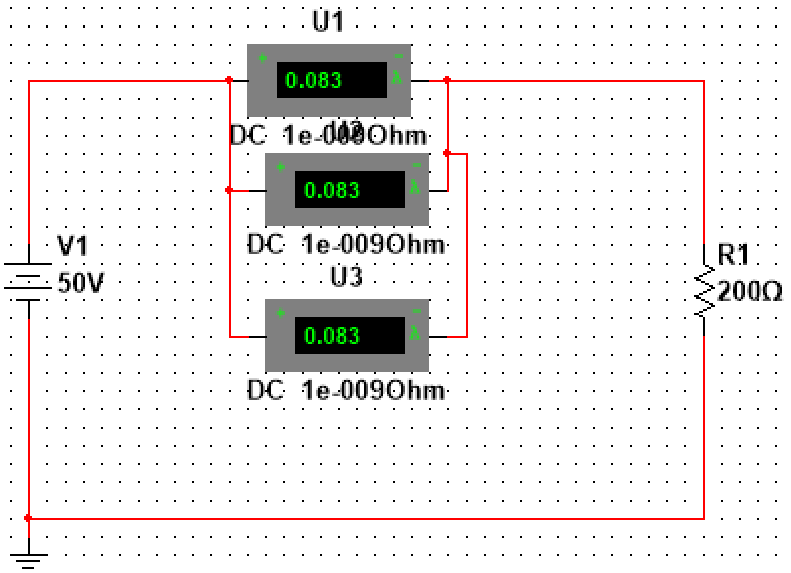
Possible solution to reduce the error of a voltmeter and an ammeter:

The resistance of an ideal voltmeter is near to infinity. If we increase the resistance of a non-ideal voltmeter by putting more non-ideal voltmeter in series, we will be able to reduce the error as less current will leak through the voltmeter. The proposed circuit is shown below.



Here the voltage across the 200-ohm resistor can be measured by summing up the measured data of three voltmeters.

For the ammeter, we know that the internal resistance of an ideal ammeter is 0. So, if we apply the same strategy like before, but instead of putting them in series we need to put the ammeters in parallel to reduce the resistance. In this way, we can keep the errors minimal. The proposed circuit is shown below.



Here, the current flowing through the circuit can be measured be summing up the three ammeters reading.