Lab3 Report

Name 柄润康 TA Checkoff ______

Teammate 赵汉卿 Score /63

Part One: Superposition Theorem

1. Consider the circuit given in Fig. 1. that you have analyzed in Prelab, in which RL is 10kΩ . Check the values of the resistors using the multimeter. Record the values in Table2. __/4pt

Table 1.

Resistor	Nominal Value	Ohmmeter Reading
R1	2.2 kΩ	2.190 kΩ
R2	1.5 kΩ	1.497 kΩ
R3	1.0 kΩ	1.008 kΩ
RL	10 kΩ	10.03 kΩ

2. Construct the circuit (Fig. 1) that you have analyzed in Prelab on your protoboard and to to verify superposition.

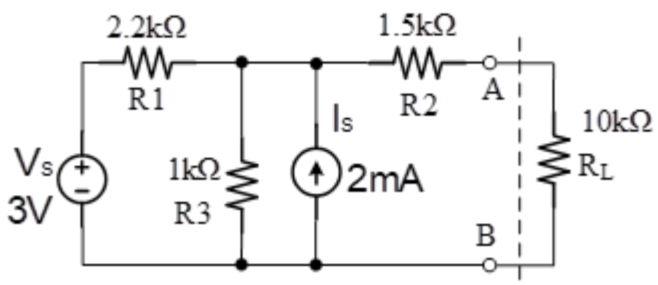

Fig. 1

1) When V_S acting alone, measure U_L' and I_L' .
2) When I_S acting alone, measure U_L'' and I_L'' .
3) Superposition (V_S acting alone + I_S acting alone)
4) Record the results in Table 2 __/12pt

$$\%Error = \frac{|Experiment\ Value - Theory\ Value|}{Theory} \times 100\%$$

Table 2

	U_L(V)	U_L' (V)	U_L'' (V)	I_L(mA)	I_L' (mA)	I_L''(mA)
Theory	1.90	0.769	1.13	190×10^{-3}	76.9×10^{-3}	113×10^{-3}
Experiment	1.989	0.773	1.124	200.0×10^{-3}	77.0×10^{-3}	117×10^{-3}
%Error	4.7%	0.52%	0.53%	5.2%	0.13%	3.5%

3. Comment on the results found in Table2. __/8pt

The theoretical value and experimental value are very close to each other (the error is small and the error occured since the sources are not ideal)
Both show that in a linear circuit with several sources, the voltage and current responses in any branch is the algebraic sum of the voltage and current responses due to each source acting independently with all other sources replaced by their internal impedance. (The superposition theorem is true)

Part Two: Thevenin's Theorem and Norton's Theorem

1. Construct the circuit (Fig. 2) that you have analyzed in Preliminary Work on your Breadboard and to to verify superposition.

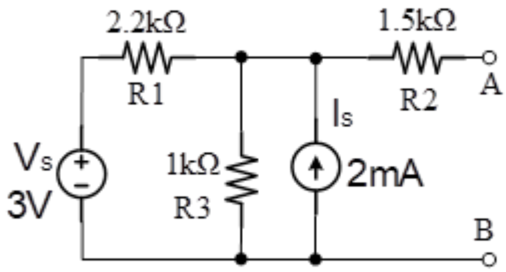

Fig. 2

2. Measure the open circuit voltage U_{OC}
3. Measure the short circuit current Isc. This is accomplished by placing an Ammeter between A and B. In this manner, the Ammeter will act as a short circuit.
4. Record the results in Table 3. __/9pt

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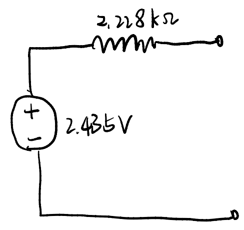
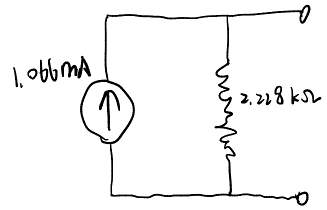
Table 3

	Uoc /V	Isc /mA	R0/kΩ
Theory	2.31	1.06	2.18
Experiment	2.435	1.066	2.228
%Error	5.4%	0.57%	2.2%

5. Draw the Thevenin's and Norton's equivalent circuit obtained **experimentally.** __/8pt

Thévenin Equivalent Circuit	Norton Equivalent Circuit
	

6. Validate Thevenin theorem.

1) Connected the variable resistor R_L between terminals A and B of the two-terminal active network (Fig. 3) , change the resistance of RL and measure the external characteristics of the linear two-terminal active network

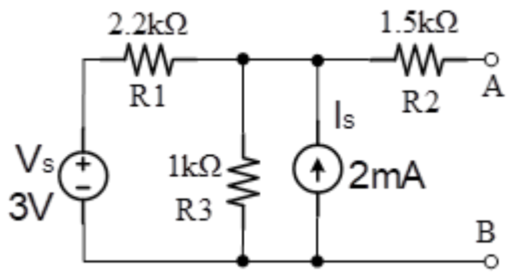


Fig. 3

2) Connected the variable resistor R_L as the load of the Tévenin Equivalent Circuit , change the resistance of RL and measure the external characteristics of the Tévenin Equivalent Circuit.

3) Compare the external characteristics of 1) and 2) and validate Thevenin theorem.

4) Record the corresponding voltages and currents into the Table 4. __/10pt

Table 4.

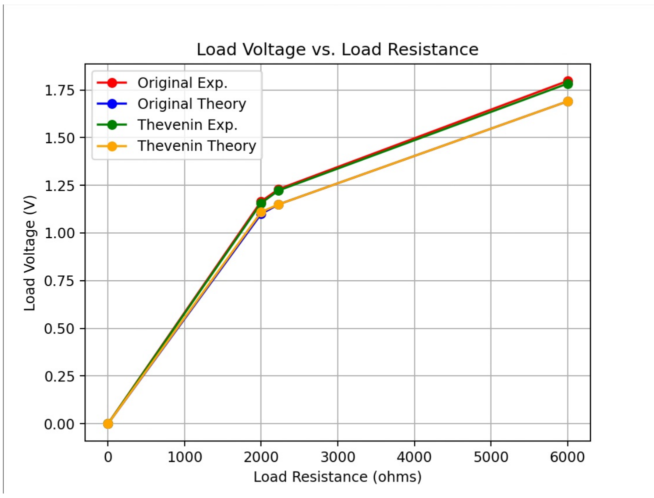
R_L/Ω	0	2k	R_0	6k	∞
V_load /V original two-terminal network, experiment	0	1.166	1.230	1.797	2.448
V_load /V original two-terminal network, theory	0	1.10	1.15	1.69	2.31
V_load /V Thevenin equivalent circuit, ~~theory~~ experiment	0	1.157	1.223	1.783	2.460
V_load /V Thevenin equivalent circuit, theory	0	1.11	1.15	1.69	2.31

7. Load V-R Characteristic Plot

For each of these 2 circuits: The Original two-terminal Circuit and Thevenin Circuit, plot the load voltage vs. load resistence on the same plot. To create your plots you can use whichever software you would like (Excel, Matlab, etc), export your plot as an image and paste it in the appropriate place below. _/8pt

Your plots should include:

- A Plot title
- Label your axes and show what unit of measure is used.
- Include a marking for your data-points.
- Include a line between your data-points in the same series.
- Include a legend.
- Make sure your scales are appropriate and visible.



5) Would you say original two-terminal network Circuit and Thevenin Circuit perform equivalently? Explain the resons. __/4pt

They perform equivalently.
From the figure above, the original two-terminal network circuit and Thevenin circuit show the same growth trend, where U_s is the open-circuit voltage at the terminals U_{oc}, and R_o is the equivalent resistance at the terminals when the independent sources are all turned off.

Finally, before leaving lab, turn off all equipment and return cables to their proper place. Leave your lab station clean and ready for other students to use. Thank you!

TA check off: