Department of Electrical and Computer Engineering
University of Victoria
ELEC 300 - Linear Circuits II

LABORATORY REPORT

Experiment No.: _____

Title: _____

Date of Experiment: _____

(should be as scheduled)

Report Submitted on: _____

(should be within one week from the time of experiment)

To: _____

Laboratory Group #: _____

Names: (please print) _____

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Fig. 0-1. The front page of a lab report

1 Objective

To create two variants of independent sources, both a voltage source and a current source, and analyze their behaviour compared to that expected from theory and calculations.

2 Introduction

Two dependent sources were created and analyzed in this lab. A voltage-controlled voltage source (VCVS) and a voltage-controlled current source (VCCS) were the examples of both voltages sources and current sources in this lab. A schematic of both circuits built is available in the lab manual. [1, p. 18]

3 Results

3.1 Voltage controlled voltage source (VCVS)

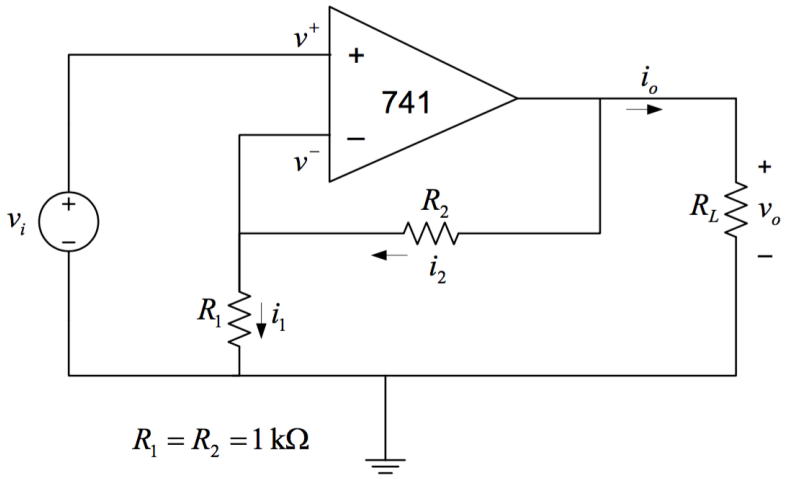

Figure 1: Schematic for VCVS with $K = 2$

The voltage controlled voltage source acted as a linear function of the input voltage, with a slope of 2, between $-4.2\text{V} < V_i < 4.5\text{V}$. The calculated linear region was between $-5\text{V} < V_i < 5\text{V}$, which is close to our experimental results when accounting for the ignored output resistance. Our calculated value of 2 for K (the gain) agrees with the results we observed.

V_i (V)	V_o (V)
-6	-8.467
-5	-8.468
-4	-8.007
-3	-6.005
-2	-4.003
-1	-2.001
0	0.001
1	2.036
2	4.007
3	6.010
4	8.011
5	9.060
6	9.060

Table 1: Response of VCVS

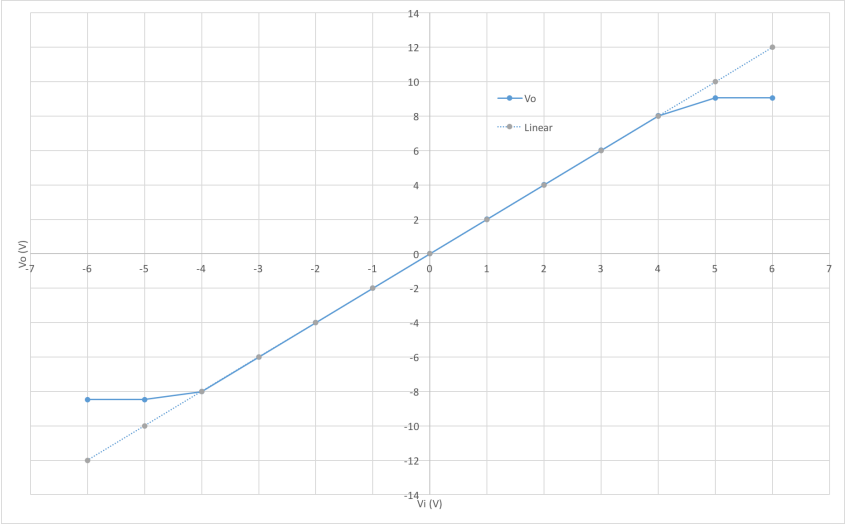

Figure 2: Response characteristic of VCVS with expected linear behavior

When we attempted to estimate the internal resistance using a 150Ω load (R_L in Fig. 1, we were only receiving a drop in voltage of approximately 6µV (peak-to-peak), which implied an internal resistance of approximately 500µΩ: this was considered to be incorrect. Replacing the 150Ω load with a 47Ω load, we experienced a more plausible result. With a load of 47Ω, the voltage across the load was measured to be 788.5mV, which means the source has an estimated internal resistance of approximately 39.1Ω (see 3).

$$I_o = \frac{V_o}{R_L} = \frac{0.7885\text{V}}{47\Omega} = 16\text{mA} \tag{1}$$

$$V_{internal} = V_i - V_L = 1.4135\text{V} - 0.7885\text{V} = 625\text{mV} \tag{2}$$

$$R_{internal} = \frac{V_{internal}}{I_o} = \frac{625\text{mV}}{16\text{mA}} = 39.1\Omega \tag{3}$$

3.2 Voltage controlled current source (VCCS)

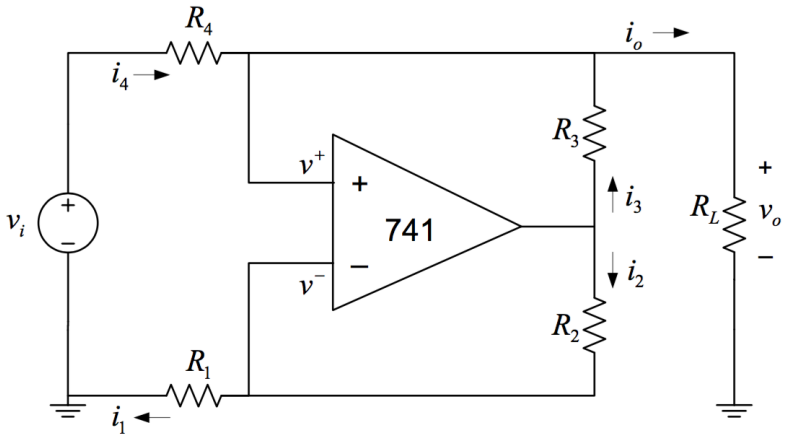

Figure 3: Schematic for VCCS with $G = \frac{1}{1000}$

Evaluating the inequality (1.15) [1] gives $-5\text{V} V_i < 5\text{V}$, whereas we observed a linear region between approximately $-4.0\text{V} < V_i < 4.2\text{V}$. When the edge of the linear region was reached, rather than hard limiting the current experience soft limiting where G dropped to 328×10^{-6}.

When shorting the output carrying 1mA when measured under a 1kΩ load, the measured current dropped to 0.951mA.

Add a internal resistance calculation. Not sure how to do this eq'n.

Measuring the voltage between the inverting and non-inverting gives a reading of 0.97mV. In comparison to other voltages within the circuit and considering the immense input impedance, the current into each pin is indeed nearly non-existent and certainly negligible.

V_i (V)	I_o (mA)
−8	−5.405
−7	−5.076
−6	−4.747
−5	−4.418
−4	−4.056
−3	−3.043
−2	−2.028
−1	−1.014
0	−0.001
1	1.104
2	2.024
3	3.042
4	4.056
5	4.638
6	4.956
7	5.293
8	5.620

Table 2: Response of VCCS

4 Discussion

What is expected response? Refer to formulas in lab manual.

Response is capped at expected values on positive side but is lower than expected on negative side. Why?

Effect of load changing Rl = 1k to 150?

Internal resistance calculation (**??**)

Expected response?

Same asymmetric capping as vcvs. Why?

Effect of changing Rl = 1k to 0?

Diff between V+ and V-? Same as expected (0)?

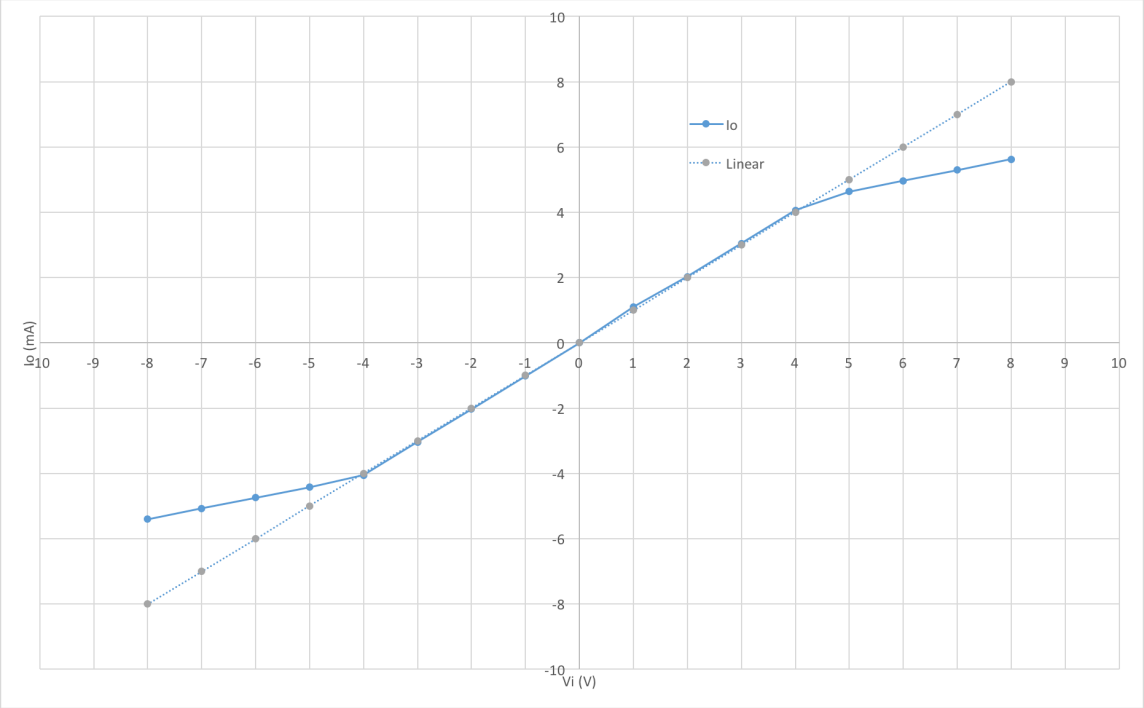

Figure 4: Response characteristic of VCCS with expected linear behavior

5 Conclusion

Justify conclusions and results.

References

[1] P. So and A. Zielinski, *Laboratory manual for elec 300 - linear circuits ii*, University of Victoria.