



Circuit Theory and Electronics Fundamentals

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Laboratory Assignment - T1

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1 Introduction

The objective of this laboratory assignment is to study a circuit containing:

- seven resistors (R_1 - R_7)
- one voltage source (V_a)
- one current source (I_d)
- one voltage-controlled current source (I_b)
- one current-controlled voltage source (V_c)

Circuit T1 is presented in Figure 1. All components, including nodes ($N1$ - $N8$) and ground(GND or 0), are identified with their respective names.

In Section 2, a theoretical analysis of the circuit is presented. In Section 3, the circuit is analysed by simulation, and the results are compared to the theoretical results obtained in Section 2. The conclusions of this study are outlined in Section 4.

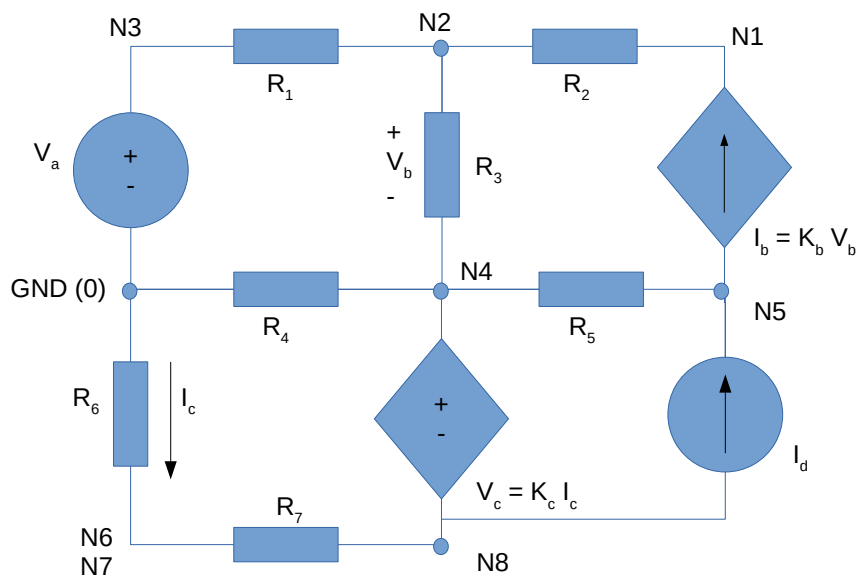


Figure 1: Circuit T1

2 Theoretical Analysis

In this section, the circuit in Figure 1 is analysed theoretically.

A precise description of the procedure used to compute all the values is presented. Furthermore, the equations that were applied and the attained results are also shown.

2.1 Methodology

$$Ri(t) + v_O(t) = v_I(t). \quad (1)$$

2.2 Computed results

All the results are organized and displayed in Table ??.

Name	Value [A or V]
V_b	-4.752955e+00
V_c	7.657904e+00
@ I_b	-2.957272e-01
@ I_c	9.187358e-01
@ I_d	1.038964e+00

Table 1: Values computed by Octave. Variables identified with a '@' have a corresponding value in Ampere (A). The others are expressed in Volts (V).

3 Simulation Analysis

In this section, Circuit T1 is reproduced with the help of Ngspice.

Firstly, the outcome of the simulation is shown, as well as a brief explanation on how it was achieved. Afterwards, a comparison is done between those values and the ones attained in Subsection 2.2.

3.1 Simulated results

Table 2 shows the simulated operating point results for the circuit under analysis. Compared to the theoretical analysis results, one notices the following differences: describe and explain the differences.

Name	Value [A or V]
@g1[i]	-2.95727e-01
@id[current]	1.038964e+00
@r1[i]	-2.82220e-01
@r2[i]	-2.95727e-01
@r3[i]	1.350709e-02
@r4[i]	-1.20096e+00
@r5[i]	-1.33469e+00
@r6[i]	9.187358e-01
@r7[i]	-9.18736e-01
n1	4.226624e+00
n2	4.830792e+00
n3	5.114025e+00
n4	4.871651e+00
n5	8.979579e+00
n6	-1.84920e+00
n7	-1.84920e+00
n8	-2.78625e+00
v(n2,n4)	-4.08594e-02
v(n4,n8)	7.657904e+00

Table 2: Values given by Ngspice. Variables identified with a '@' have a corresponding value in Ampere (A). The others are expressed in Volts (V).

4 Conclusion

For this laboratory assignment, we were given a circuit composed by 7 resistors, 1 independent voltage source, 1 independent current source, 1 current-dependent voltage source, 1 voltage-dependent current source and had the objective of analyzing it, which we did successfully.

Static analyses were performed theoretically and by circuit simulation, using the Octave math tool and Ngspice tool, respectively. The simulation results matched the theoretical results very precisely, despite the circuit having dependent voltage and current sources (which could have caused some discrepancies in the results).