Circuit Theory and Electronics Fundamentals

Department of Electrical and Computer Engineering, Técnico, University of Lisbon

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Laboratory Assignment - T1

José Miguel Goulão - 95814
Lourenço Pacheco - 95817
André Gomes - 96352

Contents

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.
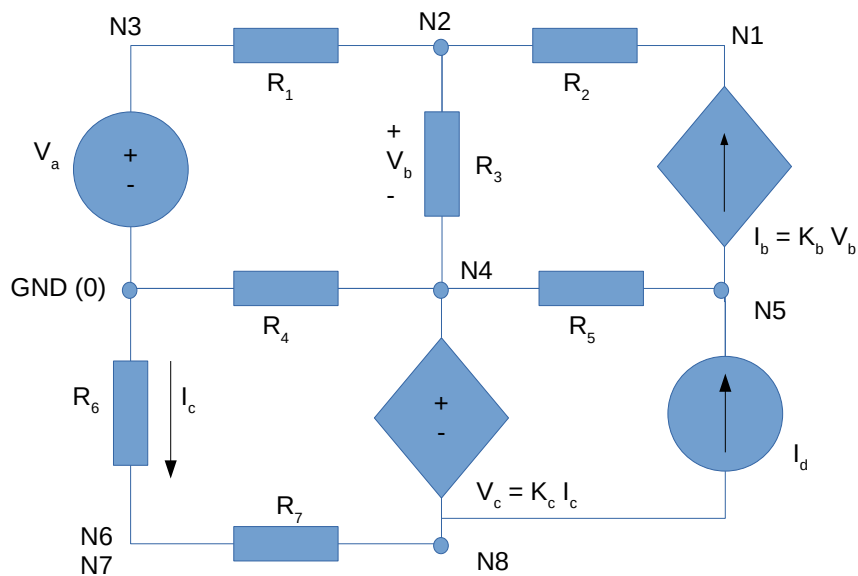

Figure 1: Circuit T1

2   Theoretical Analysis

In this section, the Circuit T1 is analysed theoretically.

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

2.1 Methodology

The circuit consists of a single V-R-C loop where a current $i(t)$ circulates. The voltage source $v_I(t)$ drives its input, and the output voltage $v_O(t)$ is taken from the capacitor terminals. Applying the Kirchhoff Voltage Law (KVL), a single equation for the single loop in the circuit can be written as

$$Ri(t) + v_O(t) = v_I(t). \tag{1}$$

2.2 Obtained results

Name	Value [A or V]
vc	7.657904e+00
ic	9.187358e-01

Table 1: Values computed by Octave

3 Simulation Analysis

3.1 Operating Point Analysis

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]
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
n2-n4	-4.08594e-02
n4-n8	7.657904e+00
i(vaux)	9.187358e-01

Table 2: Operating point. A variable preceded by @ is of type *current* and expressed in Ampere; other variables are of type *voltage* and expressed in Volt.

4 Conclusion

For this laboratory assignment, we were given a circuit composed by 7 resistors, 1 independent voltage source, 1 independent current source, 1 dependent voltage source, and 1 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).