

Circuit Theory and Electronics Fundamentals

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Example Laboratory Report

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1 Introduction

The objective of this laboratory assignment is to study a circuit containing a sinusoidal voltage source V_I connected to a resistor R and a capacitor C in series. The circuit can be seen in Figure 1.

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.

2 Theoretical Analysis

2.1 Mesh Analysis

[Falar sobre análise teórica do circuito usando método das malhas. Meter equações e matrizes usadas no NGSPICE] [Tabela do Octave]

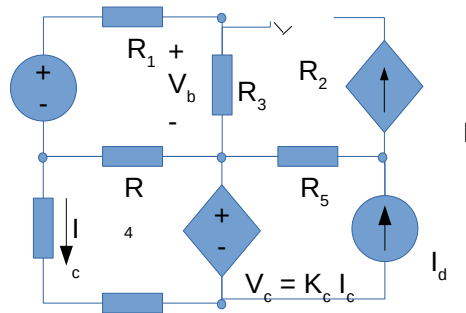


Figure 1: Voltage driven serial RC circuit.

Name	Value [A]
I_b	-2.762286e-04
I_d	1.010837e-03
I_{R1}	2.634648e-04
I_{R2}	-2.762286e-04
I_{R3}	-1.276387e-05
I_{R4}	1.274301e-03
I_{R5}	1.287065e-03
I_{R6}	9.356437e-04
I_{R7}	9.356437e-04
I_{V_a}	2.634648e-04
I_{V_c}	-7.519285e-05

Table 1: Theoretical Values for currents using Octave

2.2 Node Analysis

[Aqui mais outra]

Name	Value [V]
V_0	0.
V_1	5.06746
V_2	4.79141
V_3	4.23699
V_4	8.88222
V_5	-2.91249
V_6	-1.93698
V_7	4.82998

Table 2: Theoretical values for node voltages using Octave

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3 Simulation Analysis

3.1 Operating Point Analysis

Table 3 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]
@gib[i]	-2.76229e-04
@id[current]	1.010837e-03
@r1[i]	2.634648e-04
@r2[i]	-2.76229e-04
@r3[i]	-1.27639e-05
@r4[i]	1.199108e-03
@r5[i]	1.287065e-03
@r6[i]	9.356437e-04
@r7[i]	9.356437e-04
v(1)	5.067460e+00
v(2)	4.791413e+00
v(3)	4.236991e+00
v(4)	8.882220e+00
v(5)	-2.91249e+00
v(6)	-1.93698e+00
v(7)	4.829982e+00
v(8)	0.000000e+00
@va[i]	-2.63465e-04
@hvc[i]	7.519285e-05

Table 3: Operating point. A variable preceded by @ is of type *current* and expressed in Ampere; other variables are of type *voltage* and expressed in Volt.

[EXPLICAR SINAIS TROCADOS NAS CORRENTES DE VA E VC DEVIDO A CONVENÇÃO DO NGSPICE (CONTRÁRIA À ASSUMIDA POR NÓS)] [EXPLICAR V8 COMO FONTE FICTICIA PARA CALCULO DO NGSPICE]

4 Conclusion

In this laboratory assignment the objective of analysing an RC circuit has been achieved. Static, time and frequency analyses have been performed both theoretically using the Octave maths tool and by circuit simulation using the Ngspice tool. The simulation results matched the theoretical results precisely. The reason for this perfect match is the fact that this is a straightforward circuit containing only linear components, so the theoretical and simulation models cannot differ. For more complex components, the theoretical and simulation models could differ but this is not the case in this work.