Circuit Theory and Electronics Fundamentals

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

Second Laboratory Report

Group 20
João Maria De Carvalho Coelho Navarro Soeiro, 95803
Bruno Manuel Bento Pedro, 96363
Leonor João Dias Ferreira, 96422

March 24, 2021

Contents

1 Introduction

The objective of this laboratory assignment is to study a circuit containing a sinusoidal voltage source v_s connected to seven resistors (R_1 to R_7), a capacitor C, a dependent voltage source (current-controlled) and a dependent current source (voltage-controlled). The circuit can be seen in Figure 1.

The nodes are designated with numbers as seen in the Figure 1 and the node voltages will be represented with their respective numbers (ex. V_3 represents the voltage in node number 3). The characteristic equations of the dependent sources can also be seen in the Figure 1.

The sinusoidal voltage source follws the equation:

$$v_s(t) = V_s u(-t) + sin(2\pi f t)u(t) \tag{1}$$

where

In Section 2, a theoretical analysis of the circuit is presented. In Section 4, 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 5.
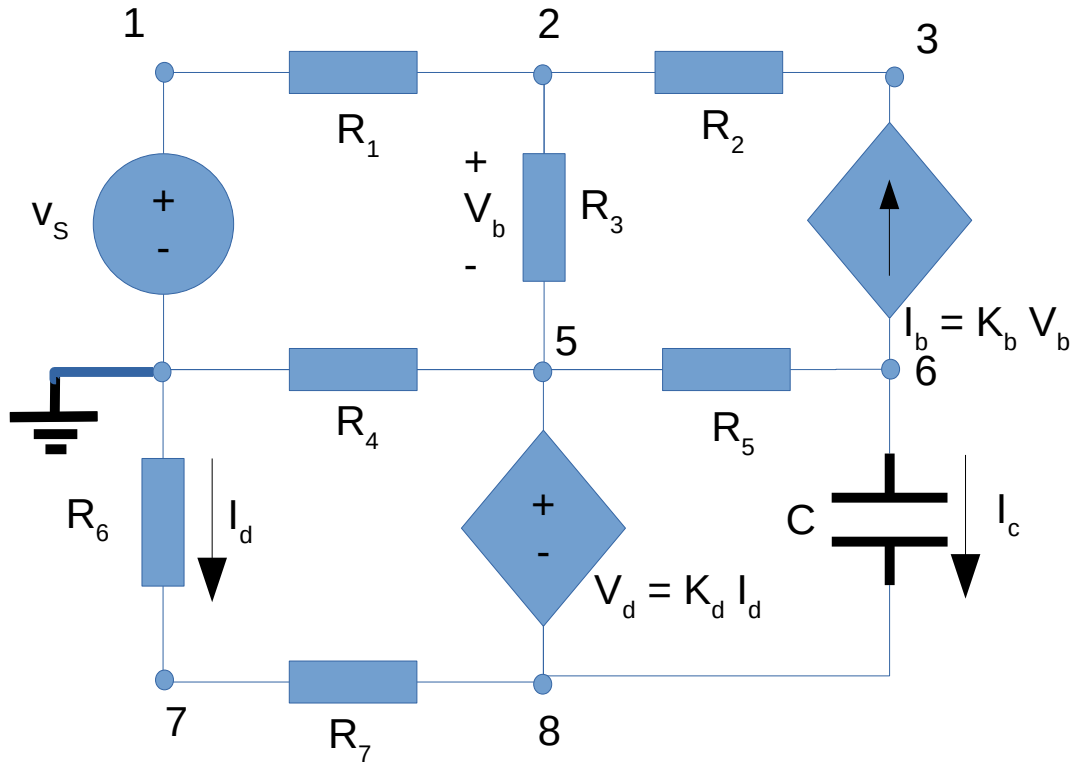

Figure 1: Voltage driven serial RC circuit.

2 Theoretical Analysis

In this section, the circuit shown in Figure 1 is analysed theoretically, in terms of its time and frequency responses.

ALTERAR TUDO

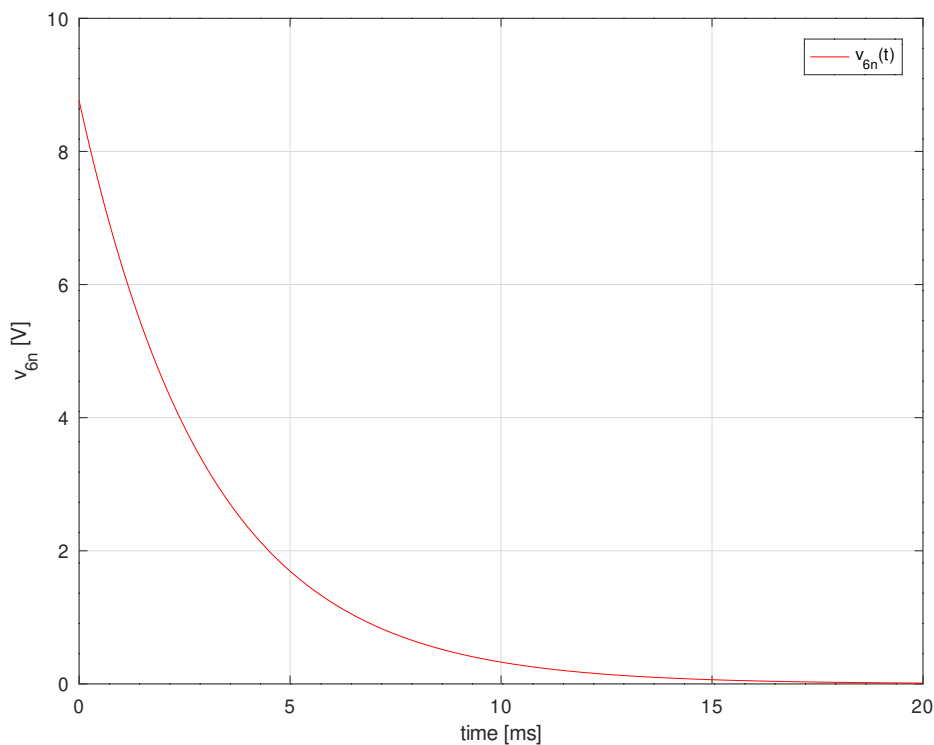| Name	Value [A]
V_1	5.201027
V_2	4.998410
V_3	4.581633
V_5	5.026771
V_6	5.644394
V_7	-2.092064
V_8	-3.121006

Table 1: Nodal analysis 1

Figure 2: Natural response of V_6 as a function os time in the interval from [0,20] ms

3 Frequency response

4 Simulation Analysis

4.1 Operating Point Analysis

Table **??** 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.

FALTA COLOCAR AS TABELAS DO NGSPICE

5 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.

Lorem ipsum dolor sit amet, consectetuer adipiscing elit. Ut purus elit, vestibulum ut, placerat ac, adipiscing vitae, felis. Curabitur dictum gravida mauris. Nam arcu libero, nonummy eget, consectetuer id, vulputate a, magna. Donec vehicula augue eu neque. Pellentesque habitant morbi tristique senectus et netus et malesuada fames ac turpis egestas. Mauris ut leo. Cras viverra metus rhoncus sem. Nulla et lectus vestibulum urna fringilla ultrices. Phasellus
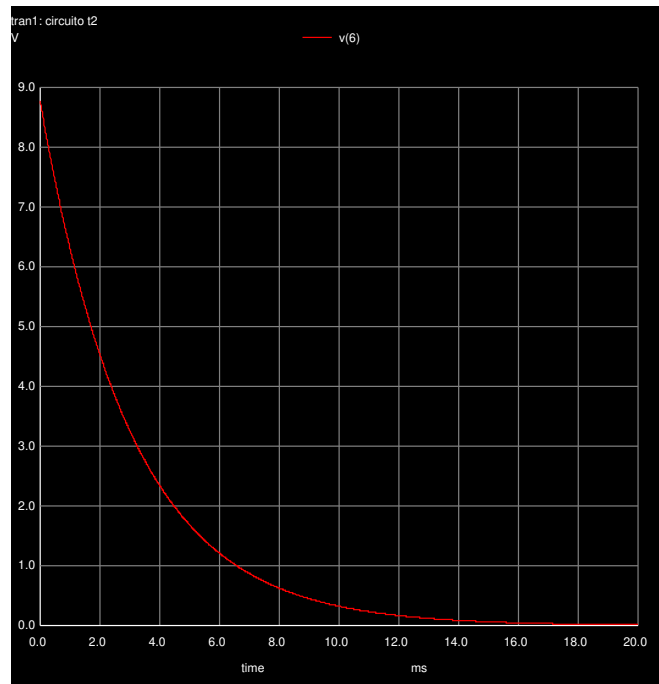
Figure 3: Simulated natural response of $V_6(t)$ in the interval [0,20] ms. The *x axis* represents the time in miliseconds and the *y axis* the Potencial in node 6 in Volts.

eu tellus sit amet tortor gravida placerat. Integer sapien est, iaculis in, pretium quis, viverra ac, nunc. Praesent eget sem vel leo ultrices bibendum. Aenean faucibus. Morbi dolor nulla, malesuada eu, pulvinar at, mollis ac, nulla. Curabitur auctor semper nulla. Donec varius orci eget risus. Duis nibh mi, congue eu, accumsan eleifend, sagittis quis, diam. Duis eget orci sit amet orci dignissim rutrum.