Circuit Theory and Electronics Fundamentals

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Example Laboratory Report

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Contents

1 Introduction

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

2 Theoretical Analysis

In this section the values used are present in the table 1:

Name	Value [A]
C1	2.200000e-07
C2	1.10000e-07
R1	1.00000e+03
R2	1.00000e+03
R3	1.00000e+03
R4	1.00000e+05

Table 1: Values for the capacitors and resistence used

In order to get a good theoretical analises of a bandpass filter using an OP amp, we first determined the gain variation with the frequency with the next formula.

$$\left(\frac{R_1 w C_1}{1 + R_1 w C_1 j}\right) \times \left(1 + \frac{R_4}{R_3}\right) \times \left(\frac{1}{1 + j w C_2 R_2}\right) \tag{1}$$

These values can easily be converted to a plot with a logarithm scale, that can be seen in Fig.1

Once we have this response, the other values are easy to find, the central frequency corresponds to the maximum gain. These values can be found in table 2

Regarding the impedances in the input and output, these are given by:

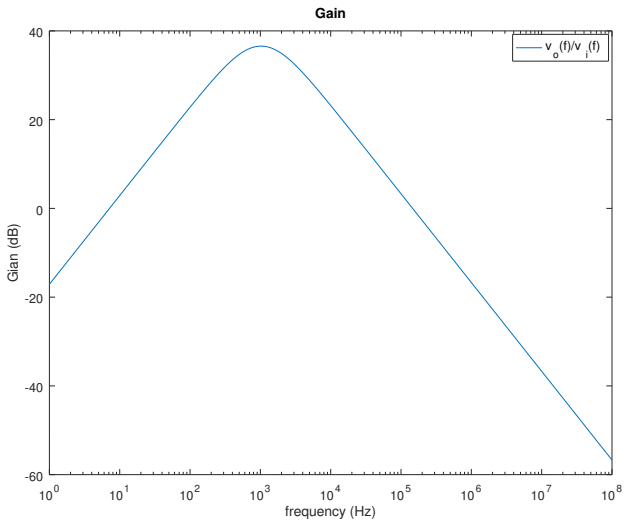

Figure 1: Gain frequência responce

Name	**Value [A]**
Gain	-5.63433e-01
Gain (db)	3.65643e+01
Input impedance	1.00000e+03 + -7.00858e+02j
Output impedance	6.627102e+02 + -4.727847e+02j

Table 2: Table of Gain, Input and output impedance

$$Z_{in} = R_1 + \frac{1}{jw_{central}C_1} \tag{2}$$

$$Z_{out} = \frac{R_2}{jw_{central}C_2} / \left(R_2 + \frac{1}{2w_{central}C_2}\right) \tag{3}$$

Regarding the values of cost and merit obtained with this circuit are:

Name	**Value [A]**
Gain Deviation	32.669024
Frequency deviation	32
Cost	1.34266e+04
Merit	1.14801e-06

Table 3: Values for the Merit calculation

With cost being calculated with:

$$Cost = 1 \times 10^{-3} \times (R_1 + R_2 + R_3 + R_4) + 1 \times 10^{6} \times (C_1 + C_2) + Cost_{amp} \tag{4}$$

3 Simulation Analysis

3.1 Operating Point Analysis

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