TÉCNICO LISBOA

Circuit Theory and Electronics Fundamentals

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Audio Amplifier

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Contents

1 Introduction

The objective of this laboratory assignment is to build an amplifying circuit based on an OP-AMP component.

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

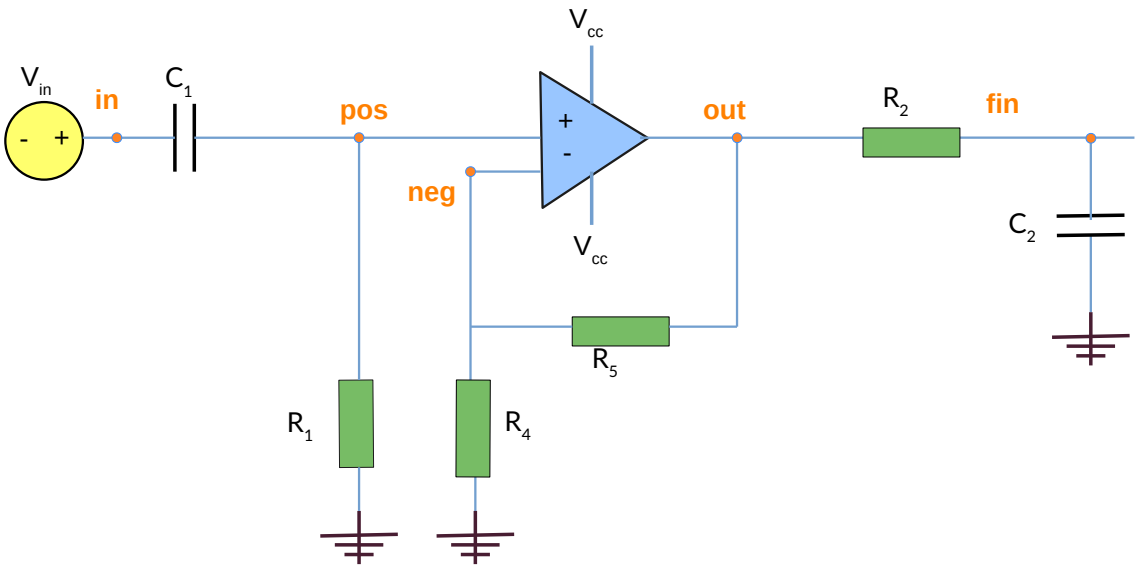


Figure 1: OP-AMP Circuit

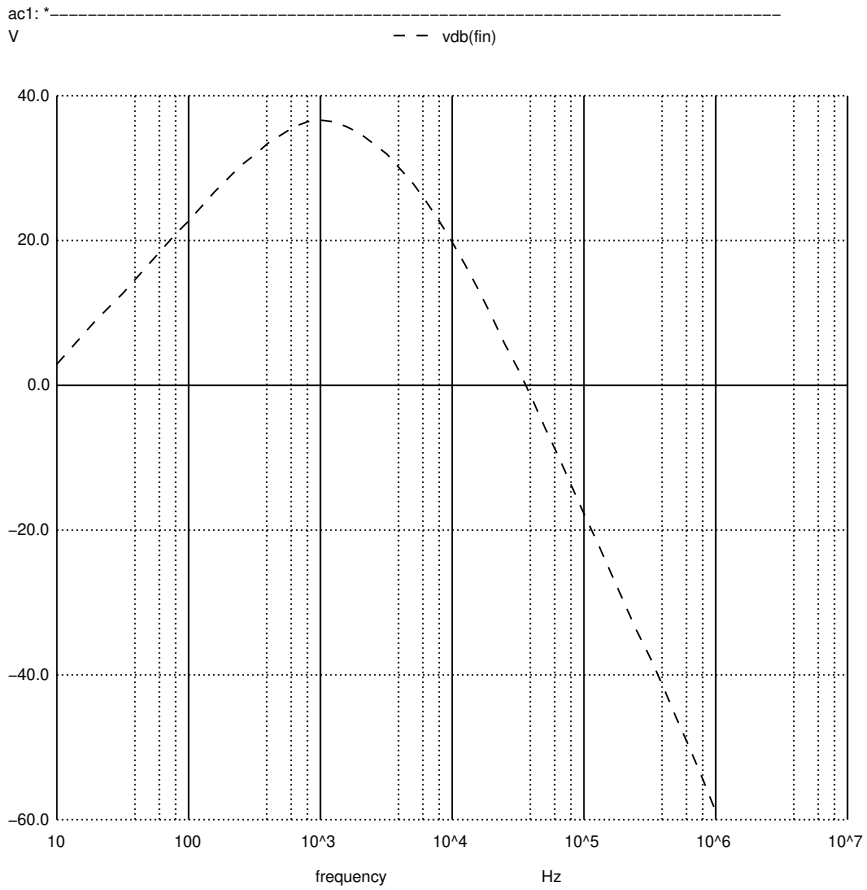
2 Simulation Analysis

We simulated the circuit using frequency analysis, using the supplied model of the OP-AMP:

Table 1: Values of capacitances and resistances for various circuit components

Vcc	10.0 V
Vee	10.0 V
C1	220 nF
C2	220 nF
R1	1000 Ohm
R2	500 Ohm
R3	100 kOhm
R4	1000 Ohm

We simulate the circuit using frequency analysis and max(vin(t))=1, obtaining the following gain in v_fin, which is the gain at the end of the circuit:



The calculated input impedance is $(0.99001 + i \cdot 0.00732)Ohm$. A different setup was used to calculate the output impedance which yielded $(-9.519 \cdot 10^{-5} + i \cdot 7.234 \cdot 10^{-3})Ohm$.

This circuit has a cost of 113.44, a maximum gain of $36.55dB$, central frequency of $1006.5Hz$. The calculated merit is therefore $3.9375 \cdot 10^{-4}$.

3 Theoretical Analysis

The lower 3dB cut-off point is at $f = 5484.4Hz$ As we can see, the lower cut-off point is accurrate, but this model does not deal well with the higher cut-off point.

Table 2: Gain as a function of frequency

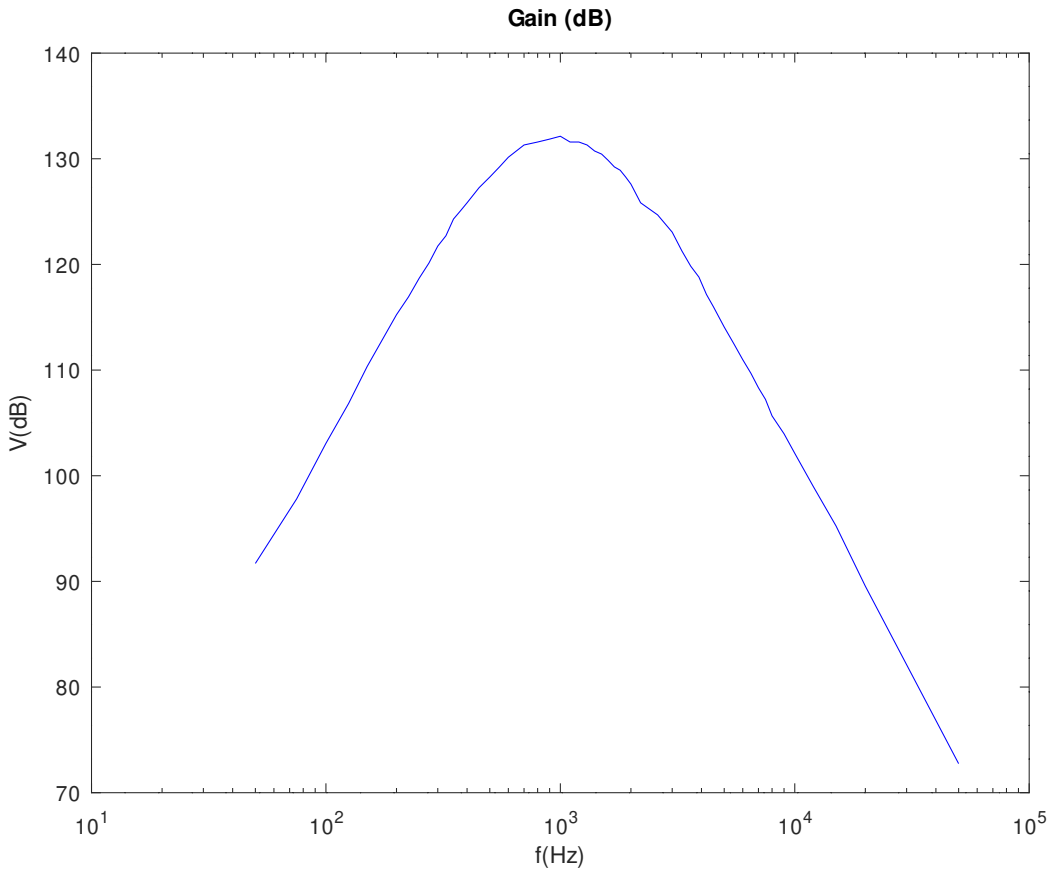
f(Hz)	$V_L(mV)$ 50.0
98 75.0	133 100.0
173 125.0	209 150.0
249 200.0	318 225.0
346 250.0	378 275.0
406 300.0	440 325.0
462 350.0	500 375.0
520 400.0	540 450.0
580 500.0	610 550.0
640 600.0	670 700.0
710 800.0	720 900.0
730 1000.0	740 1100.0
720 1200.0	720 1300.0
710 1400.0	690 1500.0
680 1600.0	660 1700.0
640 1800.0	630 1900.0
610 2000.0	590 2200.0
540 2600.0	510 3000.0
470 3300.0	430 3600.0
400 3900.0	380 4200.0
350 4500.0	330 5000.0
300 5500.0	277 6000.0
257 6500.0	241 7000.0
225 7500.0	213 8000.0
197 9000.0	181 10000.0
165 12000.0	141 15000.0
117 20000.0	88 50000.0
38 height	

4 Experimental Results

We were able to build the circuit presentially utilizing a breadboard and the various components.

Then, the frequency of the input voltage source was ajusted, from $50Hz$ to $50kHz$, at various increments and, for each value, the value of the output voltage was measured. The results are in the following table:

These results were graphed below as to compare them to the theoretical analysis and simulation done above:



5 Conclusion