Laboratory Report 4: Audio Amplifier

Circuit Theory and Electronics Fundamentals

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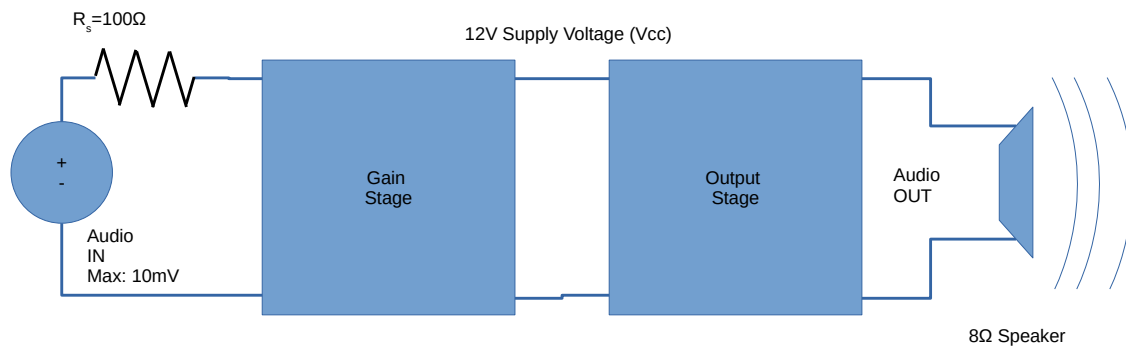
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1 Introduction

The objective of this laboratory assignment is to design an audio amplifier circuit, by choosing the architecture of the Gain and Output amplifier stages.The referred circuit is shown in the picture below.

Figure 1: Audio Amplifier Circuit

As mentioned above, it is also important to refer that we have developed an optimization algorithm (in Octave) in order to find the number of transistors, the values of the resistors and capacitor that would lead to the best value of merit, computed in Ngspice with the formula given by the Professor.

2 Theoretical Analysis

In this section we will discuss the theoretical analysis of our circuit. For this purpose, we will first explain seperately the Gain stage and the output stage circuits on the Audio Amplifier circuit. The values used throughout this analysis are shown below.

V_{ON} value is computed using *Ngspice* results for V_{out}. By definition, $V_{ON} = \frac{V_{out}}{N_{diodes}}$

Symbol	Value
R_S	100Ω
A_f	$12V$
$AudioINMax$	$10mV$
$Speaker$	8Ω

Table 1: Values for theoretical analysis
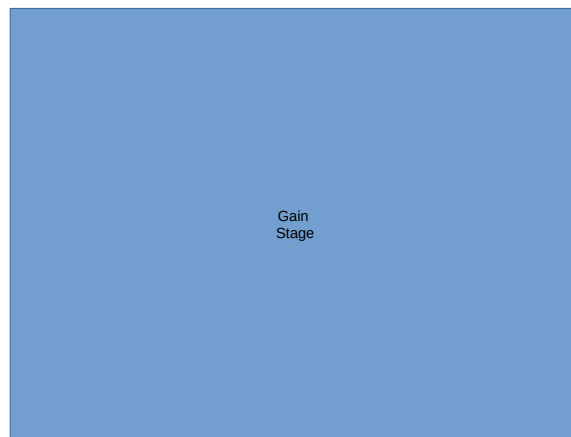
2.1 Gain Stage

Figure 2: Gain Stage Circuit.

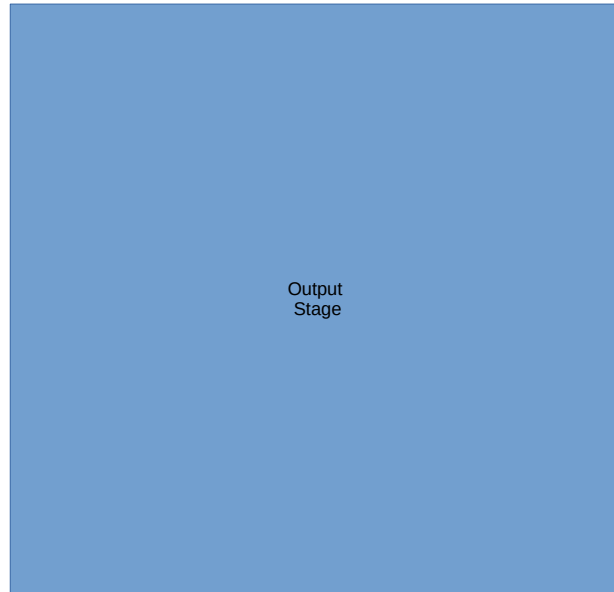As seen in figure 2...

2.2 Output Stage

Figure 3: Output Stage Circuit.

3 Simulation Analysis

In this section, we will the obtained results by simulating the referred circuit in Ngspice.

We started with the given ngspice file to simulate the audio amplifier, and further improved my doing incremental modifications, while respecting the suitable parameters.

To decide the final best values, an optimizer was used with octave, that created a new ngspice document in each iteration as to find the suitable and most optimal values.

The obtained values of interest can be found in table 2.

Element	Value
Cost	FALTA
Lower Cut Off	FALTA Hz
Upper Cut Off	FALTA Hz
Bandwidth	FALTA Hz
Voltage Gain ($\frac{V_o}{V_i}$)	FALTA
Input Impedance	FALTA
Output Impedance	FALTA

Table 2: Obtained values from Ngspice

Using the given expression for the merit it follows that:

$$Merit = FALTA \tag{1}$$

It becomes clear from changing the values the different effects the resistors and capacitors have in the bandwidth and gain.

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The coupling capacitors have the clear goal of FALTA , which is FALTA
The bypass capacitor on the other hand, is meant to FALTA, as to FALTA
The R_c resistor also affects gain, since FALTA

4 Conclusion