Electronics Lab 4: Common Emitter

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The purpose of this lab was to construct a common emitter amplifier to amplify an input signal frequency.

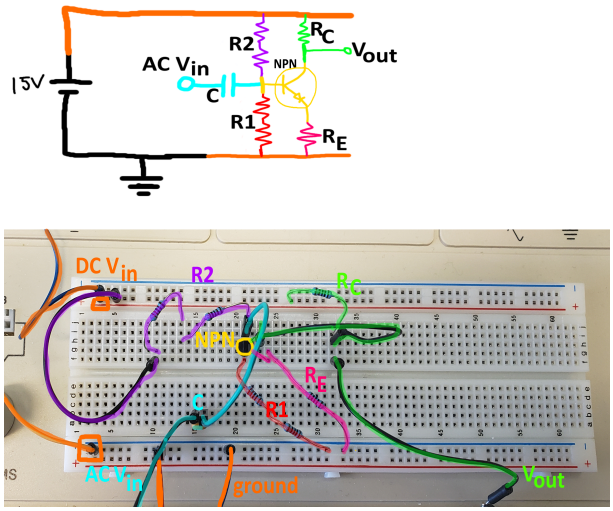

FIG. 1. The CE amplifier circuit

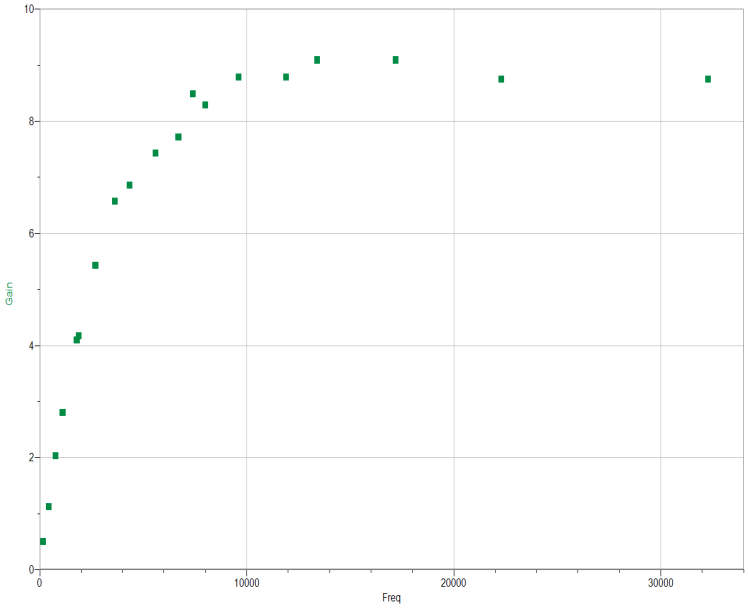

FIG. 2. Gain Plot of the common emitter amplifier

I. INTRODUCTION

In this exercise we explore the operating characteristics of bipolar transistors and design a common emitter amplifier.

II. THEORETICAL MODEL

Since we would like this circuit to amplify about 10 times the original input, we need the ratio of $-\frac{R_c}{R_e}$ to be about -10. We also would like, the potential at V_{out} to be about 9 volts without the input, to allow for the greatest range of wiggle for the amplification, to avoid unnecessary clipping. So, we want to choose our I_c such that we drop about 6 Volts over R_c, while still maintaining a ratio of 1:10, and to achieve this, we drop 90% of the voltage over R_2, so the potential of the base is at about 1.6 or so, so the potential at R_e is about a little under 1 volt, which allows us to easily set the desired I_c, which would then be given by $\frac{1}{R_e}$.

III. EXPERIMENT

We create the following circuit:

For this lab, the circuit was created with the following specifications:

1. $R_1 = 3100\ \Omega$
2. $R_2 = 470\ \Omega$
3. C $= 0.15\ \mu$f
4. $R_e = 100\ \Omega$
5. $R_c = 1000\ \Omega$

A. Data

See gain plot & table

IV. CONCLUSION

The measured upper end gain was found to be 9.091, which was not the desired 10, but this could be attributed to the fact there is unfactored resistance in the wires, as well as the ratios not being entirely perfect in terms of the original goal. Over R_2, based on the measured resistances, it dropped approximately 86.8% of the voltage, which put the initial voltage higher than the expected.

Freq	Vin	Vout	Gain
1900	1.44	6	4.167
2700	1.4	7.6	5.429
3636	1.4	9.2	6.571
4360	1.4	9.6	6.857
5600	1.4	10.4	7.429
6711	1.4	10.8	7.714
7400	1.32	11.2	8.485
8000	1.4	11.6	8.286
9615	1.32	11.6	8.788
11900	1.32	11.6	8.788
13400	1.32	12	9.091
17200	1.32	12	9.091
1120	5.28	14.8	2.803
780	5.32	10.8	2.030
440	5.36	6	1.119
180	16.8	8.4	0.500
22300	1.6	14	8.750
32300	1.6	14	8.750
1800	1.44	5.9	4.097

FIG. 3. A table of gain values vs. frequency

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