EE3302, Section 306
Laboratory Fundamentals II

Lab Topic: BJT AC Analysis
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Abstract

In this lab, the AC characteristics and small signal model of the BJT is analyzed, quantified, and measured. First, a common emitter amplifier is designed, constructed and analyzed. The frequency response is measured and its transient characteristics are recorded. Afterwards, A differential long-tailed pair amplifier was designed and constructed. The characteristics of this system were measured and compared to the theoretical values.

Introduction

The design of the common emitter amplifier was performed under the guidance of the lab manual and introduction. By using rules of thumbs and performing simulations, the circuit with the desired gain and frequency response was specified and constructed. The differential amplifier was made with a similar guise. Using the BJT equivalent model with equations listed in the manual, a differential long tailed pair amplifier was exhibited was the desired characteristics. The important characteristics of the differential amplifier includes the differential gain as well as the input and output impedances.

Procedure

The procedure consisted of constructing 2 circuits: a common emitter amplifier, a differential amplifier

1. **Common Emitter Amplifier**

   The common emitter amplifier designed and simulated in the prelab was constructed with on hand components. With the amplifier constructed, the network analyzer features of the ADALM2000 was utilized to characterize the frequency response of the amplifier. The measured frequency response allowed one to calculate the gain of the amplifier. This measured gain was compared to the theoretical expected value of the gain which was determined by the simulations and circuit analysis.

2. **Differential Amplifier**

   The differential amplifier designed and simulated in the prelab was constructed with on hand components. The transient response of the amplifier was measured by applying 2 sinusoids that were out of phase by 180 degrees to the amp inputs and by measured the voltage across the collectors. The input impedance was measured by applying a differential voltage across the inputs of the amplifier and measured the current through the inputs.

Prelab Simulations and Results

Experimental Results

Common Emitter Amplifier

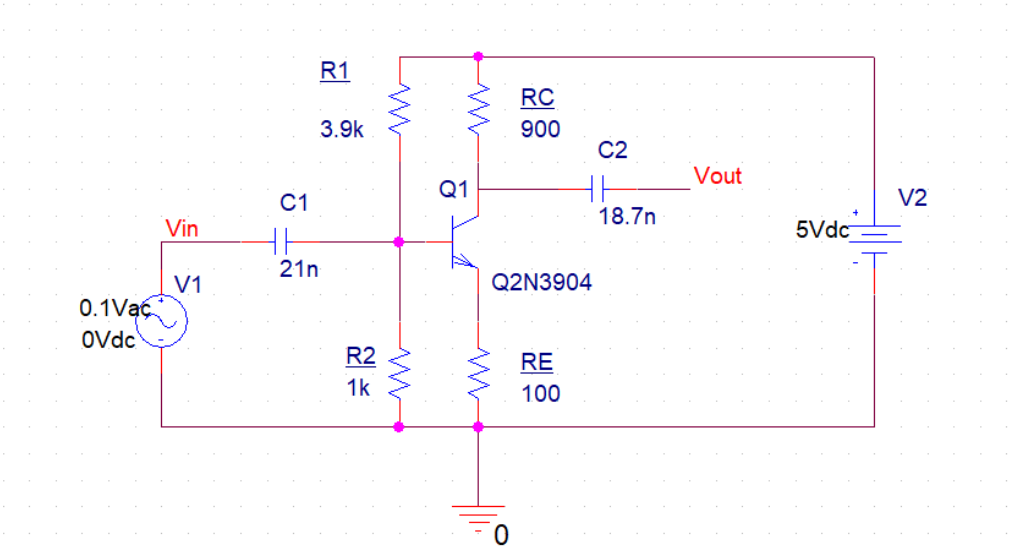

Figure 1: BJT Common Emitter Amplifier Schematic

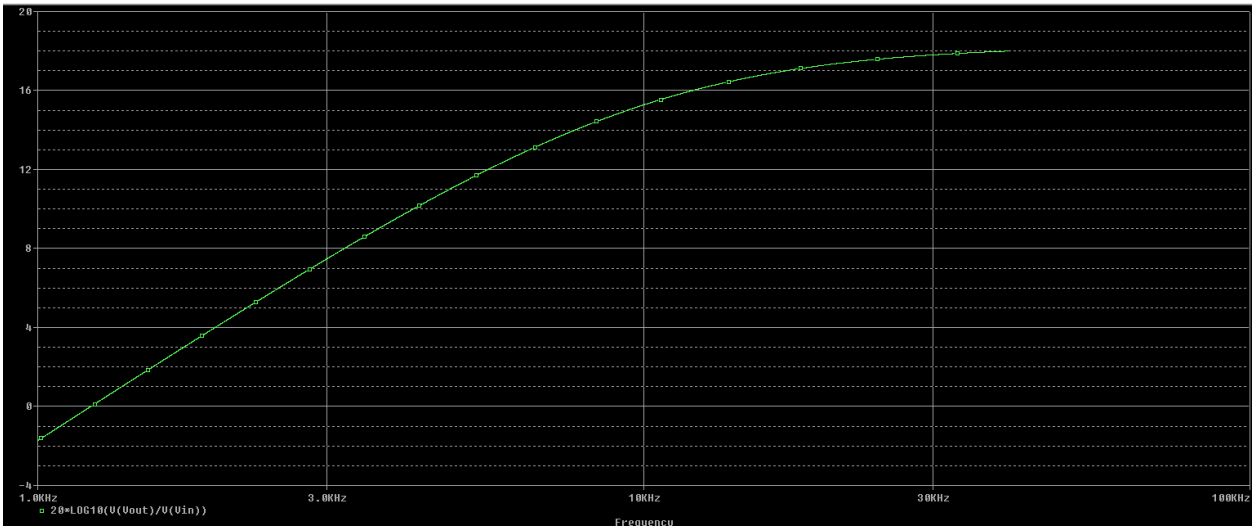

Figure 2: Simulation of BJT Common Emitter Amplifier Frequency Response

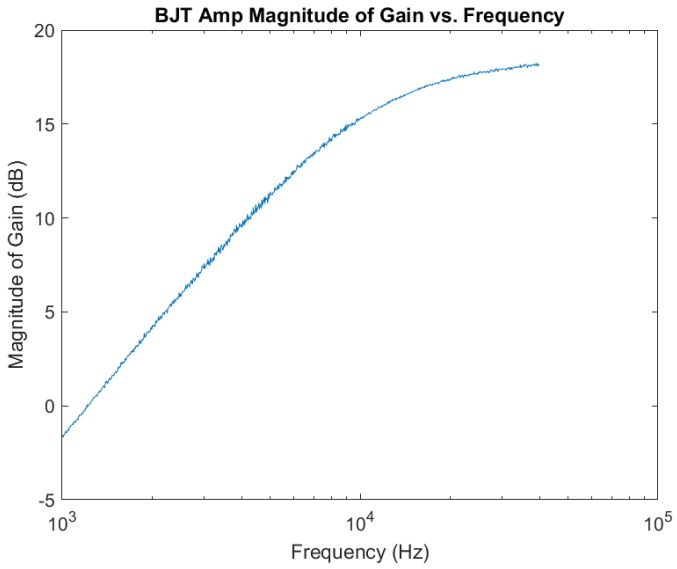

Figure 3: Measured BJT Common Emitter Amplifier Frequency Response

Does your experimental results match your simulation results in the pre-lab? If not, explain the possible causes for the discrepancy.

The simulation results match the measured values of the frequency response.

Differential Amplifier

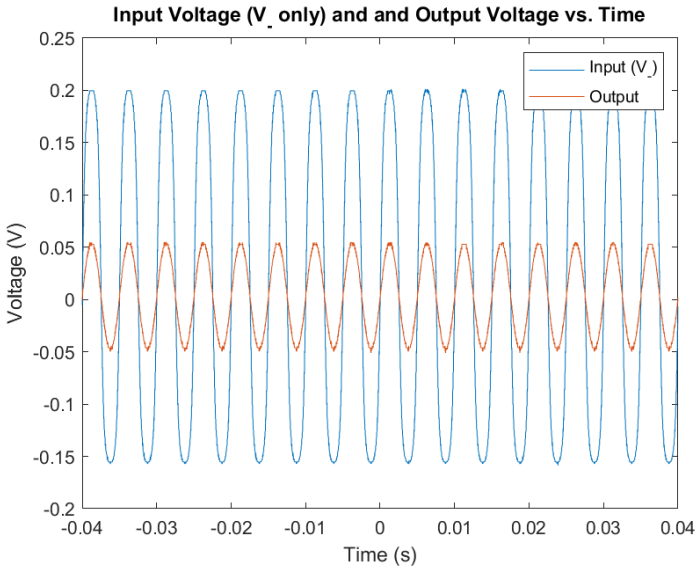

Figure 4: Transient Differential Amplifier Measurements

Does your measurement of gain and input impedance match the theoretical and simulation results? If not, provide possible reasons for the discrepancy.