**CMPE 314: Principles of Electronic Circuits**

**Dr. Yan**

**Lab 05 Report**

**Common Emitter Amplifier Circuit**

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1. **Objective**

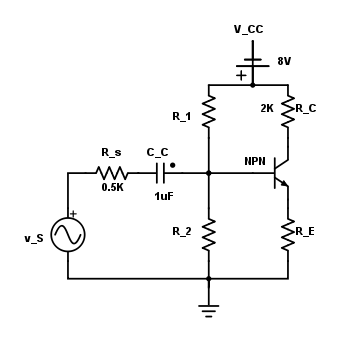
Construct and study the common-emitter amplifier circuit.

1. **Equipment**
   1. Resistors;
      1. Given: 1 × 0.5 kΩ, 1 × 2.2 kΩ
      2. Computed: 1 × 470 Ω, 2 × 4.7 kΩ, 1 × 6.8 kΩ, 1 × 15 kΩ, 1 × 22 kΩ, 1 × 47 kΩ
   2. Capacitor; 1 × 1 µF
   3. Transistor; 1 × 2N3904 NPN
   4. Breadboard, DC power supply, digital multi-meter(s), oscilloscope, function generator
2. **Background**

A common-emitter amplifier is one of three basic single-stage bipolar-junction- transistor (BJT) amplifier topologies, typically used as a voltage amplifier. In this circuit, the base terminal of the transistor serves as the input, the collector is the output, and the emitter is common to both.

1. **Procedures**

**4.1 Part A. Pre-lab Exercise**



**Figure 1: Common Emitter Amplifier with an NPN Transistor**

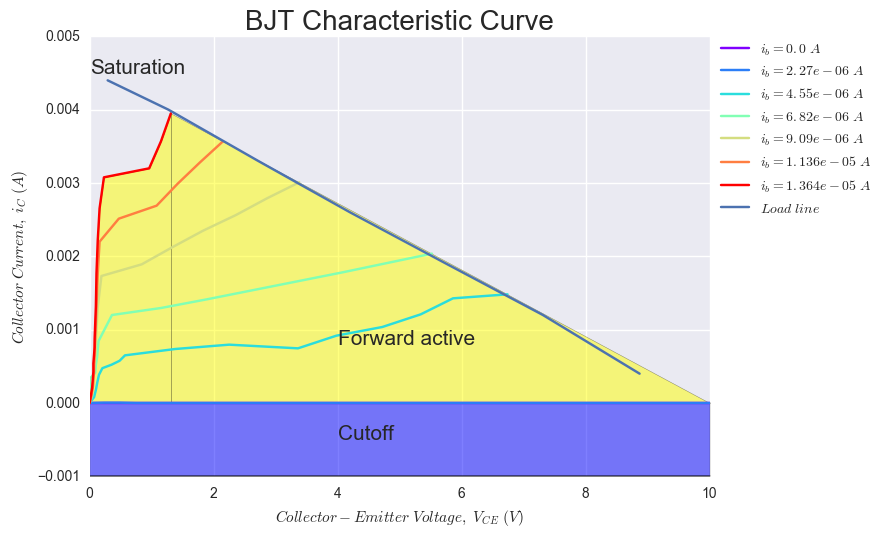
* 1. Assuming βF = 100, study the circuit from Figure 1.
  2. Determine the values of R1, R2, and RE so that the Q-point is in the middle of the forward active region VCEQ = 4 V. Calculate IBQ, ICQ, and VCEQ.
  3. Repeat step b. so that the Q-point is near the cut-off region.
  4. Repeat step b. so that the Q-point is near the saturation region.

**4.2 Part B. Lab Procedures**

1. Set VCC = 8 V. Use the values given and computed in the pre-lab for R­1, R­2, R­C and R­E such that the Q-point is in the middle of the forward active region.
2. Measure IBQ, ICQ and VCEQ and compare against the calculated values. Find the DC forward current gain.
3. Connect the sinusoidal voltage source vs with amplitude ±100 mV and at frequency 10 kHz to the circuit. Record down both the input voltage vs and output voltage vo waveforms using the oscilloscope. Comment on the phase relationship. Find the small signal voltage gain and compare to the theoretical value.
4. Increase the input sinusoidal voltage, and record down any signal distortion. Comment on whether it is due to cutoff clipping or saturation clipping. What is the maximum symmetric swing?
5. Use a potentiometer as load resistor (20 MΩ). Vary and measure the resistance, record down the output waveforms. Comment how the small signal gain is influenced by the value of the load resistance, and the output impedance of the amplifier circuit.
6. Plot the DC and AC loadlines.
7. Change R1 or R2 value (near the cutoff region). Repeat steps b. to d.
8. Change R1 or R2 value (near the saturation region). Repeat from step b. to d.
9. **Results**

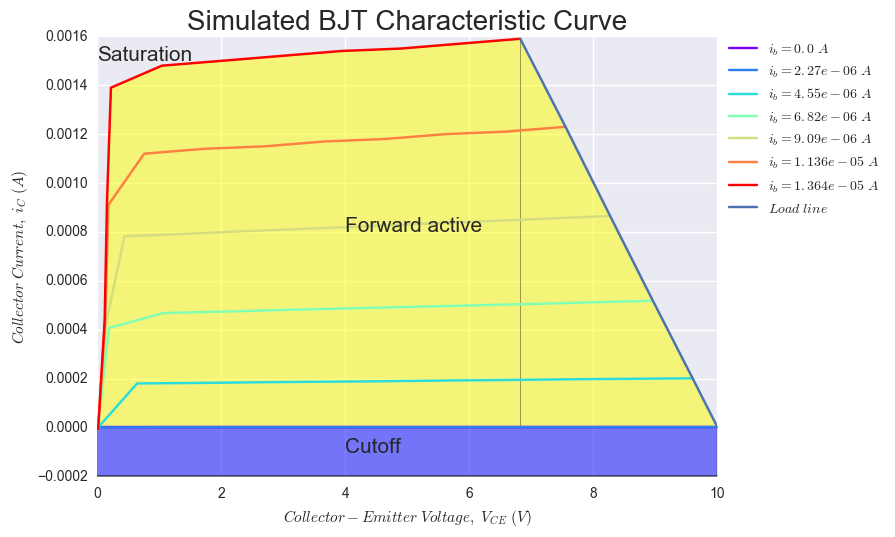
The circuit from Figure 1 was constructed and the outputs and were recorded. was computed with the relationship and through . The DC current gain was computed by taking the ratio of the average of to the average of , , which yielded as the gain.

The was plotted against , along with the cutoff, saturation and forward active regions indicated as shown below:



**Figure 2: I-V Characteristic Curves of the Transistor Used in the Circuit Constructed from Figure 1**

The transistor circuit was constructed on PSPICE, and the outputs and were dumped and plotted to create the following transistor characteristics curve plot.



**Figure 3: I-V Characteristic Curves of the Transistor Simulated on PSPICE**

1. **Conclusion**

The I-V characteristics curves plotted from the experiment have a large error from the one plotted from the simulated circuit on PSPICE. The of the curves from the measured data appear to be significantly larger than the simulated plot, and the seem to starting losing its data points after exceeds a certain threshold. The discrepancy of the plots might have been caused from inaccurate measurements of the very sensitive components used in the construction of the circuit.