

EXPERIMENT NO: 4

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Aim of the Experiment:

Analysis of BJT amplifier circuit using eSim.

Theory:

A bipolar junction transistor is a three terminal semiconductor device consisting of two p-n junctions which is able to amplify or magnify a signal. It is a current controlled device. The three terminals of the BJT are the base, the collector and the emitter. A signal of small amplitude if applied to the base is available in the amplified form at the collector of the transistor. This is the amplification provided by the BJT. Note that it does require an external source of DC power supply to carry out the amplification process. Every BJT has three parts named emitter, base and collector. J_e and J_c represent junction of emitter and junction of collector respectively. Thus in BJT amplifier of n-p-n configuration the emitter based junction is forward biased and collector base junctions is reverse biased.

Procedure:

1. Create the schematic of the BJT Amplifier as shown in Figure-1.
2. Annotate the schematic.
3. Test Electric rules.
4. Generate the netlist.
5. Insert analysis for transient analysis from 0 to 10 ms with a step time of 10 μ s.
6. Insert Source Details.
7. Add NPN.lib model in Device Modeling for BJT.
8. Convert KiCad netlist to Ngspice netlist.
9. Simulate the Ngspice netlist using Ngspice simulator.

Source Parameters:

For DC Voltage Source:

1. Enter Value for V1 - 10

Following are the input sine wave parameters:

1. Enter Offset Value- 0
2. Enter Amplitude - 10m
3. Enter Frequency- 1k
4. Enter Delay Time- 0
5. Enter Damping Factor- 0

Schematic Diagram:

The circuit schematic of BJT amplifier circuit in eSim is as shown below:

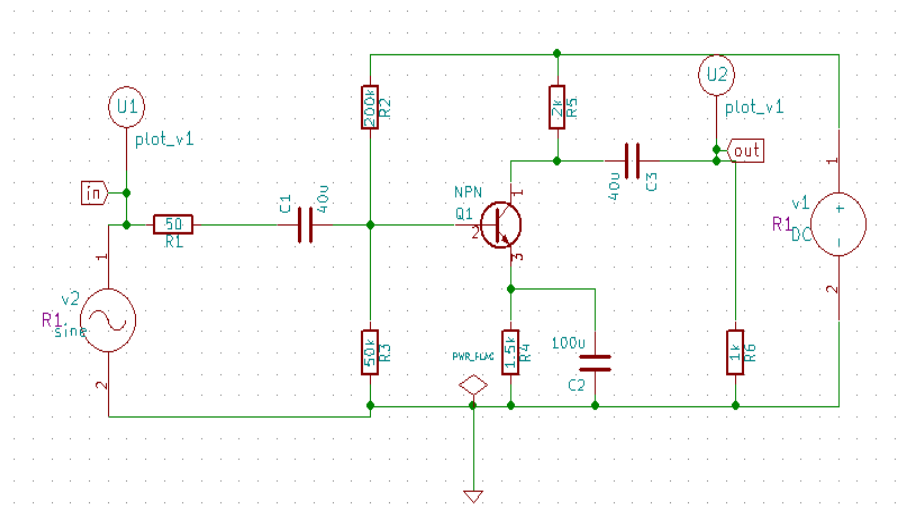


Figure 1: BJT Amplifier Circuit

Simulation Results:

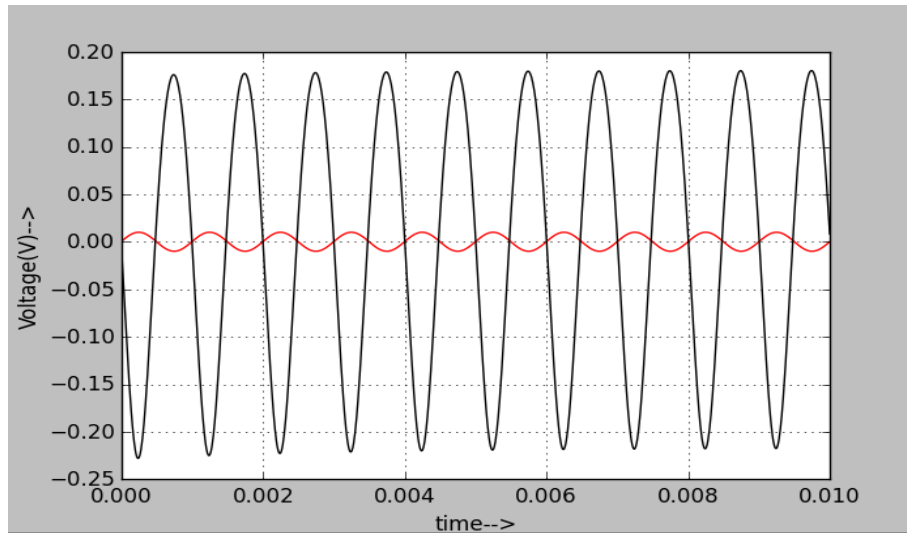


Figure 2: Python Plot

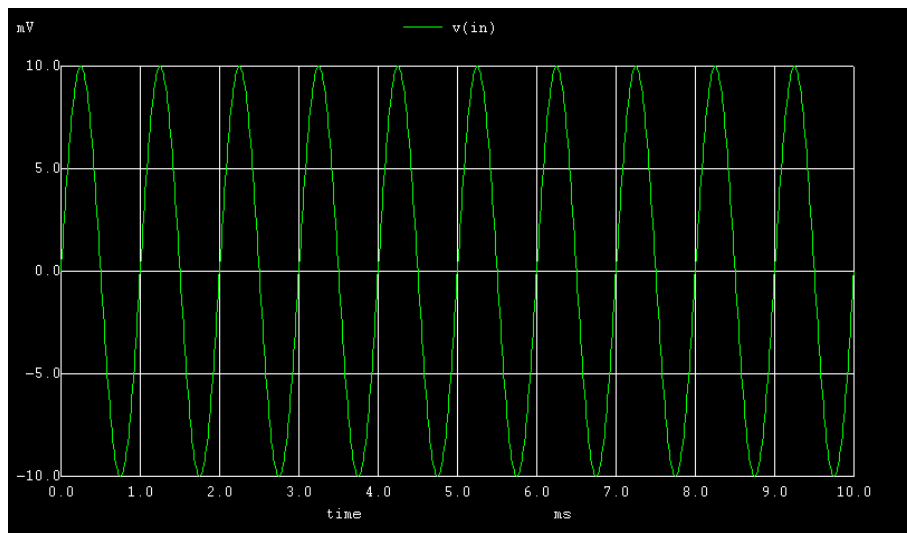


Figure 3: Ngspice Input Plot

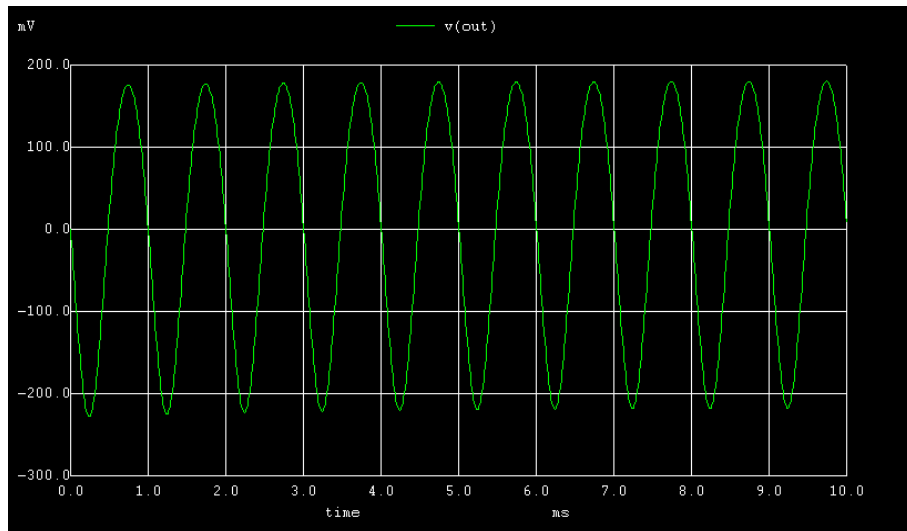


Figure 4: Ngspice Output Plot

Conclusion:

Thus, we have studied the BJT amplifier circuit using eSim and we get the appropriate waveforms.

References:

<http://www.electrical4u.com/bipolar-junction-transistor-or-bjt-n-p-n-or-p-n-p-transistor/>