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Title of the experiment

Class AB Amplifier

Theory:

The purpose of any amplifier is to produce an output which follows the characteristics of the input signal but is sufficiently large enough to supply the needs of the load connected to it.

We have seen that the power output of an amplifier is the product of the voltage and current, (P = V*I) applied to the load, while the power input is the product of the DC voltage and current taken from the power supply.

Although the amplification of a Class A amplifier, (where the output transistor conducts 100% of the time) can be high, the efficiency of the conversion from the DC power supply to an AC power output is generally poor at less than 50%. However, if we modify the Class A amplifier circuit to operate in Class B mode, (where each transistor conducts for only 50% of the time) the collector current flows in each transistor for only 180 degrees of the cycle. The advantage here is that the DC-to-AC conversion efficiency is much higher at about 75%, but this Class B configuration results in distortion of the output signal which can be unacceptable.

One way to produce an amplifier with the high efficiency output of the Class B configuration along with the low distortion of the Class A configuration is to create an amplifier circuit which is a combination of the previous two classes resulting in a new type of amplifier circuit called a Class AB Amplifier. Then the Class AB amplifier output stage combines the advantages of the Class A amplifier and the Class B amplifier while minimising the problems of low efficiency and distortion associated with them.

As we said above, the Class AB Amplifier is a combination of Classes A and B in that for small power outputs the amplifier operates as a class A amplifier but changes to a class B amplifier for larger current outputs. This action is achieved by pre-biasing the two transistors in the amplifiers output stage. Then each transistor will conduct between 180 degrees and 360 degrees of the time depending on the amount of current output and pre-biasing. Thus, the amplifier output stage operates as a Class AB amplifier.

Schematic diagram:

The circuit schematic of the Class AB Amplifier in eSim is as shown below:

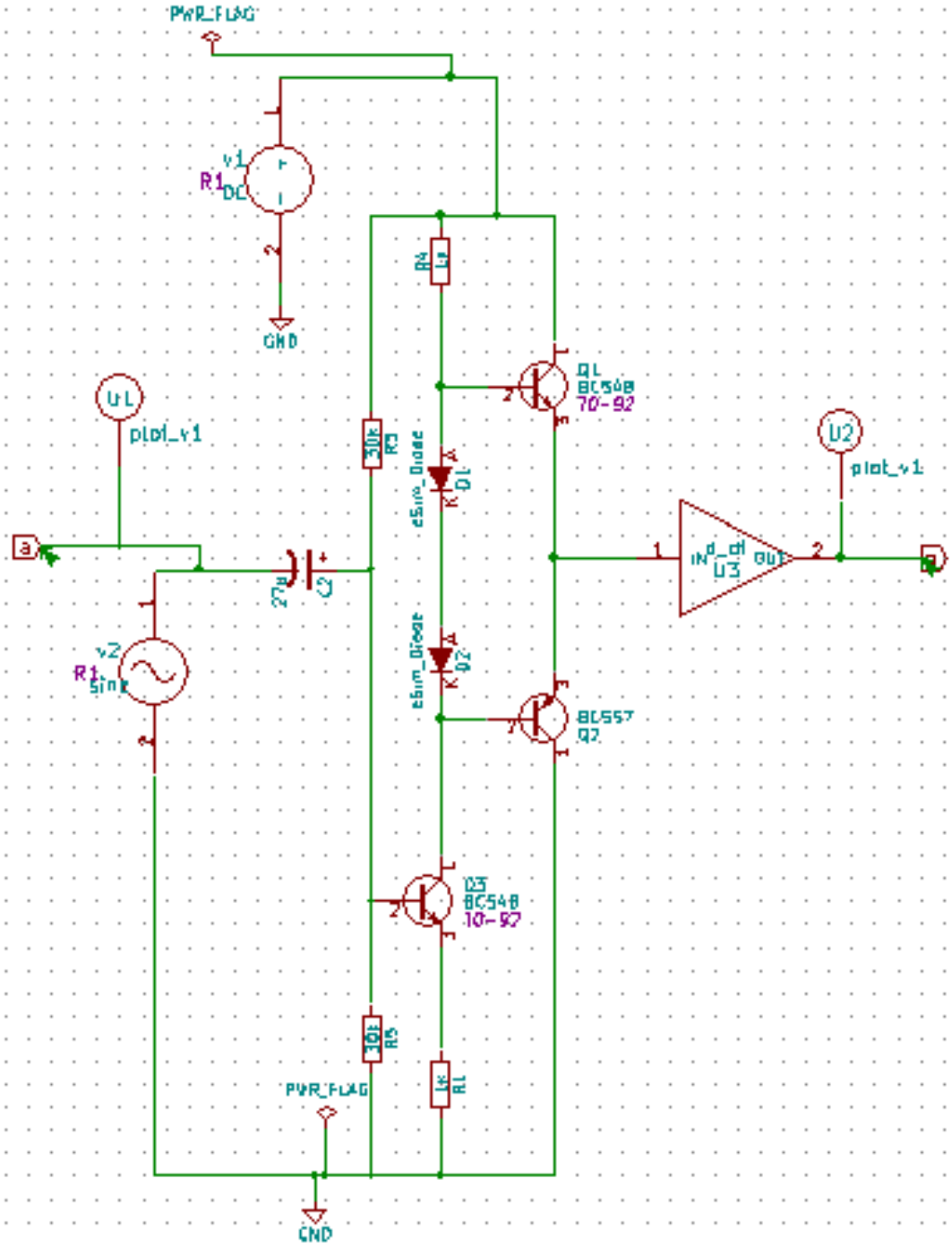

Figure 1: Class AB Amplifier

Simulation Results:

1.Ngspice Plots-

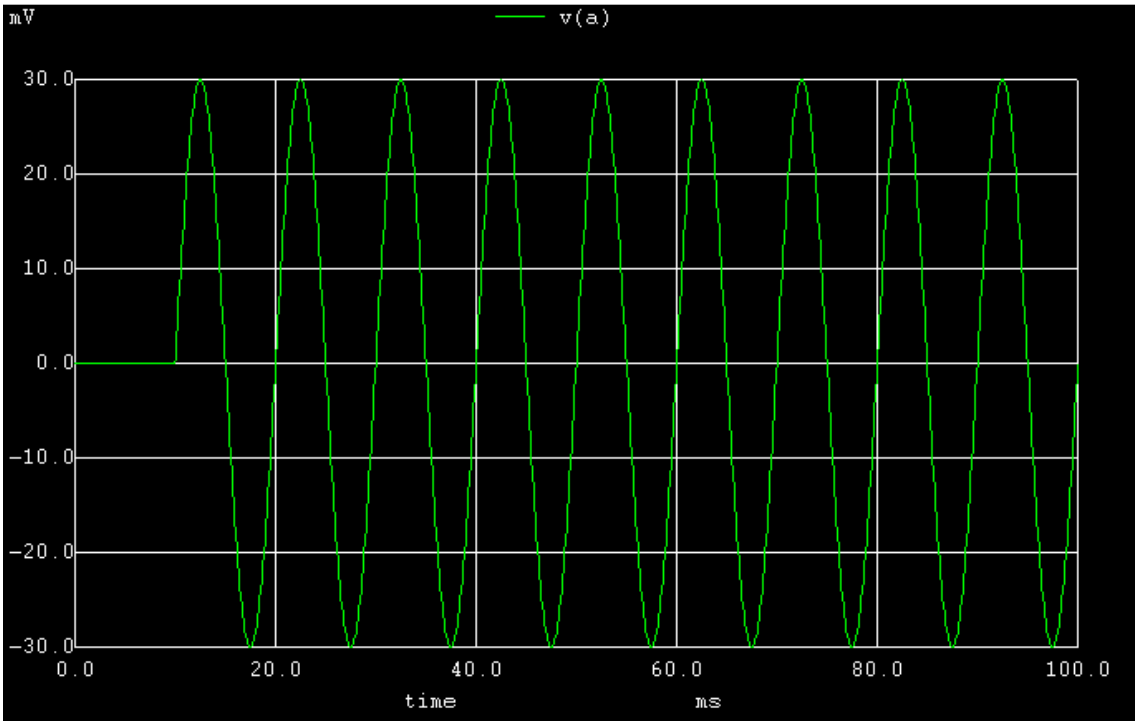

Figure 2: Ngspice Input Plot

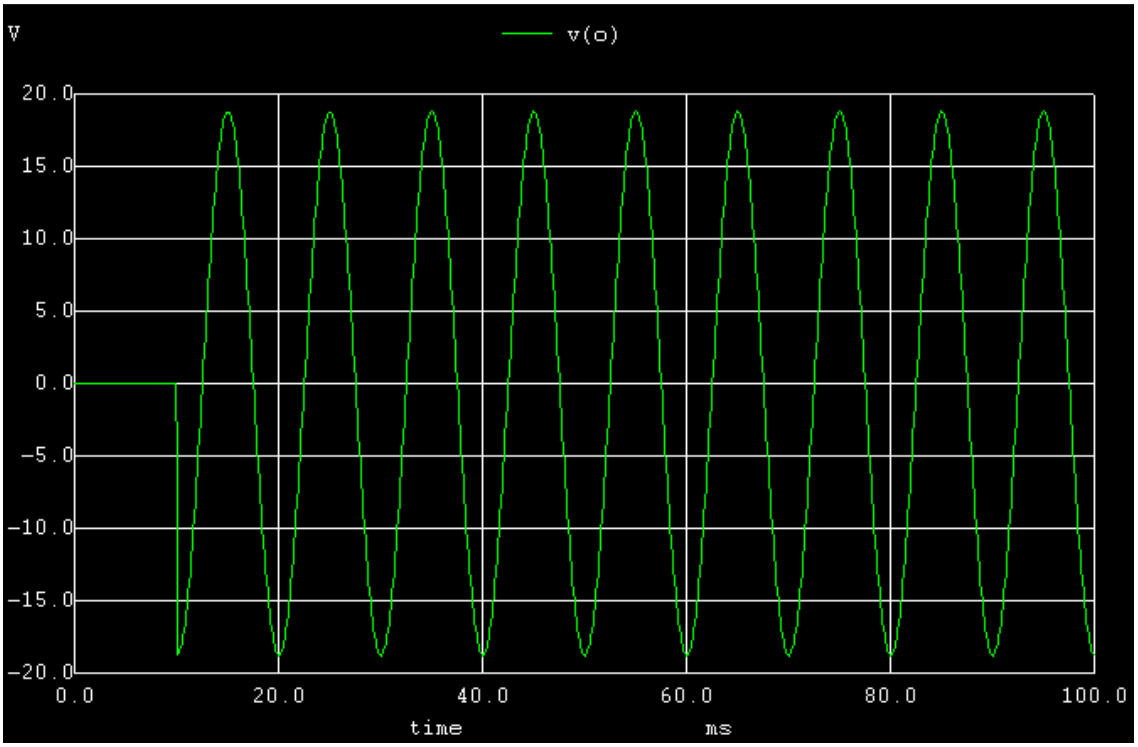

Figure 3: Ngspice Output Plot

2.Python Plots-

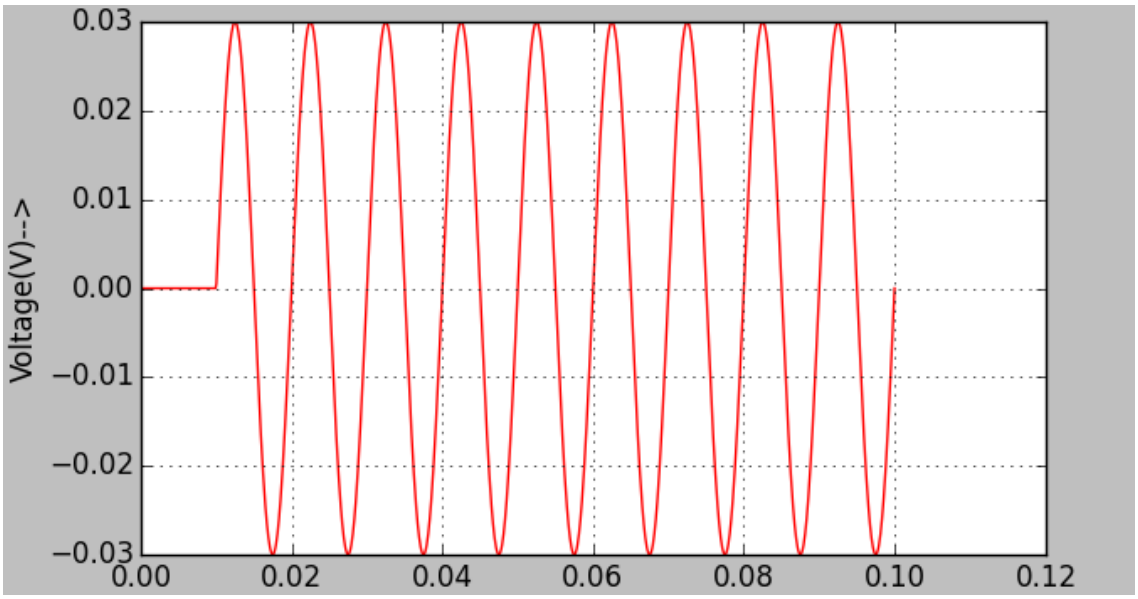

Figure 4: Python Input Plot

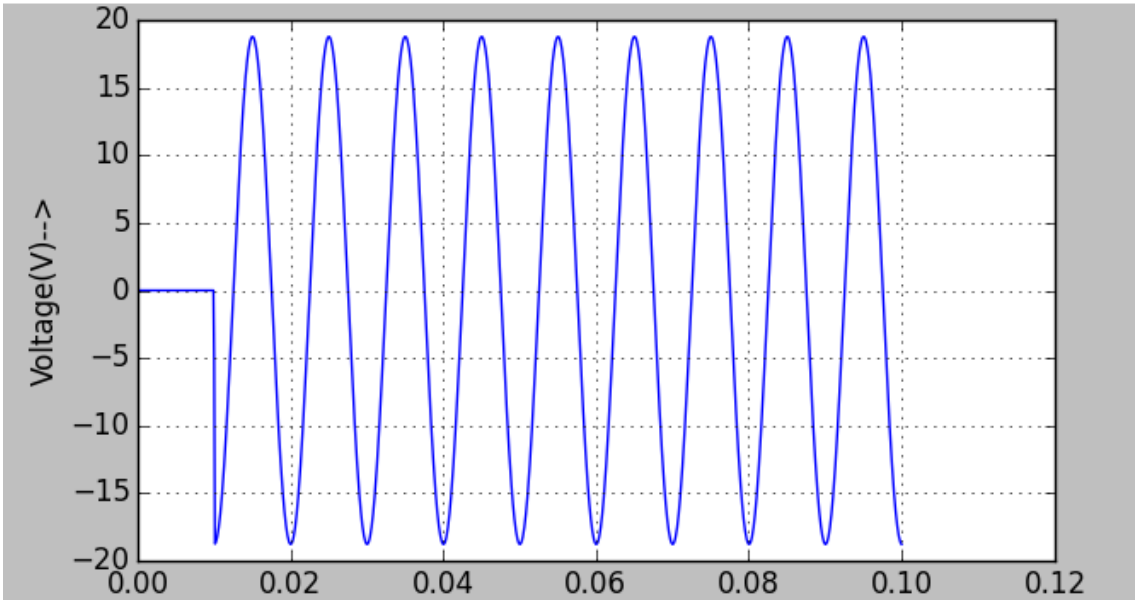

Figure 5: Python Output Plot

Conclusion:

Thus, we have studied the Class AB Amplifier and the simulation plot of ngspice and python plot obtained in eSim.

References:

1) https://www.electronics-tutorials.ws/amplifier/class-ab-amplifier.html
2) https://www.maximintegrated.com/en/glossary/definitions.mvp/term/Class%20AB/gpk/1062
3) https://www.tutorialspoint.com/amplifiers/class_ab_and_c_power_amplifiers.htm