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EEE 313 Lab 05 JFET Common Source Amplifier

In this lab we were tasked with setting up the circuit we have designed in the previous lab work. I will not repeat the calculations again in this lab I will directly show my findings of real life implementation and compare them to the expected results.

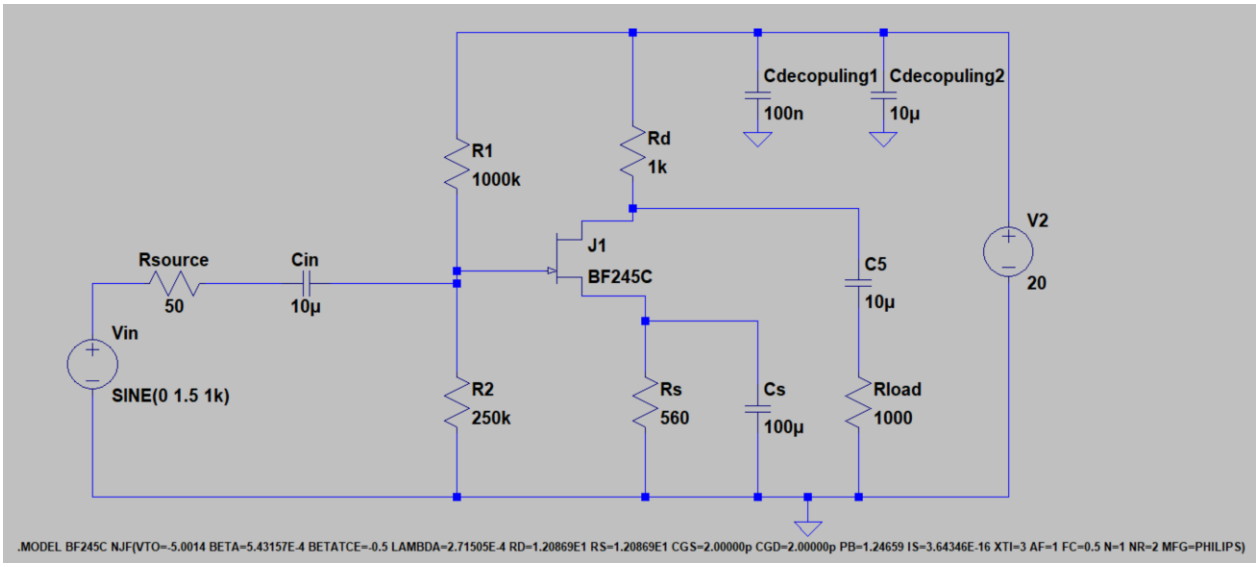

Figure 1 (This is the circuit we designed in the previous lab)

R1 = 1000 kΩ, R2 = 250 kΩ, Rs = 560 Ω, Rload = 1 kΩ

The gain (A_v) is should be -2.

Part A

I have implemented my circuit without changing any values from the LTSPICE circuit. I am using the real values of the BF245C because of that the real life results should be decently close to this simulation.

This is the circuit I have implemented on the lab:

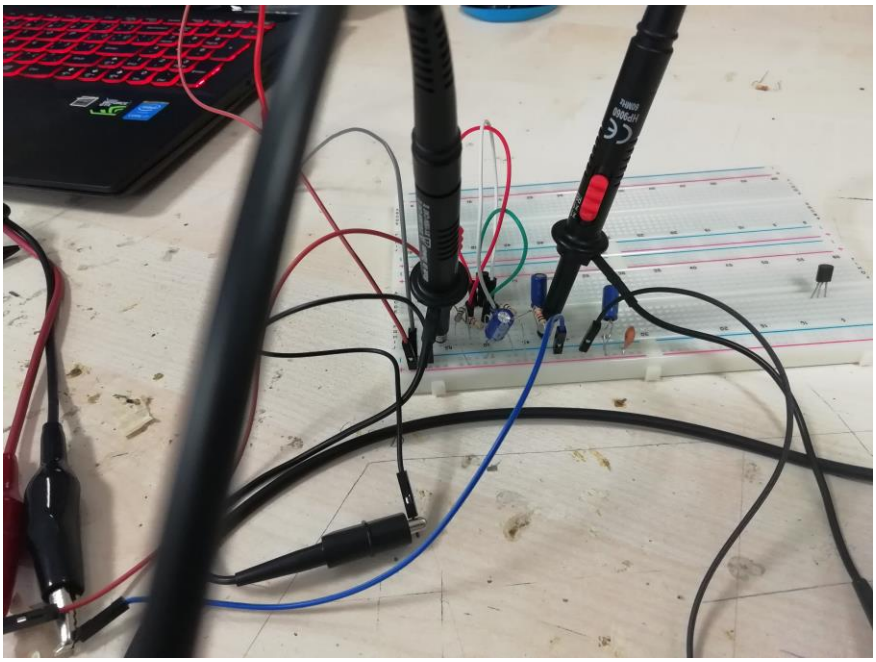

Figure 2 (The implementation of the circuit in the lab)

Note: CH1 (Yellow) is connected to the input, CH2 (Blue) is connected to the output

Part B

The resulting waveforms looked like this:

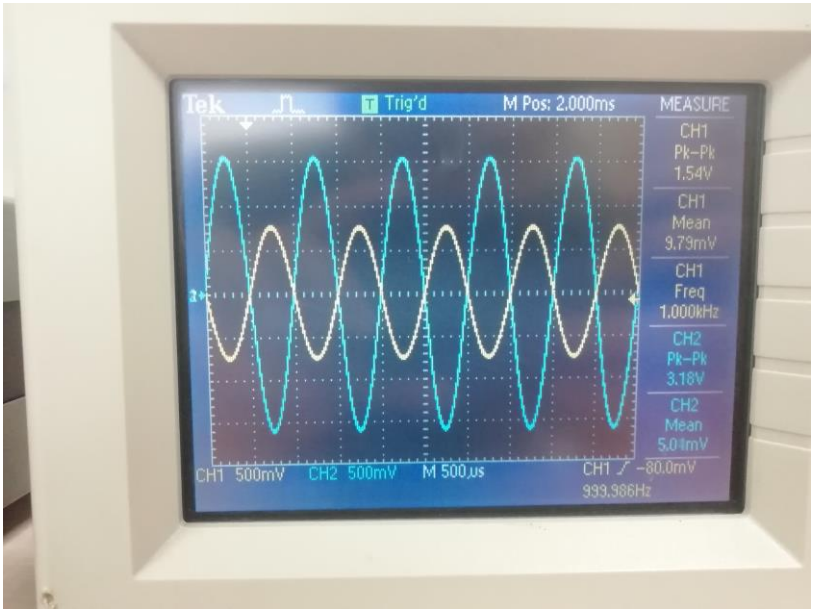

Figure 2 (Input(CH1) and Unclipped output (CH2))

The signal in this case is a small signal there is no clipping. We can see that the Vpeak-to-peak of the input is 1.54V and the output is 3.18V. This gives us $|A_v| = -2.06$. Which is very close to the simulation result.

Part C

In this part I have used the FFT utility of our oscilloscope to find the max input ac peak level for which the highest harmonic has less than 1% amplitude (40DB) compared to the fundamental (1kHz).

This is the result:

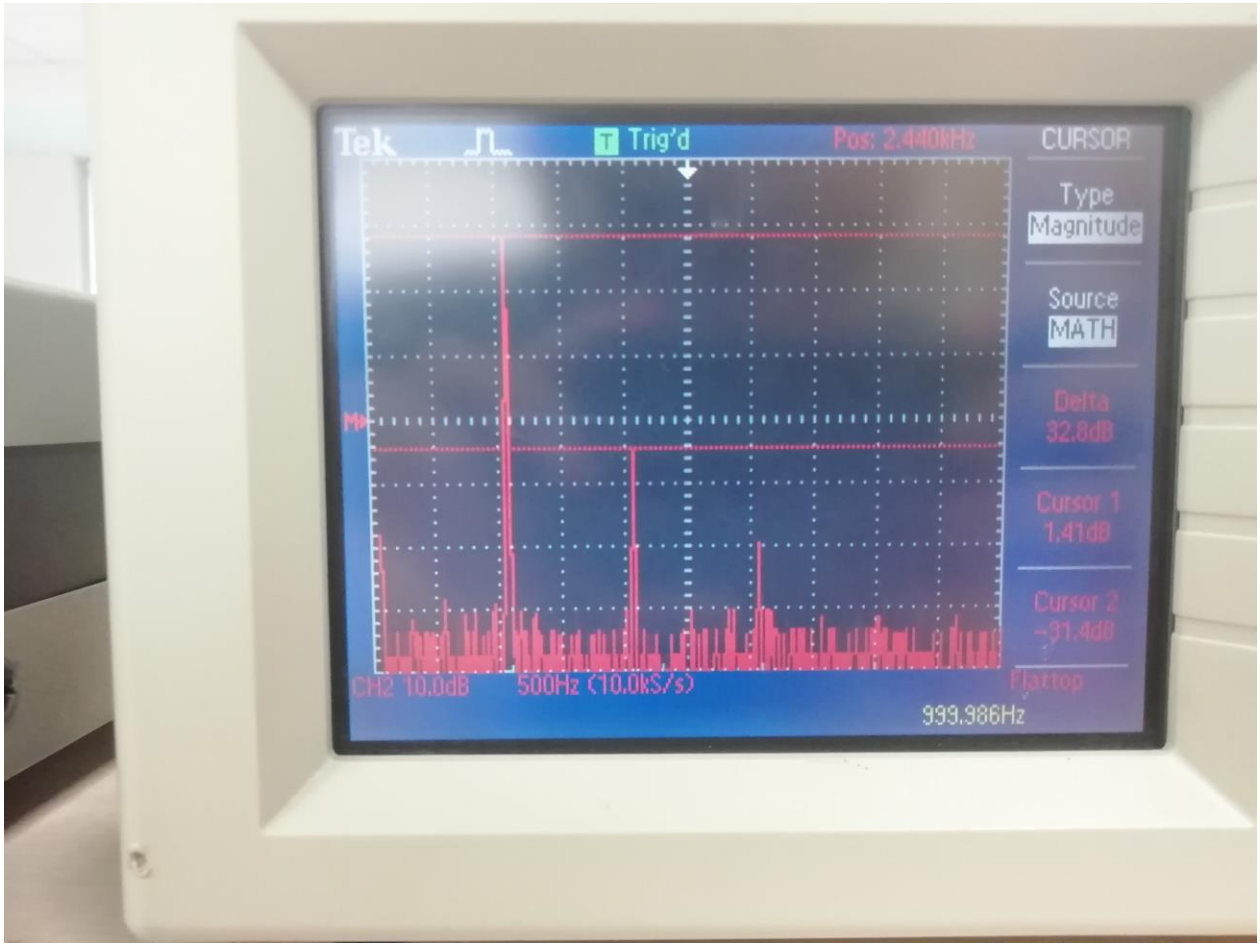

Figure 3 (Delta is 32.8 dB)

In the oscilloscope probe I have adjusted the frequency rate to 500Hz to clearly see the harmonics and I have also set up the two cursors in magnitude mode to see the dB difference. It can bee seen from the Delta value that the difference is 32.8 dB. This is fairly close to the 40 dB value we have originally wanted.

Part D

In this part I have increased the input value to see what happens when we exit from the territory of the small signal analysis.

This is the resulting waveforms:

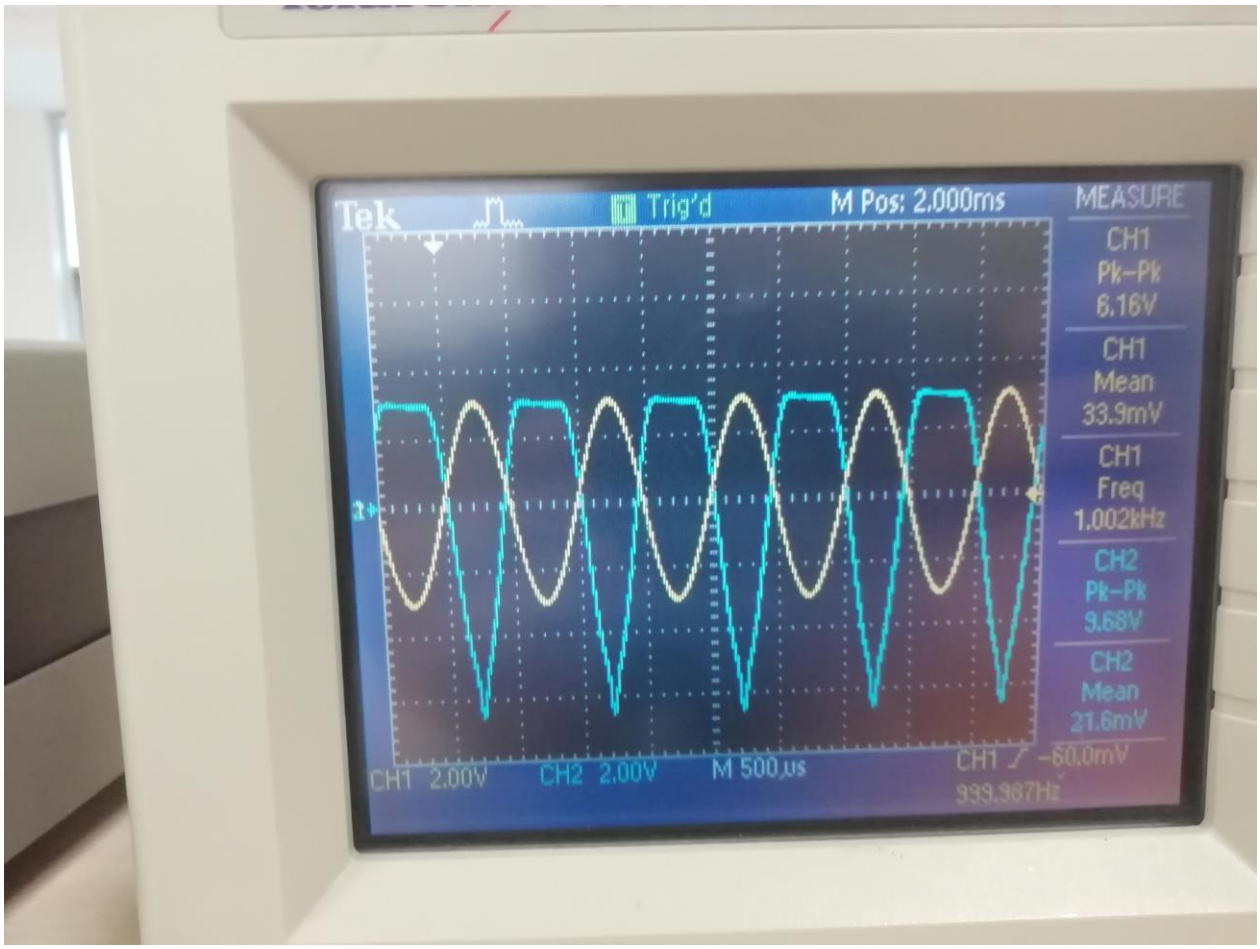

Figure 4 (Output is clipped)

This is the FFT:

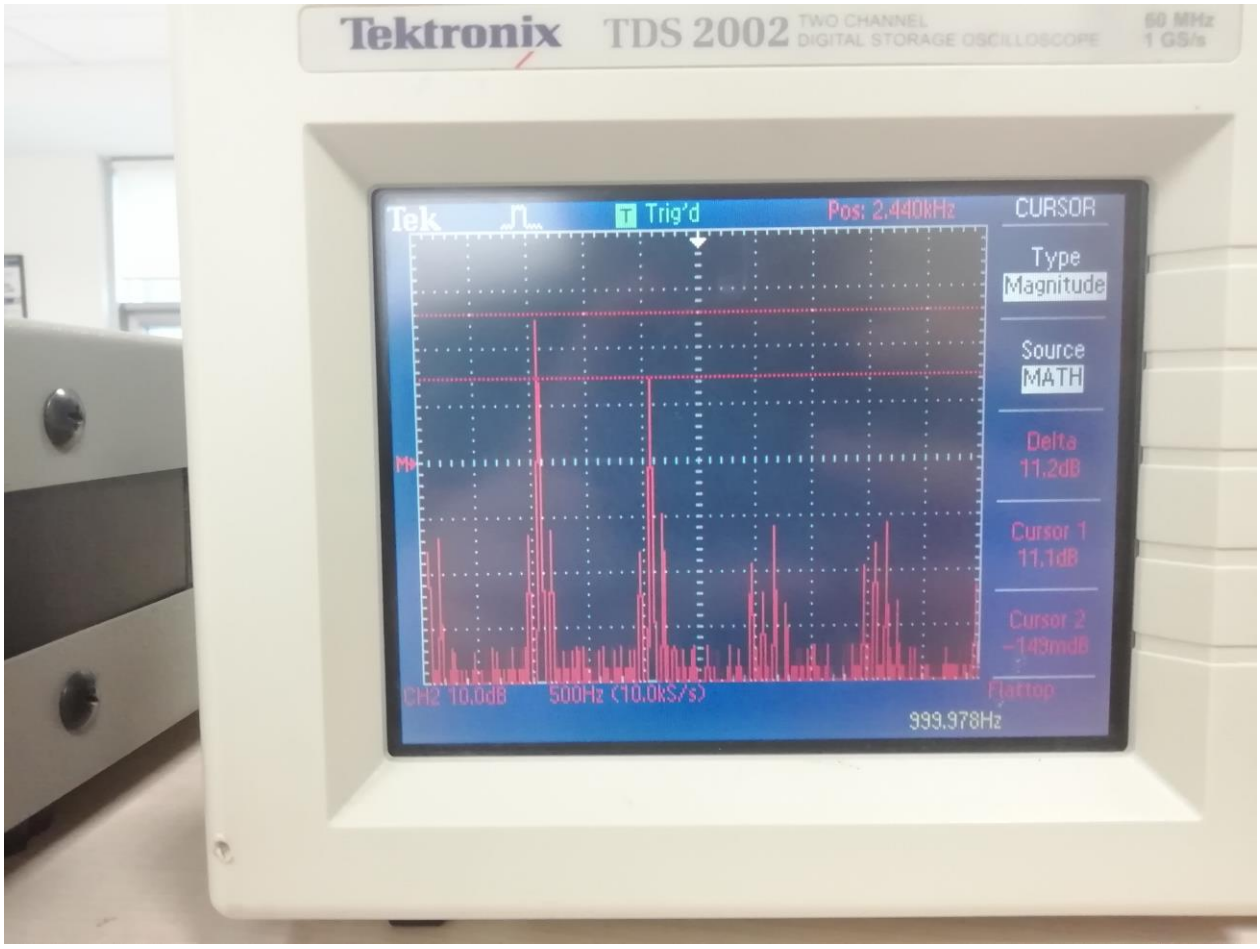

Figure 5 (FFT)

As you can see from the waveform in the Figure 4 that when the input goes to the extreme negative, the device goes into the OFF state.

In figure 5 we can see the FFT plot, we can clearly see that unlike the small signal version, in this one the unwanted harmonics have much greater impact than we would like. Second harmonic is only 10dB less from the fundamental.

Conclusion

The results and the waveforms I have gathered in this lab experiment mostly coincides with the simulation results we have found previously. Also as expected when I have increased input value to the beyond the small signal analysis range, I have observed that the results strayed considerably further from the expected values. For best results we need be in the range of the small signal analysis.