

ECE 1895 - ASSIGNMENT 5 REPORT

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1 SPICE Verification

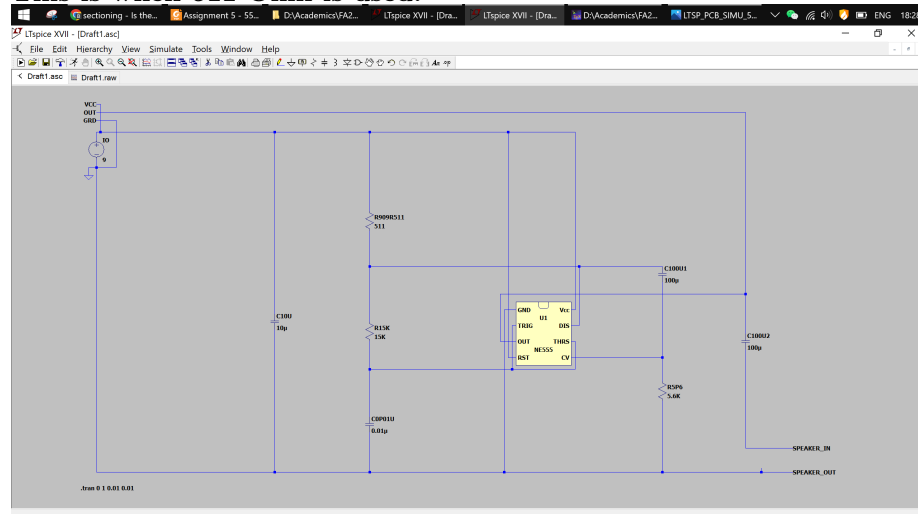
There are going to be two versions of the spice simulation: one is for the actual PCB design and one is solely for testing purpose only. The reason I would have to create a separate ones for testing and PCB design is **I was unable to find capacitors with large values (more than 1 μF) in Benedum 1223**, so I have decided to replace all capacitors with values more than 1 μF with 1 μF . If everything goes well, the only changes should be the frequency of oscillations and nothing else. I'll demonstrate this is the case in the upcoming sections.

1.1 Version 1 - SPICE for PCB Design

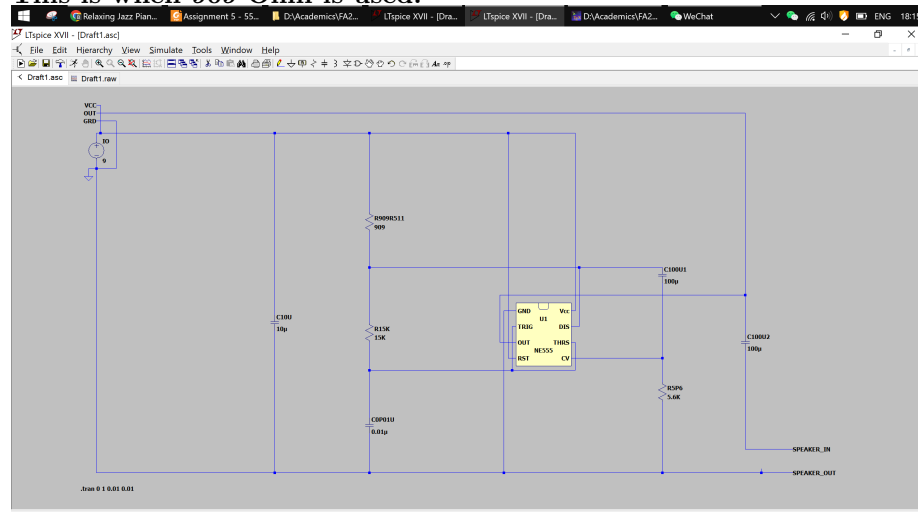
For resistor designated with $R909$ and $R501$, I would simplify the circuit by combining them into a new resistor designated with $R909R501$, and I'll change simulate the circuit two times with each resistances.

1.1.1 Schematics

This is when 511 Ohm is used:



This is when 909 Ohm is used:



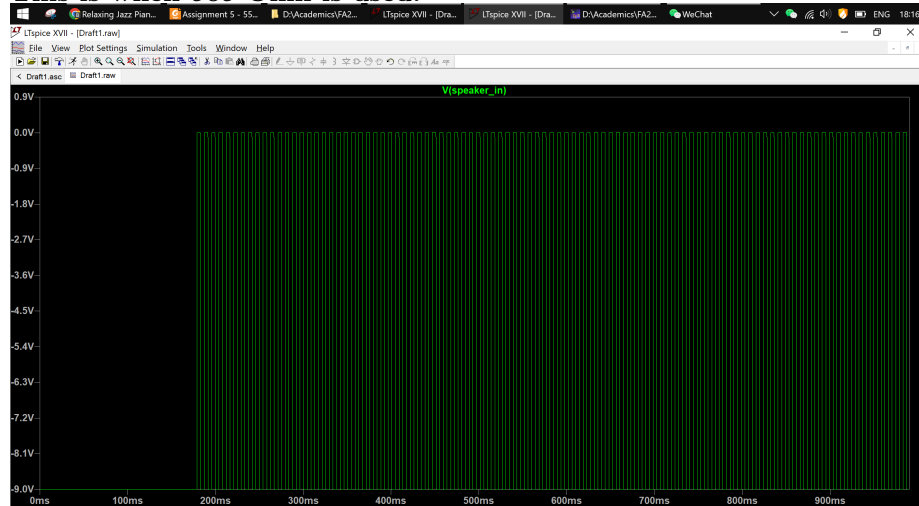
No other changes are made except for the resistor values.

1.1.2 Simulation

This is when 511 Ohm is used:



This is when 909 Ohm is used:



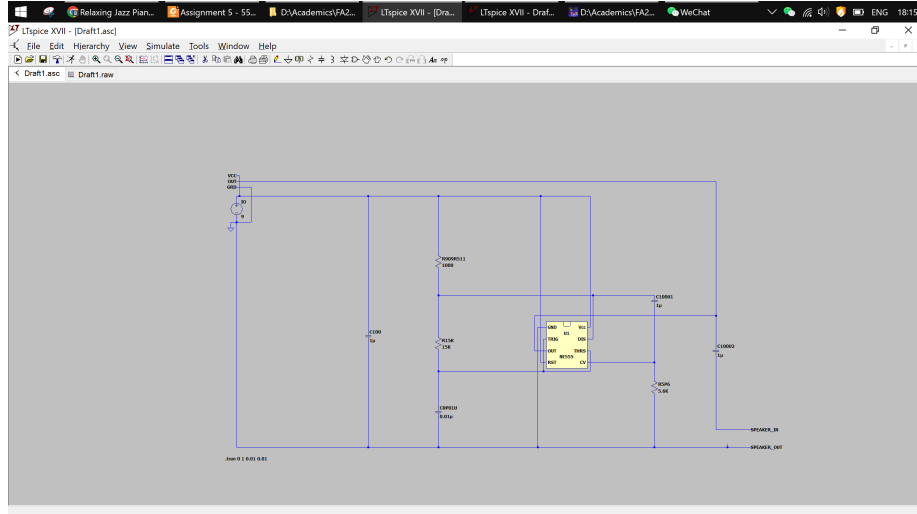
An interesting observation here is that the resistance of $R909R511$ is **directly proportional** to the frequency of generated output.

1.2 Version 2 - SPICE for Breadboard Testing

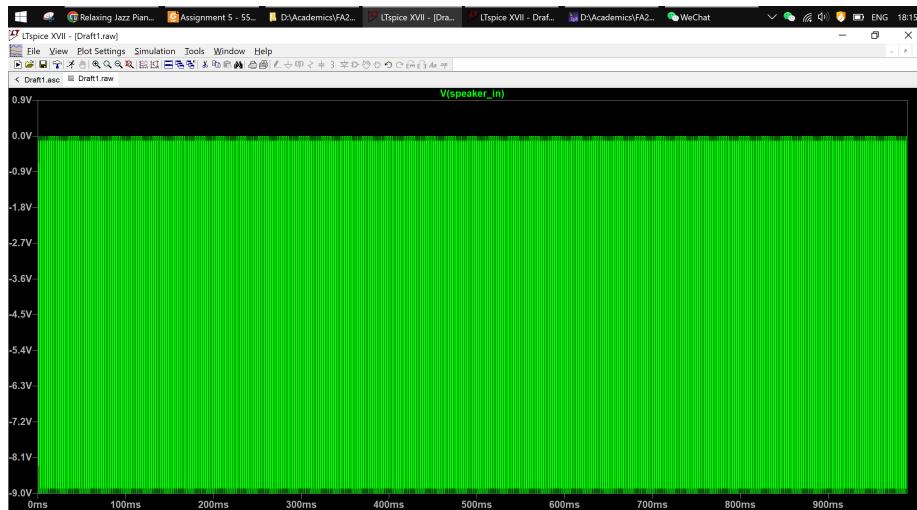
For resistor designated with $R909$ and $R501$, I would simplify the circuit by combining them into a new resistor designated with $R909R501$, and I'll generalize the model by using a 1K-Ohm resistor, since it's the one I found in Benedum 1223.

1.2.1 Schematics

Note that all capacitors with capacitance greater than $1\mu F$ are replaced with capacitors of $1\mu F$.



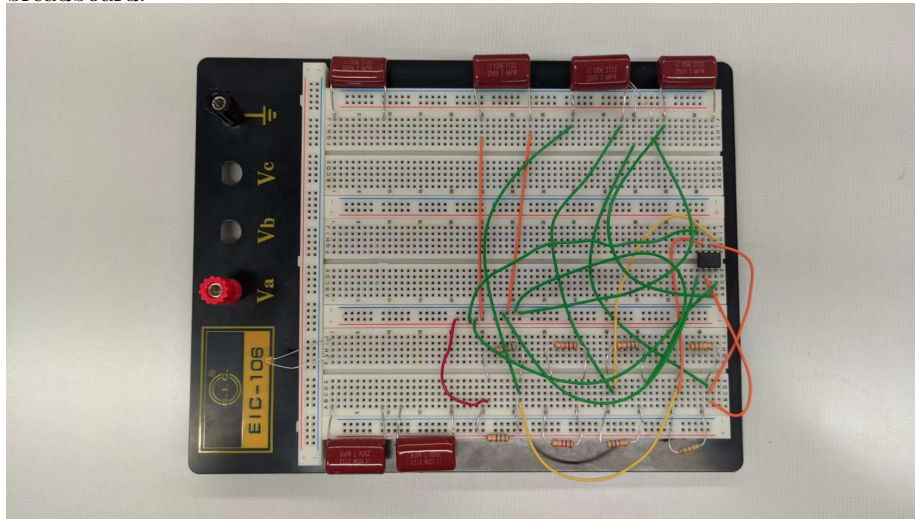
1.2.2 Simulation



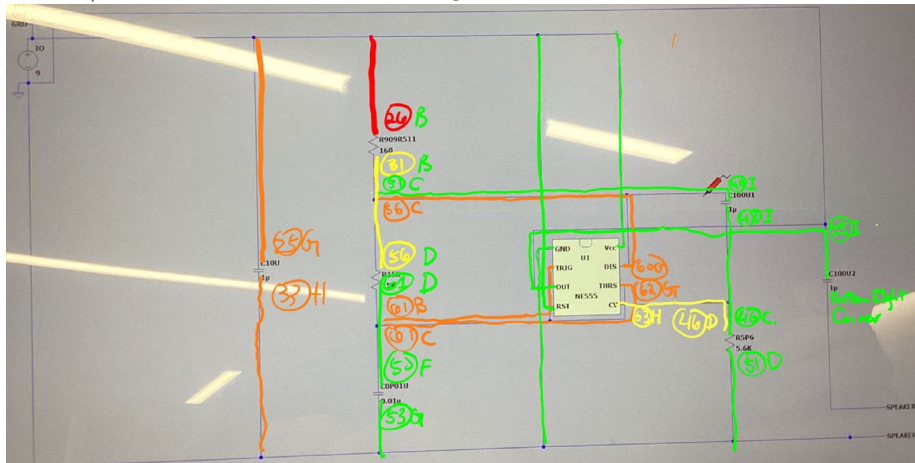
We have noticed that the frequency does increased a lot, but as long as our measured voltage oscillates, we are good to go.

2 Breadboard Verification

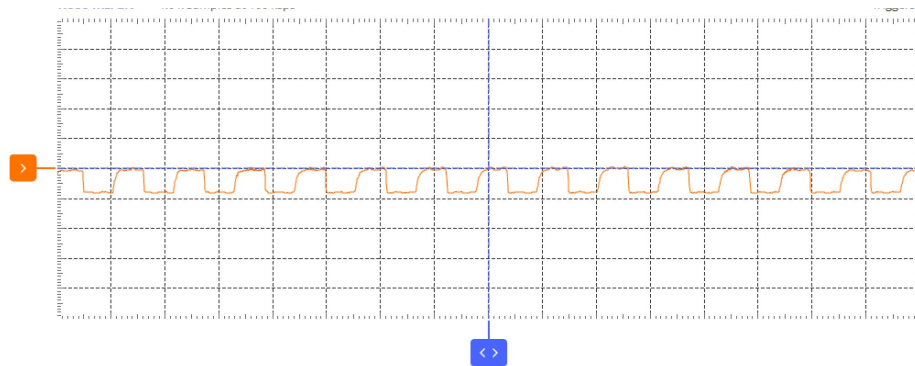
I have connected wires and attempted to make matching circuits with reference to the schematics we made from previous section. Here's what it looks like on breadboard:



I understand it looks messy, that's why I hereby provide an visual aid with column/row numbers and wire-coloring matches.



After measuring the output from my ADALM 2000, I have achieved a oscillating voltages shown below:



Looking at the waveform, we can tell that the frequency matches with our simulation 800Hz.