# Lab 4

Mixer and Microphone Preamp

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10/11/2024

ECEN 299

# Objectives

The objectives for this lab is to work on creating the microphone preamp and mixer parts for a stereo system, focusing on designing the layout for a printed circuit board (PCB). By the end of the lab, we will have the PCB layout ready to be built. In a later lab, we will put the PCB together and test how well our design works.

# Procedure

## Equipment and supplies

- Altium Designer

## Procedure

The process began by creating a new project within the BYUI workspace. We created a project named according to our lab bench number and team members. We also edited the sharing settings to restrict access to just us and the TAs, removing unnecessary users to keep the project secure.

Once the project was set up, we added a schematic sheet and a PCB layout document to the project. We then copied the integrated library from Lab 3 into this project, allowing us to reuse components from the previous lab. The library was integrated into the project and saved to the server so we could extract the stuff from the integrated library to allow for adding new components to our schematic, like a custom 10-pin header. We then verified that the project library was correctly linked to our workspace, and saved everything to the server.

Using the integrated library, we placed components such as resistors and op-amps then connected them with wire and added labels, following the circuit design for the microphone preamp and mixer. The resulting schematic can be seen below as “Figure 1, Schematic”.

The final step was simulating the preamp and mixer, making sure they functioned right by running transient analysis tests. The preamp simulation can be seen below as “Figure 2, Preamp Simulation” and the mixer simulation as “Figure 3, Mixer Simulation”. These simulations helped us verify that the amplifier stages produced the expected gains and that the mixer combined signals from multiple channels as intended. These numbers can be viewed in “Table 1 Calculated and Simulated Results for Each Amplifier Stage”. We finished by saving everything again.

*Figure 1, Schematic*

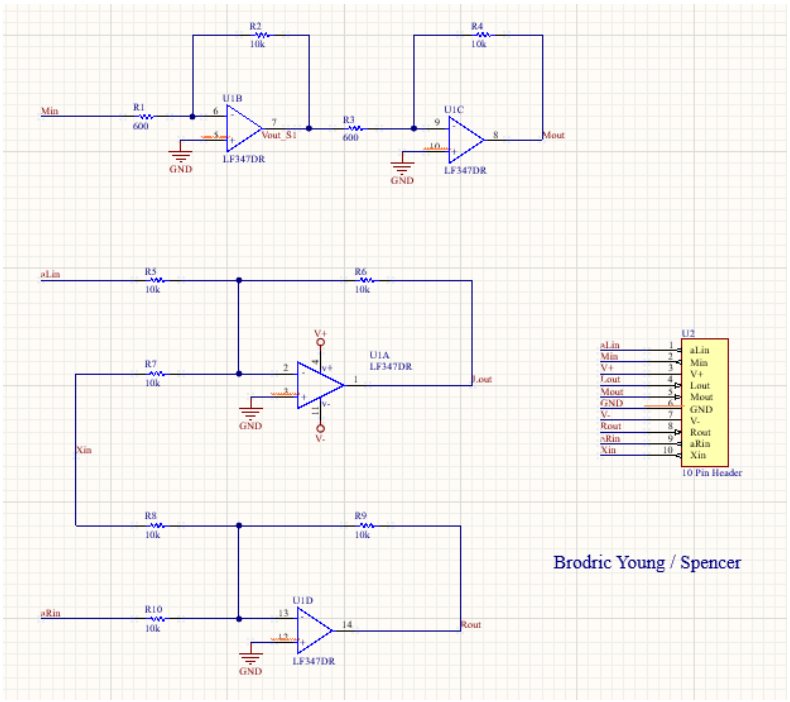


*Figure 2, Preamp Simulation*

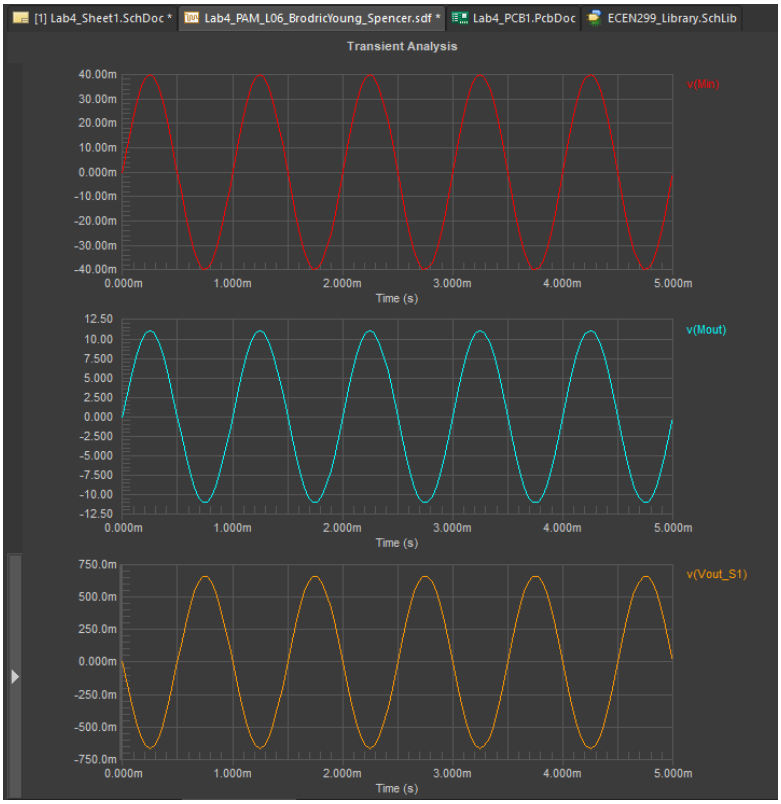

*Table 1 Calculated and Simulated Results for Each Amplifier Stage*

| Description | $V_{in}$ | $V_{out(calculate}$ | $A_{v(calculated)} = \frac{V_{out(calculated)}}{V_{in}}$ | $V_{out(simulated)}$ | $A_{v(Simulation)} = \frac{V_{out(simulated)}}{V_{in}}$ |
|---|---|---|---|---|---|
| Pre-Amp, Stage 1 | 40mV | -665mV | 16.6 | -665mV | 16.6 |
| Pre-Amp, Stage 2 | -665mV | 11.1mV | 16.7 | 11.1V | 16.7 |
| Pre-Amp, Total | -625mV | 11mV | 17.6 | 11V | 17.6 |

# Conclusion

In conclusion, the objective of this lab was to design and simulate the schematic for a microphone preamp and mixer, with a focus on creating a functional PCB layout. We achieved this by following the detailed instructions about using Altium Designer, resulting in a completed schematic that we simulated.

I encountered a couple challenges throughout the lab though. One issue was correctly integrating the library components from the previous lab, which initially caused some simulation errors. This was resolved through making sure the components we connected right. Another challenge was connecting the right files for the op-amps to simulate it. After we were showed how to do that it went pretty smoothly.

Through this lab, I gained a deeper understanding of PCB layout design and simulation, as well as how to work with Altium Designer. This experience will be go to have had in future labs, especially when assembling and testing the actual PCB in Lab 8.