Final Project Report

Report for ENGE 250
Electrical Circuit Analysis
George Fox University
Newberg, OR
04/21/2017

Caleb Hubbell

A:

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The project was created to give us students a way to apply what we had been learning in class, and testing in lab, to something that we are able to keep and be proud of. The acquired knowledge was put to the test when we were told to design, and build, many parts to create a full speaker system. These “parts” include: a voltage regulator, a voltage gain, active filters, and a peak detector. All must work together to create the final product. The purpose therefore was for us as students to become familiar with the circuit components and to gain some hands on experience. This is best done through trial and error. Values needed to be calculated in order to make the speaker work. Those required a book knowledge of how to perform the calculations. Parts needed to be soldered onto a board, that required knowledge of soldering. The circuit construction reinforced the idea of continually checking your work.

The speaker construction itself went much quicker than expected. I thought I would spend a long time building it, then I would have to debug it, and then I could fine-tune. Surprisingly, I think I was the first one in the class with a working speaker. I attribute this to my meticulousness. I paid a lot of attention as I soldered, checking each connection twice. I also plotted everything in my head before I even touched the board. I knew how big each IC was, and how I would space it on my board. Then, it was time for calculations. I was able to find the equations in my notes from class. This part was hard because the equations were really simple once you understood what it was you were trying to find. But breaking down the circuit and getting it to look like something in my notes was definitely a challenge. But, calculations were completed. Then it was time to solder! This went much quicker than expected, and I was done after a long night of work. I tested the speaker the next day, and it sounded great!

The next challenge I encountered was with the volume display. Even though my calculations were correct (I checked them with others) it did not appear how I wanted it to. So, I set out to make it better! Much guessing and checking later, I found out that my resistor for the RC constant was the issue. Furthermore, I found that the bottom resistor of the ladder needed changed. So, after finding a satisfactory combination of both (which included wiring two resistors in series for the ladder) I was done with the project part.

As I have played around with my speaker, and as I tried to fit it into its box, I have found one major design flaw. I wired the speaker so that I could pull it out of the box and work on different components. Which meant a lot of excess wire. Well, this was good in theory, but not in practice. Now, my speaker box works as a radio antenna, receiving any and all frequencies it can. Such creates a very annoying hum. I was aware that noise could be created by leaving components long, that was noted in the worksheet. Because of such, I kept my board wires very short. But, I failed to think that even the few wires that need to be run long can create a lot of noise. So, now that is something I either must deal with, or fix. To fix it I would need to take the box apart, and measure precisely how long each wire needed to be in order to run from the main board to the mounted components. Then I would re-solder. Even with the small bug, I enjoyed this project immensely and am excited to show off my finished product.

2:

Table of Voltage Measurements

	Theoretical:	Experimental:	% Difference:
	Initial = 40V	Initial = 240mv	
	Amped = 671V	Amped = 3.4V	
Left	1577.5% Gain	1316.67% Gain	18.02%
Right	1577.5% Gain	1205.36% Gain	26.75%

Table 1. Speaker voltage measurements

Table of Frequency Response

	Theoretical:	Experimental:	% Difference:
Left	1kHz	1.2kHz	18.18%
Left	80Hz	82.5Hz	3.08%
Right	1kHz	1.18kHz	16.51%
Right	80Hz	78.2Hz	2.28%

Table 2. Speaker frequency response measurements

Table of Time Constant

	Theoretical:	Experimental:	% Difference:
		Full decay = 480us	
Left	tc = .0003s	tc = .000346s	14.24%
Right	tc = .0003s	tc = .000328s	8.92%

Table 3. Speaker time constant measurements

B:

Completed Multisim Drawing

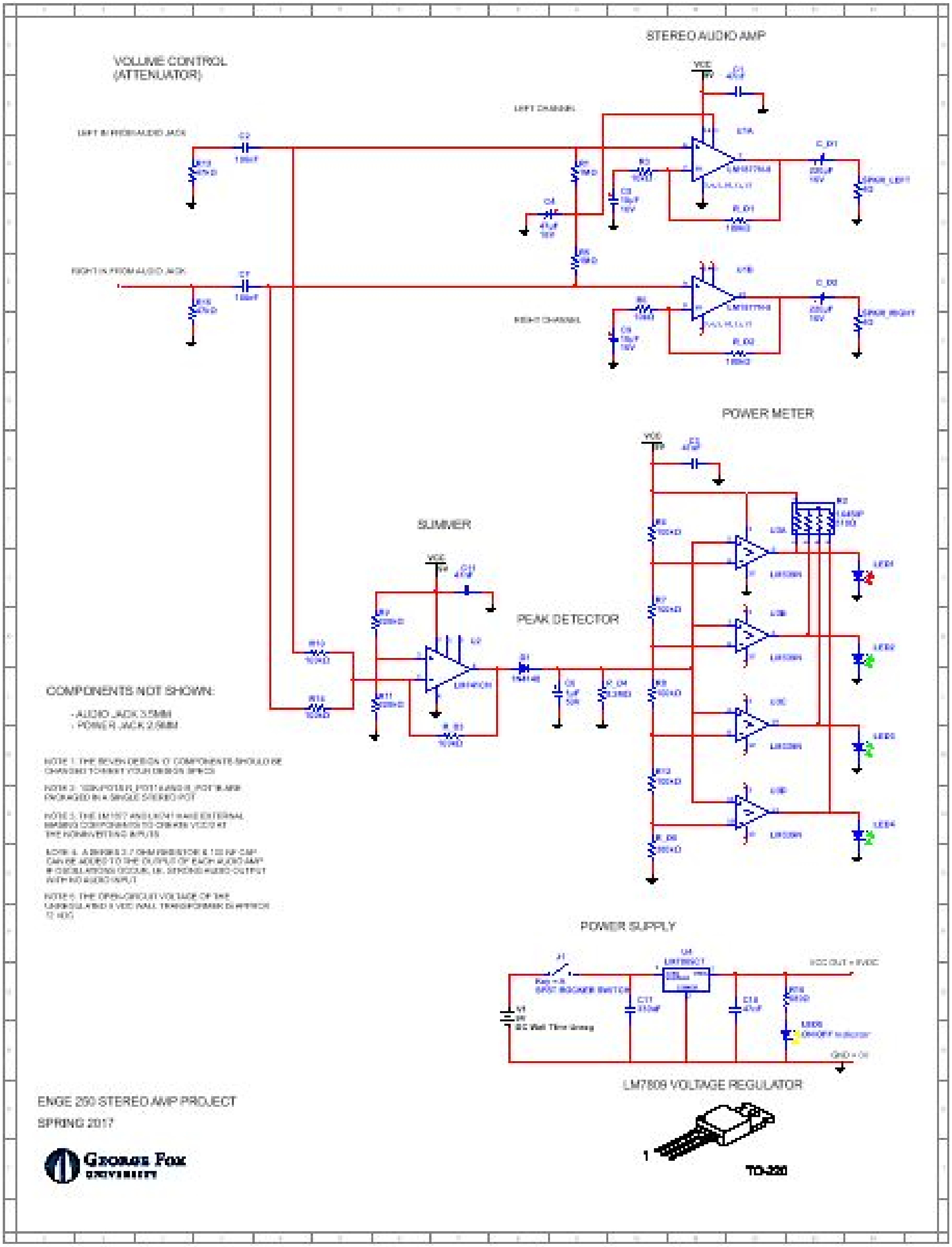

Fig. 1. Multisim Schematic

C:

A current research project by NASA is on the use of sonar in medical fields. They began the research on the International Space Station many years ago, but now the technology is being used in remote locations around the world. Basically, they take a sonar image of the body and transmit it to a location where a doctor can take a look. So, I think this will be the new way that audio electronics benefit humankind. The current issues that I can see arising are twofold: size of equipment, and transmission latency. Recently, audio components have significantly decreased in size, but they still take up lots of space. We can fit a whole motherboard in less space than a decent sized capacitor! Secondly, transmission of audio has a significant delay. This makes it difficult for the doctors who, I imagine, recieve a choppy image. So, once this technology becomes more prominent, and is recognized for its genius, I can see audio components miniaturizing and latency decreasing.

Another application I could see for sonar is actually an app my friend and I were discussing this week. He proposed the problem of figuring out the same location on a wall, on either side of the wall. Say you want to drill a hole through your wall, from indoor to outdoor, and the wall is too thick for your drill bit. So, you must drill in halfway from each side of the wall. But how do you make sure the holes will match up? I think sonar could solve this issue. Using the speakers and microphones built into cell phones, two could work in conjunction to determine each other's location. This would require lots of audio processing, to filter out junk noise, and to find precisely what direction the source comes from. But, it also uses sonar, so I found it interesting that it fit into this discussion so well.