

Date: 2/27/17

Group number: dec1712

Project title: Sound Effect Devices for Musicians

Client &/Advisor: Professors Geiger and Chen

Team Members/Role: Jake Asmus/Team Leader, Joseph Brown/Team Communicator, Daniel Peterjohn/Team Webmaster, and Jiangning Xiong/Team Key Concept Holder

o **Weekly Summary**

- This week the group worked on testing the Teensy to see if it was capable of measuring the input frequency and outputting the correct frequency doubled or halved. There were some initial troubles with our testing/measuring, we were reading some random analog values, but not necessarily correct values. We are going to look into whether or not we need a more capable microcontroller, and to see if the system could benefit from a higher clock cycle. Our weekly meeting with professor went well, he agreed that we could very well achieve the functionality that we desire with the pedal using the A/D converter of a microcontroller and then manipulating the digital signal. As a group, this past week was very busy with other classes' workloads.

o **Past week accomplishments**

- Jake Asmus: worked on a circuit that doubles the input frequency and proved its functionality in PSPICE.
- Joseph Brown: Tried to help Daniel figure out the measuring of frequency, looked into possible digital circuits for frequency manipulation. Found a theory to halve the input frequency.
- Daniel Peterjohn: With the group, attempted to measure the frequency of an audio signal with the Teensy. Discussed with group possible options for sampling audio signals on other microcontrollers if more processing more is required.

o **Pending issues**

- Joseph Brown: Retesting microcontroller, finding a new method to measure frequency.
- Daniel Peterjohn: Setting up website.

o **Individual contributions**

<u>NAME</u>	<u>Individual Contributions</u>	<u>Hours this week</u>	<u>HOURS cumulative</u>
Jake Asmus		2	13
Joseph Brown	Research on microcontroller programs for measuring the frequency	2	12
Daniel Peterjohn		1	8
Jiangning Xiong		1	8

o **Comments and extended discussion**

- Jake Asmus: I researched for a pedal that's able to take the input signal and output the signal at twice the frequency. The name of the pedal I found is called the "Green Ringer" and it's able to double the frequency with only analog components. However, the sinusoids function as you would expect besides the output sinusoid having a decrease in amplitude every other period. My suspicion are the transistors and the capacitors in the circuit but it's still an investigation. However, with the help of Professor Geiger, we have an idea what the circuits function is: a "squared-circuit". Looking at the trig identities, $\sin^2(x) = (1 - \cos^2(2x))/2$, it has a DC component and a sinusoid with half the amplitude and out of phase put 180 degrees. Building a low pass filter can suppress the DC component and because of our human ears, we cannot hear phase, but we will hear that the amplitude decreased by a factor of two. So, I believe this might be playing factor as to why the amplitudes are changing every two periods. I well analyze the circuit further but still explore more options. This coming week, I hope to have a digital circuit that doubles the frequency and see what the tradeoffs are compared to the analog circuit.

o **Plan for coming week**

- Jake Asmus: We are now going to be working with a microcontroller to manipulate the output to increase/decrease the octave, so we are not going to be using the analog circuit. I will be working with the teensy that Dan handed to me to read the input frequency accurately, manipulate the code to increase/decrease octave and output the new frequency.
- Joseph Brown: Explore further capabilities with the microcontroller, and research if we should be using a different microcontroller for what our purposes require.
- Daniel Peterjohn: Start work on the senior design website after Tuesday. Explore the microcontroller audio signal sampling we attempted last week.
- Jiangning Xiong: keep researching on the digital frequency modulation circuit, hope it works to change the frequency.

o **Summary of weekly advisor meeting**

- This week our advisor suggested that we also look into different frequency modulations for our pedal. He suggested that we could also add another frequency at a portion of the octave value to create various chords or other note structures. As a group, we will possibly pursue this goal, once we successfully transpose the input signal up/down an octave with relative accuracy. He discussed how we might need to be careful about the frequency the microcontroller will output, since a few Hertz could mean a dissonance in the sound. He encouraged us to reach out to musically included people/societies for feedback on pedal design and functionality.