GPGN 404: Digital Signal Analysis Final Project
Can you hear the shape of a room?

Stuart Farris, Garrett Sickles, Meghan West

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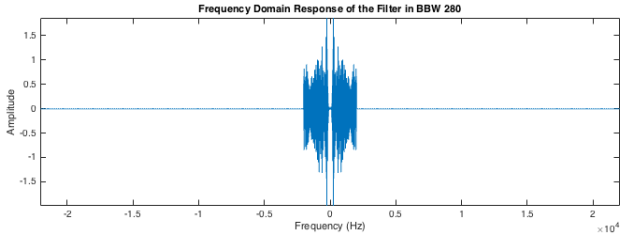
Questions

1. **Find out what the shape of the *Brown Building West 280* (subject to change) sounds like. Plot it. Describe your approach.**

   To find the shape of BBW 280, we decided to find the filter that a student in the middle of the classroom experiences listening to a teacher speaking at the front of the classroom. First, we played a frequency sweep ranging from 20 Hz to 2000 Hz from a speaker located at the front of the classroom and recorded the response of this frequency sweep played in the middle of the room. Next, we resampled the played and recorded data to the same sampling frequency and we transformed both to the frequency domain. Finally we deconvolved the played signal from recorded signal by performing a frequency domain division of the played frequency response from the recorded frequency response. This quotient provided us with the frequency domain response of the room's filter.



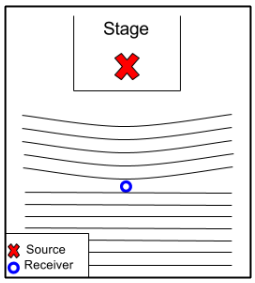
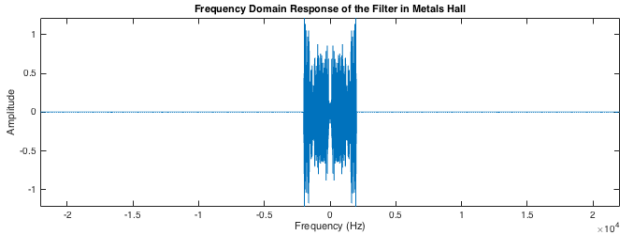


Figure 1: Layout for data acquisition in Brown Building West 280

2. **Find out what the shape of the Metals Hall (subject to change) sounds like. Plot it.**

   We used the same process for data acquisition in GC Metals that we used in BBW 280.



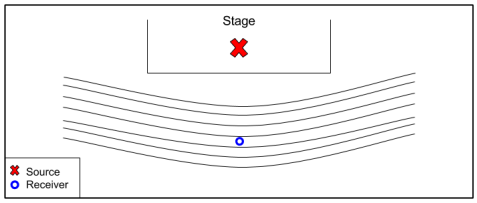


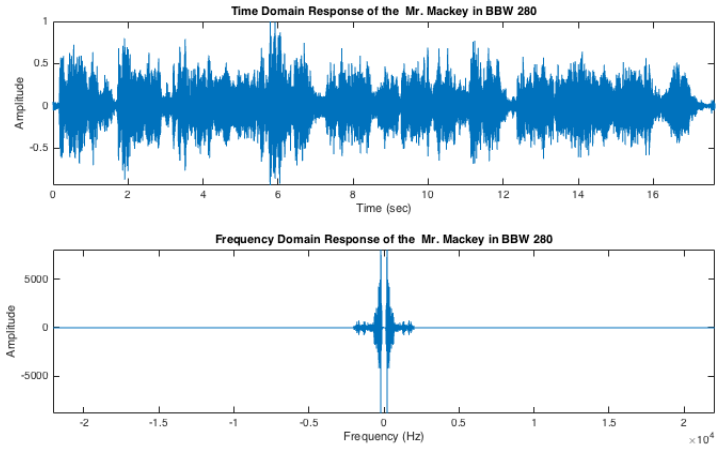
Figure 2: Layout for Data Acquisition in Metals Hall

3. **Which of the two is a better venue for giving a lecture and why?**

   The lecture hall in Brown Building is a better venue for giving a lecture. We can confirm this result by comparing the frequency response of the filters in both rooms with the typical frequency response of human speech. The higher amplitudes in the filter of BBW280 lower than 200 Hz are more suitable for a lecture.

4. **How would Mr. Mackey sound like in Brown Building West 280 (assume that you are not allowed to play and record these sounds in the room)? Use the .wav file given. Describe your methodology. Plot it.**

   Mr. Mackey would sound like the convolution of the filter response of BBW 280 convolved with the supplied audio file containing his voice. That convolution is plotted in the time domain and frequency domain in the plot below. We performed this operation by transforming Mr. Mackey's voice to the frequency domain, multiplying it with the frequency filter response, and then transforming it back to the time domain.



Division of Labor

Team Member	Responsibility
Stuart Farris	Data Acquisition, Methodology, Programming, Final Report Assistance
Garrett Sickles	Data Acquisition, Programming, Processing, Final Report Asistance, Graphics
Meghan West	Data Acquisition, Decision Making, Methodology, Final report assembly and dictation