Lab 3 Final Report

What happened:

This lab involved undistorting audio files by removing the frequency tuning error. This was done using MatLab to read in a distorted audio file, break the audio down into smaller pieces, estimate the frequency error in each piece, adjust the frequency based on the estimated frequency error, and then recombine the pieces to form the undistorted file. This process involved some trial and error to narrow down the frequency error and undistort accordingly. The script successfully estimates the frequency to be within 1 Hz of the actual frequency for the averages of all of the individual pieces. This was true for the manually distorted files with a known frequency and then for the unknown frequency error of the sample recordings.

Who worked on what:

Undistort for a known frequency: Pengyang Xiang

Undistort for a unknown frequency: Pengyang Xiang

Test Plan: Junyan Yang

Test Log: Pengyang Xiang

Final tests and recording results: Everyone

Documentation: Everyone

Final Report: Everyone

Test Log:

1. Firstly, we tried to load the audio files directly into Matlab. We used the ‘audioread’ command to load the ‘.wav’ files. However, the Matlab displayed an error message. Then we tried to use ‘wavchunksizefix’ function to correct the audio format, this time we successfully loaded the audio files.
2. The first task of lab3 is to design a Matlab module to estimate the frequency of a distorted signal. We tried to follow the ‘simple\_freq\_estimator.m’ sample code to design a function called ‘freq\_estimate’ to get the frequency estimation. In our first attempt, we got 0 Hz for the frequency estimation, but the actual frequency is 253 Hz. We checked our code and found that we didn’t unwrap the phase angle. After fixing that problem, we got about an estimated frequency of about 253 Hz.
3. After calculating the estimated frequency, we tried to undistort the audio and create an undistorted signal output. After we got the estimated frequency for each block, we calculated the average frequency equal to 253.0308 Hz, which was very close to the given frequency. In addition, we played back the undistorted signal output. This output audio sounded good but there was still some noise. We added a hanning window function to reduce leakage and frequency interference.
4. Finally, we tested our code by going through the test plan we wrote before. We passed all the tests with the original audio files. Then tested the program with the other recordings (lab3\_recording 1-5), and we passed all those tests as well.

Success/Failures as a group:

As this is our final lab of the semester, we have gotten used to communicating and working together as a group. It was a much busier time for everybody compared to the last labs but we able to use our approach developed through the last labs of working together and completing the lab. After completing the labs we feel that we have a good approach and are well prepared to work together next semester for our senior design project. We also have a good understanding of our team’s strengths and weaknesses which will help us allocate tasks accordingly for the project.