PURE-Yang’s group

Mike Hernandez,
Kuo Hao Chen,
Joonoh Lim
Mentor

- Yang Li
- Major: Electrical Engineering
- Received Bachelor’s from U of I in 2007
- Will receive Master’s this semester
- Has participated in PURE for 2 semesters
- Yang’s side project
Project Overview

• Goal: Perfect autonomous slide whistle which can be played using a keyboard
• Task: be able to adjust itself to play the right notes
• Began in 2006
• Continue the project from last semester
• Focus on programming
• Tool: Matlab, C++
Fourier Transform

- Method for converting analog sounds into digital signals
- Allows us to read in information from microphone
- Converts from time domain to frequency domain
- \( NFFT = 65536 \) : number of samples
- \( \text{Sampling rate} = 44.1 \text{ kHz} \)

\[
F[k] = \sum_{n=0}^{N-1} f(n)e^{-\frac{2\pi knj}{N}}
\]
• Modeling the frequency output as an inverse function of the motor’s position on the slide whistle

• We found the curve of best fit for frequencies given a position

• $F = \frac{195.6}{(t+0.1658)}$; found by using matlab’s function fitting tool
Secant Method

- Originally meant to find root of functions
- Wrote into C++
- Finds new position closer to actual frequency
- Zero is where the actual frequency is
- Takes two previous and finds where they intersect the actual frequency, plays, and updates positions

Created by Jitse Niesen
Matlab Implementation

- Starting position
- First iteration: Newton's Method using inverse model
  - Desired Frequency
  - If Correct
    - New position
    - Takes another position
      - Secant Method
  - End
- Final Position