Active Vibration Damper

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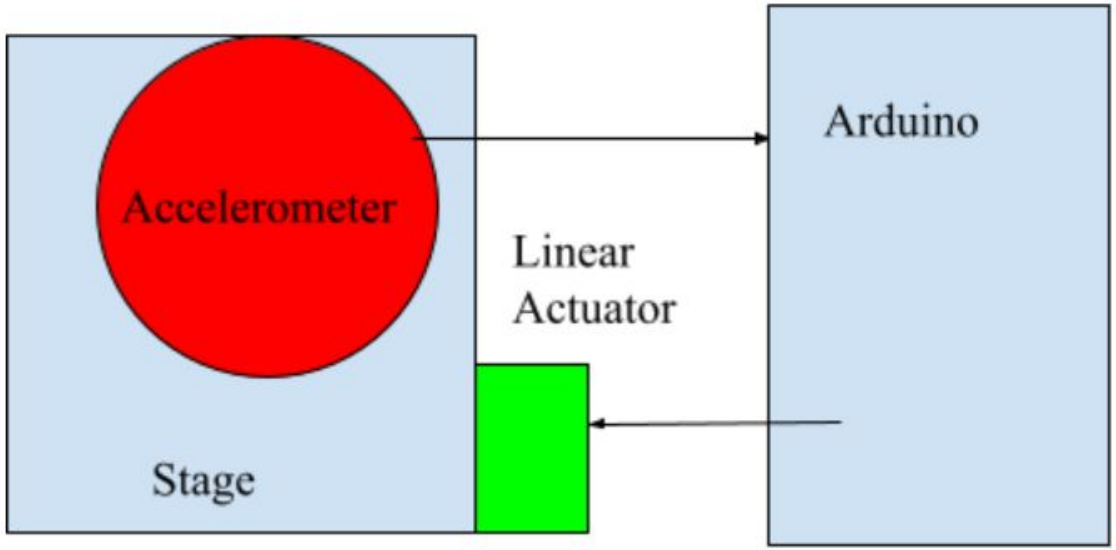
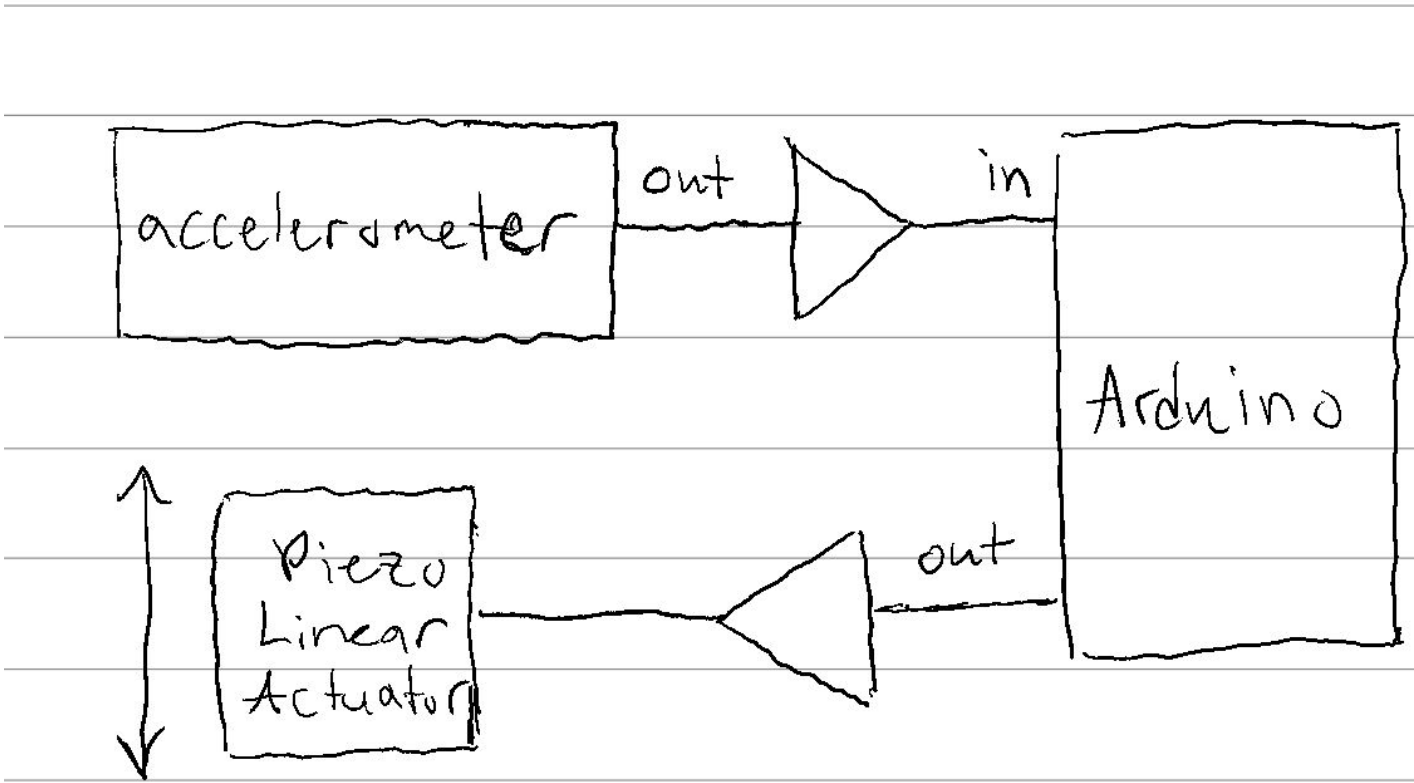
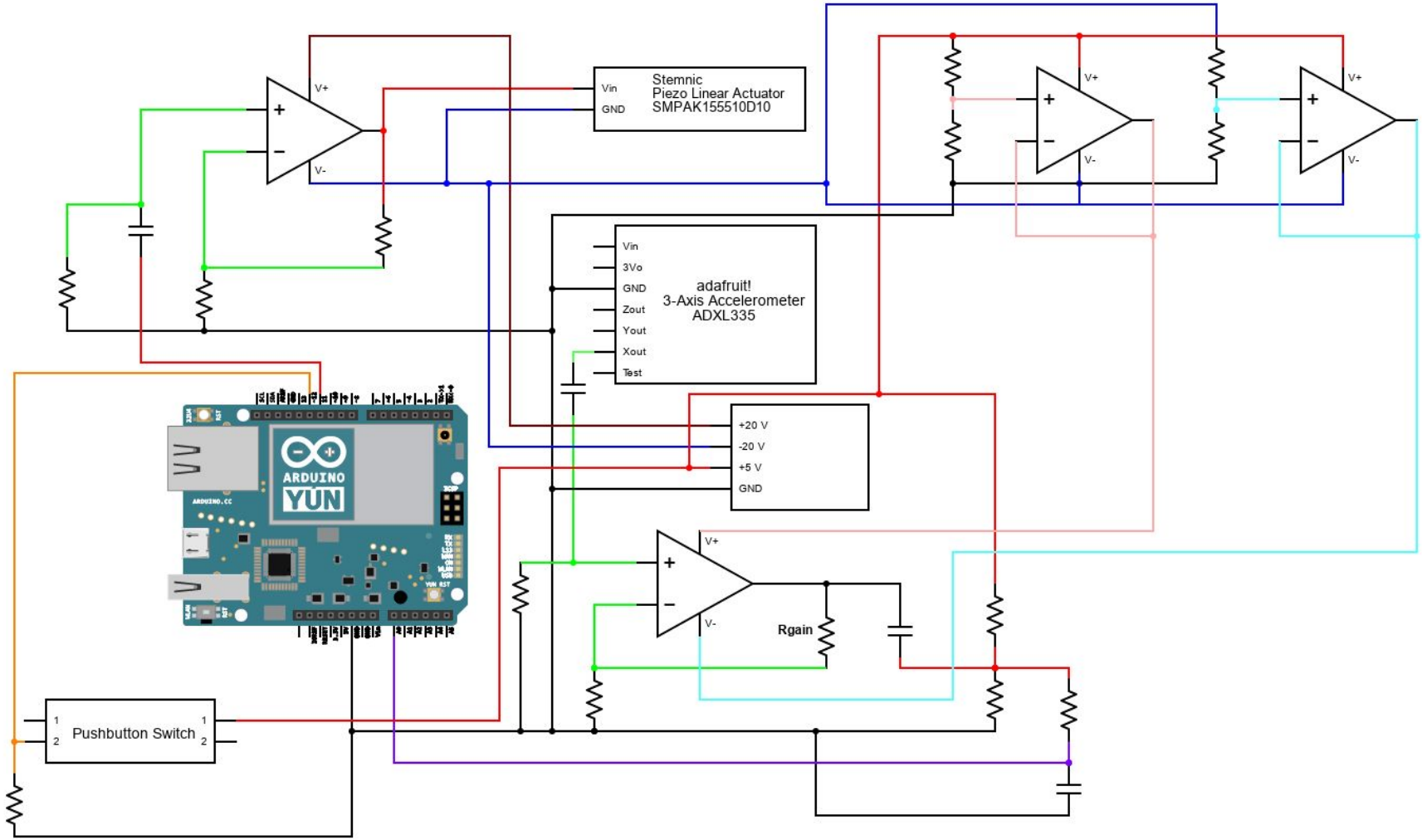
Abstract and Block Diagram

- Based on output of accelerometer, a brain (Arduino) outputs a signal to a linear actuator (Piezo) which damps the vibrations along one dimension



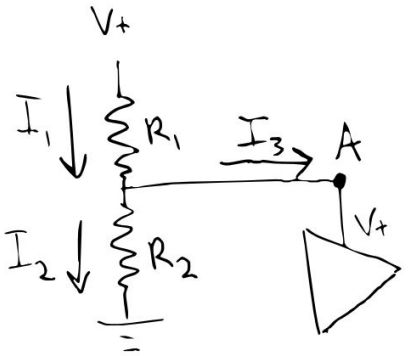
Block Diagram II



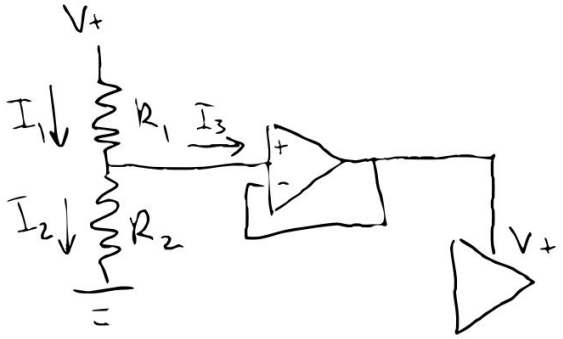

V+
V-
Vin
GND
Stemnic
Piezo Linear Actuator
SMPAK155510D10
Vin
3Vo
GND
Zout
Yout
Xout
Test
adafruit!
3-Axis Accelerometer
ADXL335
+20 V
-20 V
+5 V
GND
ARDUINO
YUN
Rgain
Pushbutton Switch

Stiff Voltage Divider

- Don’t want Op-Amp to draw current directly from voltage divider
- Provide alternate current source (power source of Follower)



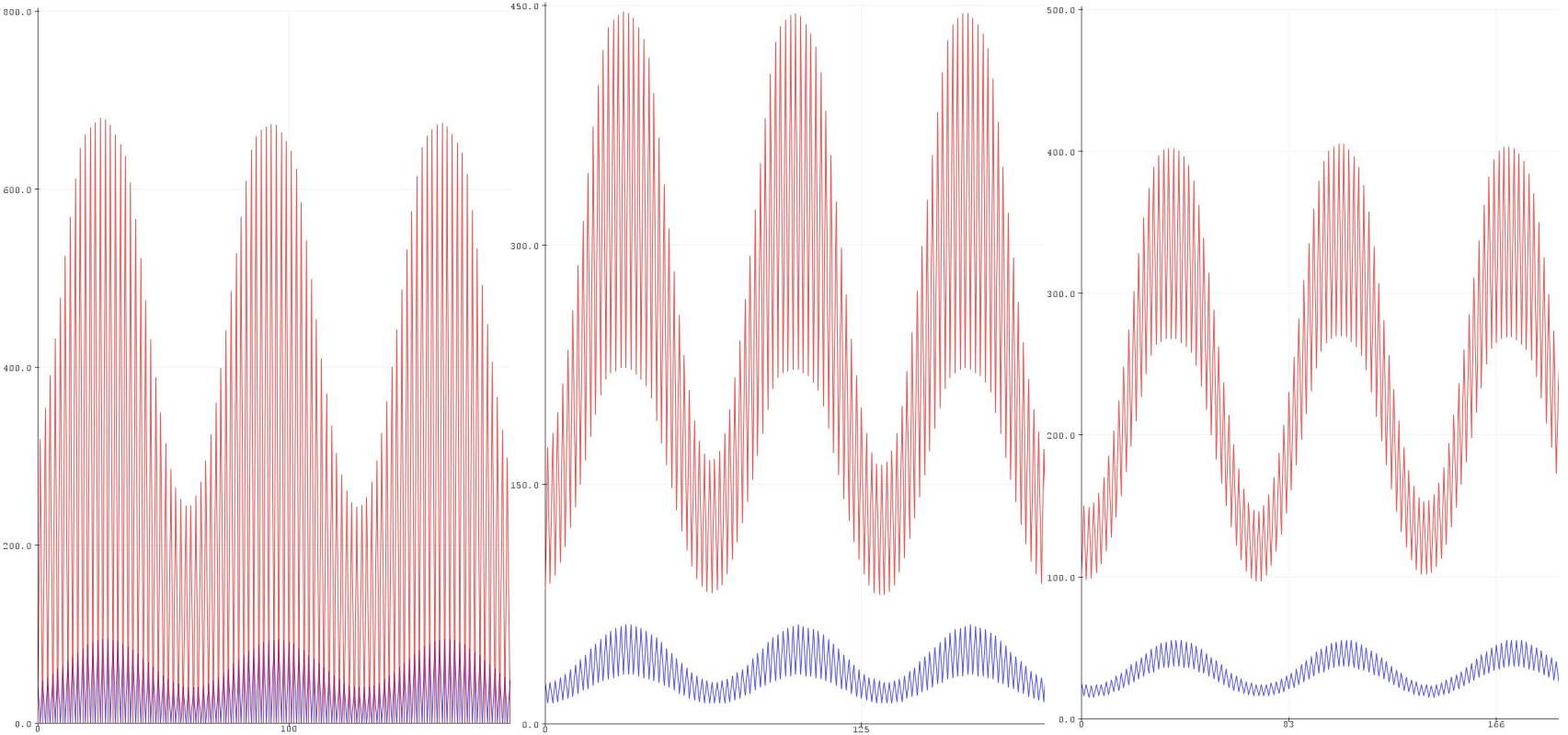
- Op-Amp draws large current
- $I_3 > I_2$
- V_A goes down ($< \frac{R_2}{R_1} V_+$)



- Follower provides high input impedance
- $I_3 << I_2 \Rightarrow I_1 \approx I_2$

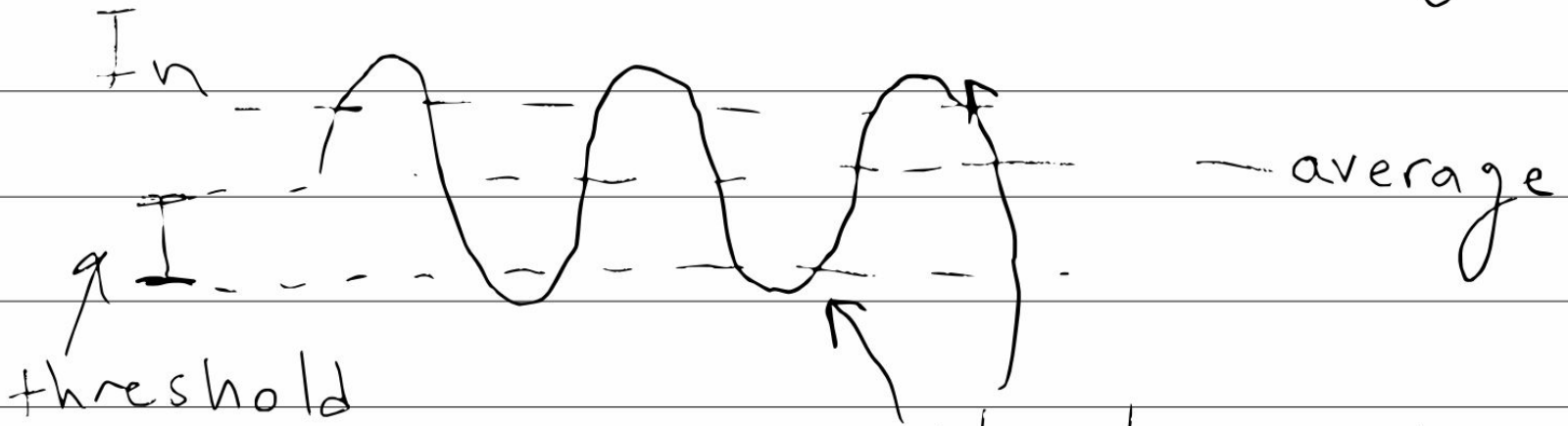
Detecting Speaker Signal on Arduino

- 100Hz speaker signal, arduino “scope”, much noisier signal than on actual scope



- Blue = input, red = output, from left to right - 1, 3, and 5 point averaging to reduce noise

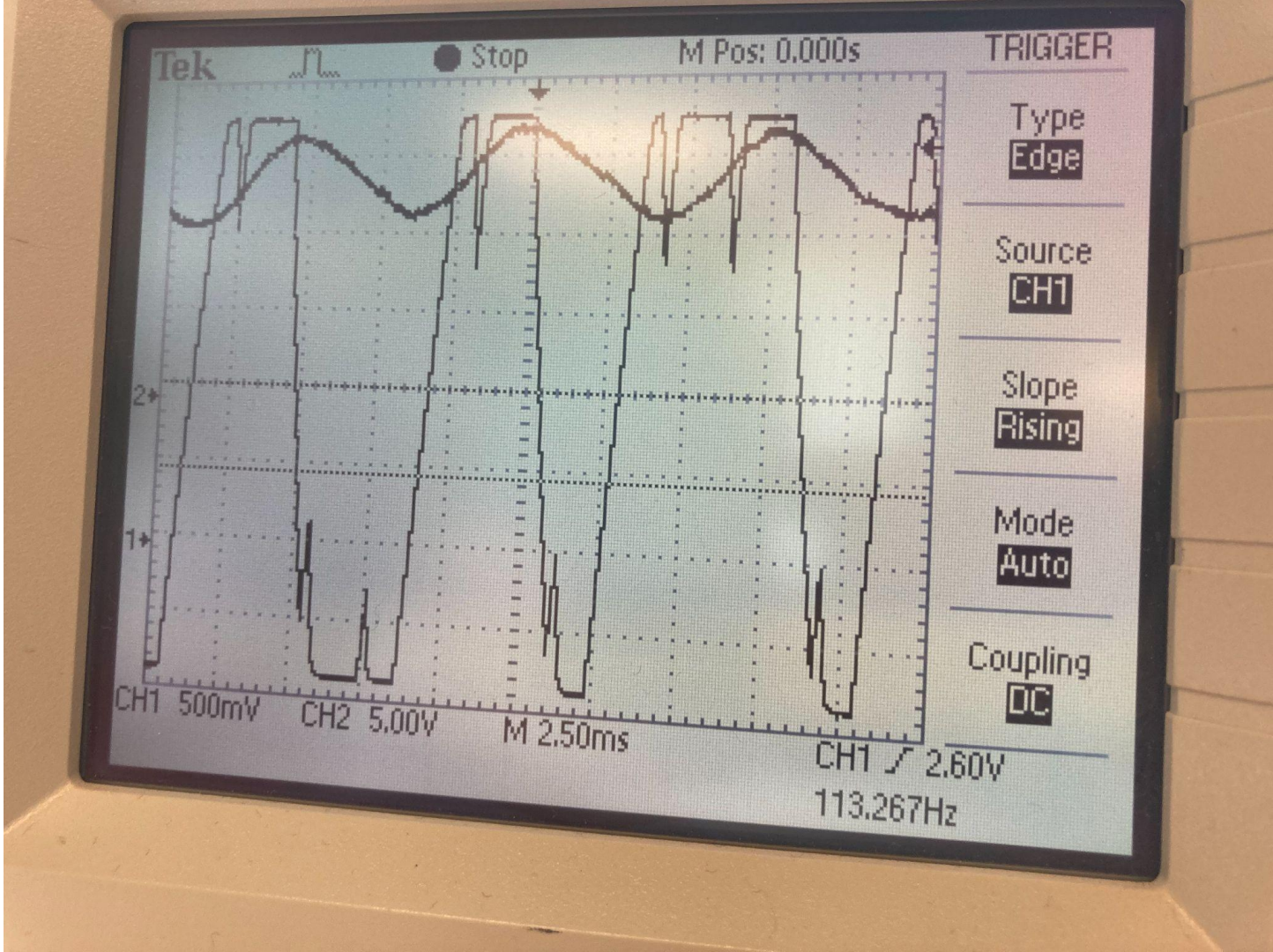
Value Threshold Damping



Derivative Threshold Damping

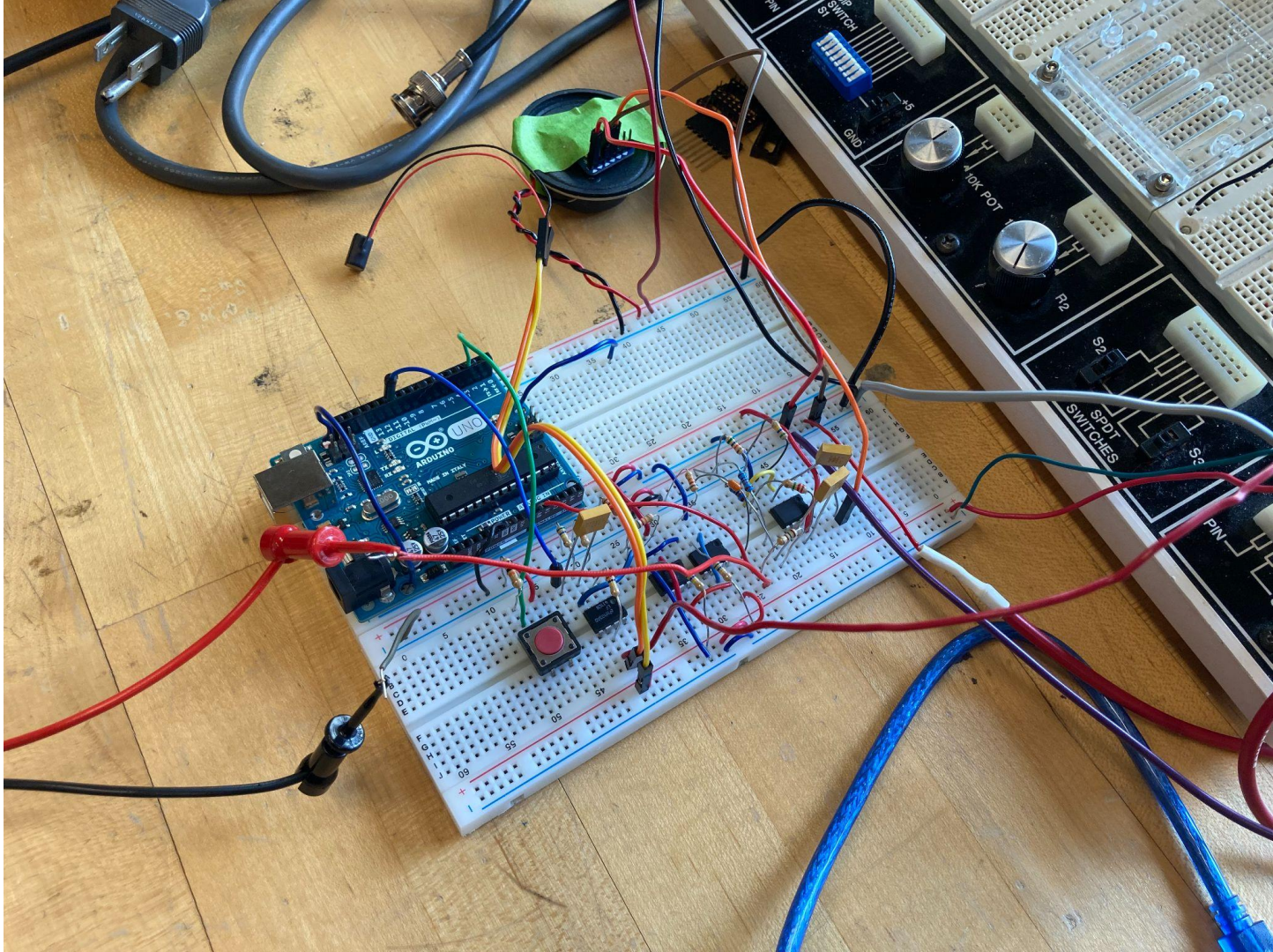
only do something if signal is here

Arduino In vs Out on Scope



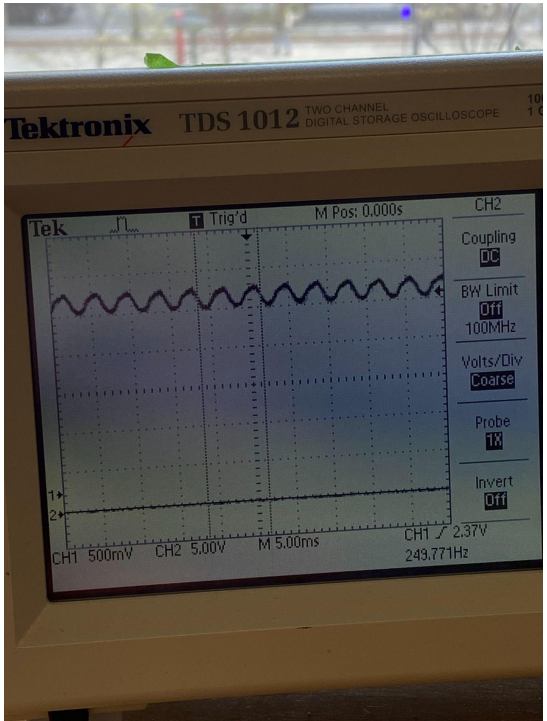
Setup

- Will move to microscope table

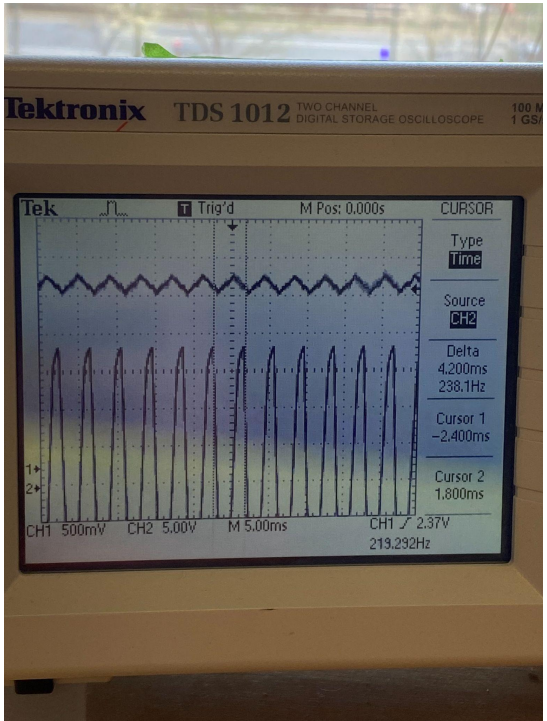


Accelerometer Reading

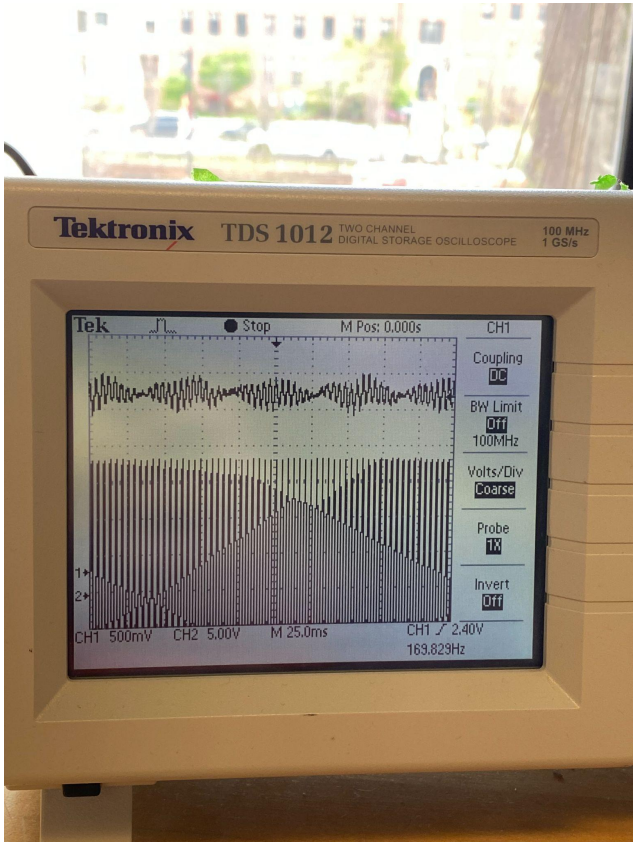
From Speaker



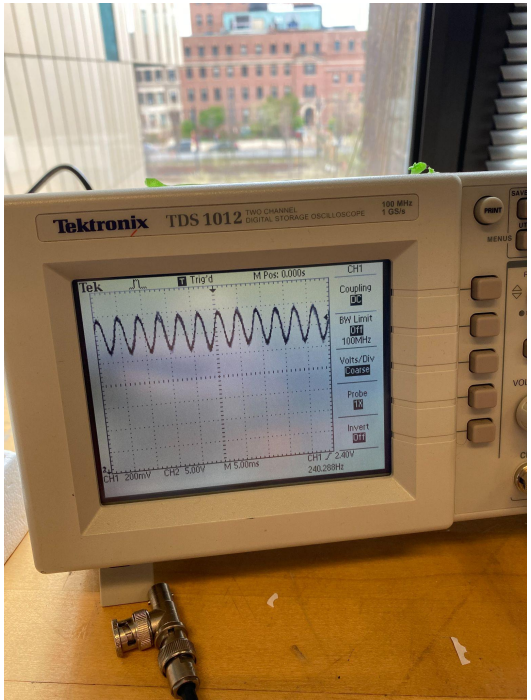
From actuator



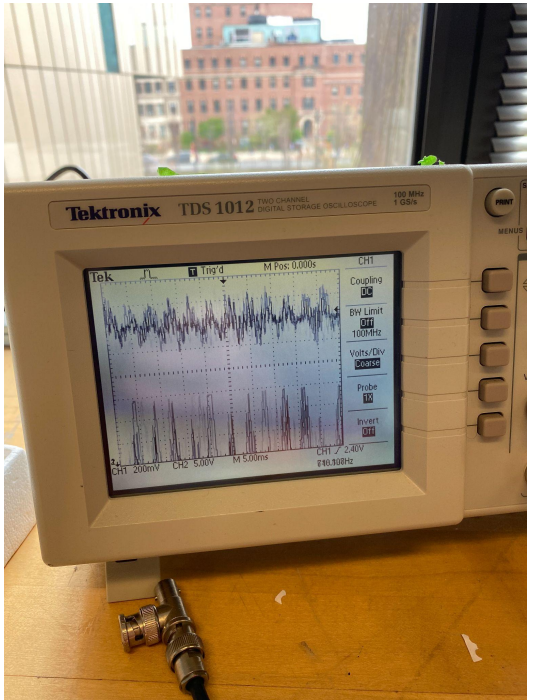
Frequency mismatch = Beats



Undamped



Damped



Issues

- Ambient vibrations too small to detect.
- Not all speaker signals produce measurable vibrations, resonance of stage?
- Hard to make quality and variable actuator signals.