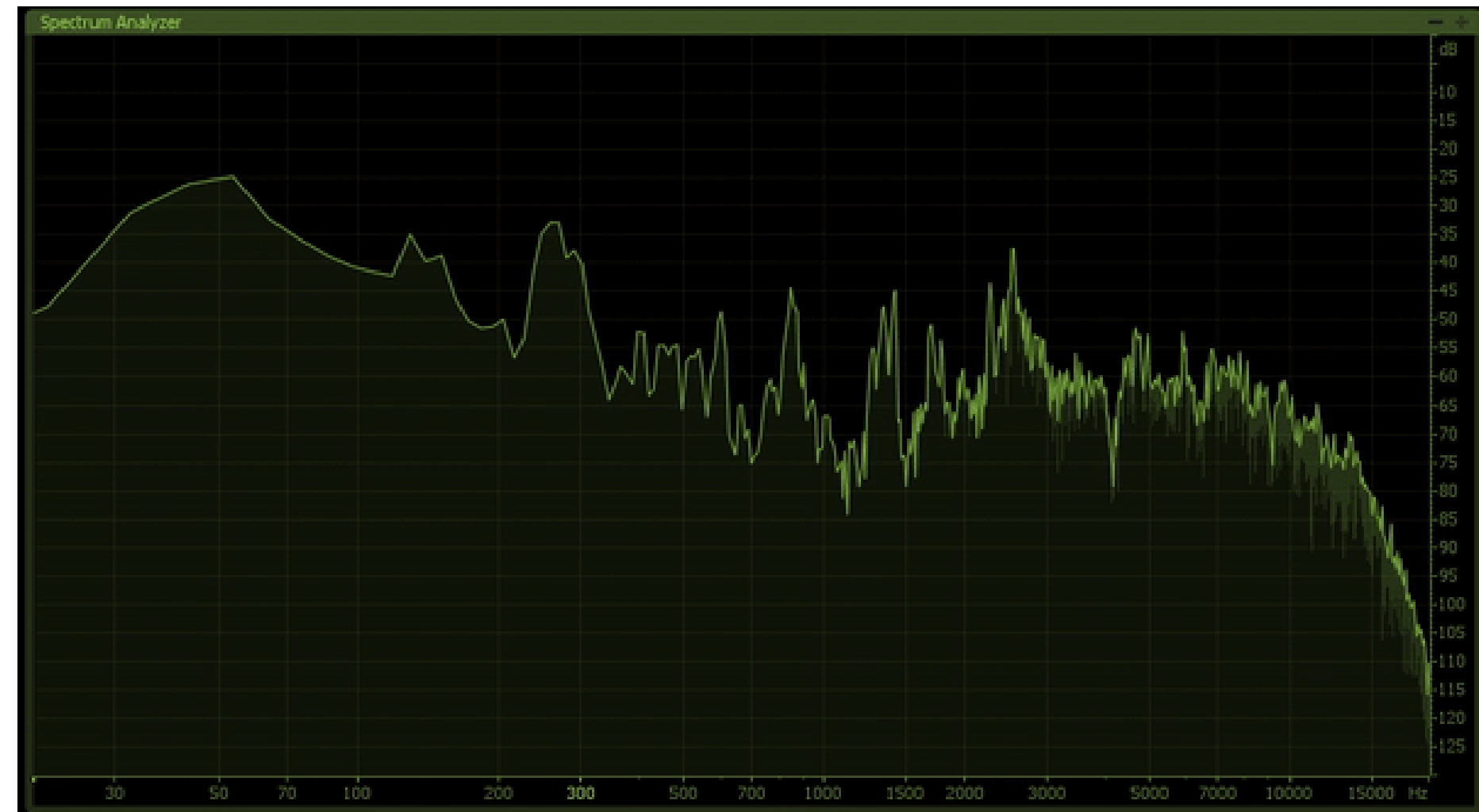


Spectral Analysis

Decomposing audio with algorithms

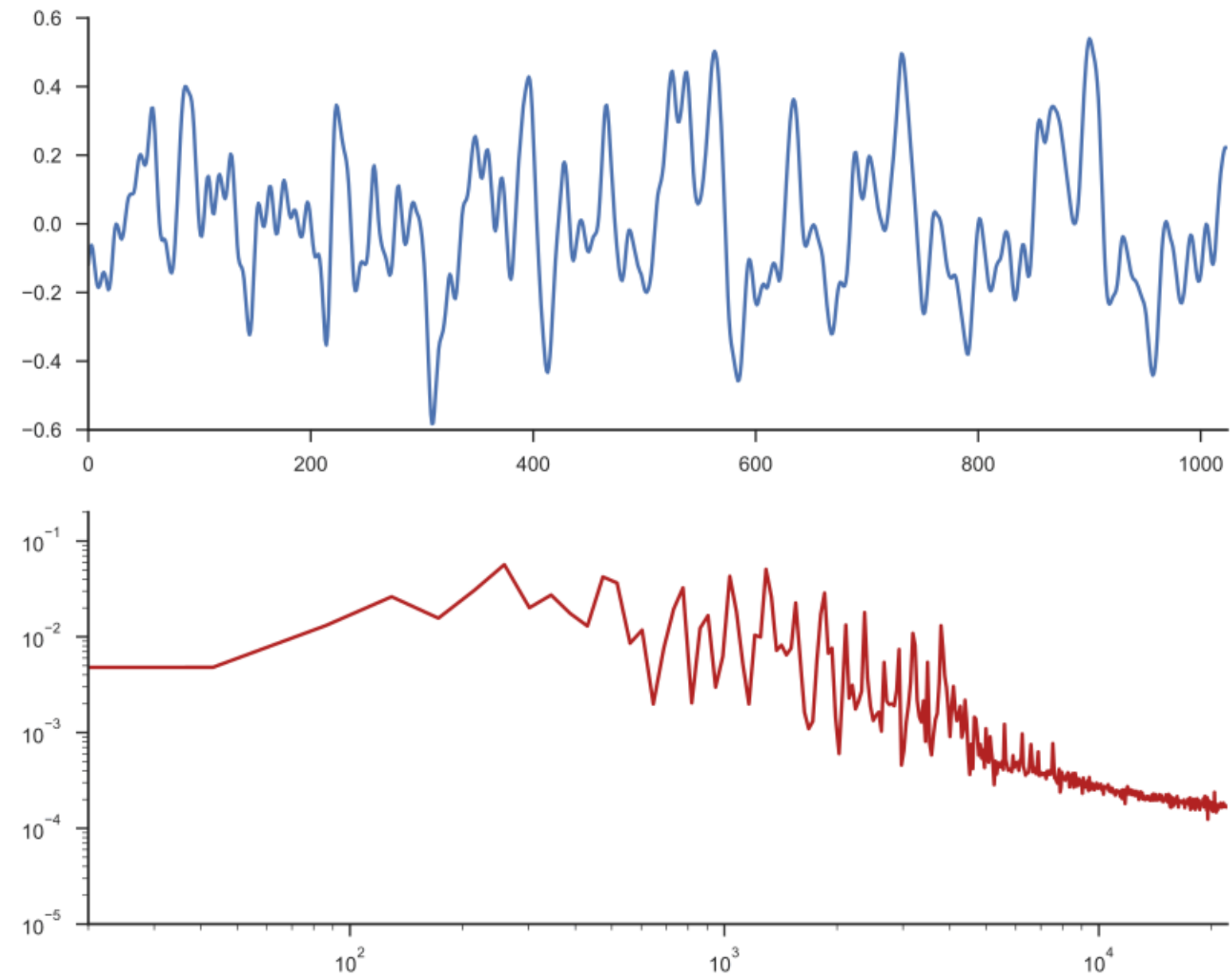
Spring 2019 - Audio Tech Talk Series

February 5, 2019



Frequency

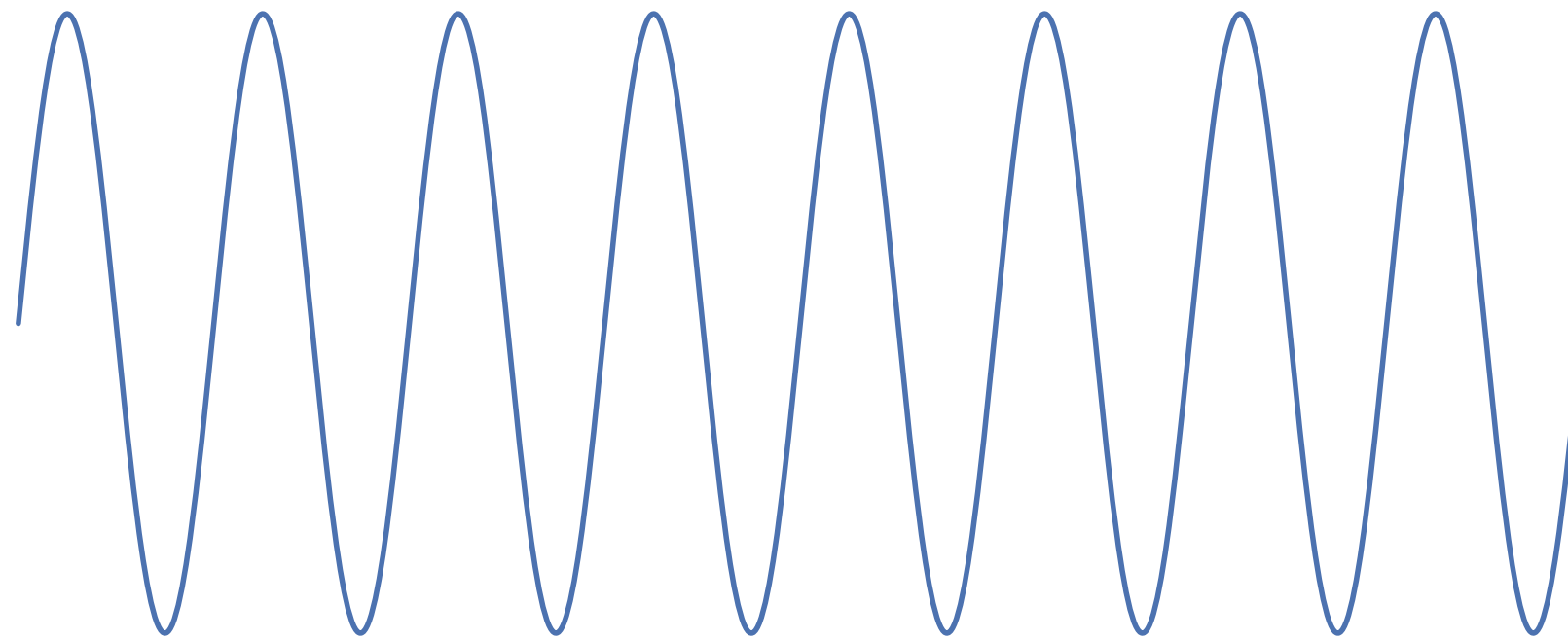
Time Domain -> Frequency domain



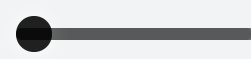
Fourier Transform

But first we have to talk about correlation...

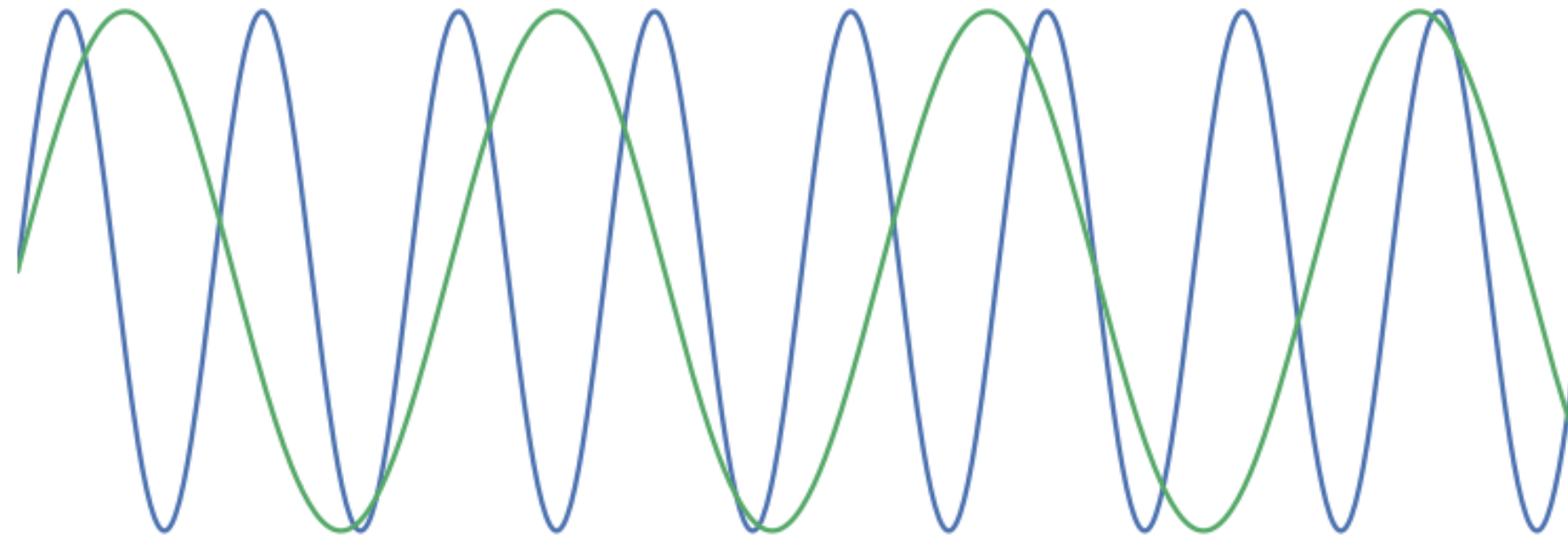
440 Hz sine wave



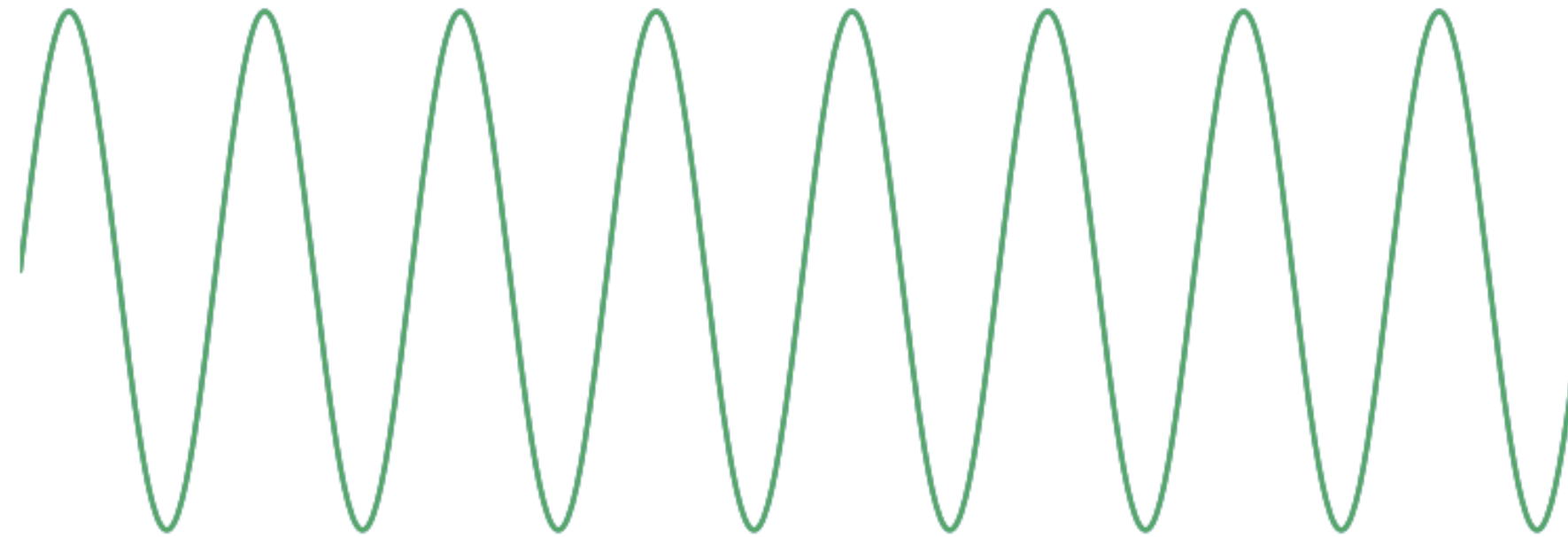
0:00 / 0:03



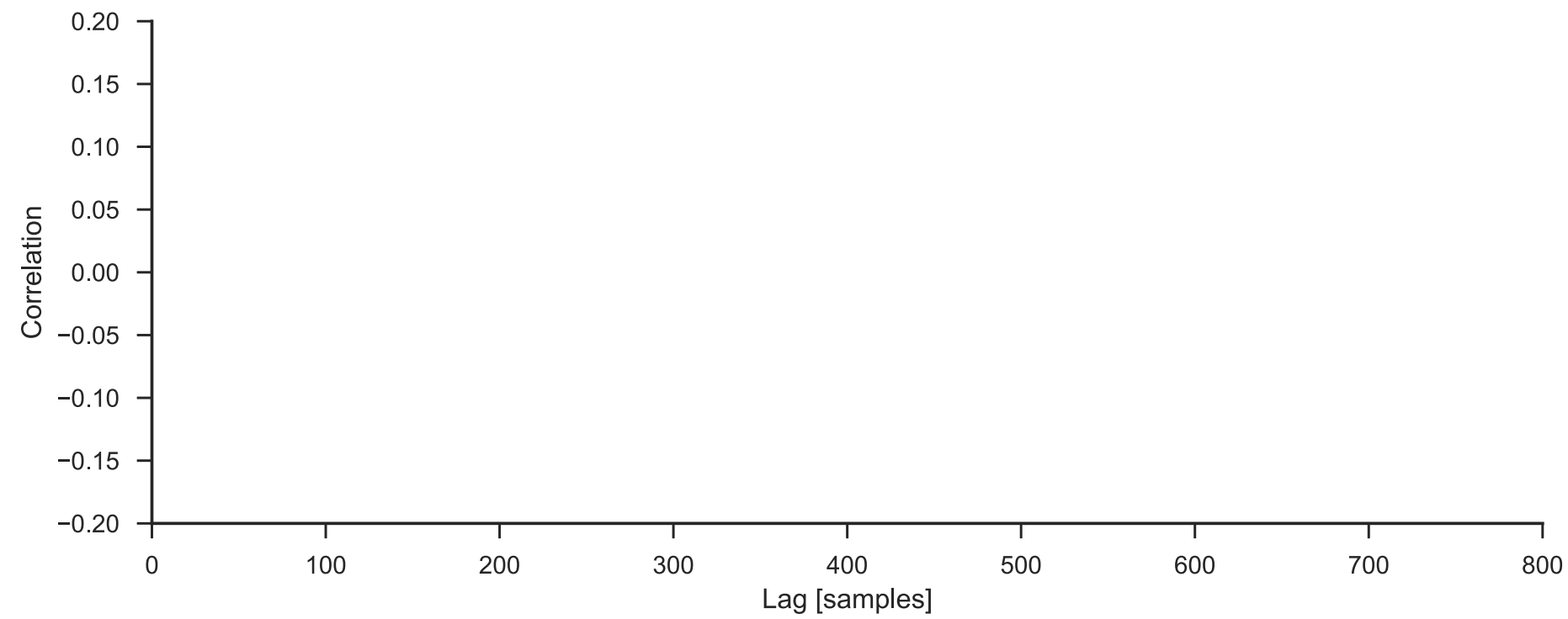
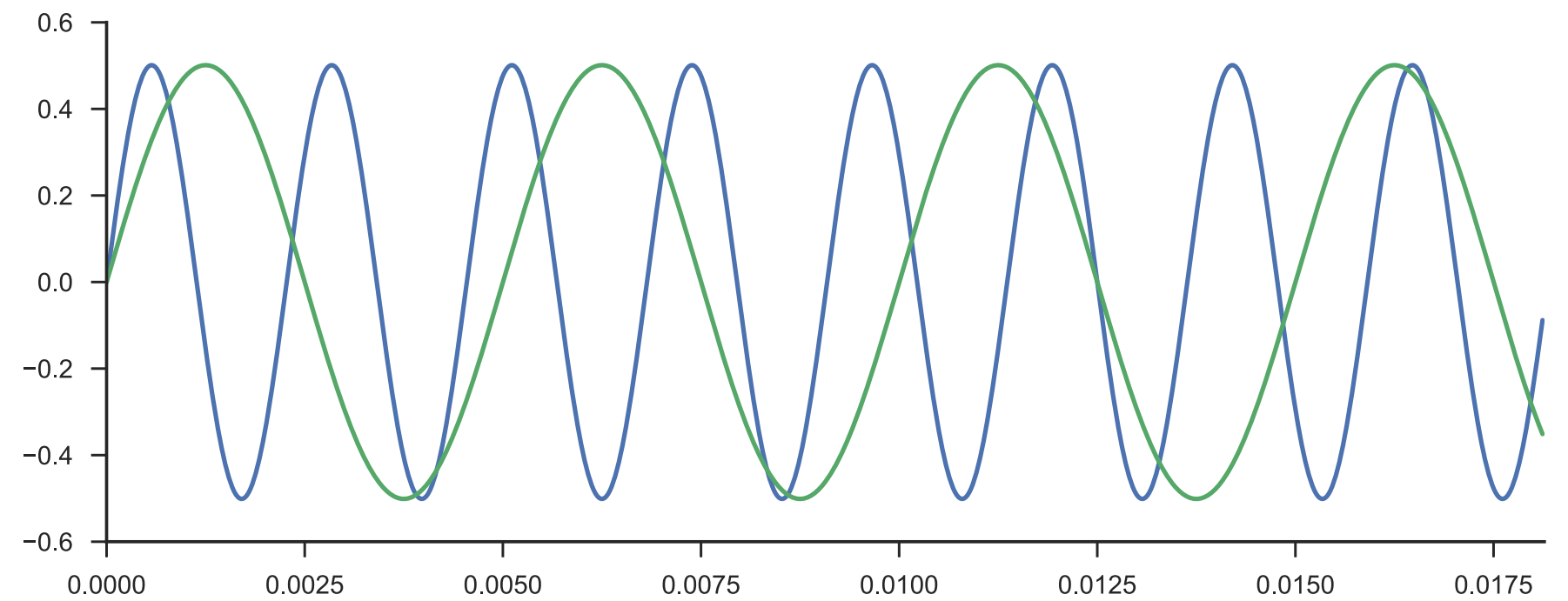
Corrleation between 440 Hz and 200 Hz



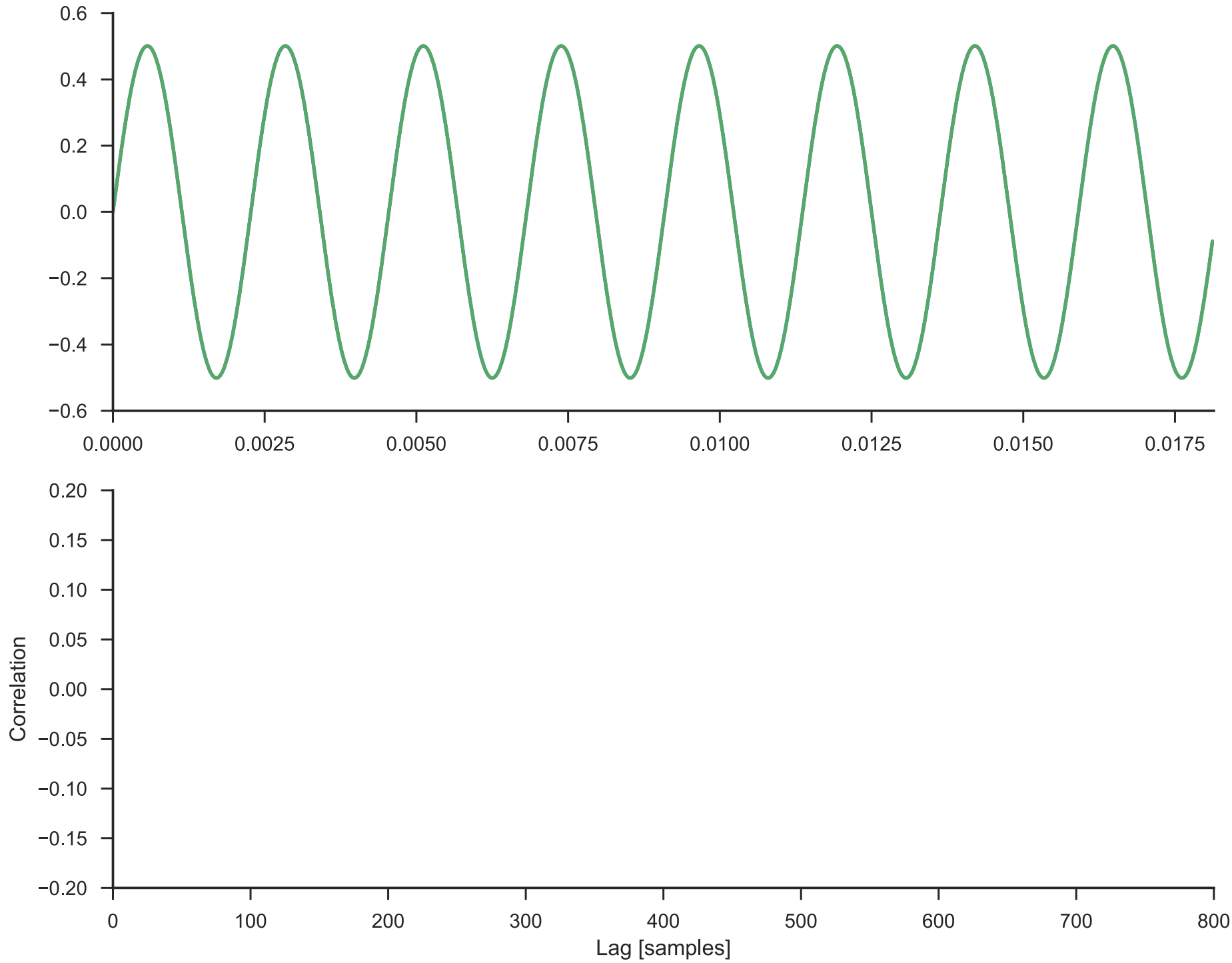
Corrleation between 440 Hz and 440 Hz



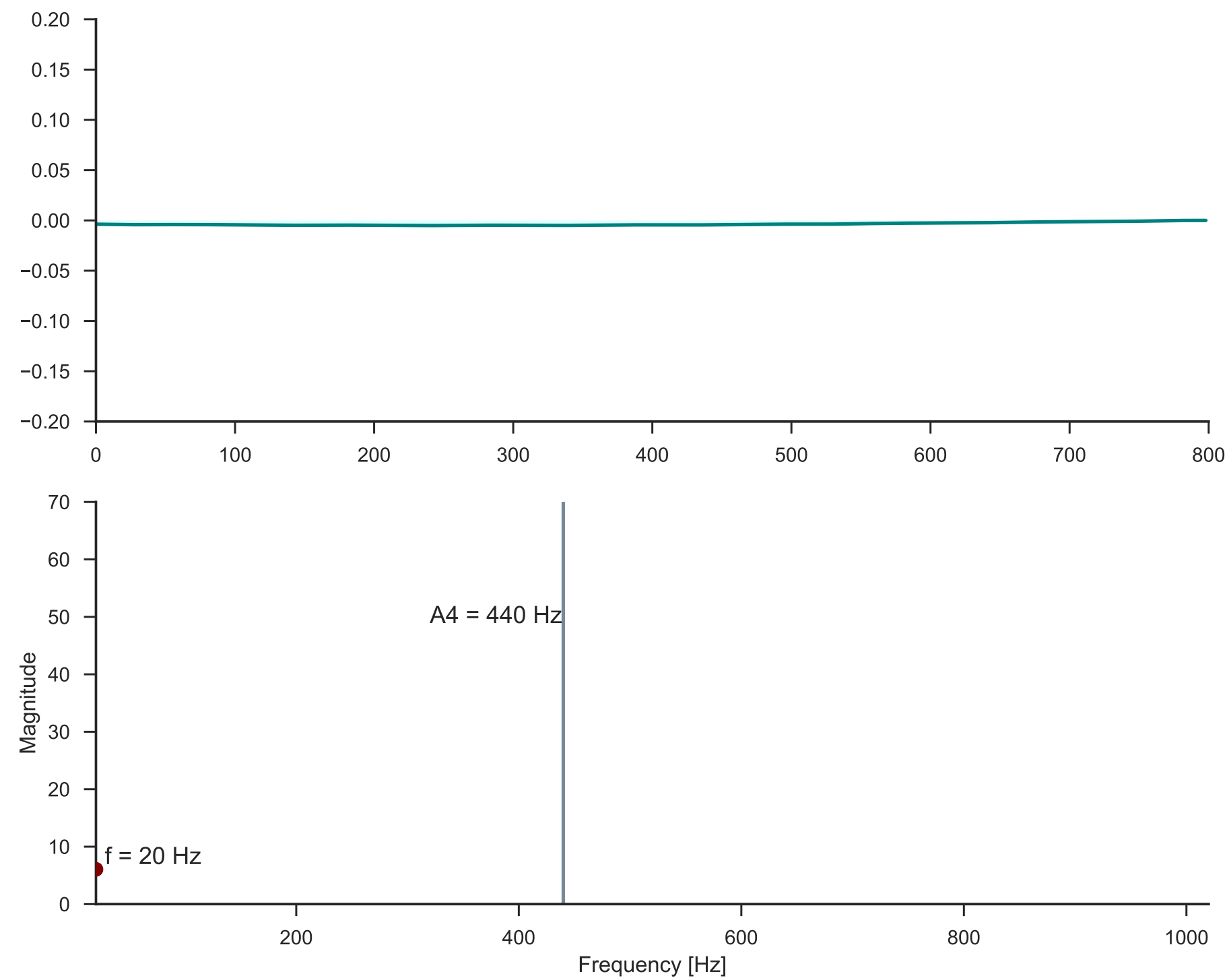
start



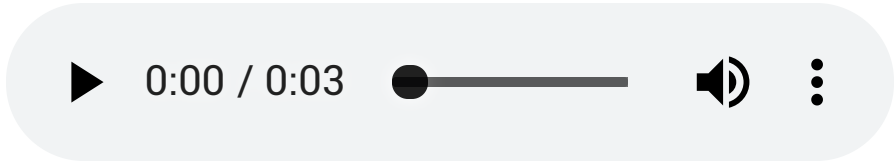
start



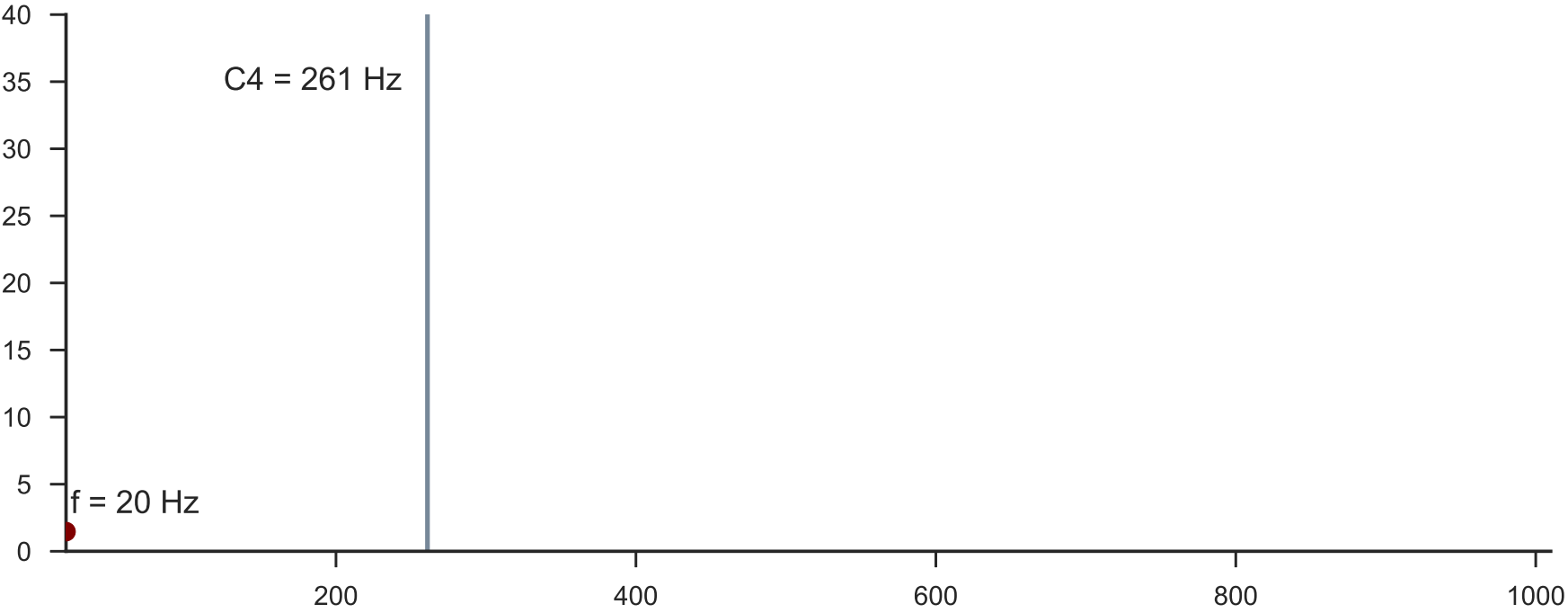
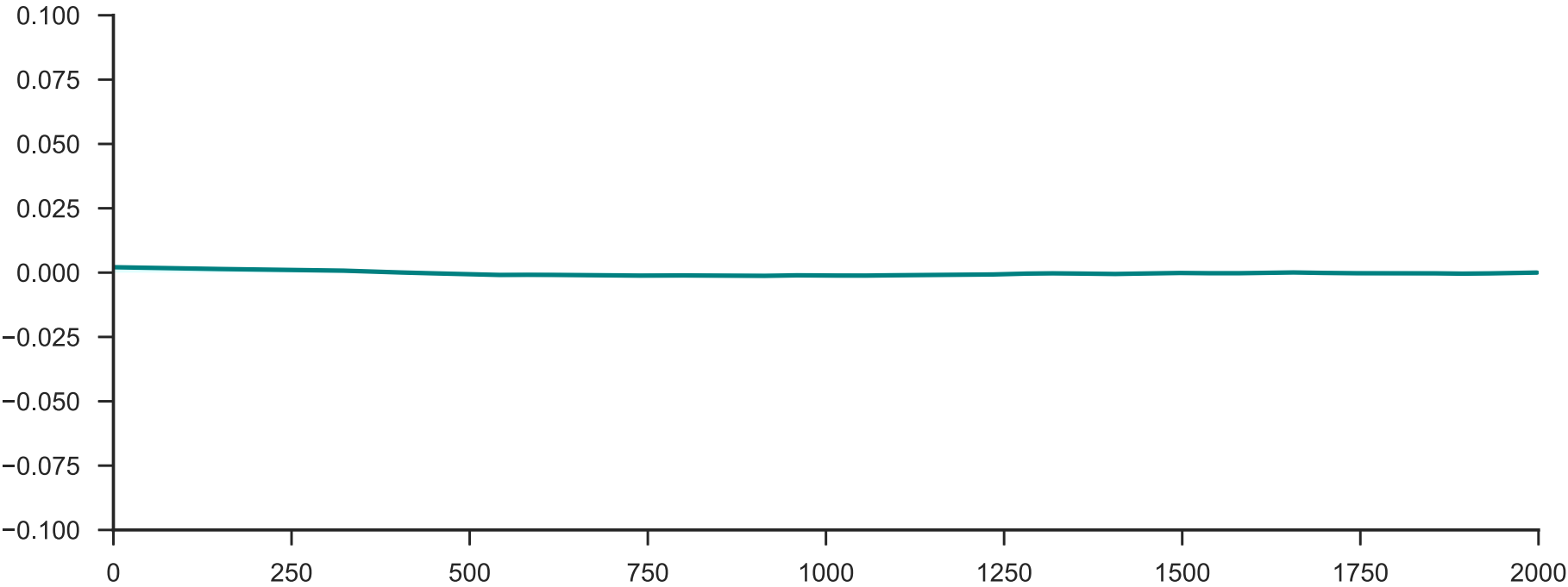
start



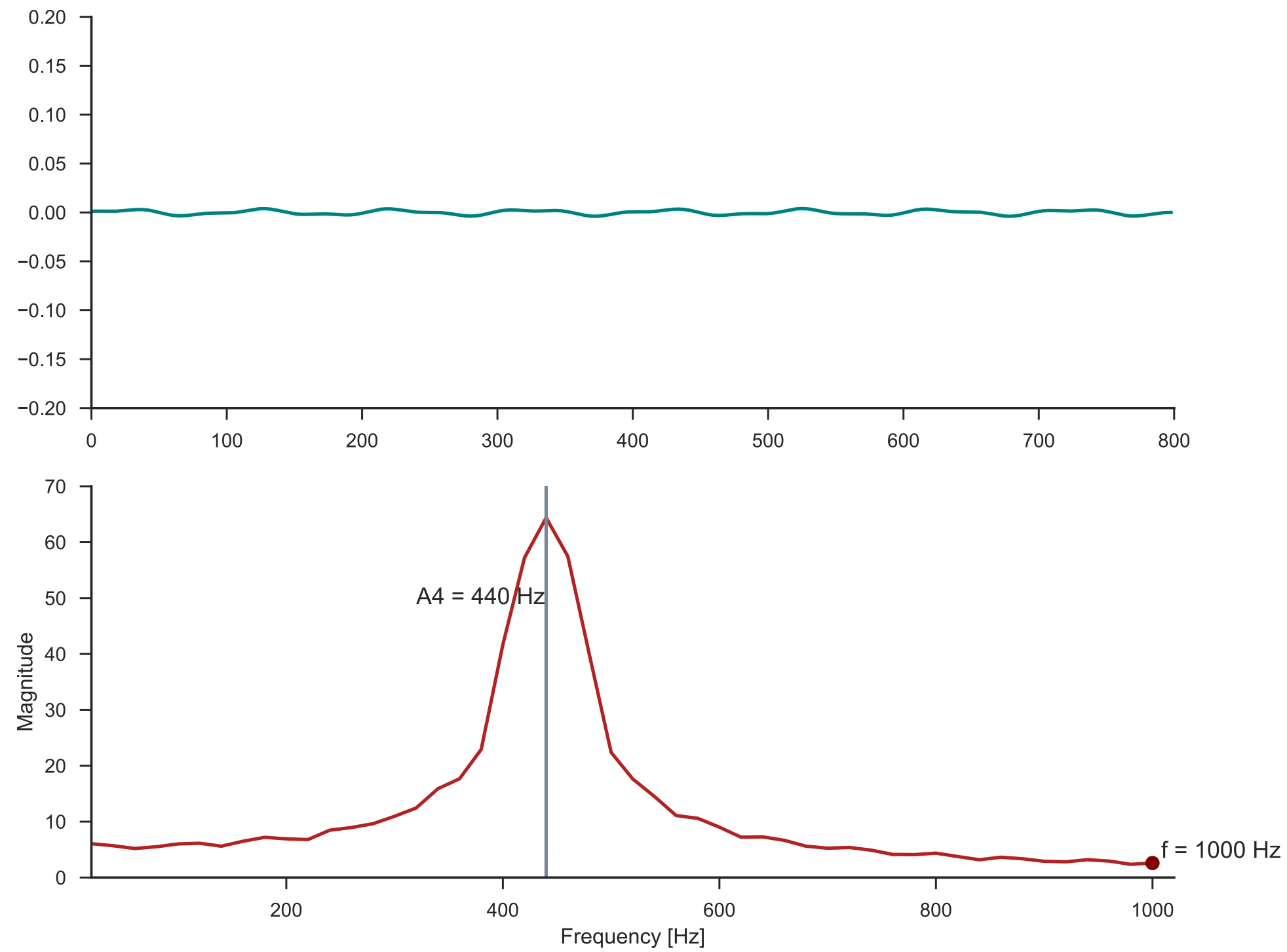
How about a piano note?



start

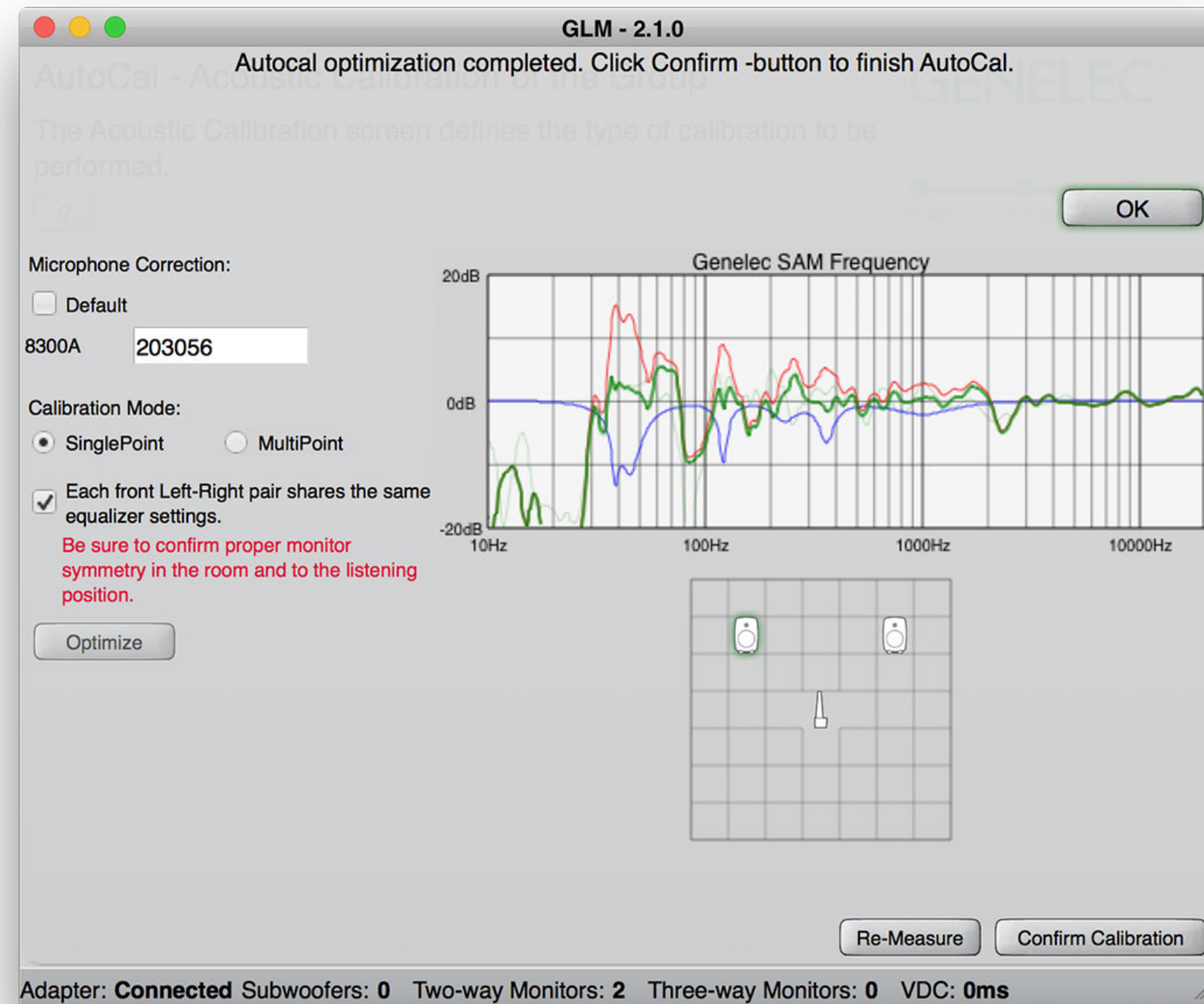


One more question?



How can we use this?

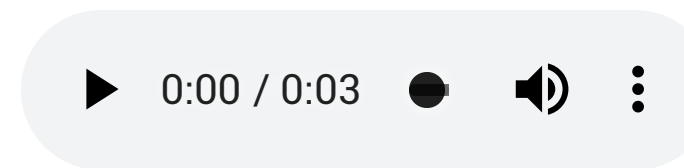
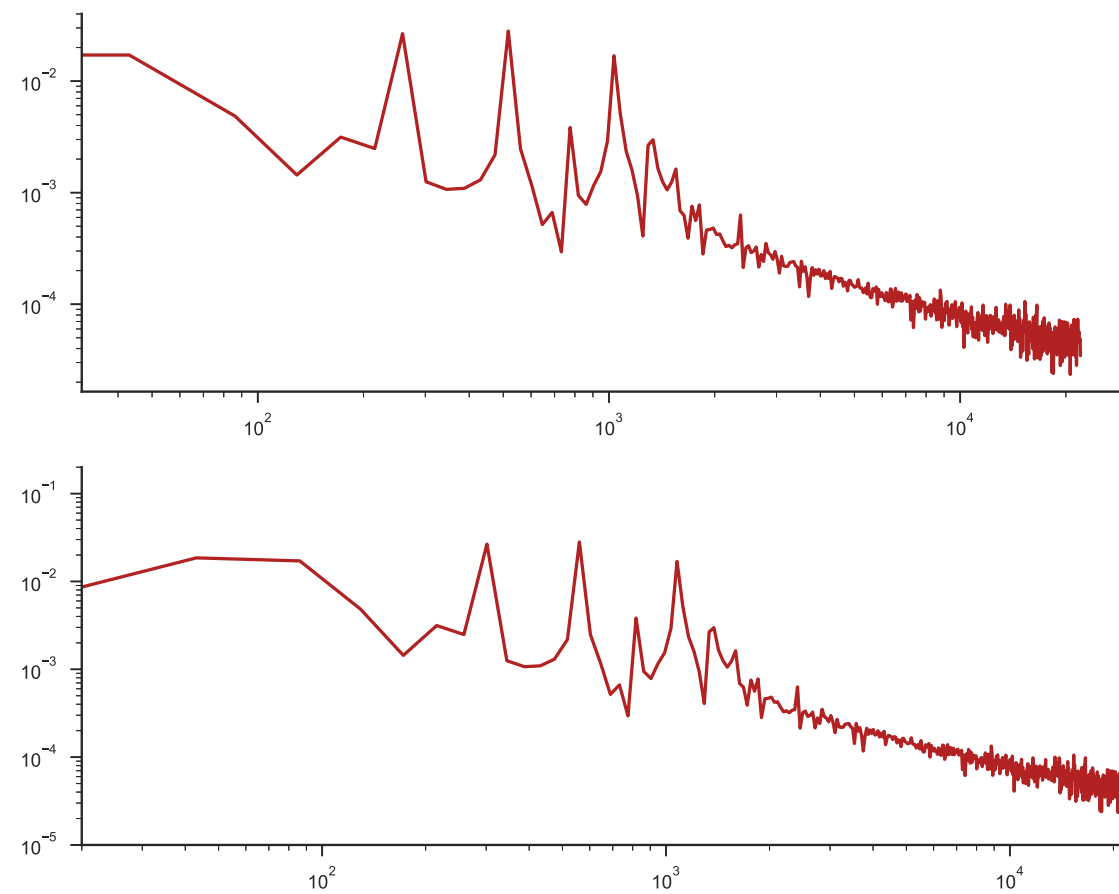
Frequency Analysis & Correction



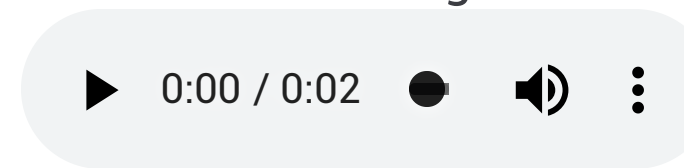
Pitch Shifting



Pitch shifting our piano example...

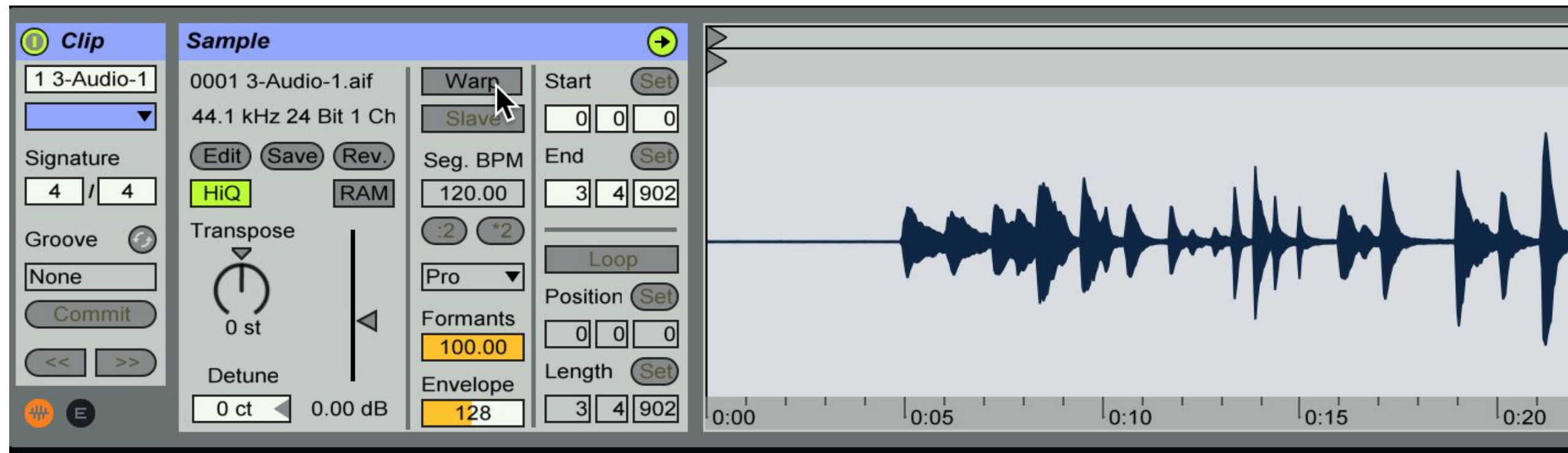


Original



Shifted

Time Stretching



Fast Fourier Transform

Samples	Length	N^2	$N/2 \cdot \log_2(N)$	ratio
64	0.001	4,096	192	21.3
256	0.006	65,536	1,024	64.0
1,024	0.023	1,048,576	5,120	204.8
4,096	0.093	16,777,216	24,576	682.7
16,384	0.372	268,435,456	114,688	2,340.6
65,536	1.486	4,294,967,296	524,288	8,192.0
131,072	2.972	17,179,869,184	1,114,112	15,420.2

* Assuming 44.1 kHz sampling rate

Next Talk - February 19

Audio Myths

Dispelling common misconceptions and misleading truths