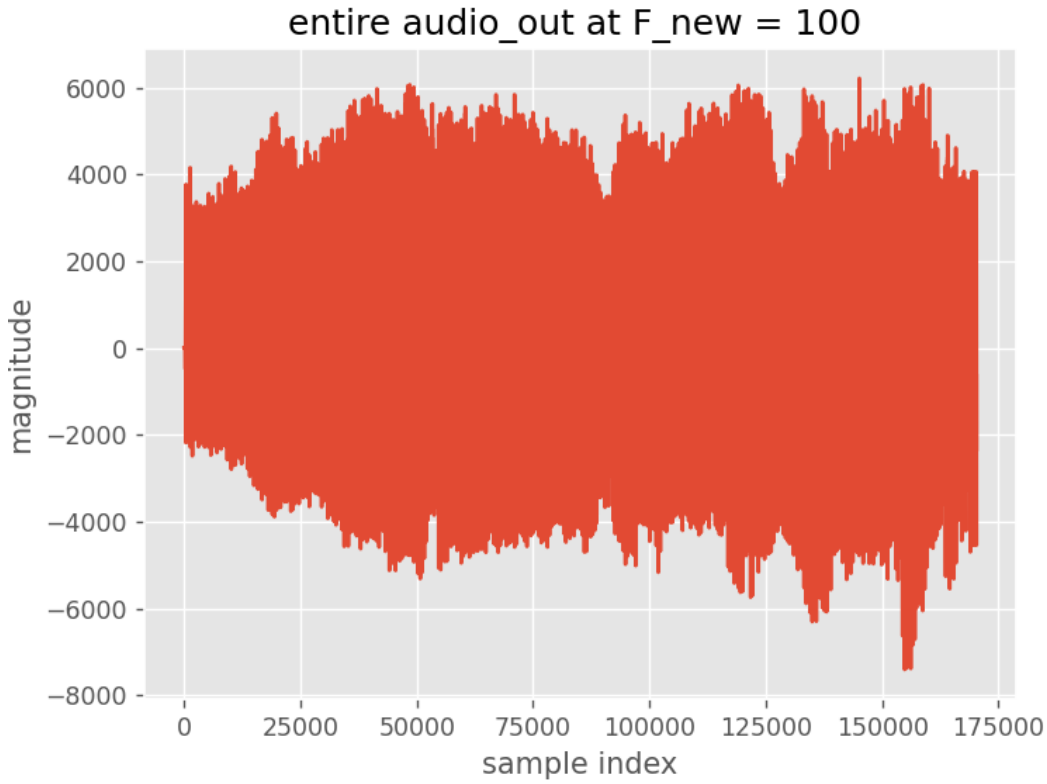
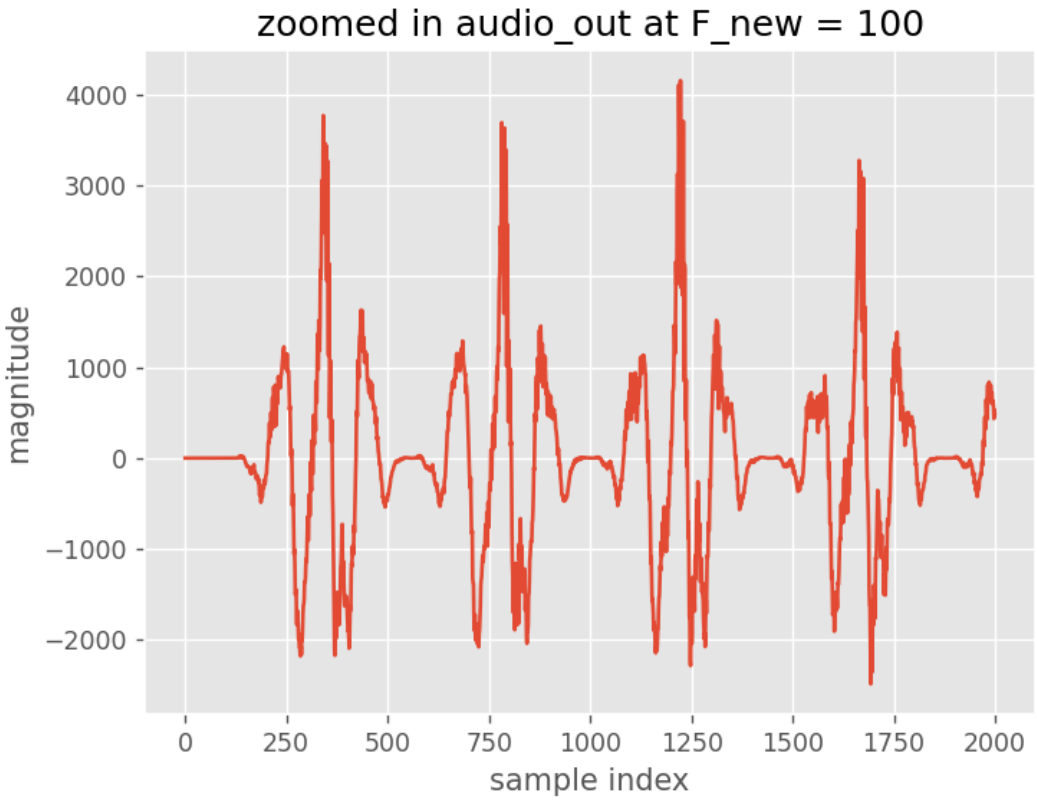
```python
import numpy as np
from numpy.fft import fft
import matplotlib.pyplot as plt
import scipy.io.wavfile as spwav
#from mpldatacursor import datacursor
import sys

plt.style.use('ggplot')

# Note: this epoch list only holds for "test_vector_all_voiced.wav"
epoch_marks_orig = np.load("test_vector_all_voiced_epochs.npy")
F_s, audio_data = spwav.read("test_vector_all_voiced.wav")
N = len(audio_data)

######################## YOUR CODE HERE ############################

F_new = 100
new_epoch_spacing = F_s//F_new

#print (epoch_marks_orig)


audio_out = np.zeros(N)
# Suggested loop


#since the mapped epoch on original(index) is non-decreasing
#we only need to start there to find the next map for the next new epoch
def find_map (new_epoch, epoc_org, epoch_mark):
    itr = epoch_mark
    delta_min = 0
    for k in range (epoch_mark,len(epoc_org)):

        if (k == epoch_mark):
            delta_min = abs(new_epoch - epoch_marks_orig[k])

        else:
            delta_new = abs(new_epoch - epoch_marks_orig[k])
            if (delta_new <= delta_min):
                delta_min = delta_new
                itr = k
            else:
                #print('triggered')
                break
    return itr
```

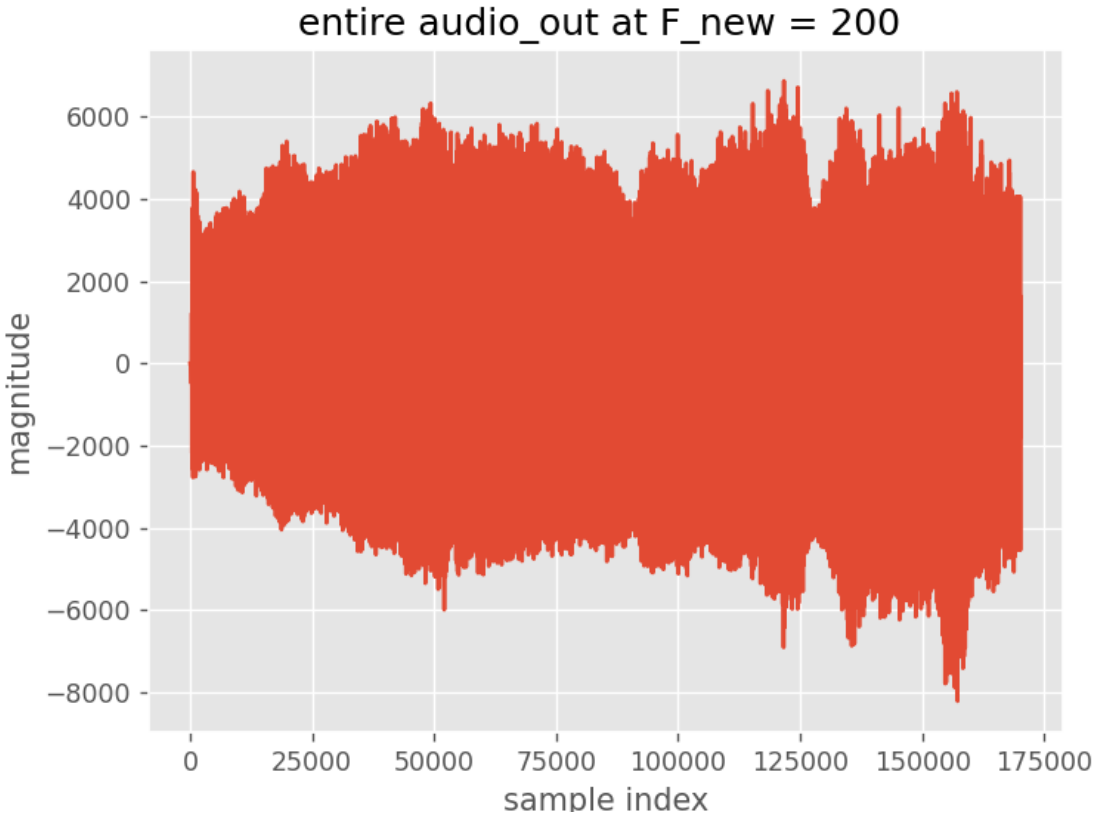
```
def window_apply (a,b):
    output = []

    for j in range(len(a)):
        result = a[j]*b[j]
        output.append(result)


    return output

def sample_addition(a,b,start):
    for x in range(len(b)-1):
        if (start+x > 170267):
            break
        a[start+x]+=b[x]
    return


epoch_mark = 0
epoch_mark_array = []
itr = 0

debug_epoch_new = []
debug_epoch_map = []
print(len(epoch_marks_orig))
epoch_marks_orig = np.insert(epoch_marks_orig,0,0)

for i in range(0, N, new_epoch_spacing):

    # https://courses.engr.illinois.edu/ece420/lab5/lab/#overlap-add-algorithm
    # Your OLA code here
    itr = find_map(i,epoch_marks_orig,epoch_mark)
    #print ("event a")
    epoch_mark = itr
    debug_epoch_new.append(i)
    debug_epoch_map.append(epoch_marks_orig[itr])


    epoch_marks_orig = np.append(epoch_marks_orig,len(audio_data)-1000)

    p0 = int(abs((epoch_marks_orig[itr-1])-(epoch_marks_orig[itr+1]))/2)
    epoch_marks_orig = np.delete(epoch_marks_orig,len(epoch_marks_orig)-1)
    #epoch_marks_orig = np.delete(epoch_marks_orig,0)



    window = np.hanning(p0*2)
    print("debug po = ", p0)
```

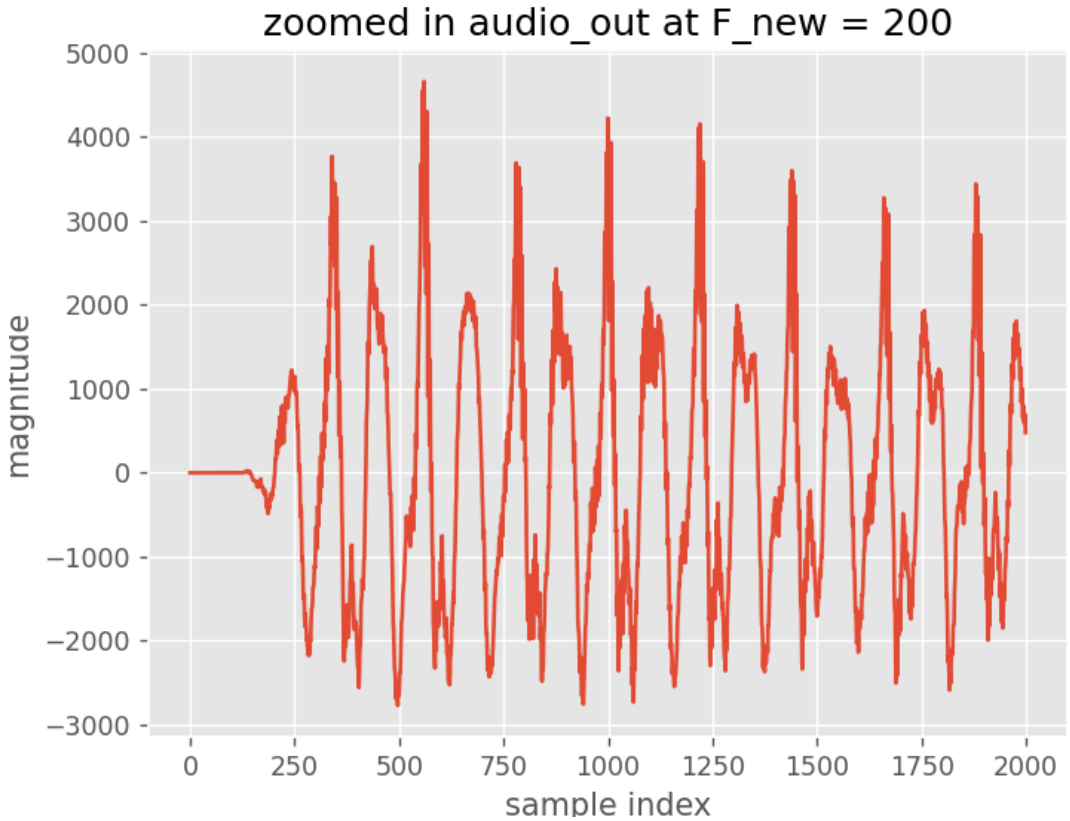
```
100
101         windowed_sample = window_apply(audio_data[epoch_marks_orig[itr]-p0:epoch_marks_orig[itr]+p0] ,windo
102         #print ("event c")
103
104         #audio_out[i-p0:p0+i+1] += windowed_sample
105         print("debug audio_out length", len(audio_out))
106
107         sample_addition(audio_out,windowed_sample,i-p0)
108
109
110
111
112     print ("DEBUG: debug_epoch_new:", debug_epoch_new[:10] )
113     print ("   ")
114     print ("   ")
115     print ("DEBUG: debug_epoch_map:" , deb
116     print ("DEBUG: original epoch marks", epoch_marks_orig[:10])
117     plt.figure()
118     plt.title('zoomed in audio_out at F_new = 100')
119     plt.xlabel("sample index")
120     plt.ylabel("magnitude")
121     plt.plot(audio_out[100:2100])
122
123     plt.figure()
124     plt.plot(audio_out)
125     plt.title("entire audio_out at F_new = 100 ")
126     plt.xlabel("sample index")
127     plt.ylabel("magnitude")
128     #plt.plot(audio_data[0:2000])
129     plt.show()
130
131     audio_out = audio_out.astype('int16')
132     spwav.write('audio_out.wav',F_s,audio_out)
133     print ('finished')
134
135
136
```

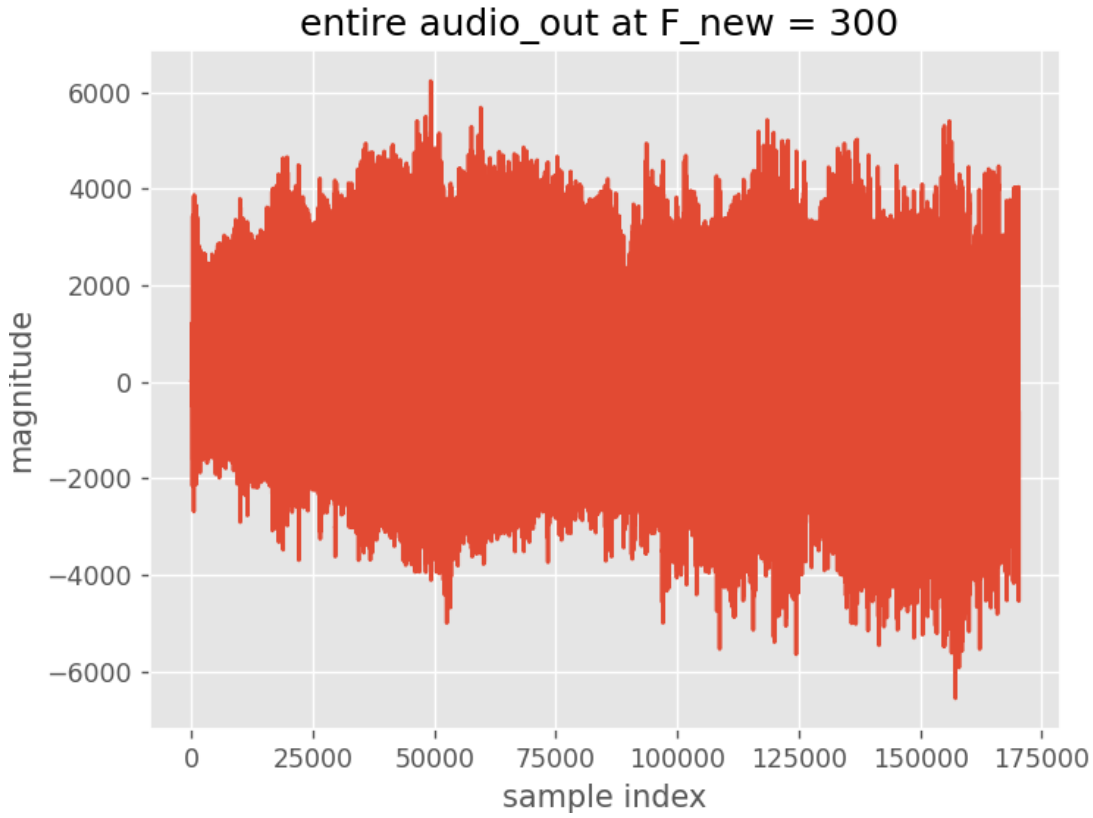
(variable) epoch_marks_orig: Any

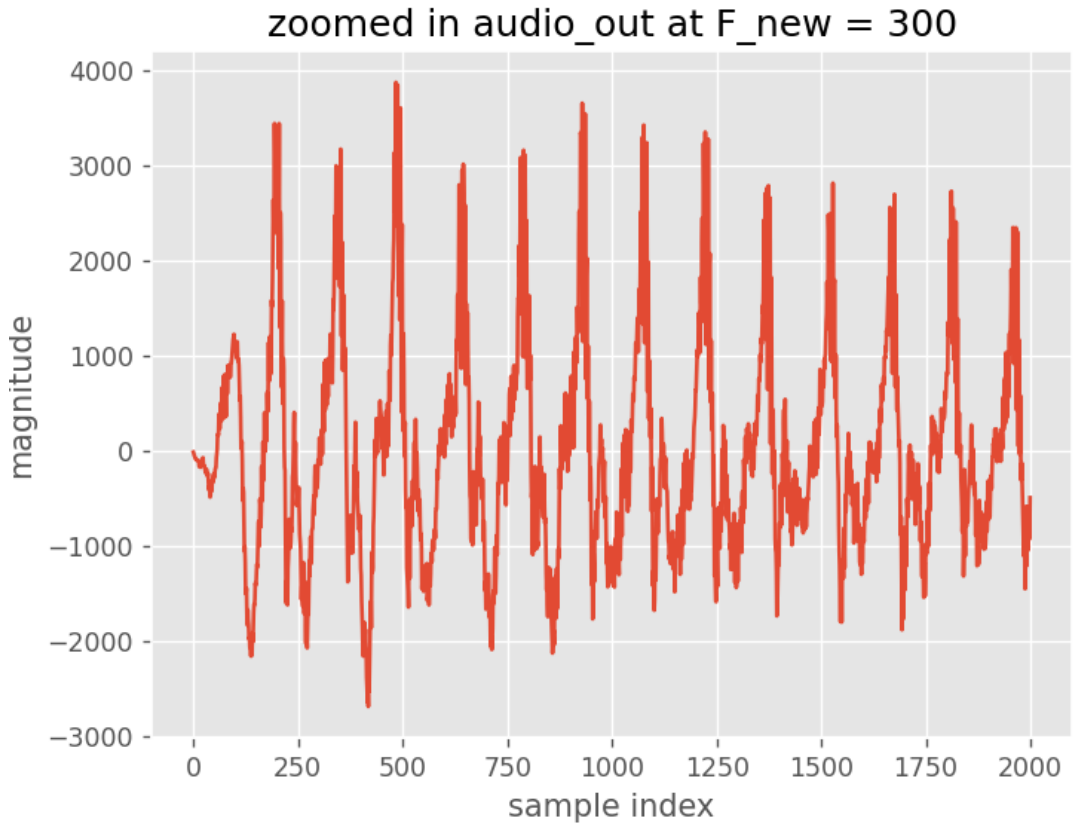

entire audio_out at F_new = 100
magnitude
sample index
6000
4000
2000
0
−2000
−4000
−6000
−8000
0
25000
50000
75000
100000
125000
150000
175000

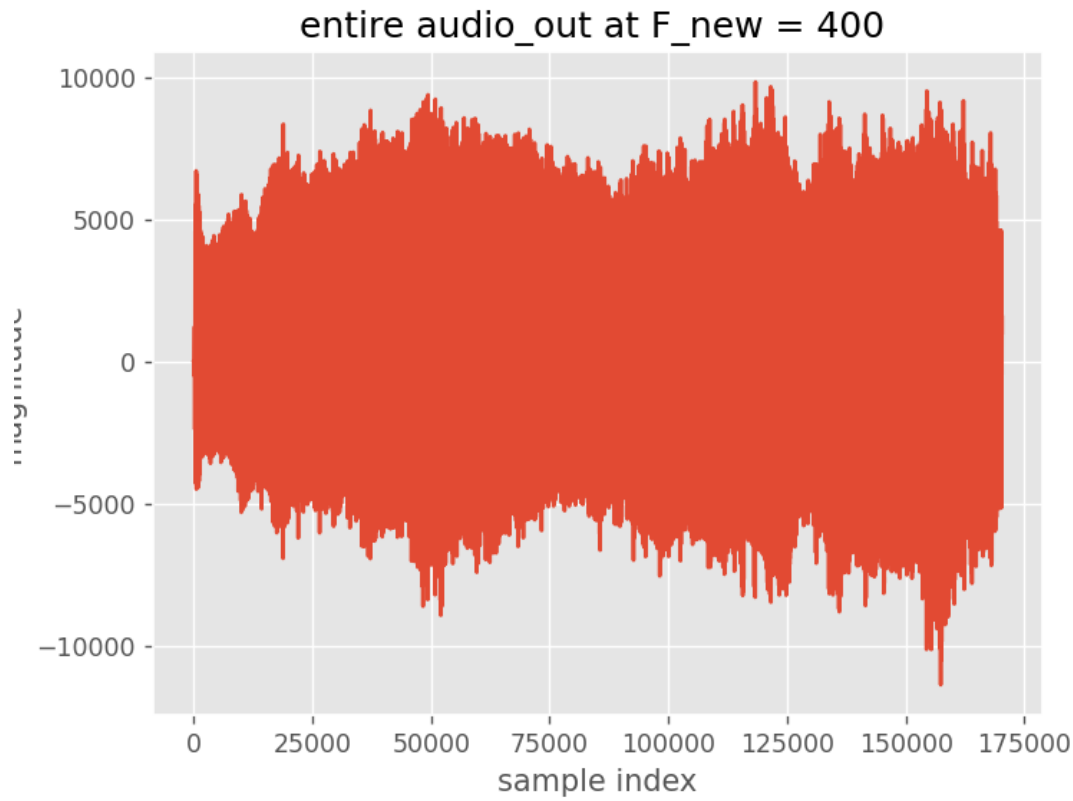

zoomed in audio_out at F_new = 100
magnitude
sample index
4000
3000
2000
1000
0
−1000
−2000
0
250
500
750
1000
1250
1500
1750
2000

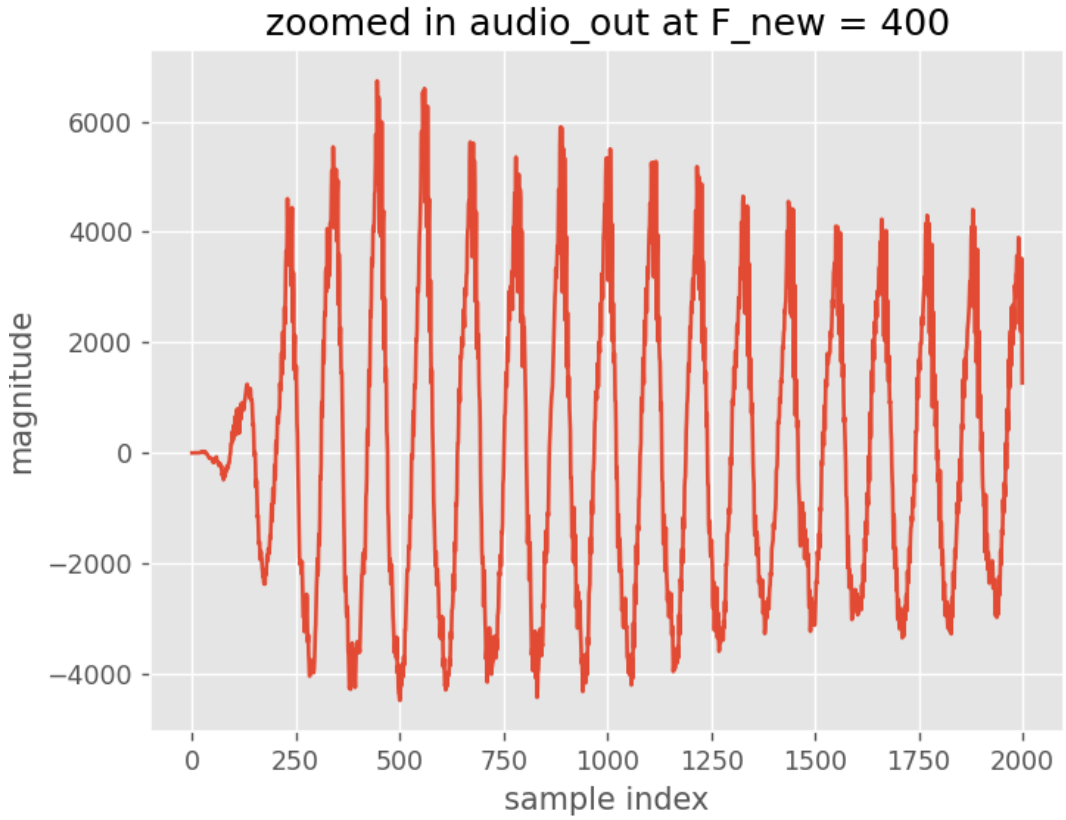

entire audio_out at F_new = 200
6000
4000
2000
0
−2000
−4000
−6000
−8000
magnitude
0
25000
50000
75000
100000
125000
150000
175000
sample index


zoomed in audio_out at F_new = 200
5000
4000
3000
2000
1000
0
−1000
−2000
−3000
magnitude
0
250
500
750
1000
1250
1500
1750
2000
sample index


entire audio_out at F_new = 300
6000
4000
2000
0
−2000
−4000
−6000
magnitude
0
25000
50000
75000
100000
125000
150000
175000
sample index


zoomed in audio_out at F_new = 300
4000
3000
2000
1000
0
−1000
−2000
−3000
magnitude
0
250
500
750
1000
1250
1500
1750
2000
sample index


entire audio_out at F_new = 400
10000
5000
0
−5000
−10000
0
25000
50000
75000
100000
125000
150000
175000
sample index


zoomed in audio_out at F_new = 400
magnitude
6000
4000
2000
0
−2000
−4000
0
250
500
750
1000
1250
1500
1750
2000
sample index