EE 679 Speech Processing

Computing Assignment 1

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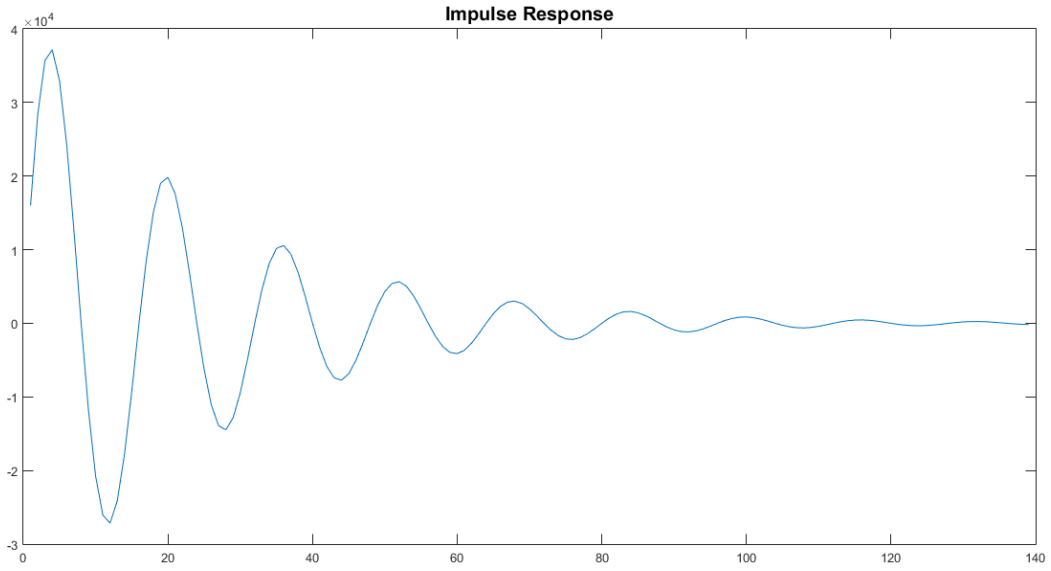
1. For given,

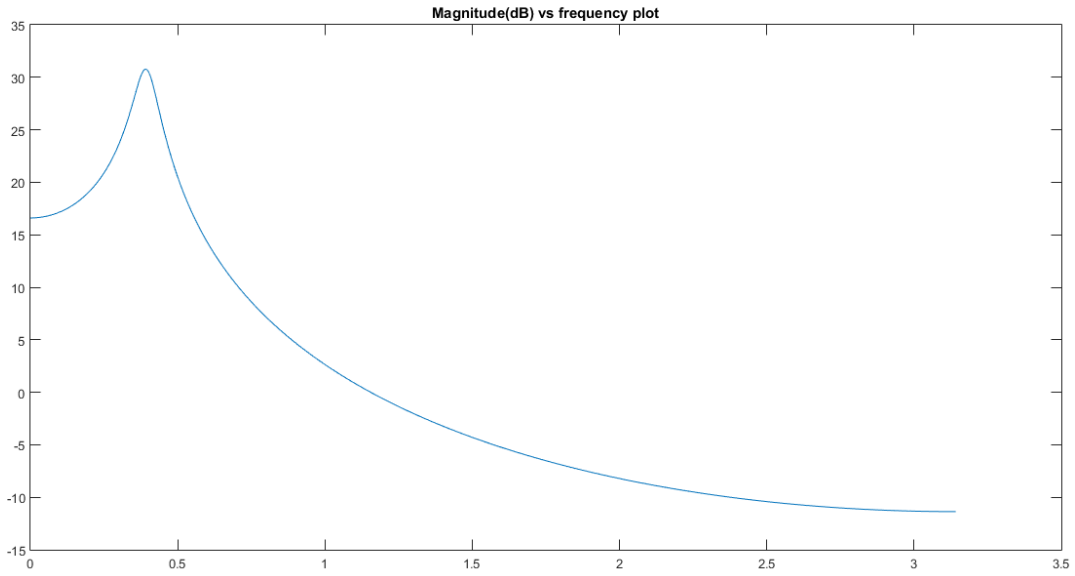
   F1 (formant) = 1 kHz
   B1(bandwidth) = 200 Hz
   Fs (sampling freq) = 16 kHz

   Single formant resonator -

$$H(z) = \frac{z^2}{(z^2 - 1.777z + 0.9245)}$$

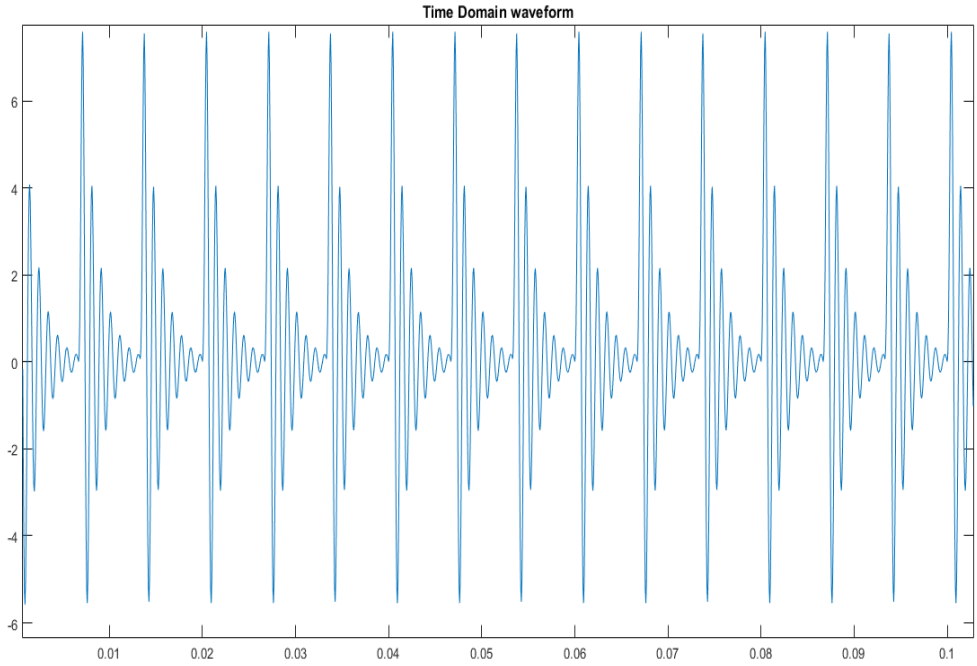


Impulse response



For implementation of above plots, please find the matlab codes.

2.



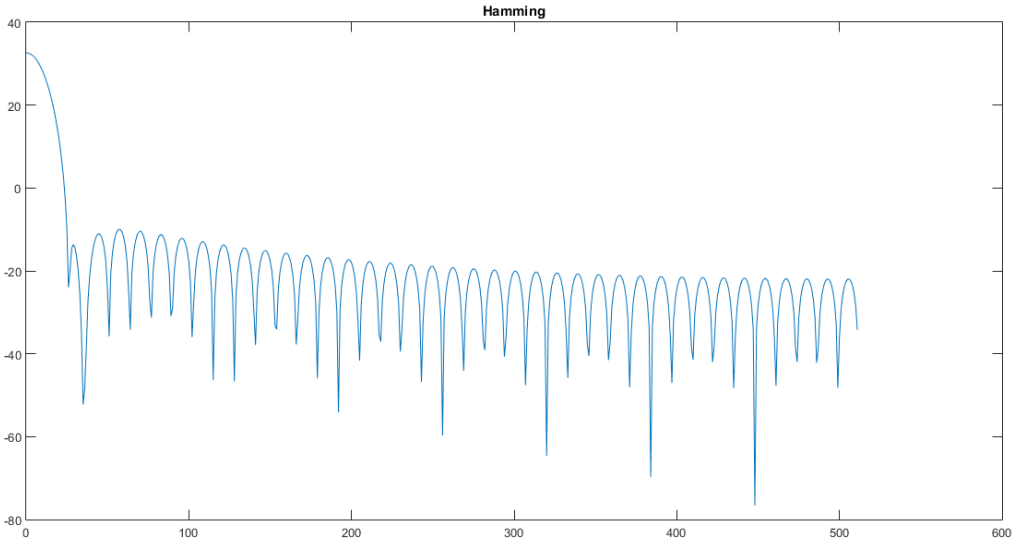
This is time domain waveform of output of source – filter system.
If we broaden the length of a triangular pulse, we can hear significant change in the output wave file. Sound loses the sharpness as we increase the triangular width.

3. For different values of bandwidth, formant and period of source excitation different wav files are generated. In (c), F0 is increased; hence pitch of the sound is increased. Between (a) and (b), formant as well as bandwidth is changed, by hearing we can clearly distinguish these two sounds. Hence the quality of the sound is changed.

4. For different vowels sounds are generated.

5. As said in the class, spectrum is taken from Q3.

   By looking at the plots, there is a huge difference between two spectras due to two different windows. With Hamming window spectra looks more smoother. There is huge peak for points, that peak corresponds to the formant in the transfer function.

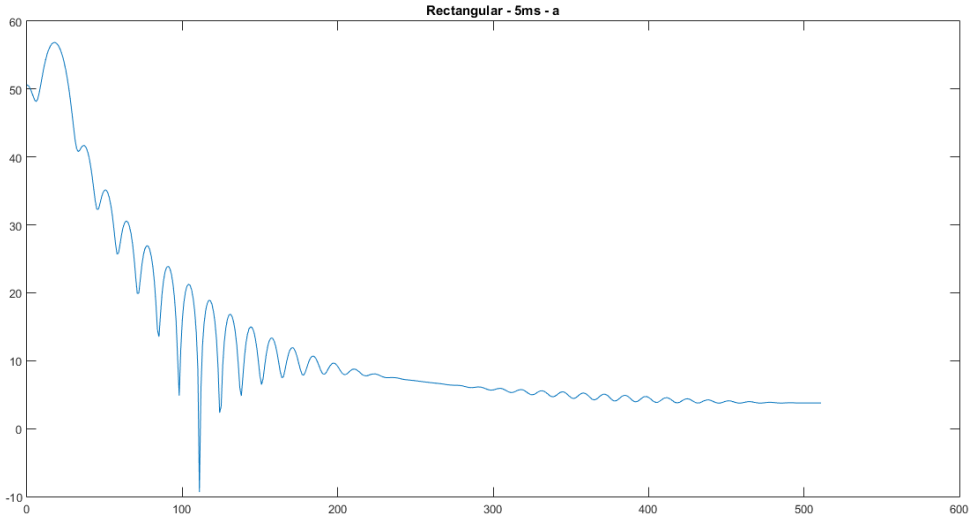


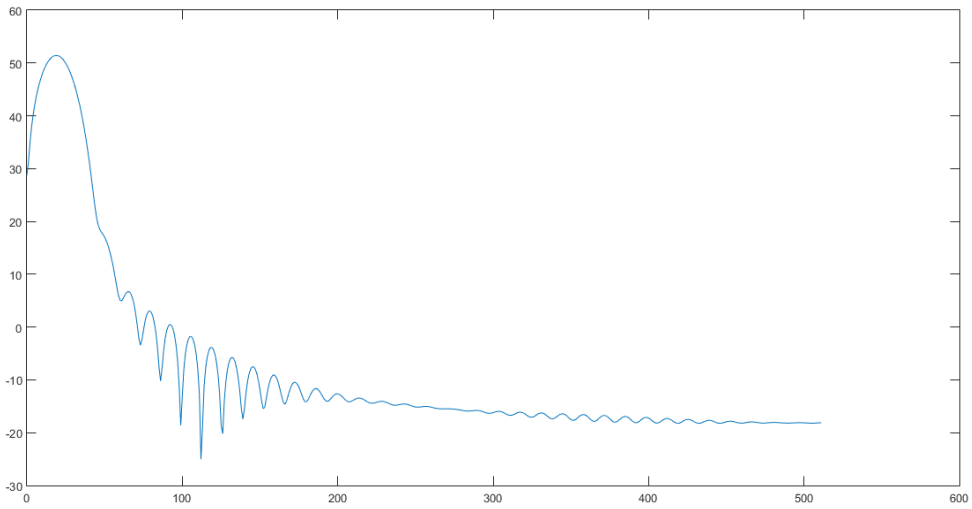
DTFT of Hamming window of size 80

For a,

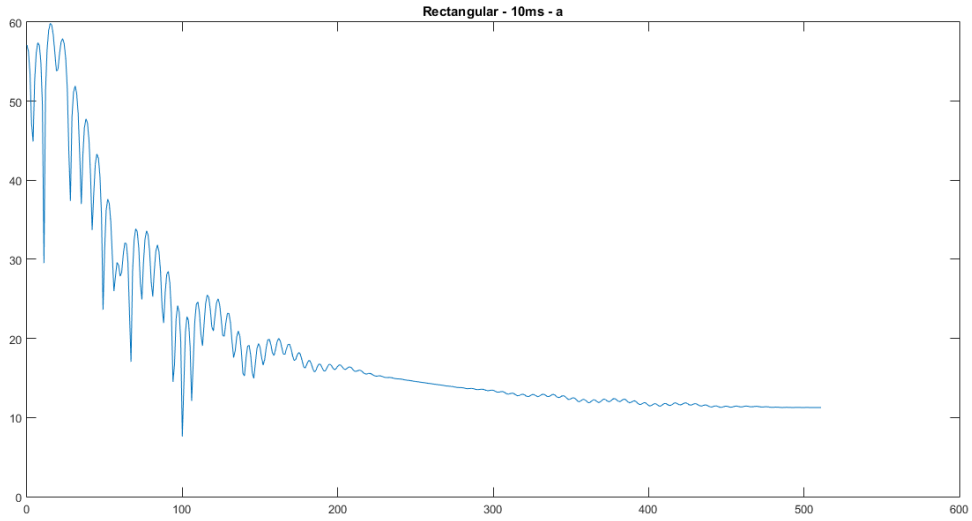
F0 = 120 Hz, F1 = 300 Hz, B1 = 100 Hz

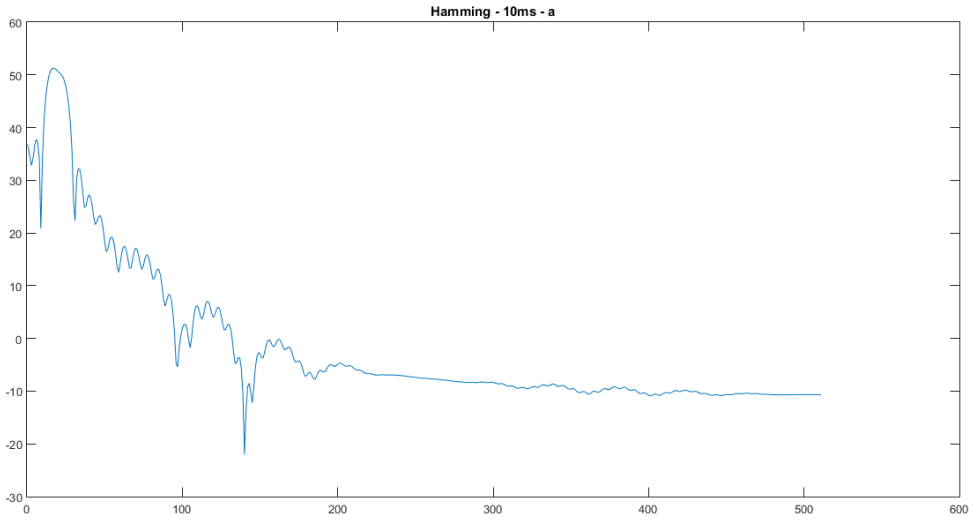
DTFT plots for 5ms windows-



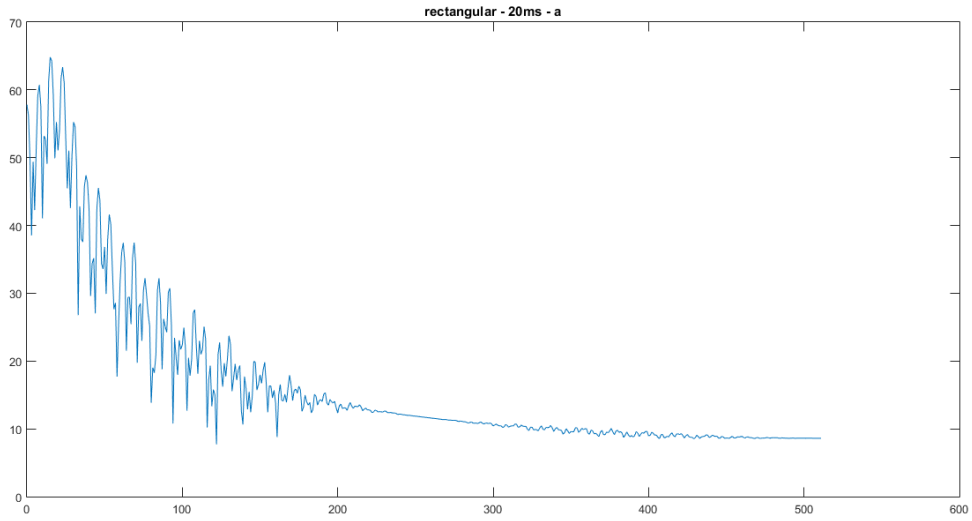


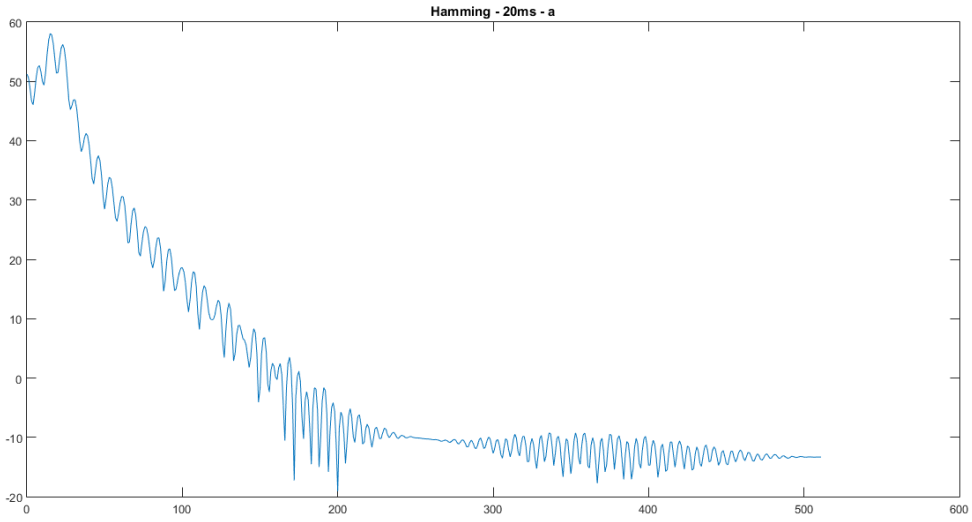
DTFT plots for 10ms windows-



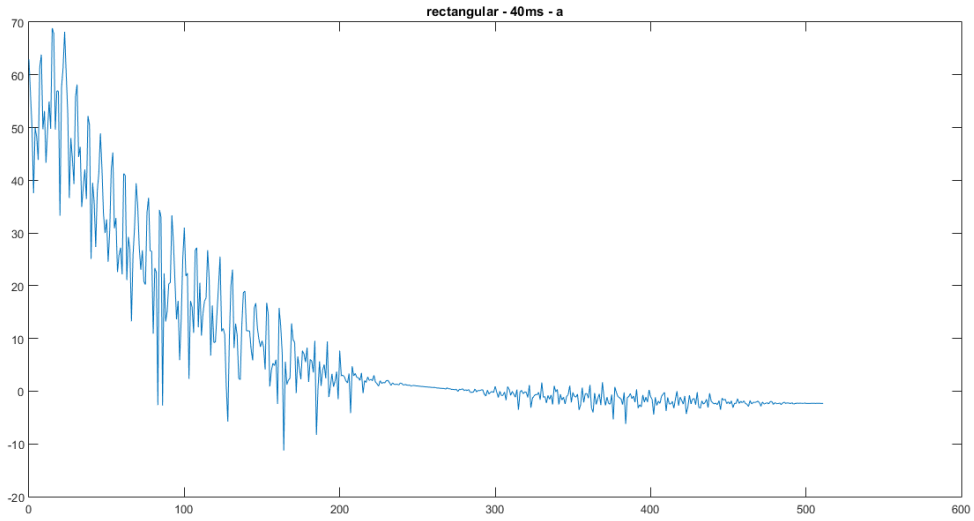


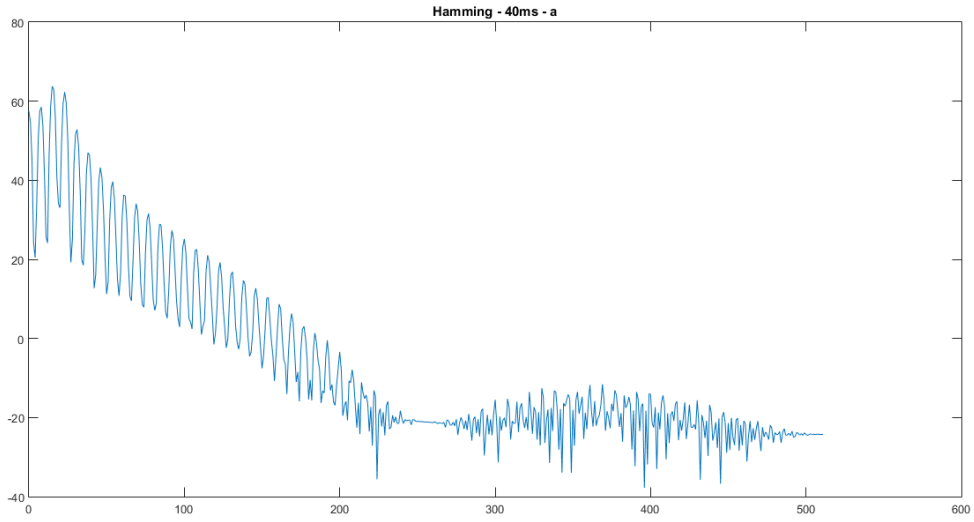
DTFT plots for 20ms windows-





DTFT plots for 40ms windows –

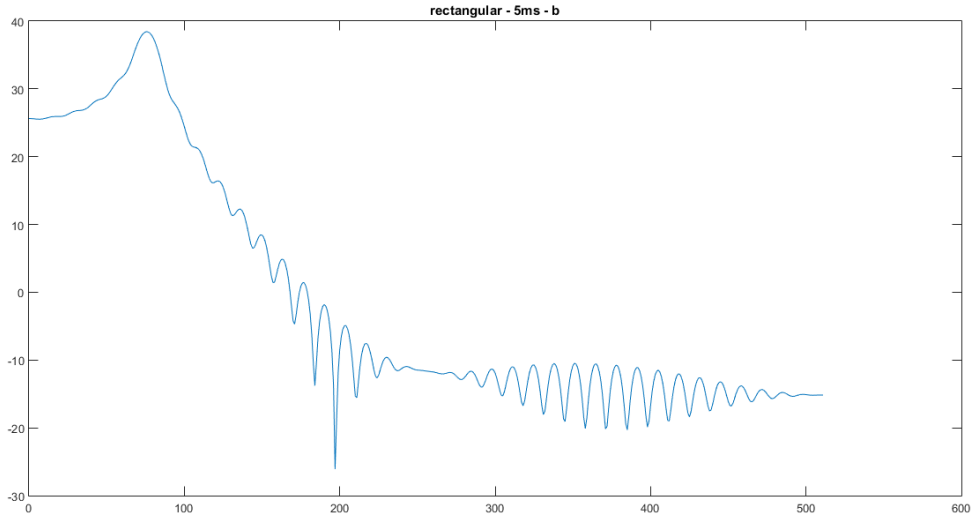


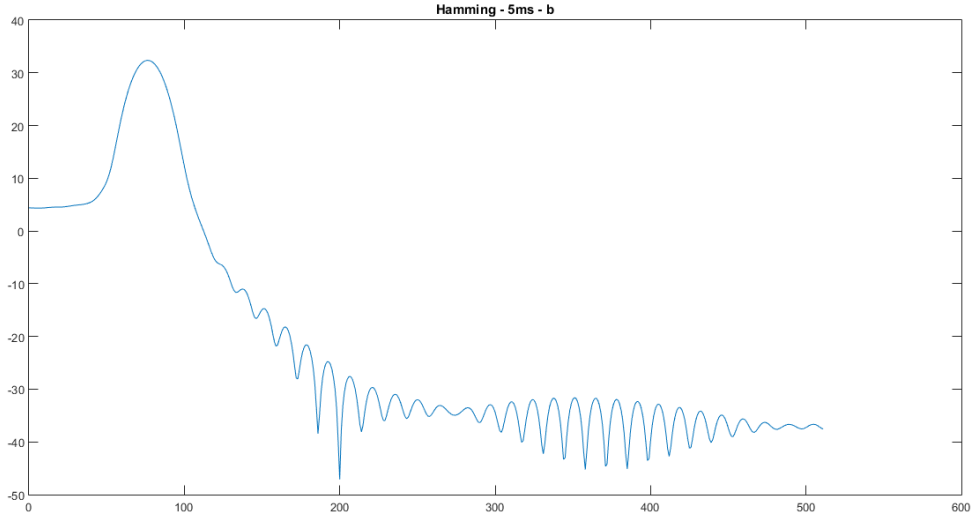


For b,

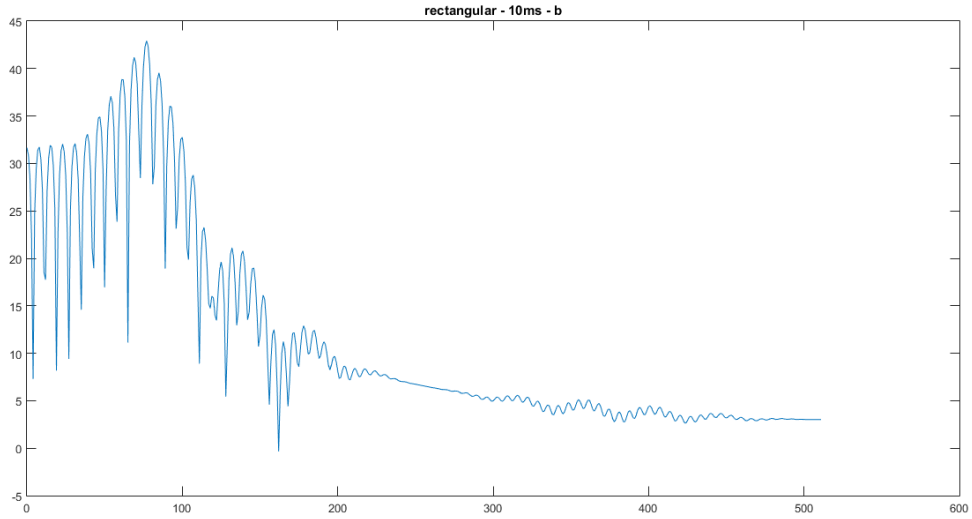
F0 = 120 Hz, F1=1200 Hz, B1 = 200 Hz

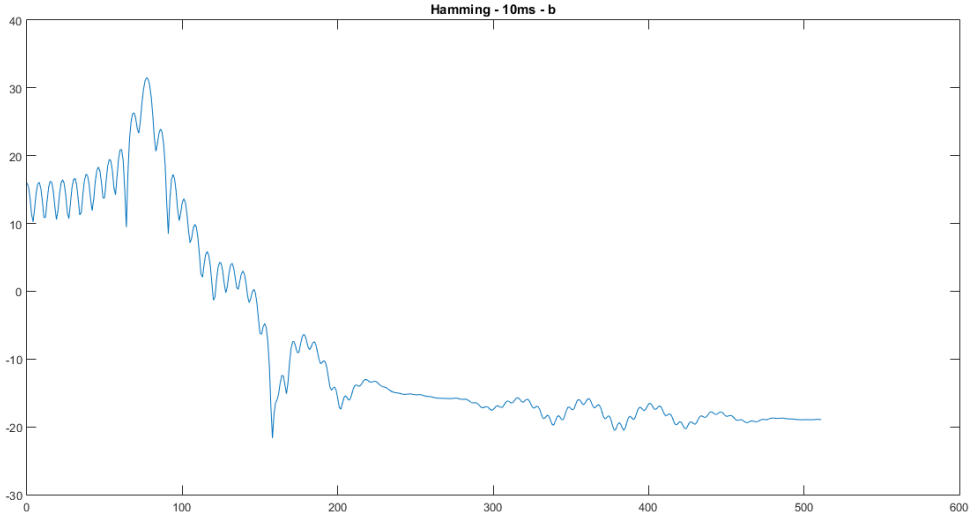
DTFT plots for 5ms windows –



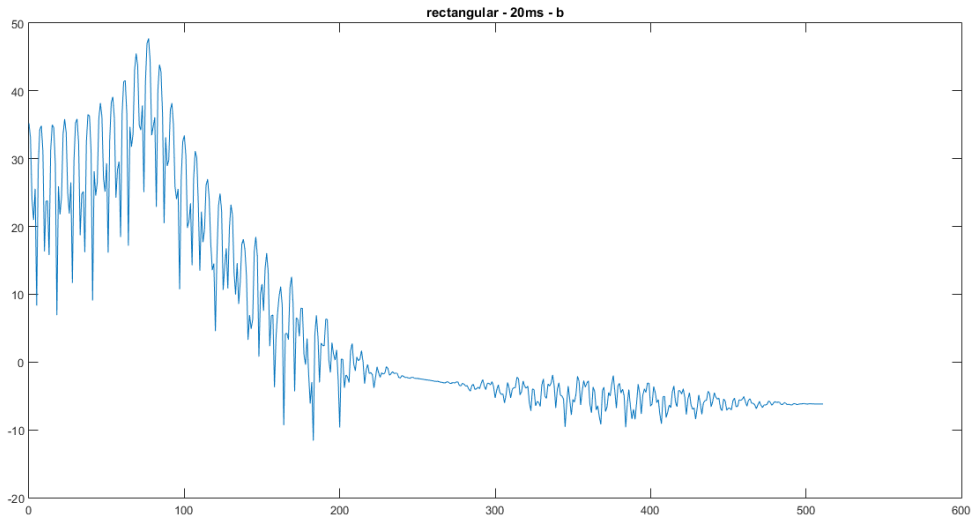


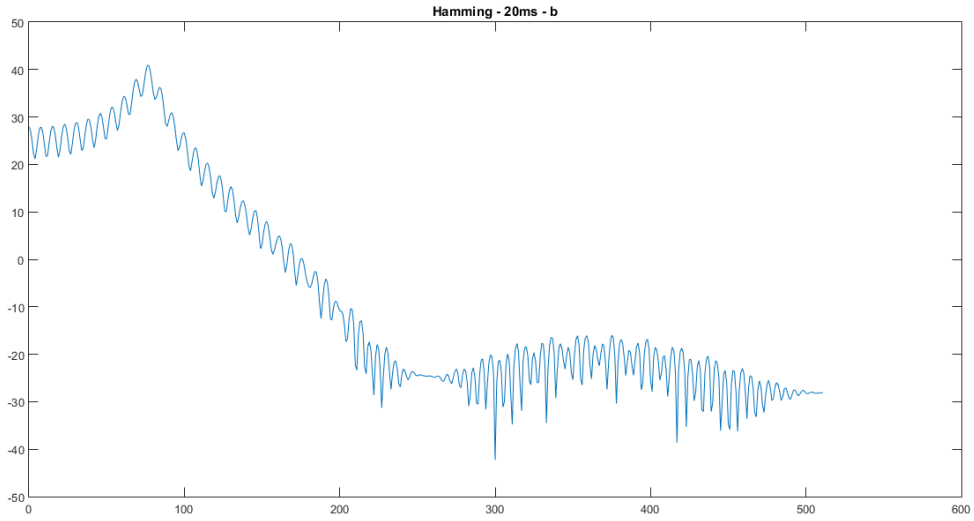
DTFT plots for 10ms windows –



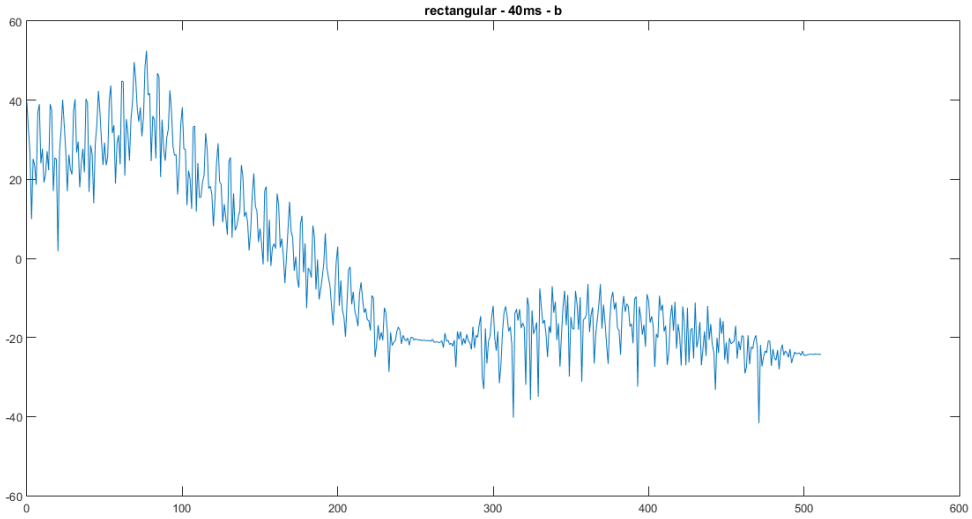


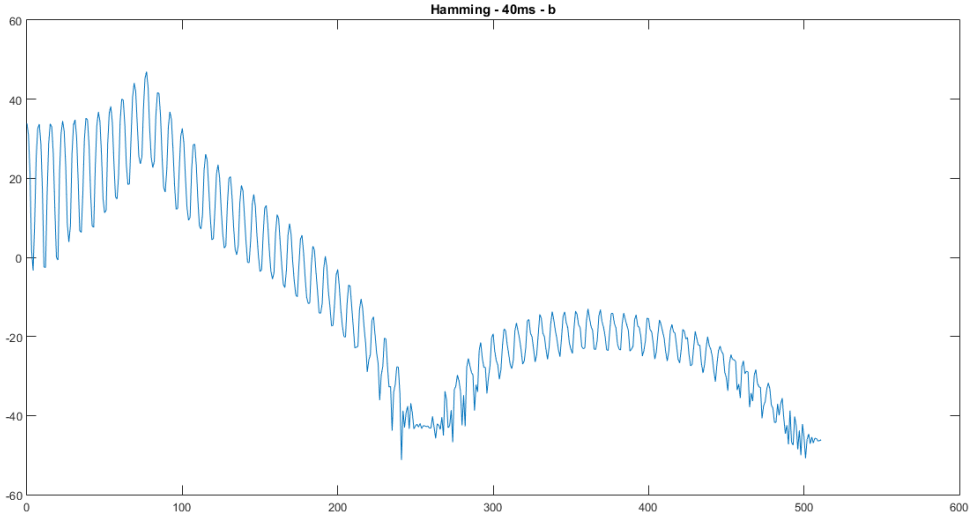
DTFT plots for 20ms windows –





DTFT plots for 40ms windows –


rectangular - 40ms - b
60
40
20
0
-20
-40
-60
0
100
200
300
400
500
600


Hamming - 40ms - b
60
40
20
0
-20
-40
-60
0
100
200
300
400
500
600