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Matlab #3

Question 1

In this part, we compared the effects of different kinds of windowing. First, we created 128 point rectangular window and we multiplied it with 3 different x signals. Then, we took 128 point DFTs for three of them. The plots are as following,

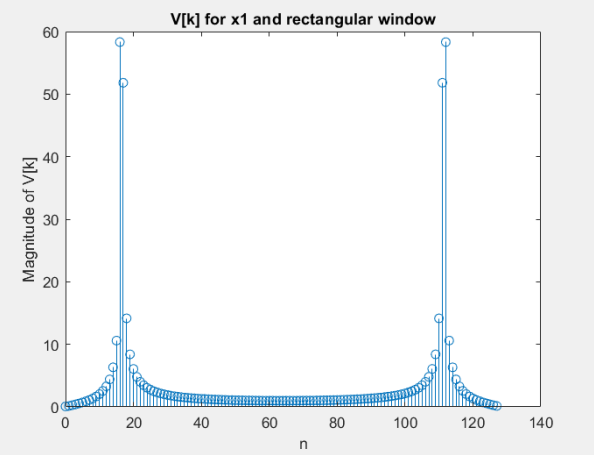


Figure 1.

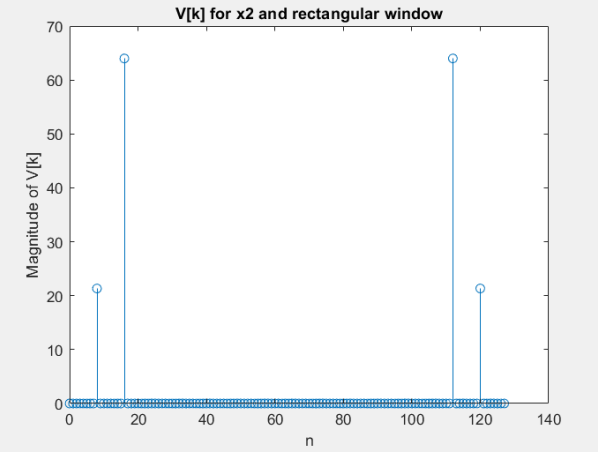


Figure 2.

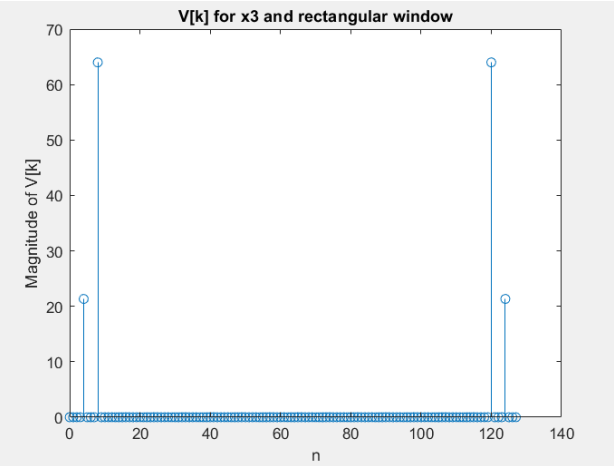


Figure 3.

Then, again, we applied same prosedure for hamming window. First we created 128 point hamming window, we multiplied it with three different x signals. Then, we took 128 point fft, the plots are as following,

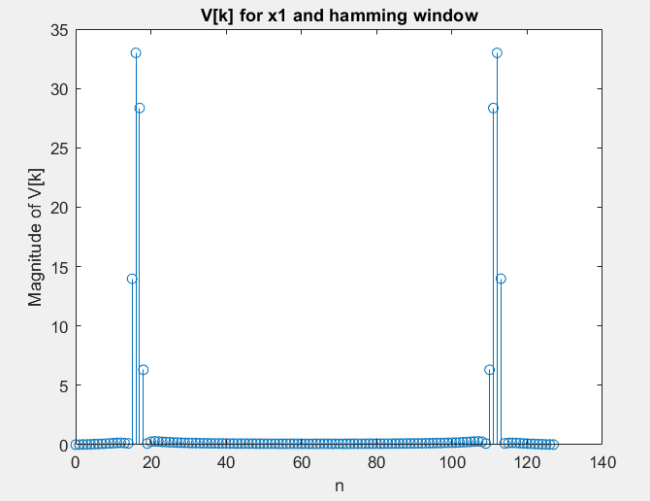


Figure 4.

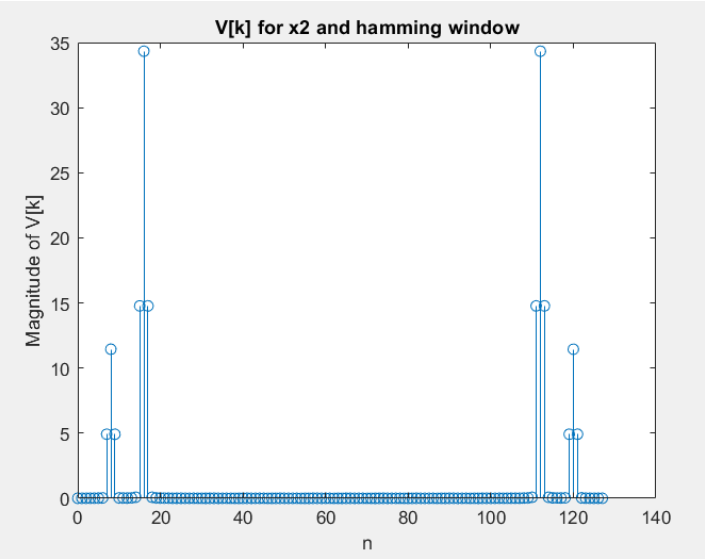


Figure 5.

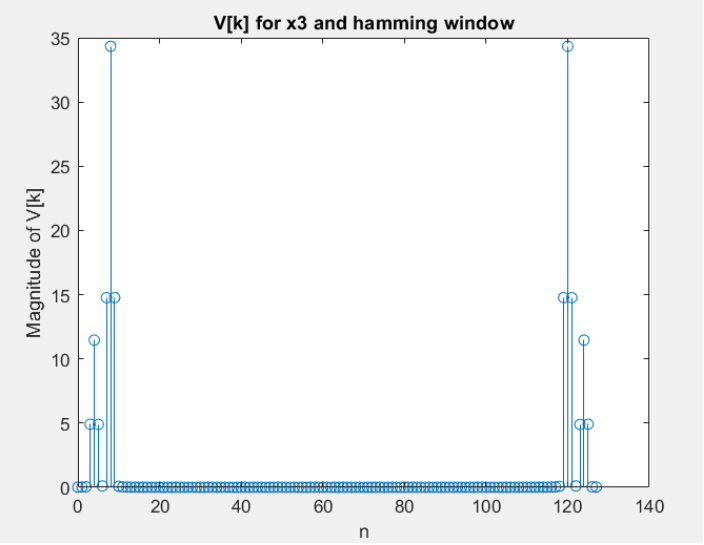
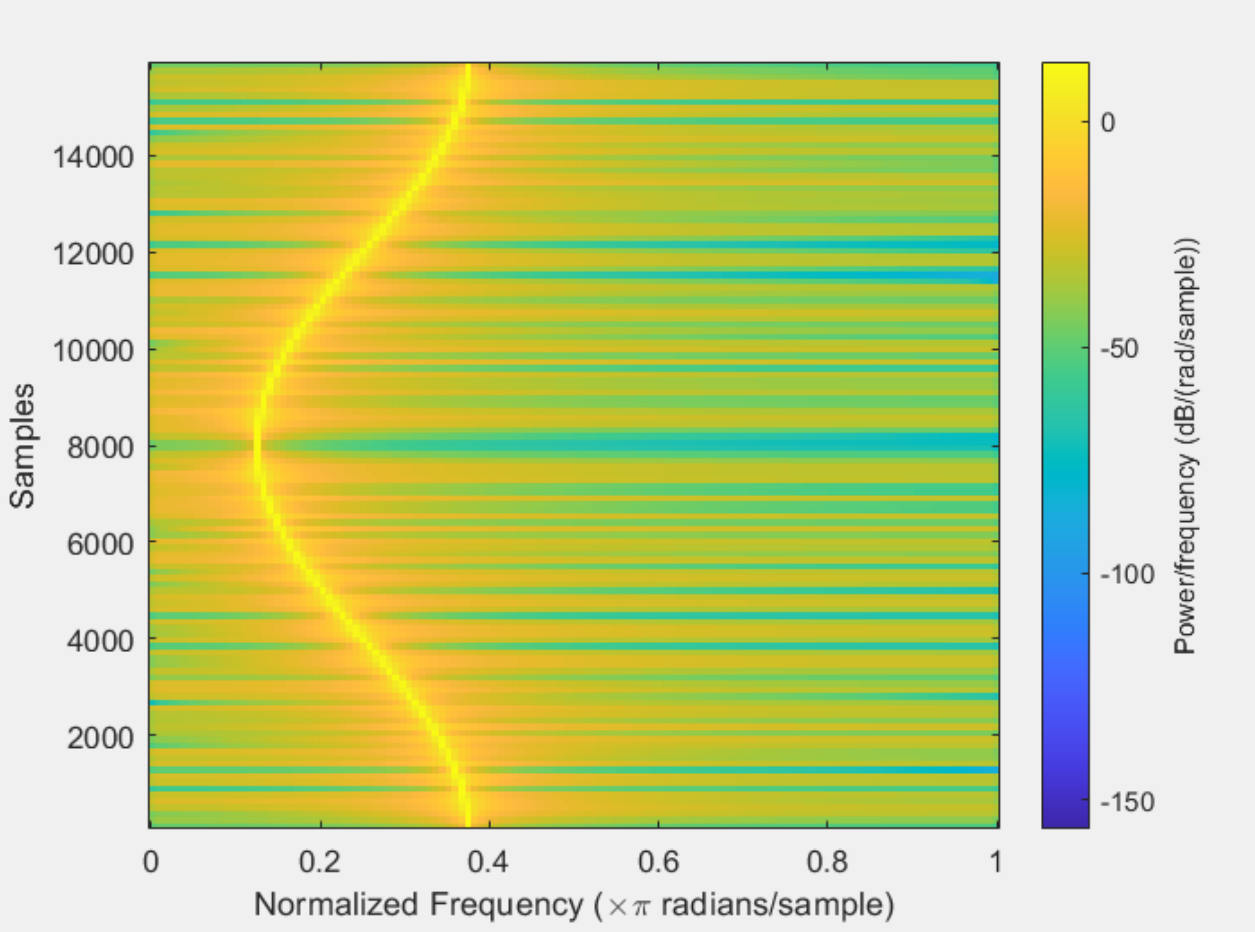


Figure 6.

Window type is the one of the main factors to determine leakage and spread of the signals. If all frequencies of the given signal presents on multiples of the window signal, the leakage and the spread are reduced. For example, the first signal(x1) has frequency on 0.26 which is not multiple of 128, so the signal significantly spread through other frequencies as seen above. To avoid this, one can apply other types of windows to reduce leakage and spread. For example, Figure 4 shows same signal that has 0.26 frequency, however, since we applied hamming window we reduced the spread. X2 and x3 contains frequencies that are multiple of 128, hence the spread is lower than x1, but still, we can see that hamming window reduced the spread and leakage.

Question 2



In this part, we plotted the spectrogram of 256 point rectangular window. In the x axis we see the normalized frequency values and in the y axis we see samples of this signal. On the right hand side, the color scale shows that which color corresponds to which frequency.