DSP Course Project Report

FIR digital filter design and MATLAB simulation using window function method

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AIM:

To design and simulate FIR filter using window function method.

METHOD:

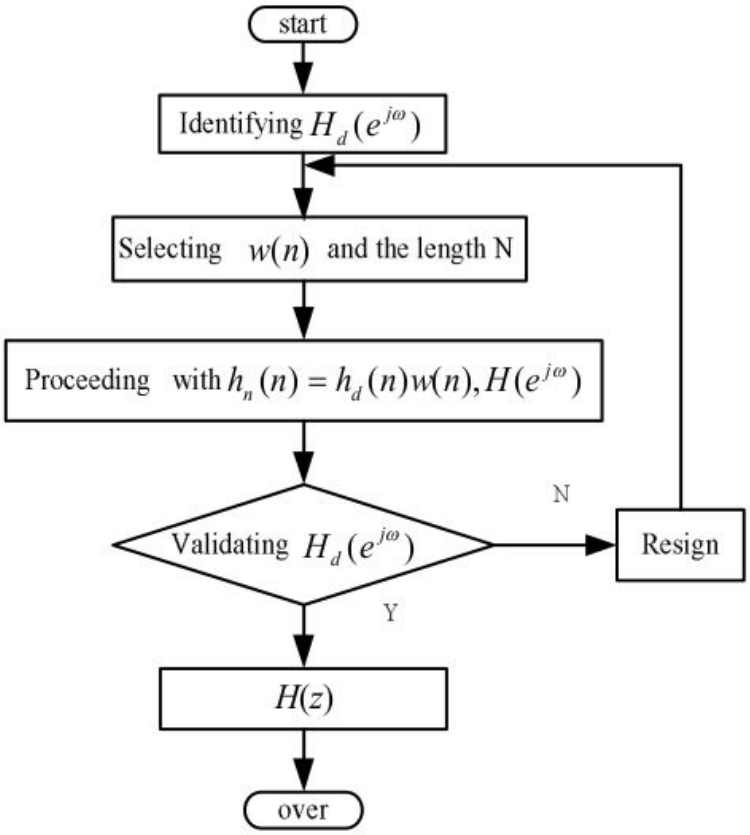
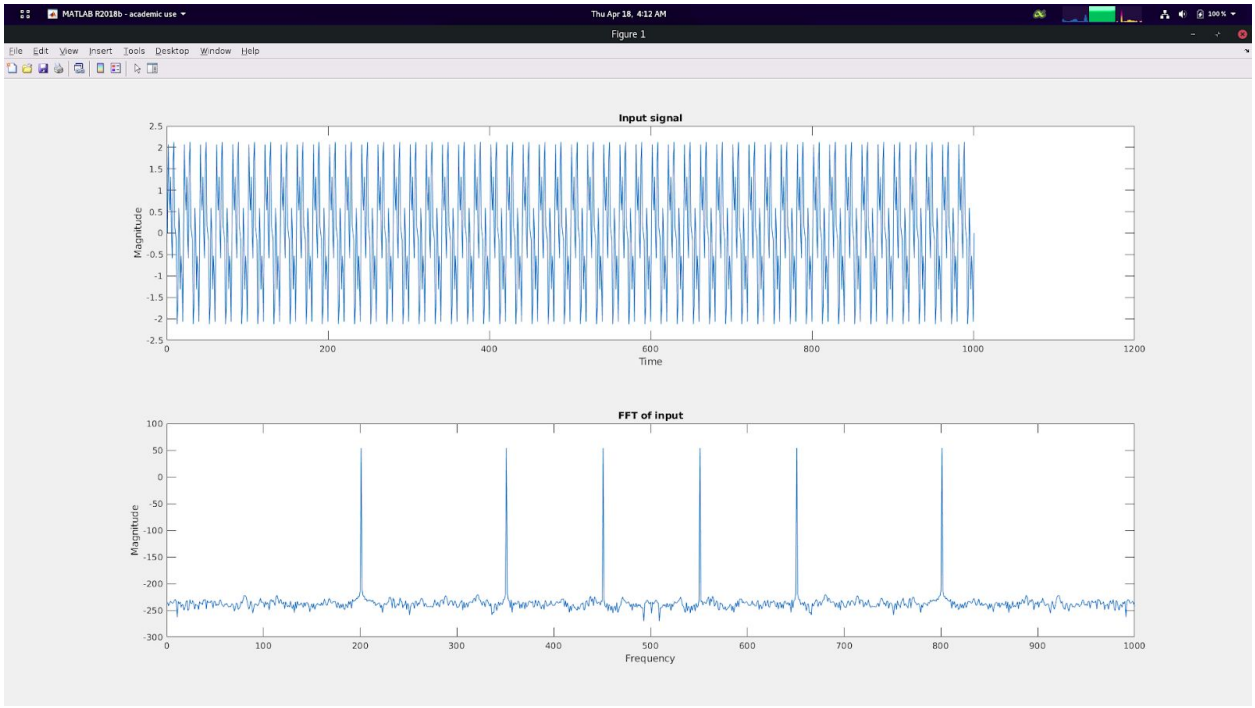
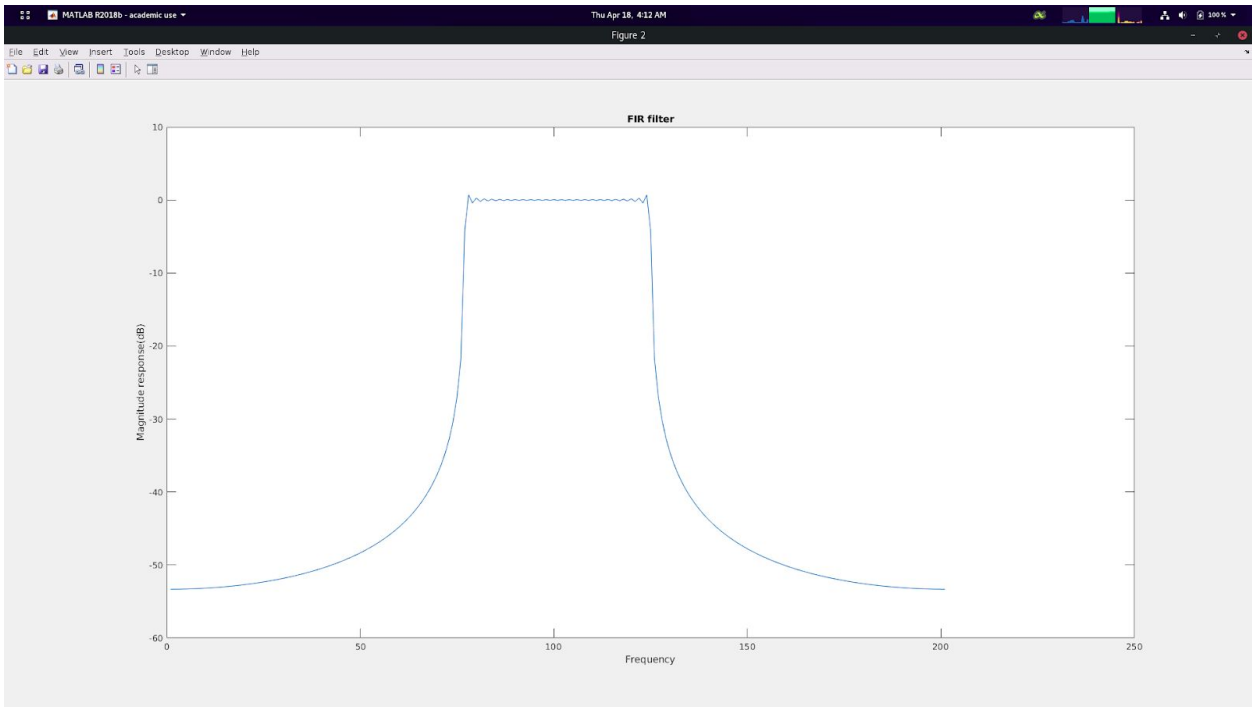


Figure 5. Design flow of window function

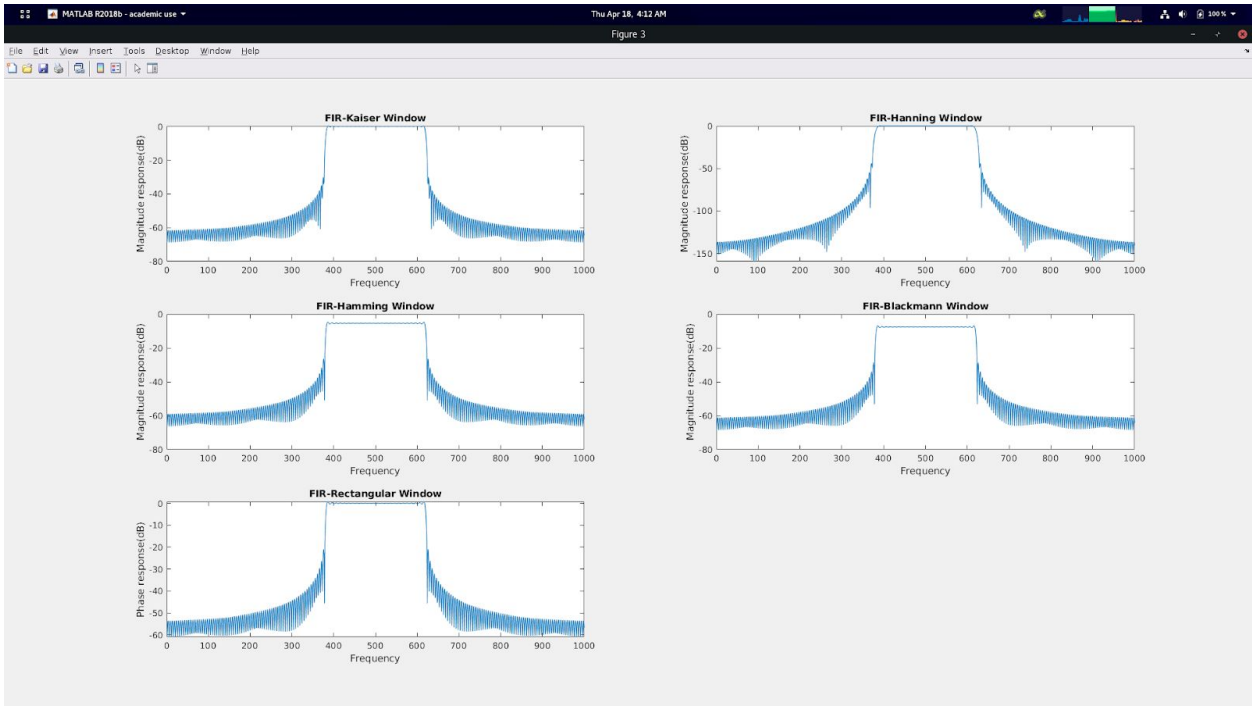
OBSERVATIONS:



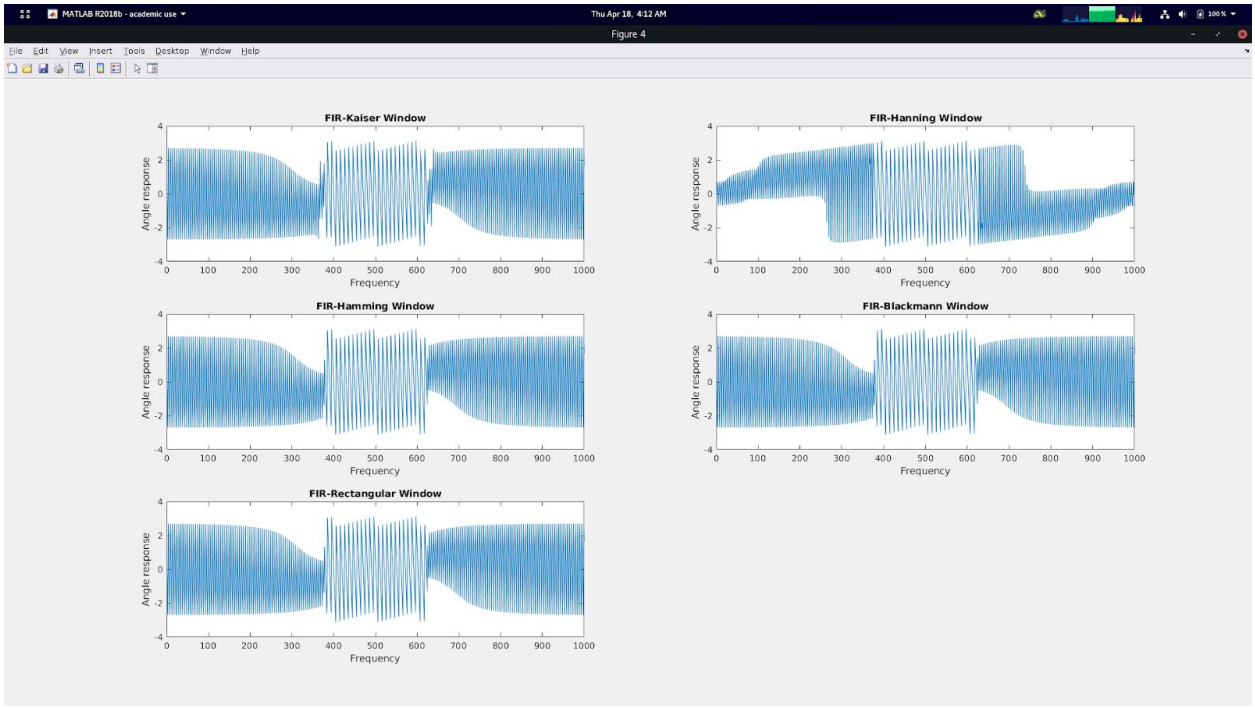
Input signal and its FFT



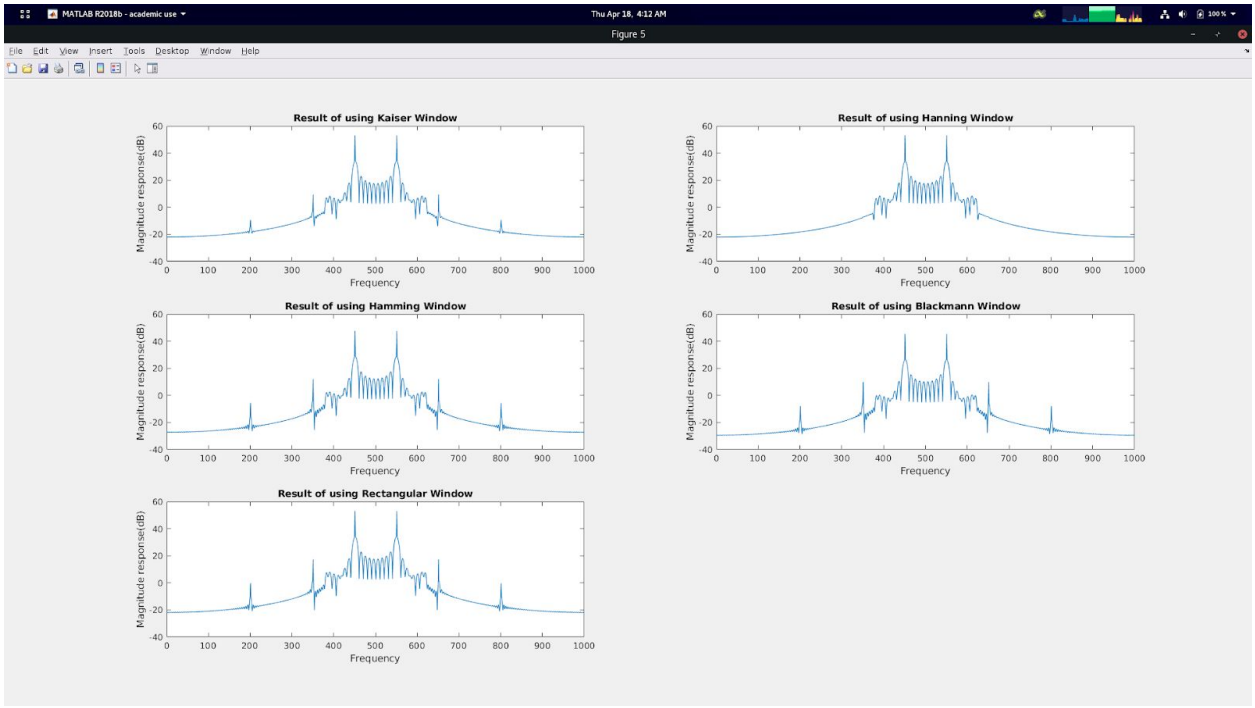
Low pass FIR filter frequency response



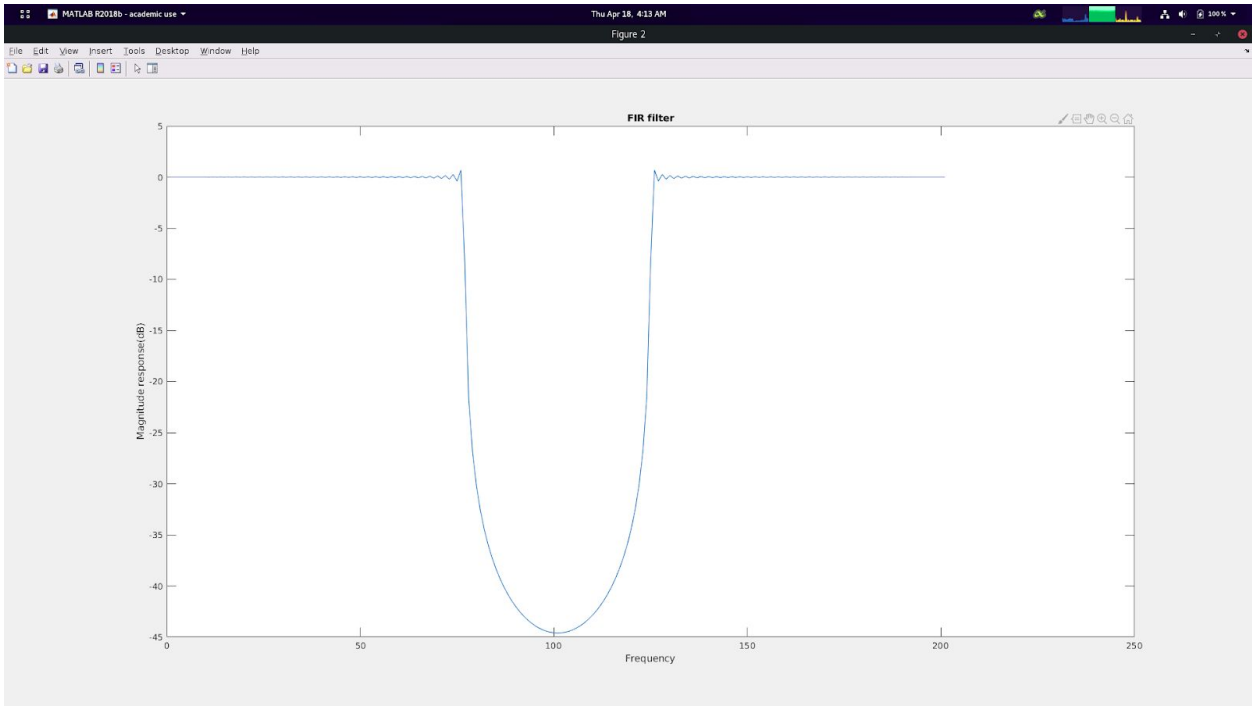
Frequency responses of low pass FIR filter with windows



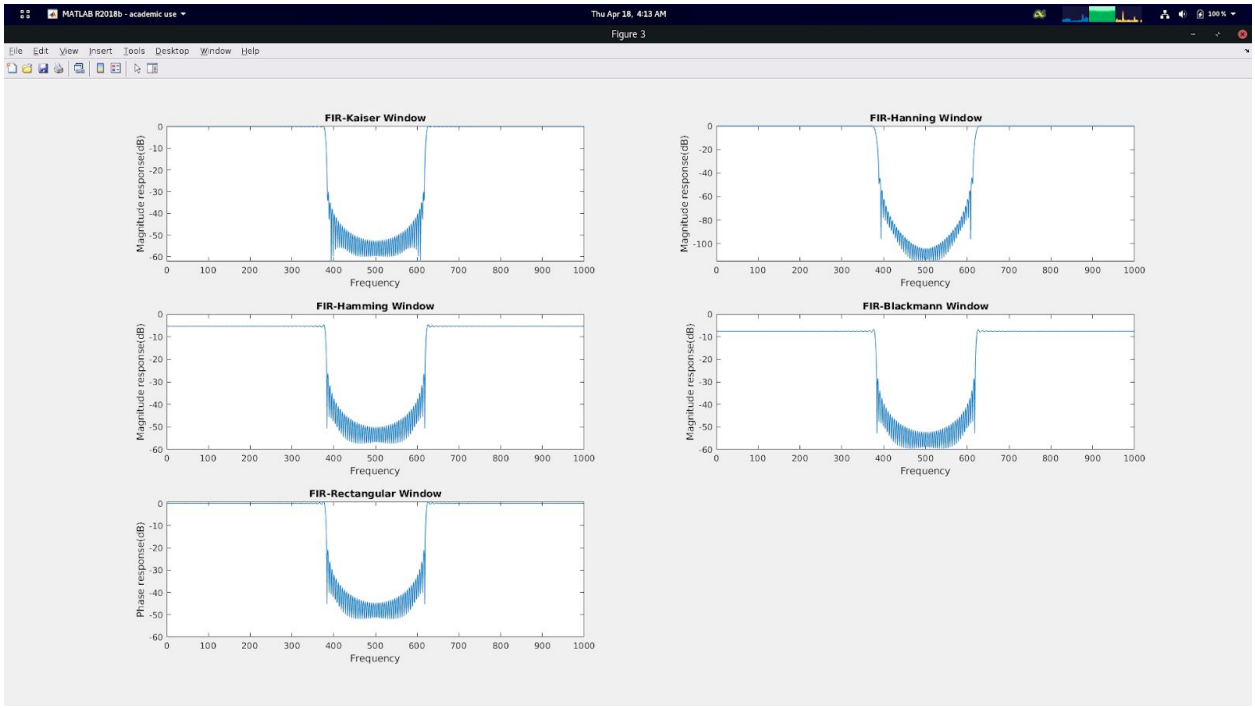
Angle responses of low pass FIR filter with windows



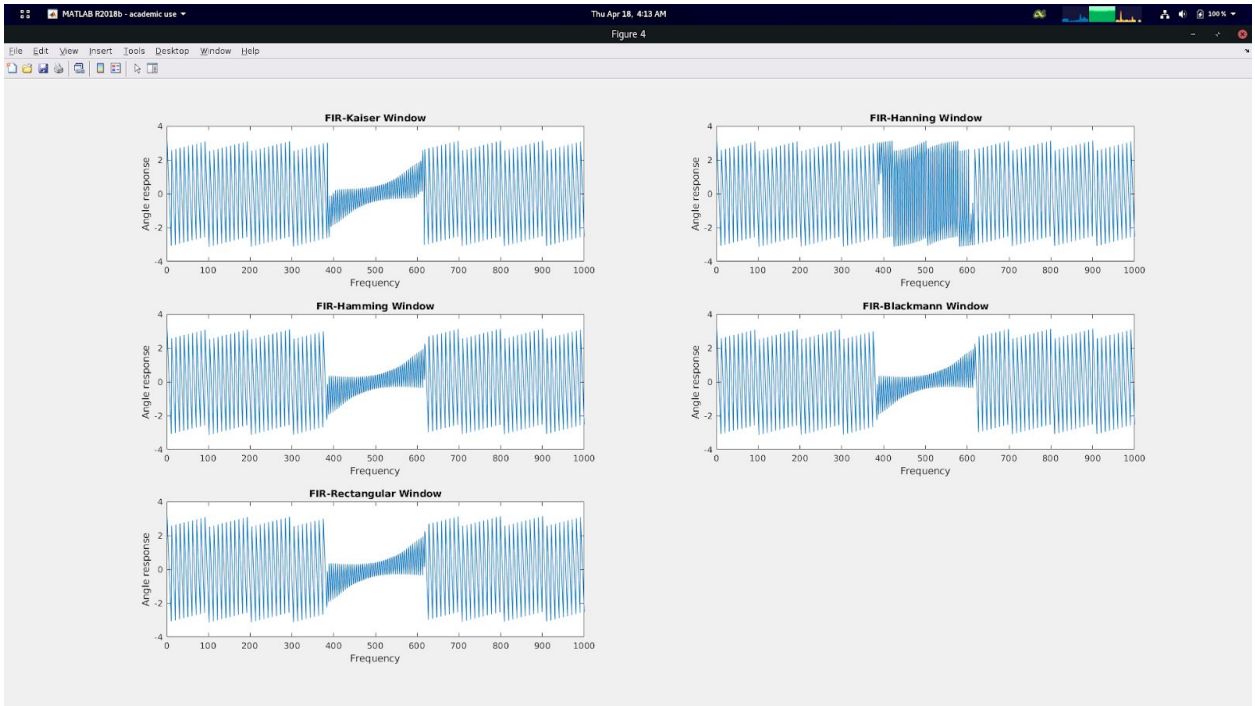
FFT of filtered signals



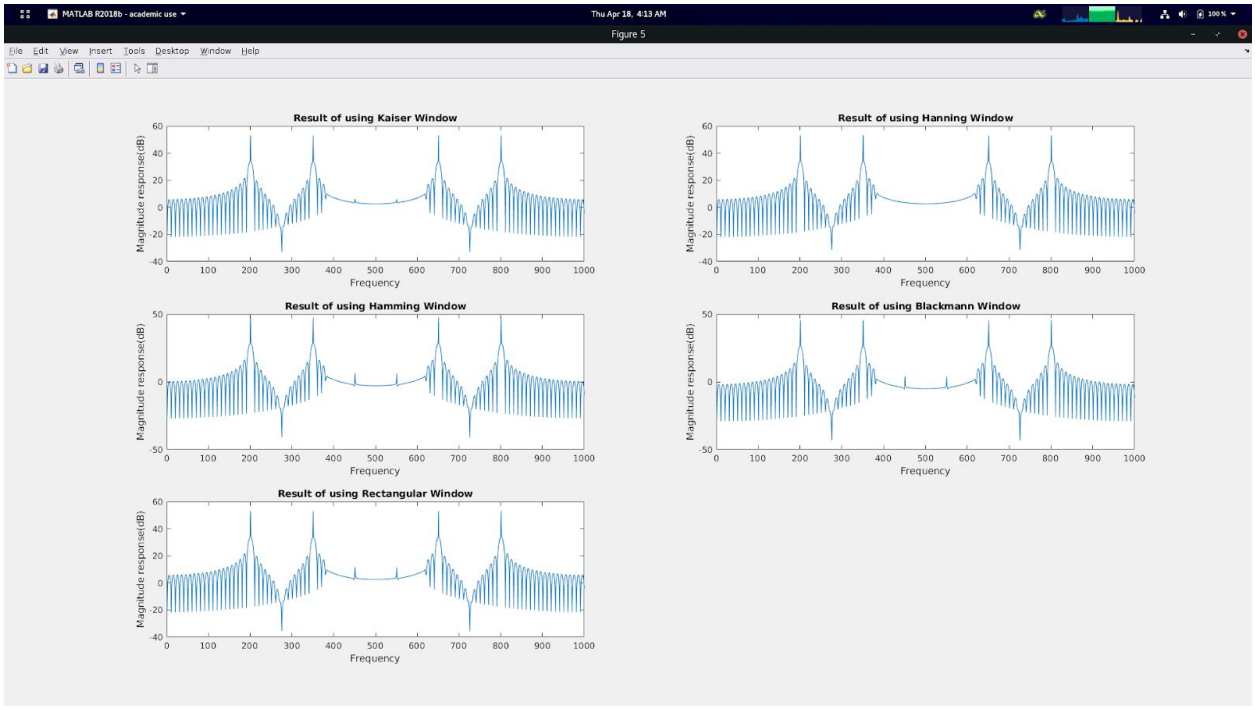
High pass FIR filter frequency response



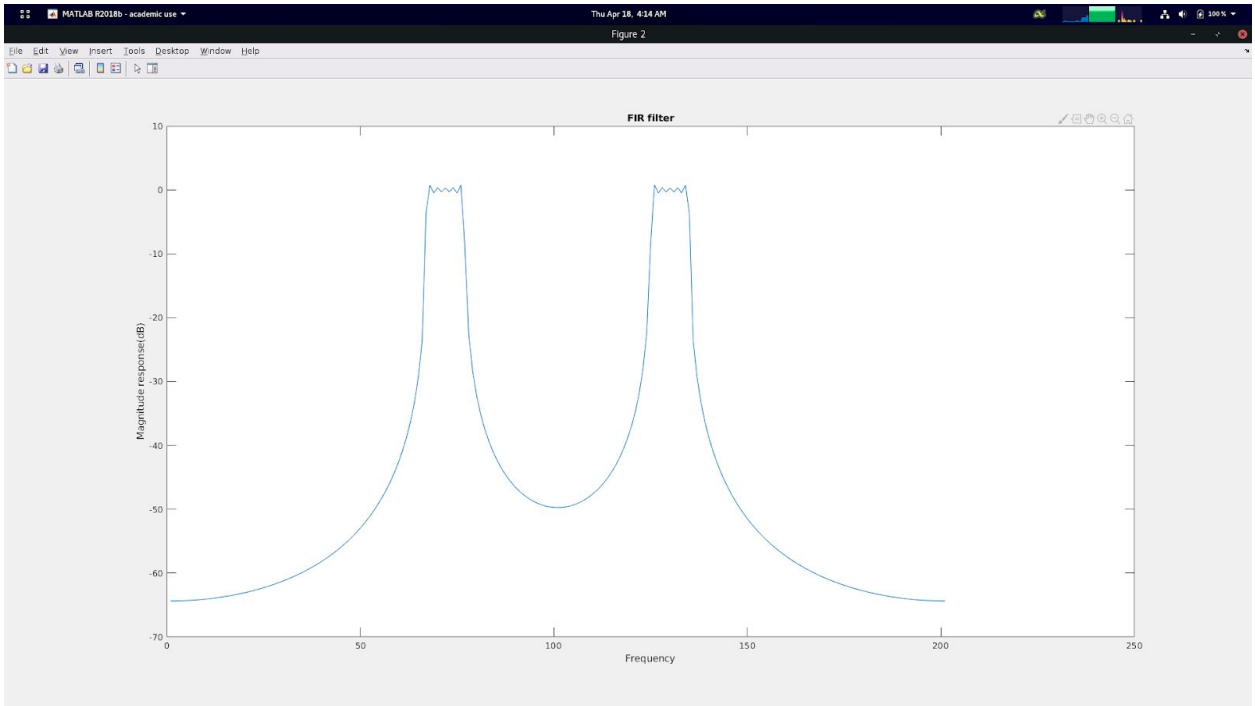
Frequency responses of high pass FIR filter with windows



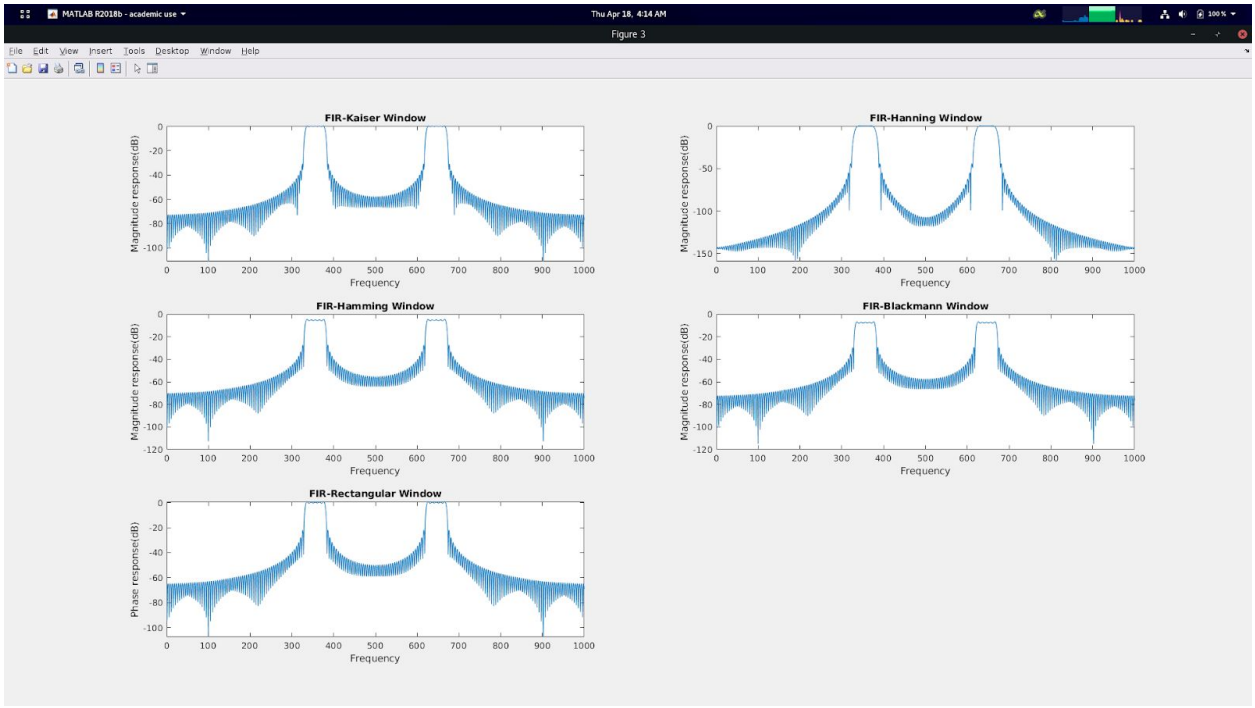
Angle responses of high pass FIR filter with windows



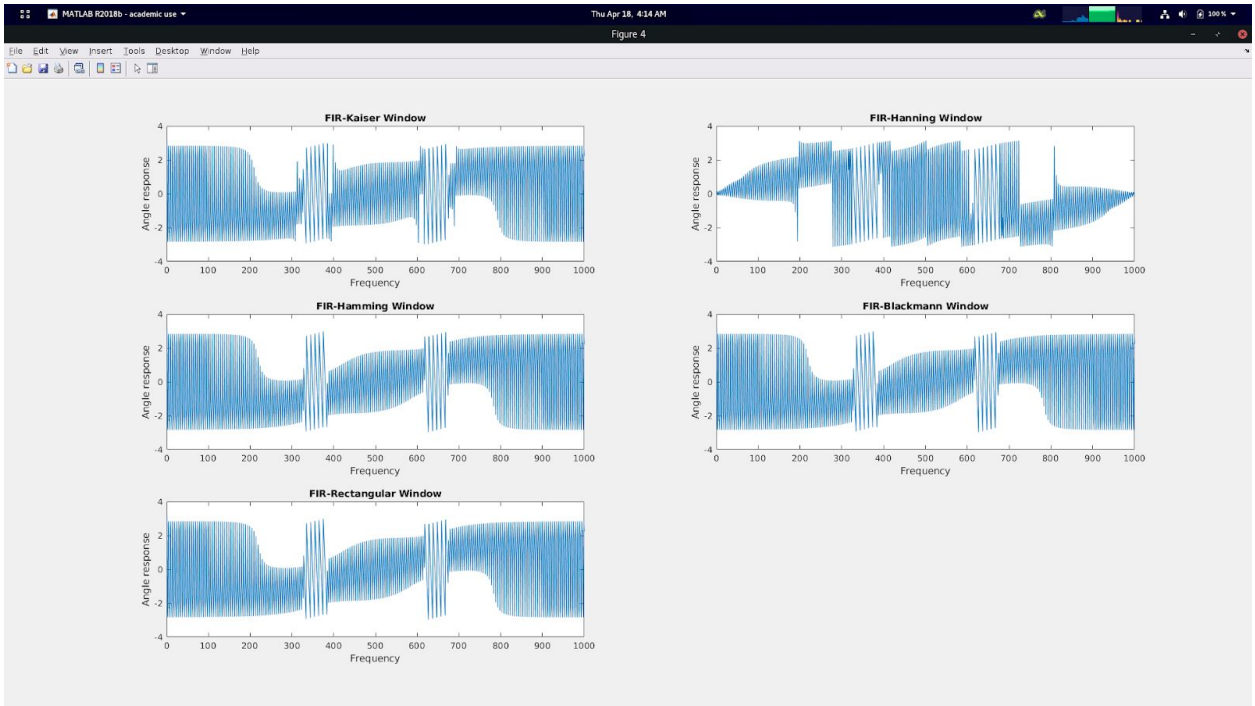
FFT of filtered signals



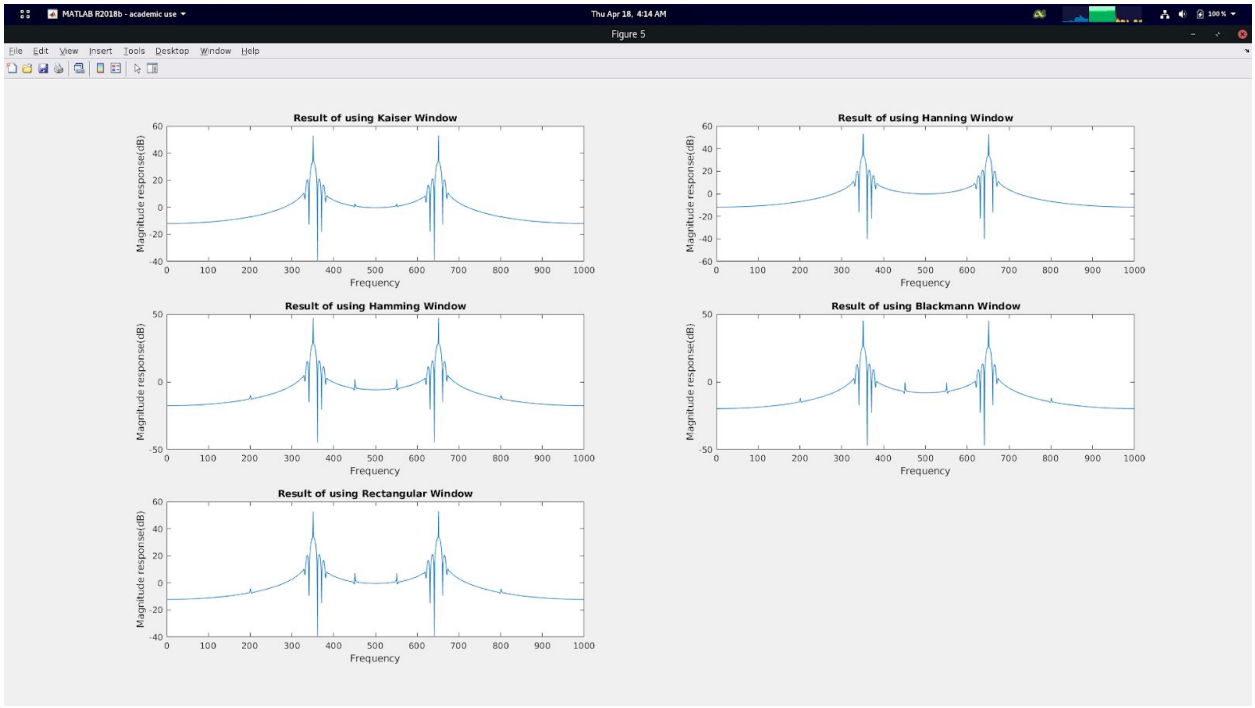
Band pass FIR filter frequency response



Frequency responses of band pass FIR filter with windows



Angle responses of band pass FIR filter with windows



FFT of filtered signals

CONCLUSION:

We have successfully designed and implemented FIR filter in MATLAB.

We have also gained insights into the Kaiser window:
Kaiser window implements a modified bessel function (a substitute for the prolate spheroidal function). This ensures that the the signal in the frequency domain has maximum energy in the main lobe. In this window, the side lobe level can be controlled with respect to the main lobe peak by varying the dynamic parameter beta, and the main lobe width can be varied by adjusting the length of the filter. Although Blackman window provides better stop band attenuation and Hamming is the most stable, the Kaiser Window is the most important for transition band due to better attenuation and transition from pass band to stop band at the cutoff frequency.
Disadvantage:
We design the same ripple size for both the passband and stopband. This can lead to overdesign in the bands depending on the application.