DSP Project Report

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Code:

We created 10 Filters [7 FIR Filters and 3 IIR Filters],
Types of FIR:

1) Constr_band_equiripple
2) Constr_Least_squares
3) Equiripple
4) Generalized_equiripple
5) Least_squares
6) Window_Chebyshev
7) Window_Rectangular

Types of IIR:

1) Butterworth_
2) Chebyshev_type_1
3) Chebyshev_type_2

As well as, we created three main functions [initialize_data(), amplify_signal() and add_filterd_signal()]

In initialize_data(), we convert original signal from time domain to frequency domain then we filter the original signal and create 9 output signals in time domain then convert them to frequency domain.

In amplify_signal(), we multiply the 9 filtered signals in gains that user enters then convert 9 amplified signals from time domain to frequency domain.

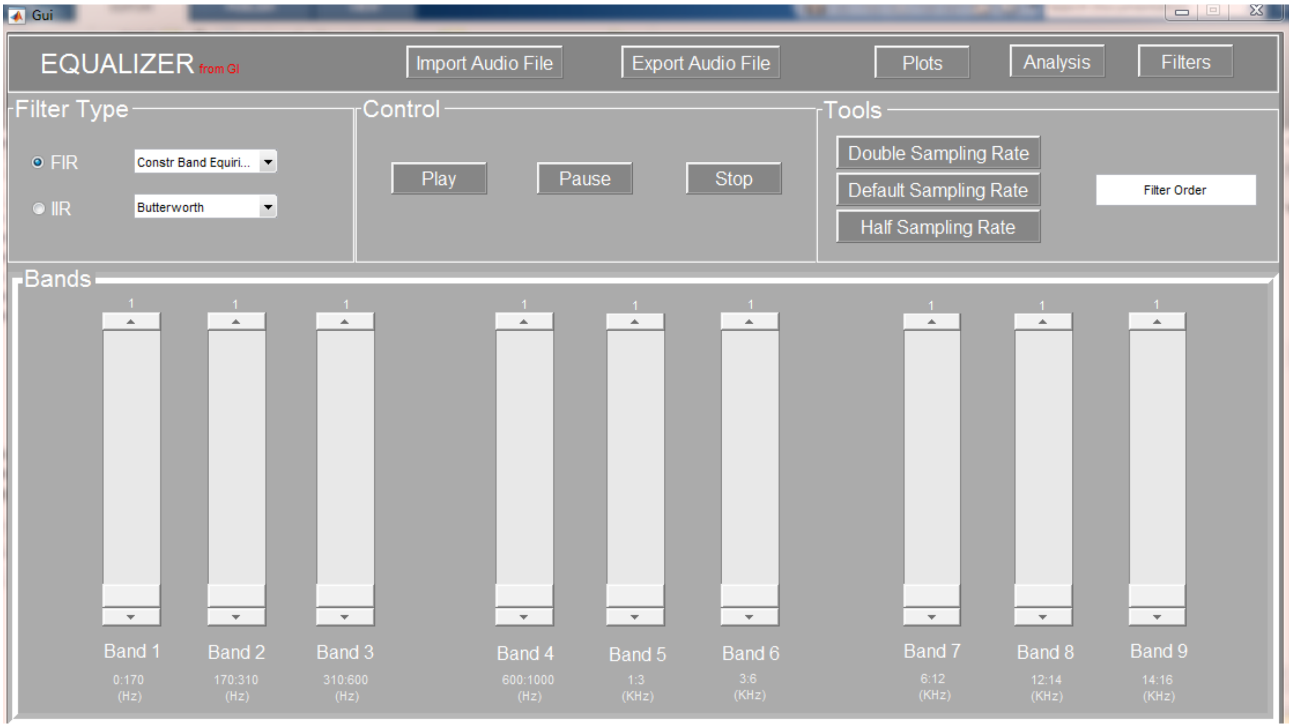
In add_filterd_signal(), we add 9 amplified signals to create the composite signal then convert it from time domain to frequency domain.

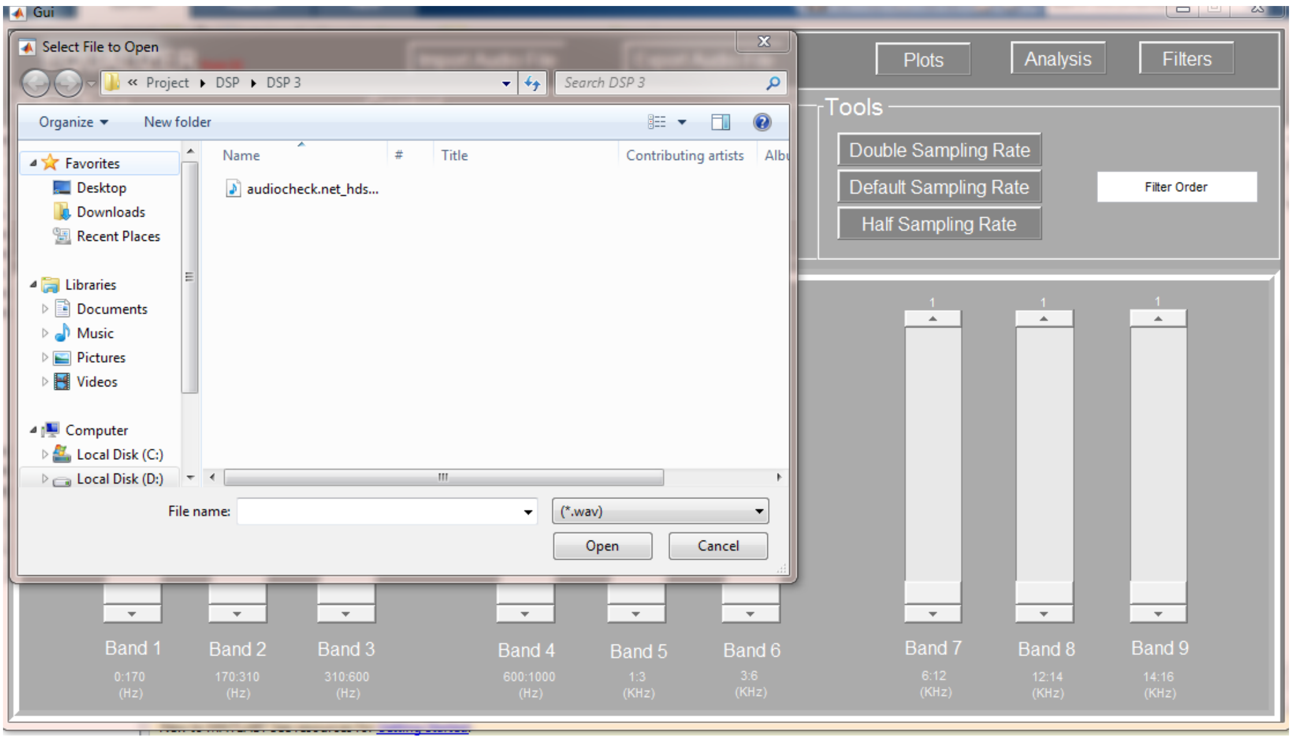
GUI:

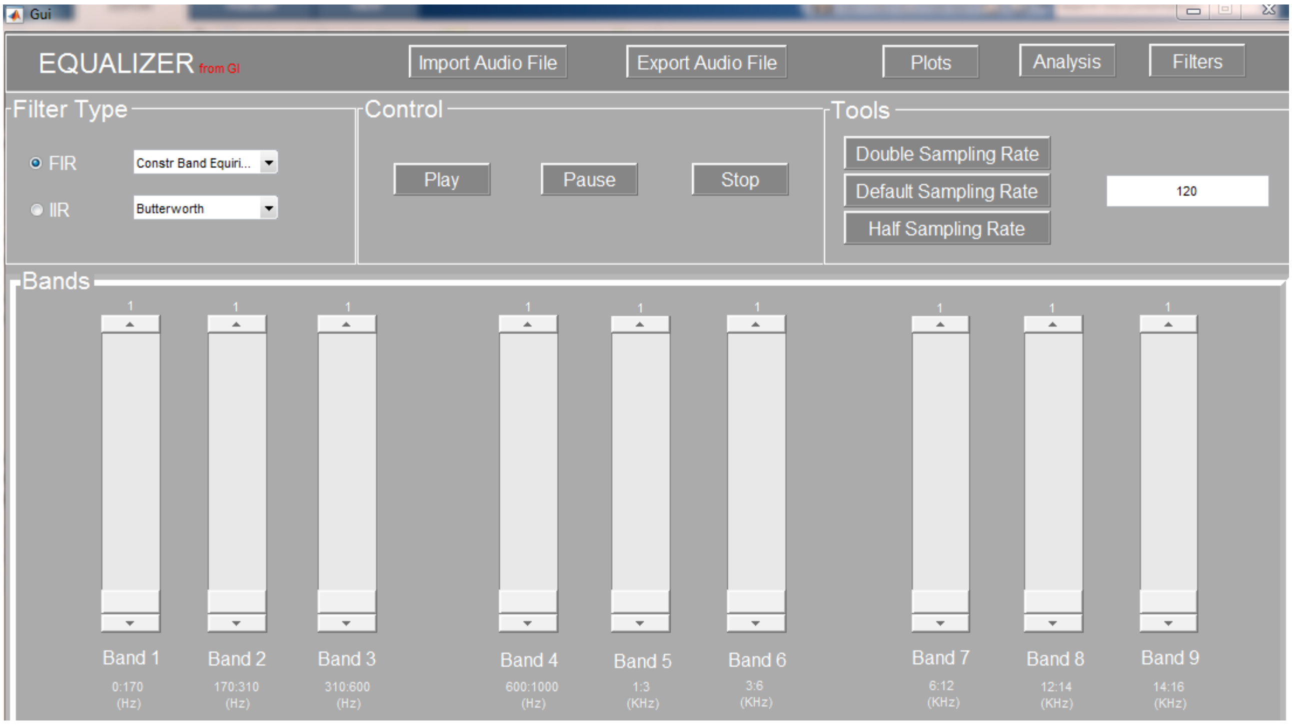
In our GUI, we give user the ability to:

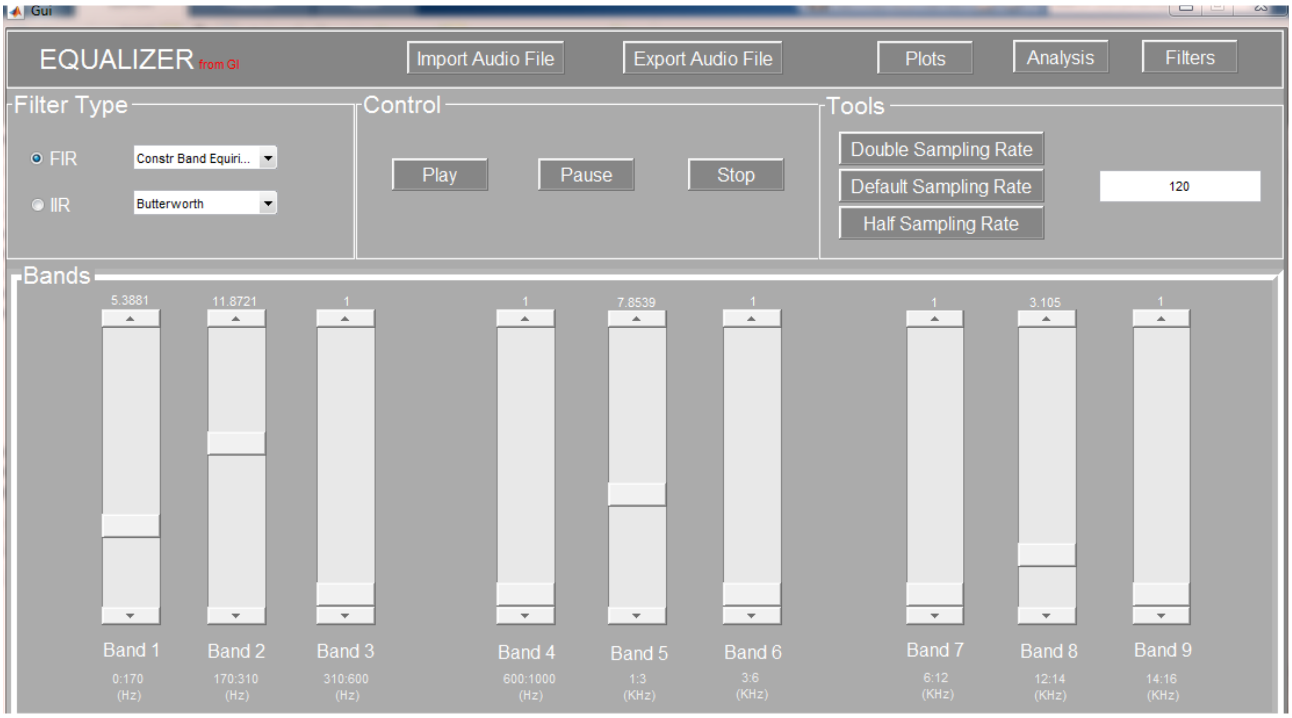
1) import any audio as input.
2) export or save the audio after filteration and amplification.
3) choose the filter type.
4) enter 9 gains for 9 filters.
5) play or stop the audio.
6) choose the sampling ratio.
7) enter filter order.
8) plot (input and composite signals) or (analysis of each filter) or (output signals from filters).

GUI Screenshots:

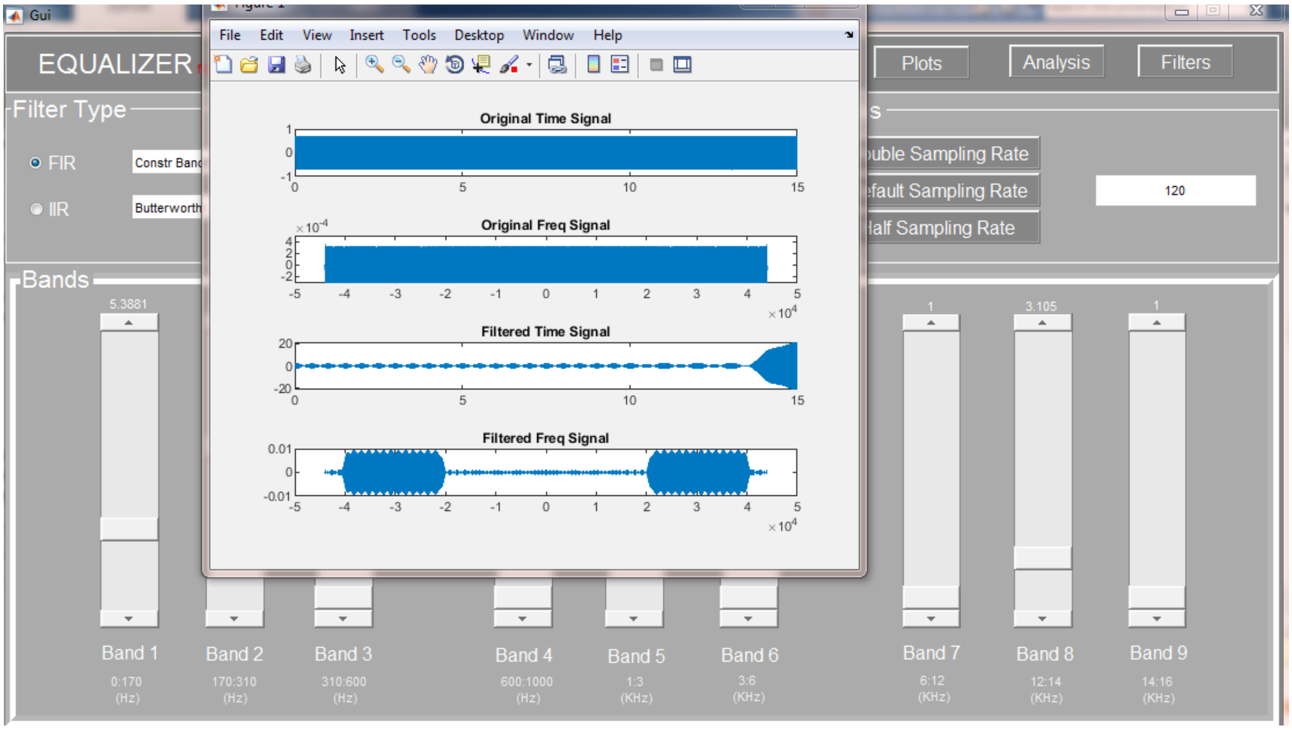




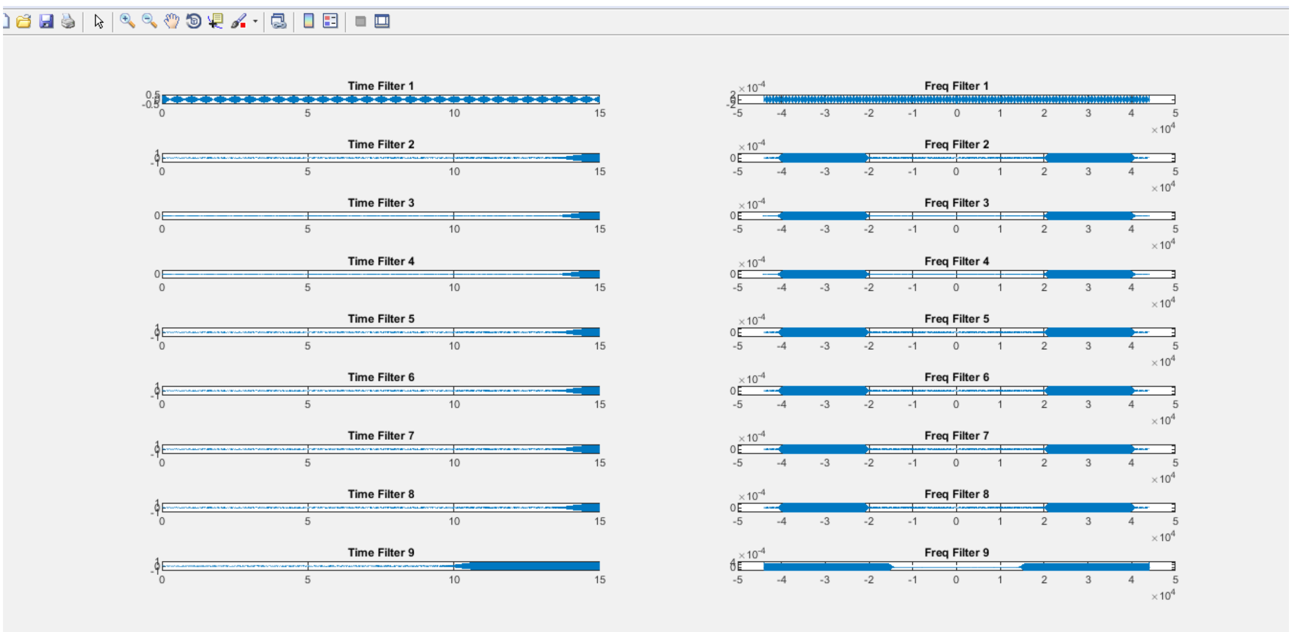

Gui
EQUALIZER
from GI
Import Audio File
Export Audio File
Plots
Analysis
Filters
Filter Type
FIR
Constr Band Equiri...
IIR
Butterworth
Control
Play
Pause
Stop
Tools
Double Sampling Rate
Default Sampling Rate
Half Sampling Rate
120
Bands
Band 1 0:170 (Hz)
Band 2 170:310 (Hz)
Band 3 310:600 (Hz)
Band 4 600:1000 (Hz)
Band 5 1:3 (KHz)
Band 6 3:6 (KHz)
Band 7 6:12 (KHz)
Band 8 12:14 (KHz)
Band 9 14:16 (KHz)


Gui
EQUALIZER
from GI
Import Audio File
Export Audio File
Plots
Analysis
Filters
Filter Type
FIR
Constr Band Equiri...
IIR
Butterworth
Control
Play
Pause
Stop
Tools
Double Sampling Rate
Default Sampling Rate
Half Sampling Rate
120
Bands
5.3881
11.8721
7.8539
3.105
Band 1 0:170 (Hz)
Band 2 170:310 (Hz)
Band 3 310:600 (Hz)
Band 4 600:1000 (Hz)
Band 5 1:3 (KHz)
Band 6 3:6 (KHz)
Band 7 6:12 (KHz)
Band 8 12:14 (KHz)
Band 9 14:16 (KHz)

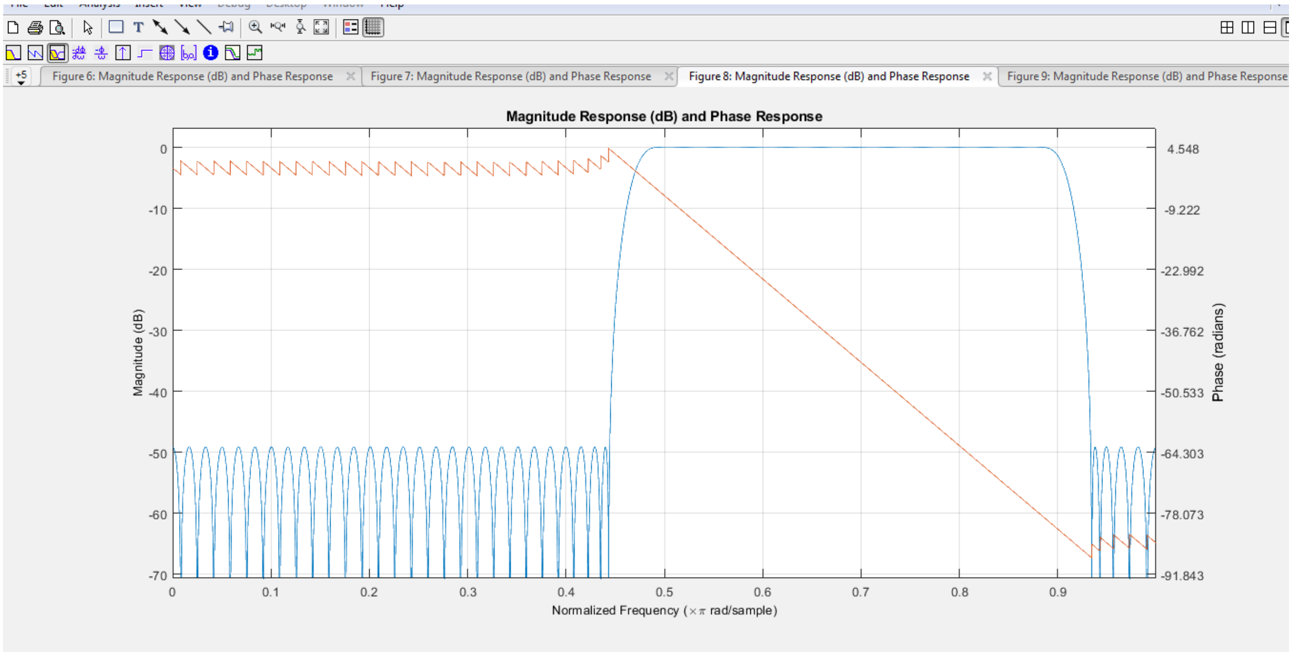
Original and Composite signals:

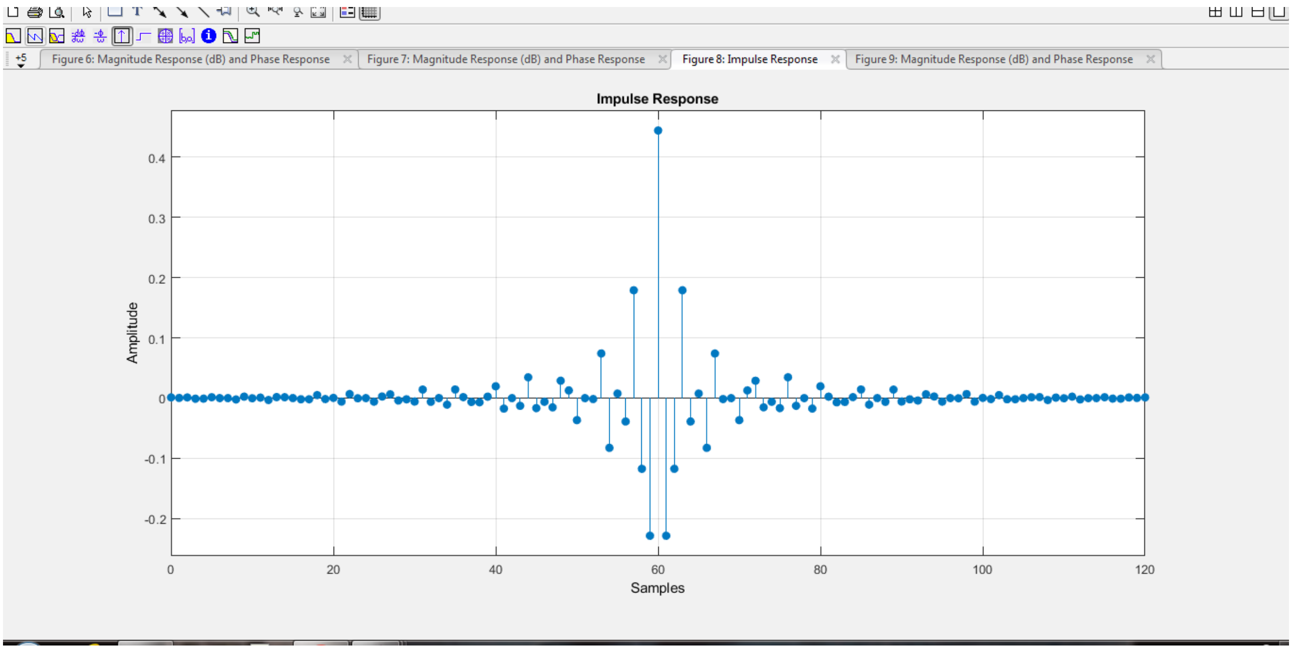


Filters' Analysis:



Signal Filteration:





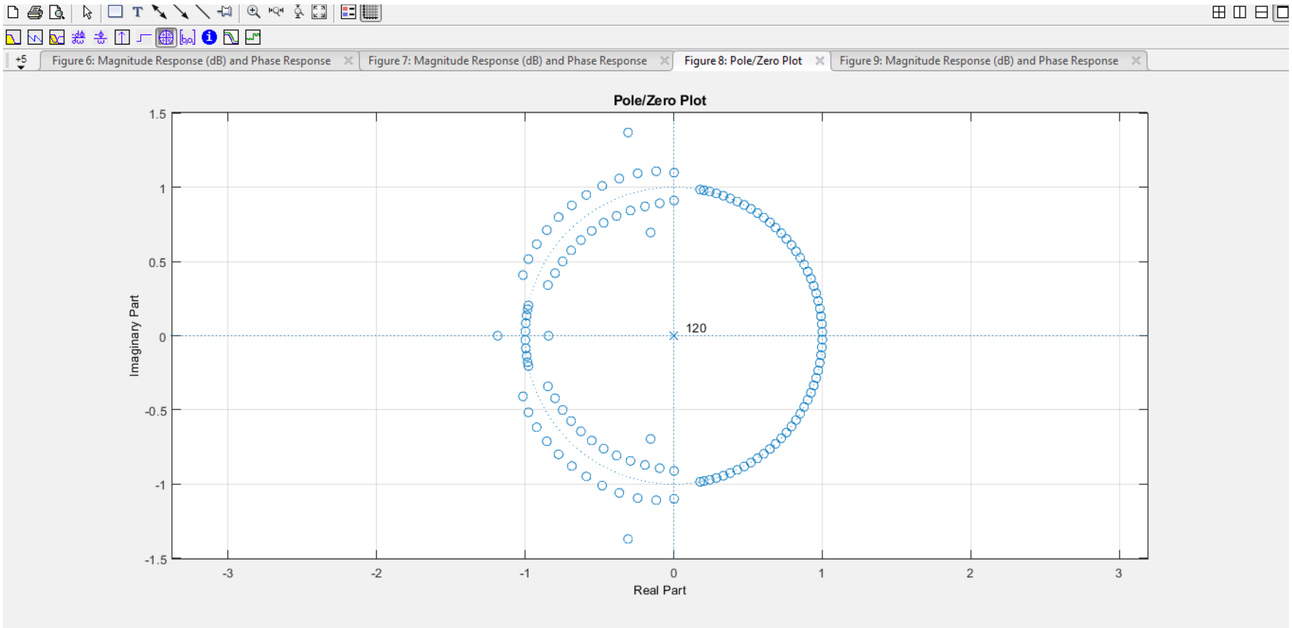


Figure 6: Magnitude Response (dB) and Phase Response
Figure 7: Magnitude Response (dB) and Phase Response
Figure 8: Pole/Zero Plot
Figure 9: Magnitude Response (dB) and Phase Response
Pole/Zero Plot
Imaginary Part
Real Part
120
1.5
1
0.5
0
-0.5
-1
-1.5
-3
-2
-1
0
1
2
3

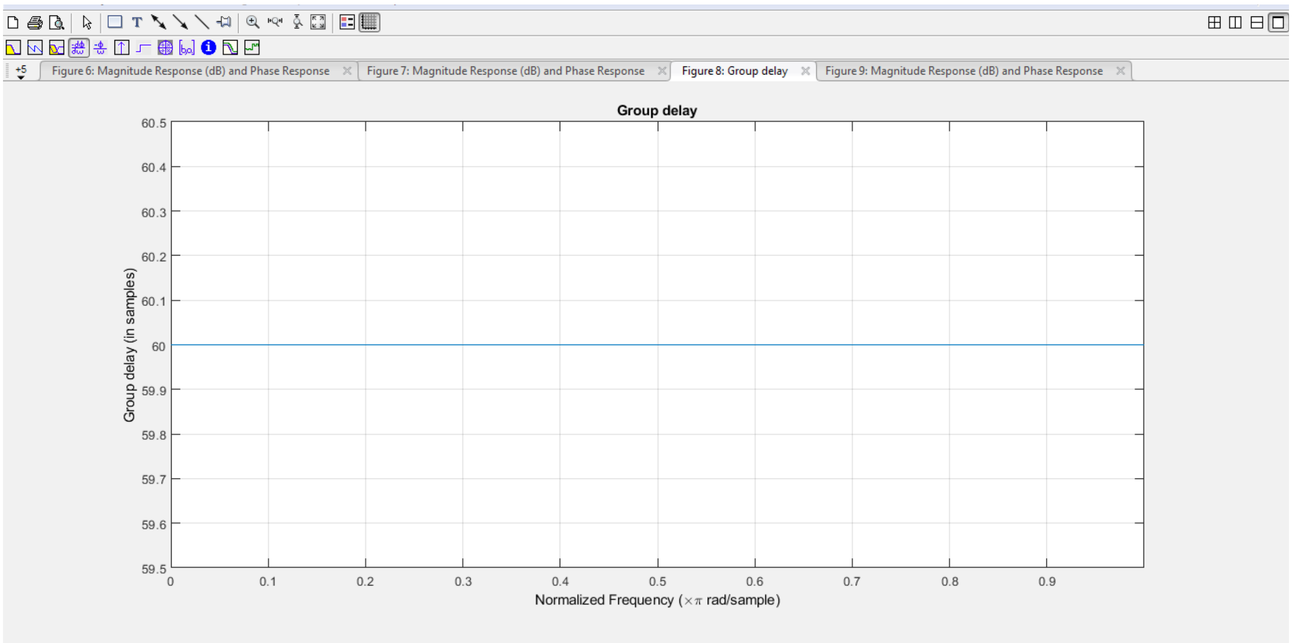


Figure 6: Magnitude Response (dB) and Phase Response
Figure 7: Magnitude Response (dB) and Phase Response
Figure 8: Group delay
Figure 9: Magnitude Response (dB) and Phase Response
Group delay
Group delay (in samples)
Normalized Frequency (×π rad/sample)
60.5
60.4
60.3
60.2
60.1
60
59.9
59.8
59.7
59.6
59.5
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9