Lab 1

SYSC4405

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Lab Section: L4O

1 Generating Example Noisy Signal

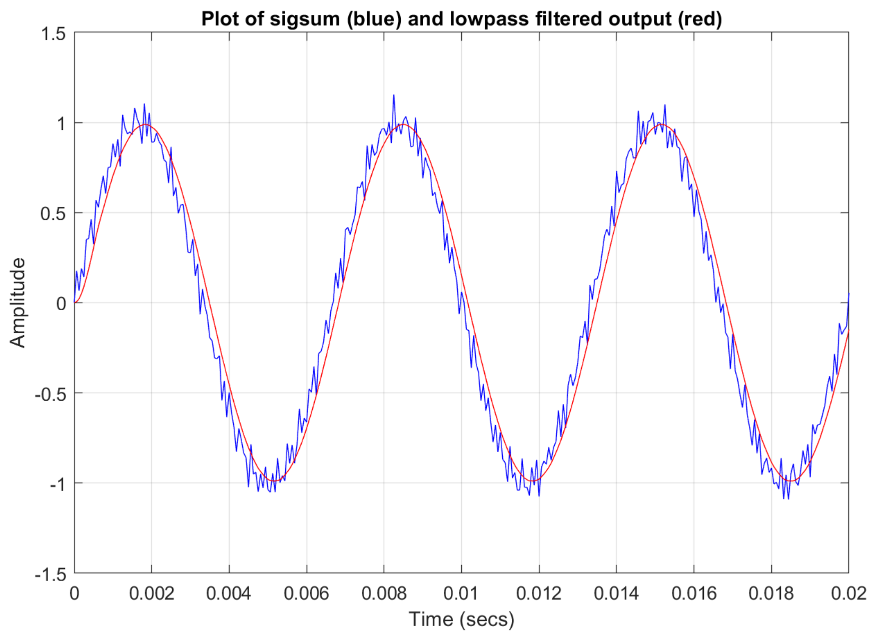

Figure 1: Input Noisy Signal 'sigsum' and Output Filtered Signal

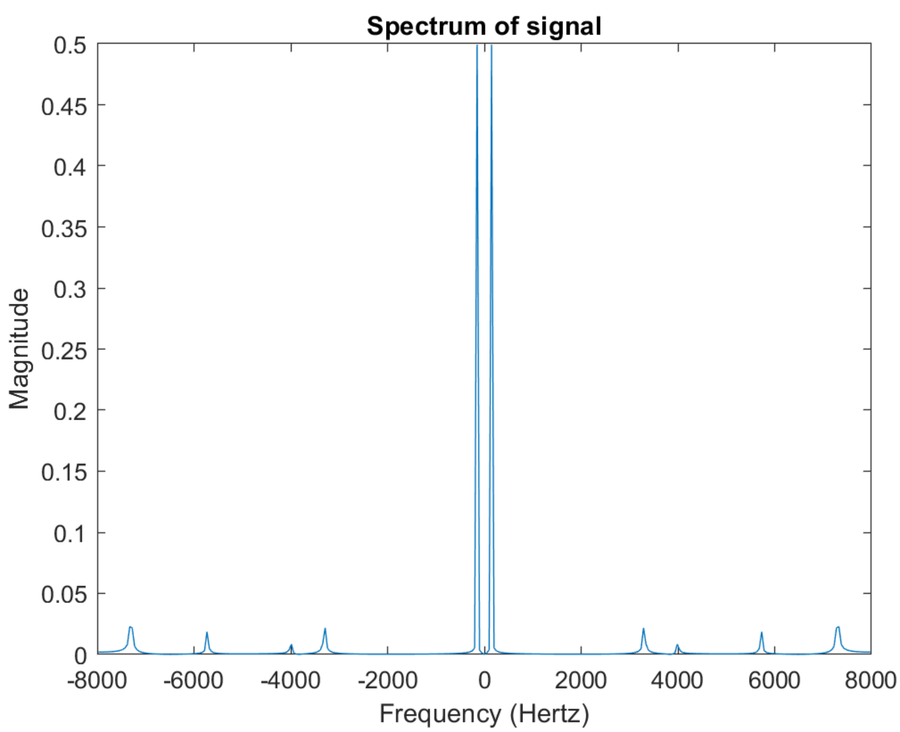

Figure 2: Frequency Spectrum of Input Noisy Signal 'sigsum'

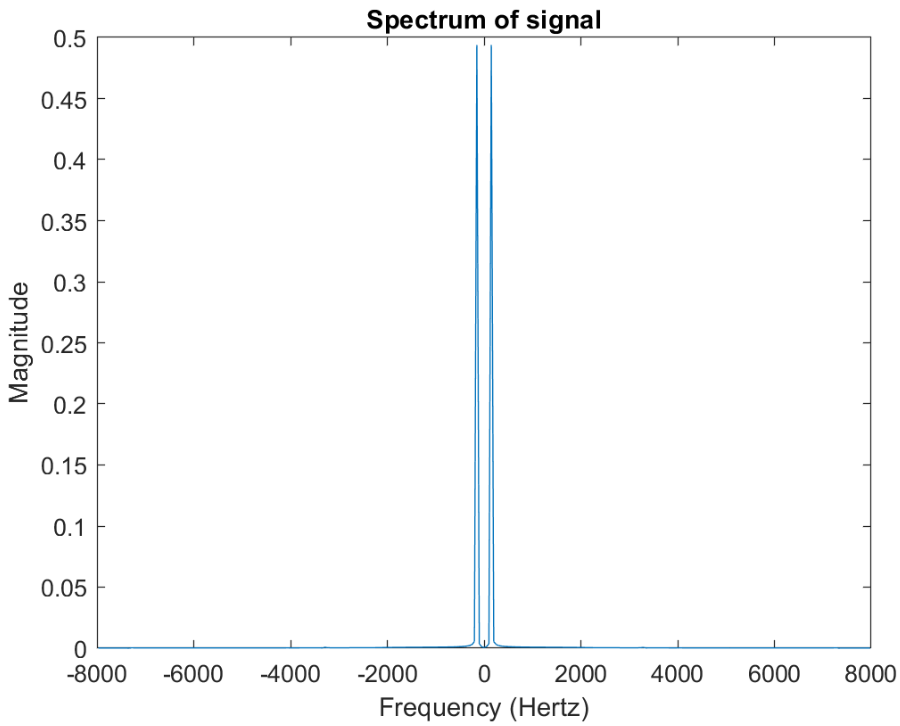

Figure 3: Frequency Spectrum of output Filtered Signal

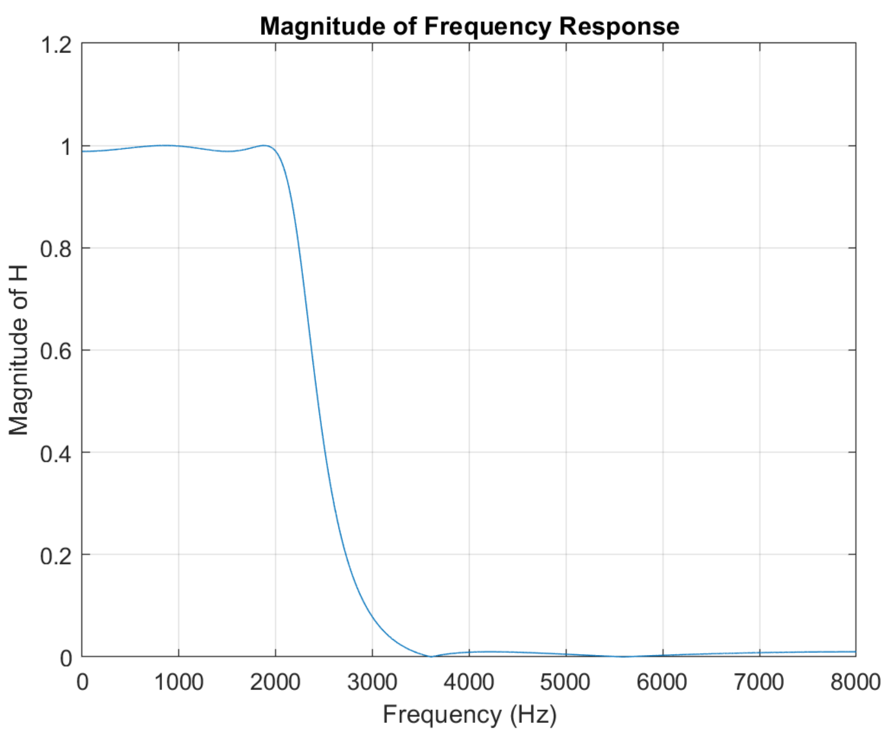

Figure 4: Frequency Response of Filter

2 Using Simulink for Spectral Analysis

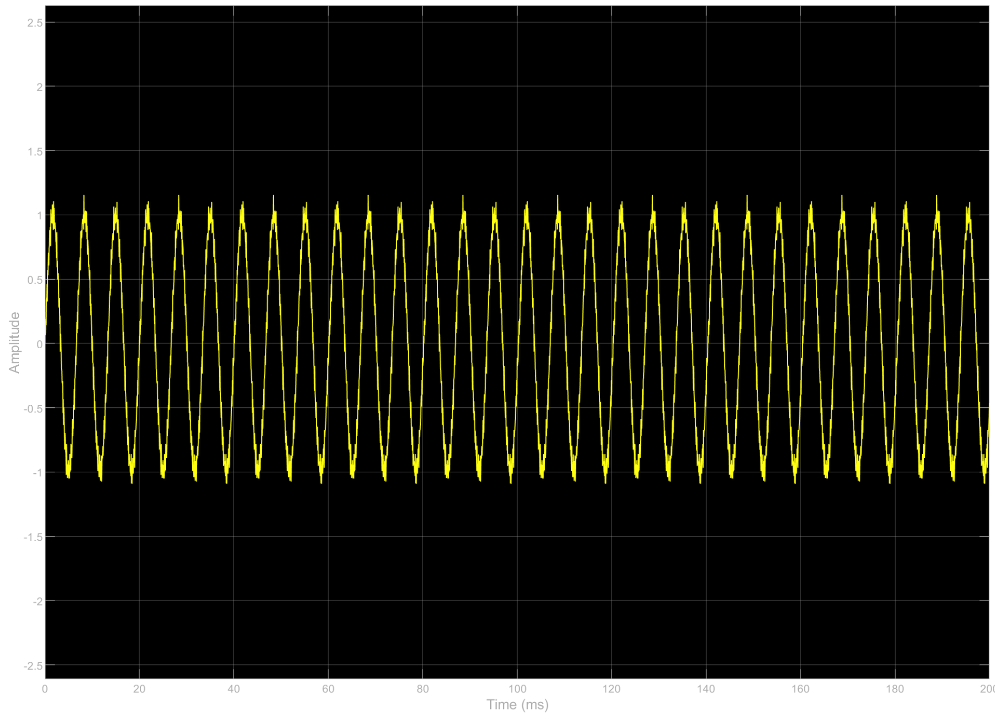

Figure 5: Input Signal 'sigsum' from Time Scope

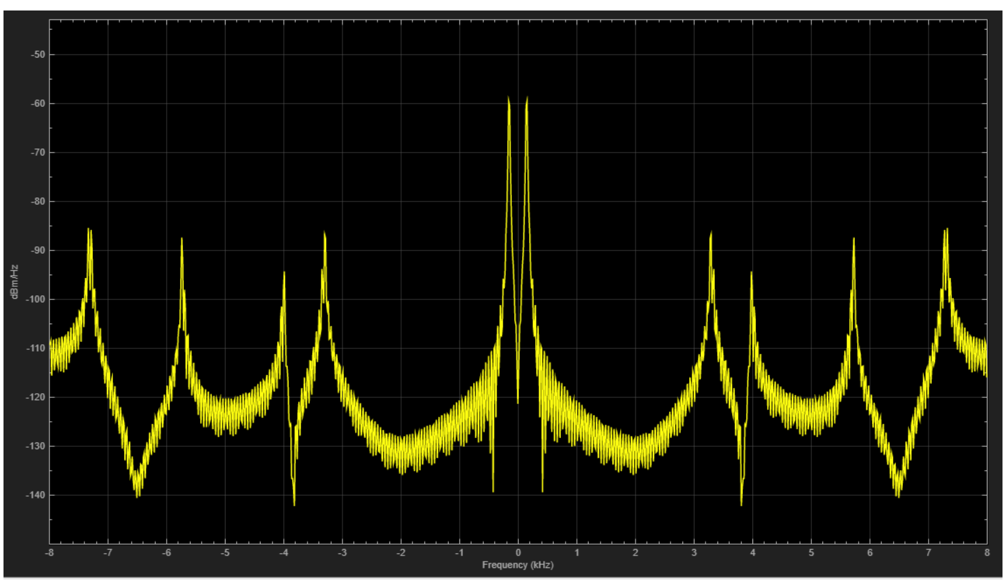

Figure 6: Input Signal 'sigsum' Frequency Response Plot from Freq. Analyzer

3 Implementing 4^{th}-order IIR Lowpass Filter

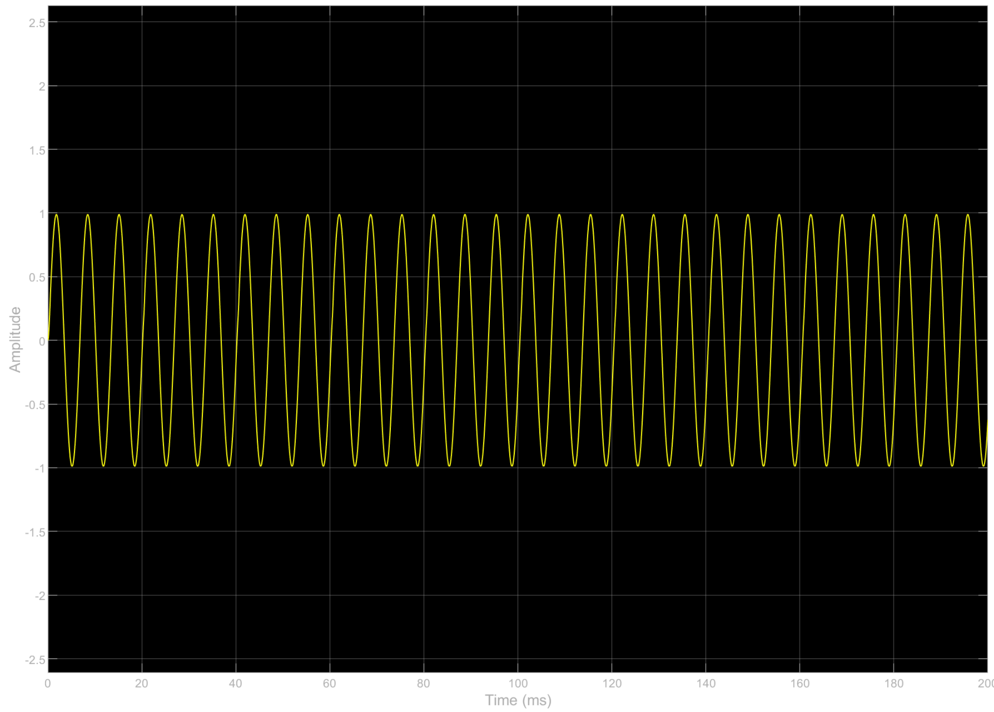

Figure 7: Time Scope of the IIR Filtered Signal

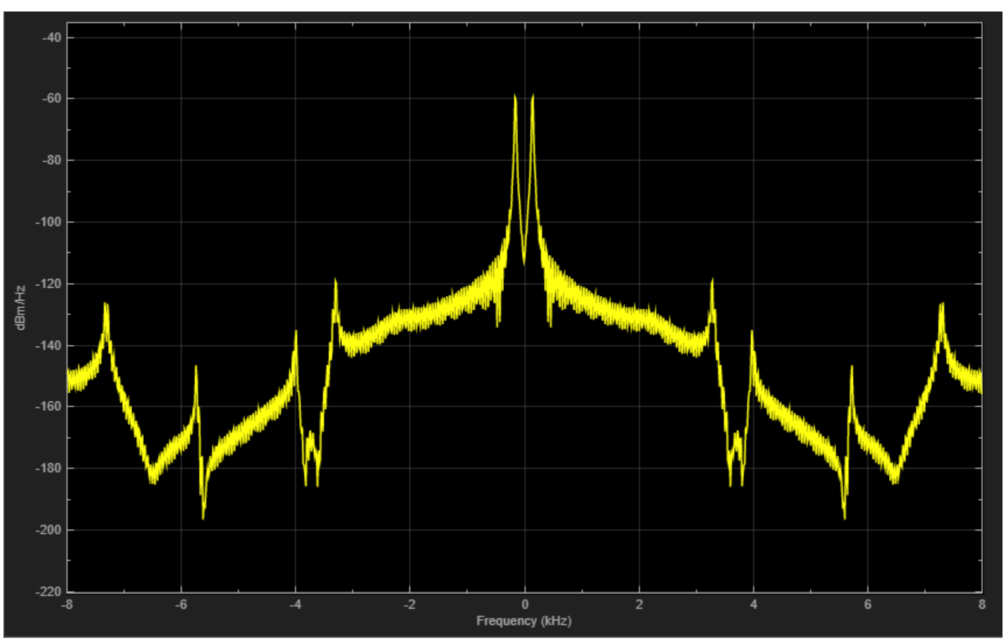

Figure 8: Frequency Analyzer of the IIR Filtered Signal

4 Implementing 4^{th}-order IIR Lowpass Filter (Take Two)

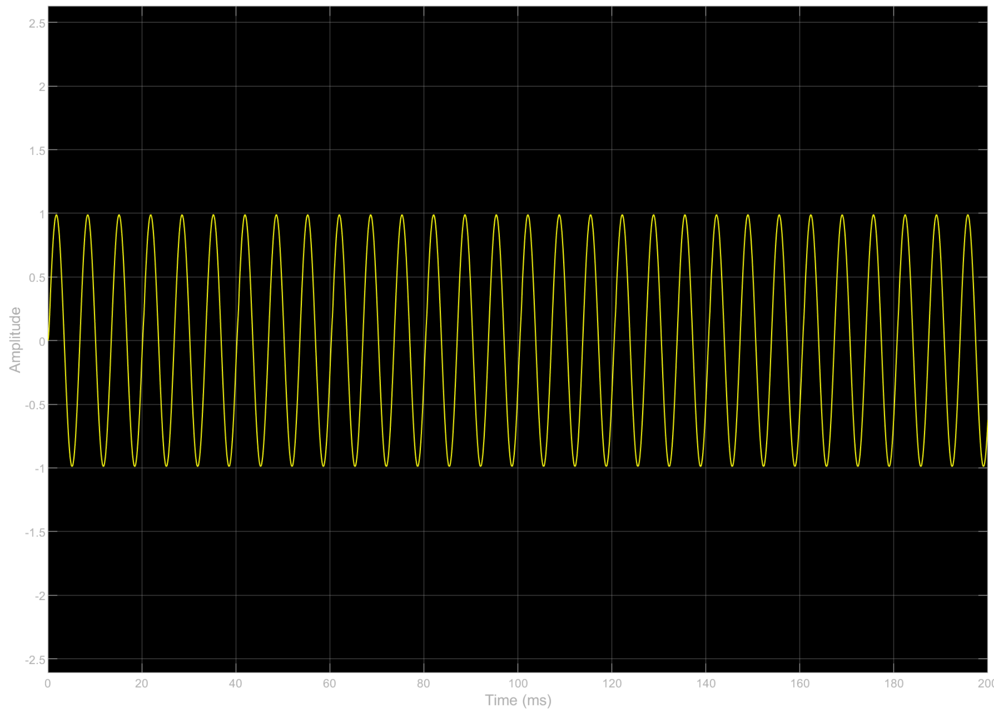

Figure 9: Time Scope from Discrete Filter Block

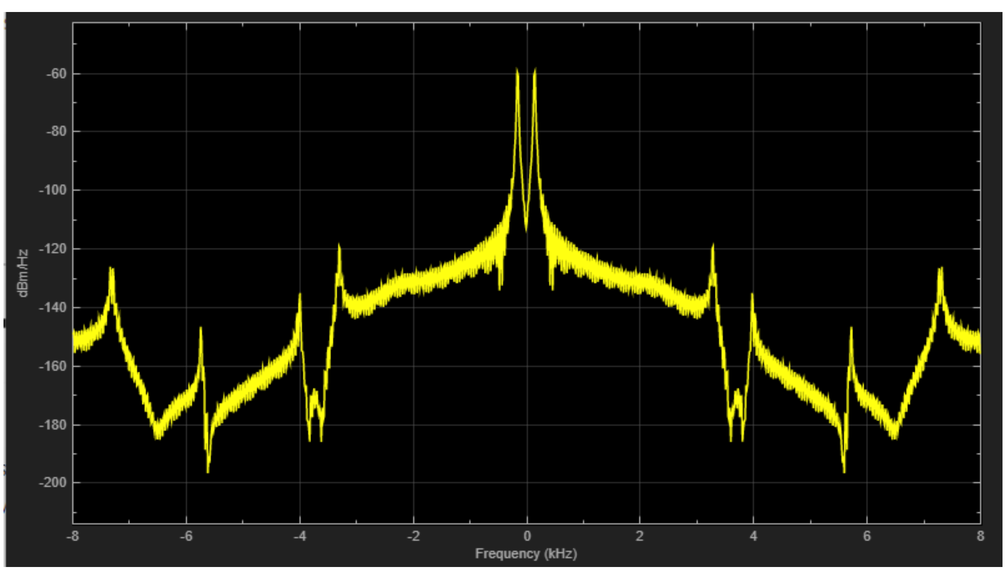

Figure 10: Frequency Analyzer from Discrete Filter Block

5 Questions

5.1 Comparing Input and Output Signals in The Time Domain

From Figure 1, we see that the filtered signal is smoother, indicating the filter effectively removes unwanted noise resulting in a cleaner/truer representation of the wanted signal.

The filtered signal's amplitude is slightly decrease, never reaching 1, while the input signals highest value reaches about 1.2.

There is a slight phase change/delay to the filtered signal; the delay and phase change remain consistent throughout the new filtered signal.

5.2 Comparing Input and Output in The Frequency Domain

In Figure 2, we can see the characteristic frequencies within the input signal.

In Figure 3, it can be seen that all frequencies past 150Hz have severely attenuated, only leaving the 150Hz as the filtered signal.

This is congruent with the Frequency Response plot in Figure 4, with frequencies past 2500Hz being attenuated to near 0.

5.3 Same results obtained in Simulink?

The results obtained in the Simulink hand-built filter and with the Discrete Filter block are the exact same as the results from MATLAB.

Using the Discrete Filter block is an interesting tool to use as it represents the mathematics behind the filter; the transfer function! From the transfer function and simulation, a real life filter can be made.