Birzeit University
Faculty of Engineering and Technology
Department of Computer Systems Engineering

DIGITAL SIGNAL PROCESSING (DSP)

ENCS4310

Assignment #1

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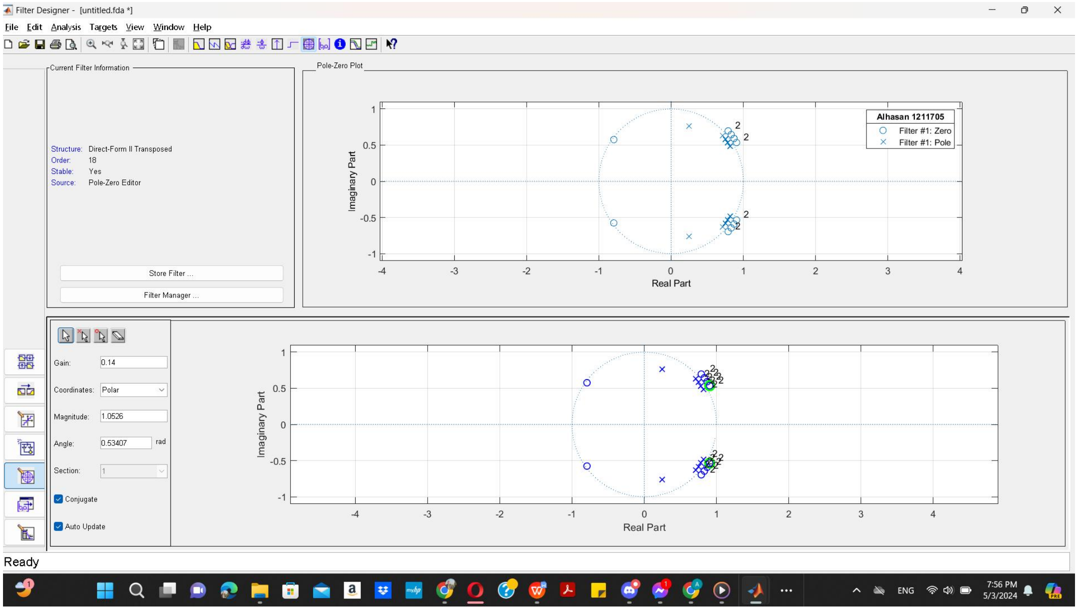
Section: 2

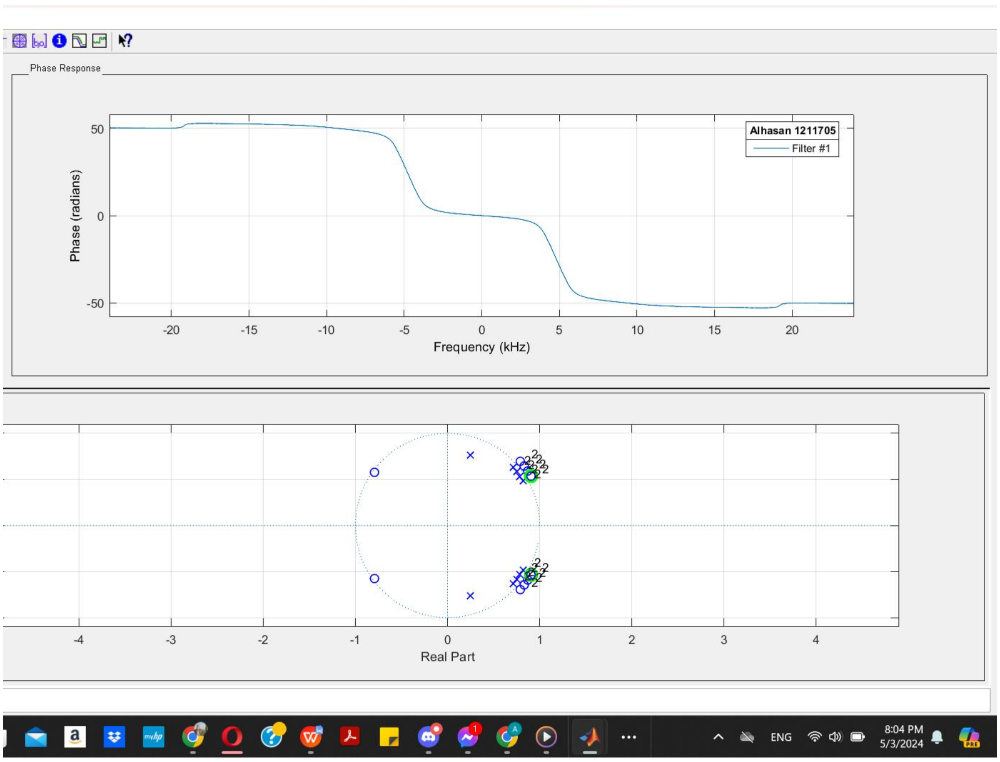
Date: 4/5/2024

1. Part I:

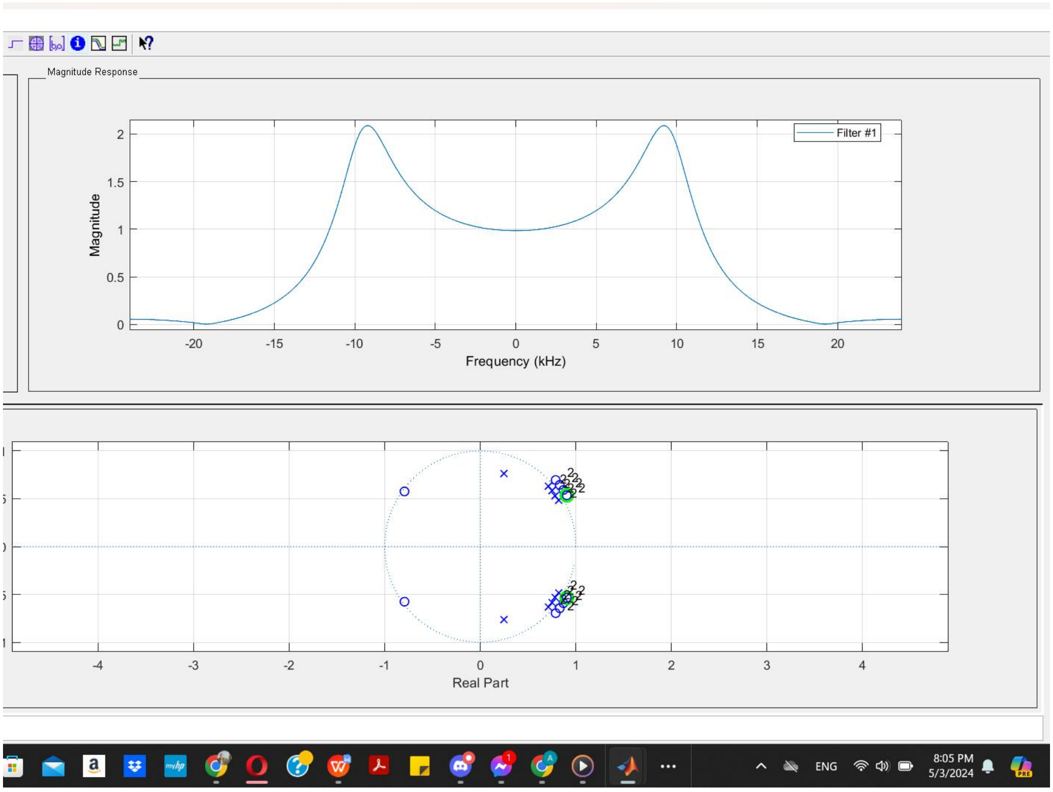
- Zeros & Poles



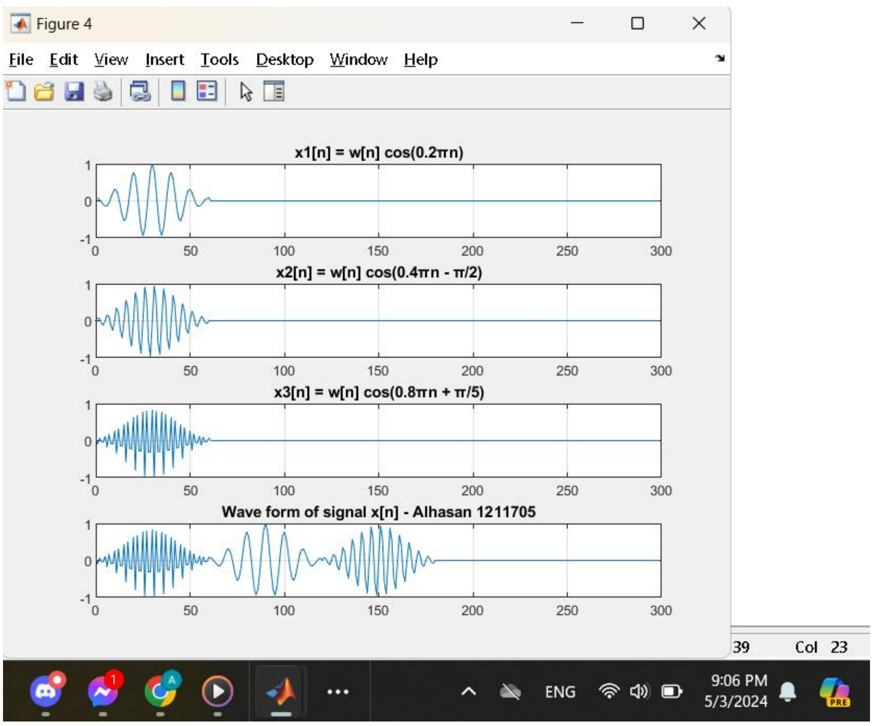
- Phase



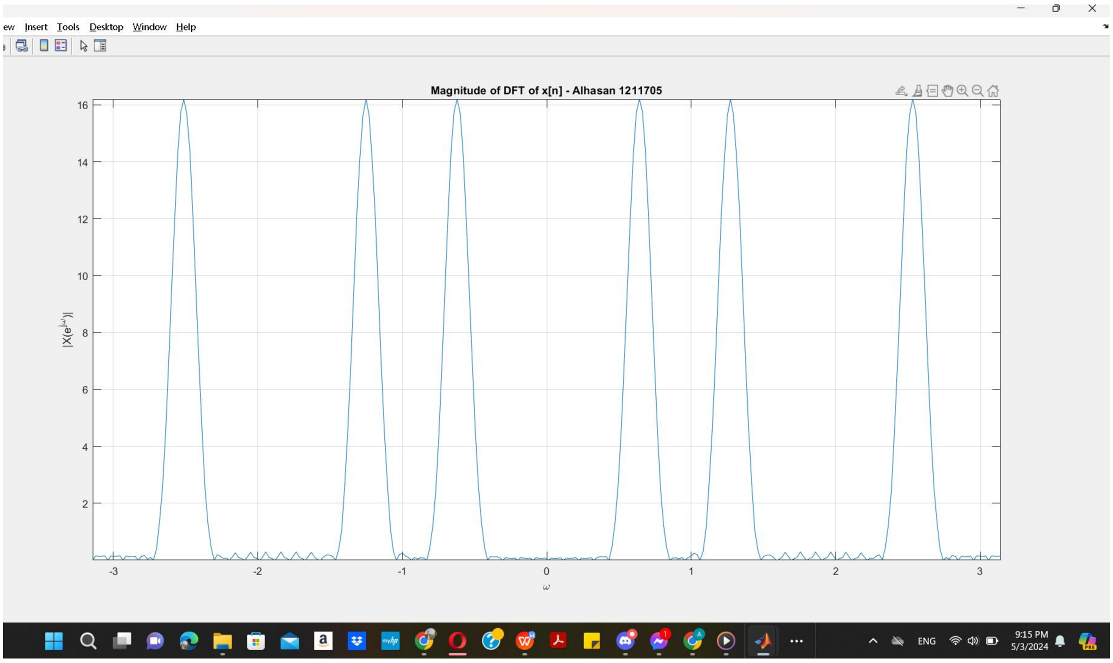
- Magnitude



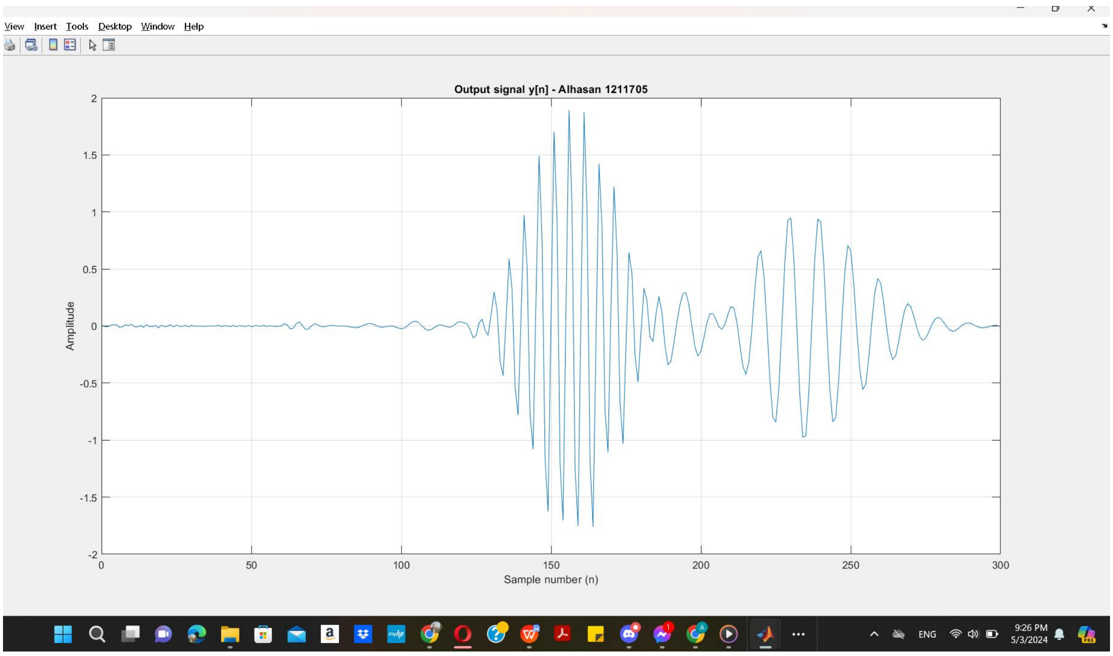
- Input



- DFT of X[n]



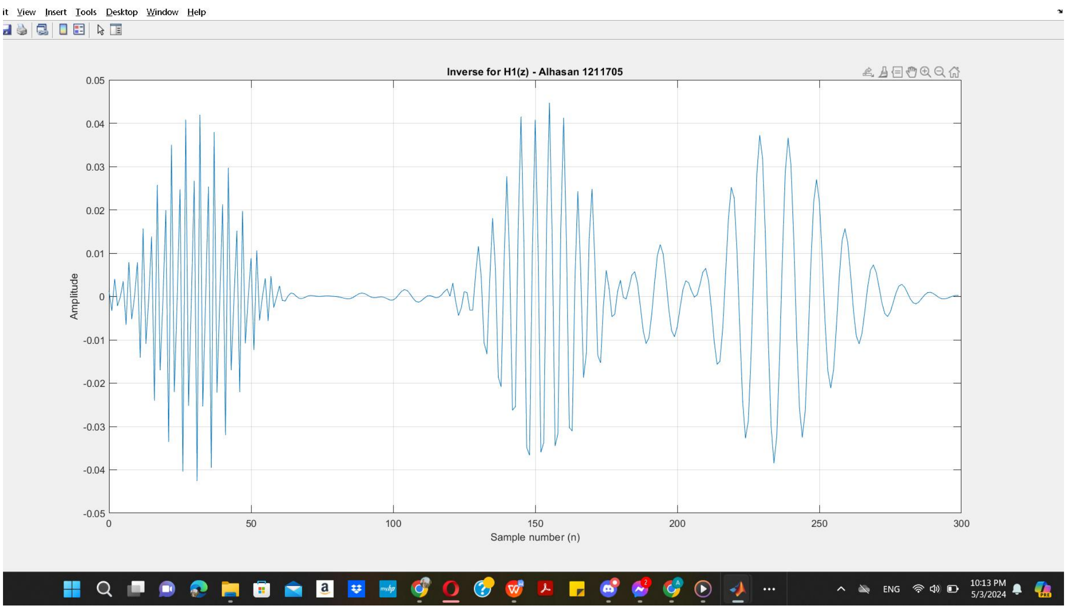
- output



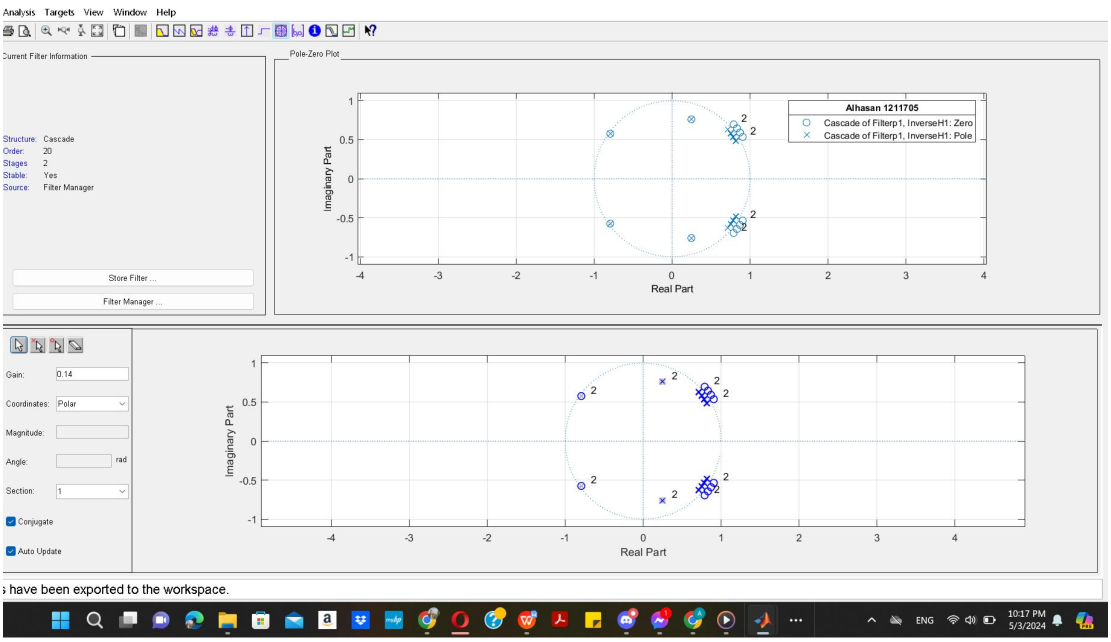
2. Part II:

Here in this part we cascaded the filter H(z) with the inverse of H1(z), and we swap the values of zeros & poles to do it correctly.The filter H(z) will be cascaded with the inverse of H1(z) in this section of the analysis.This setup is designed to remove the impact of H1(z) from the combined filter H(z) allowing H2(z) to influence the signal processing.

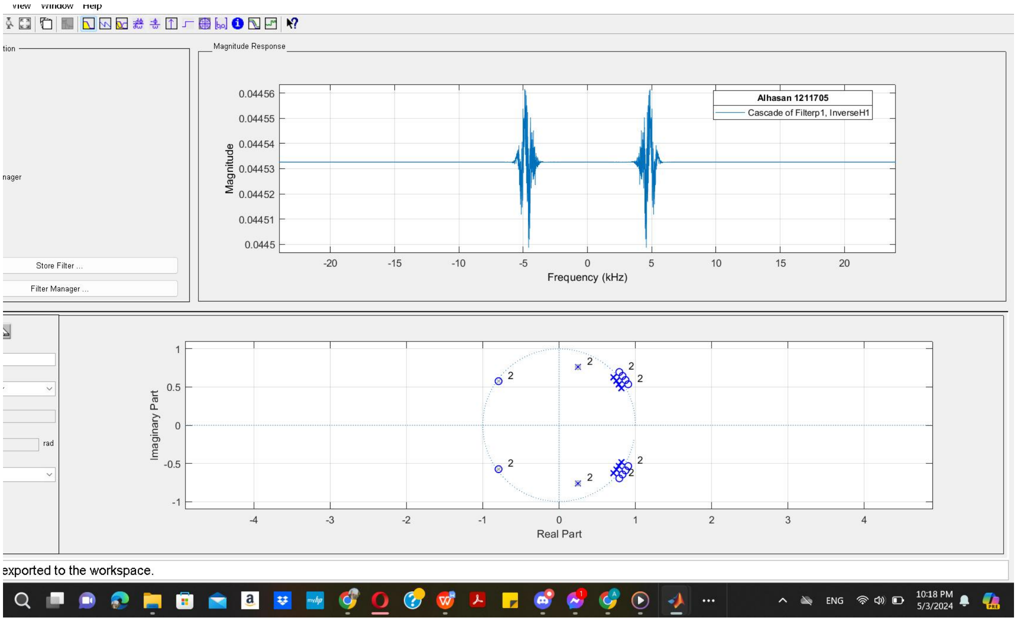
- Inverse of H1



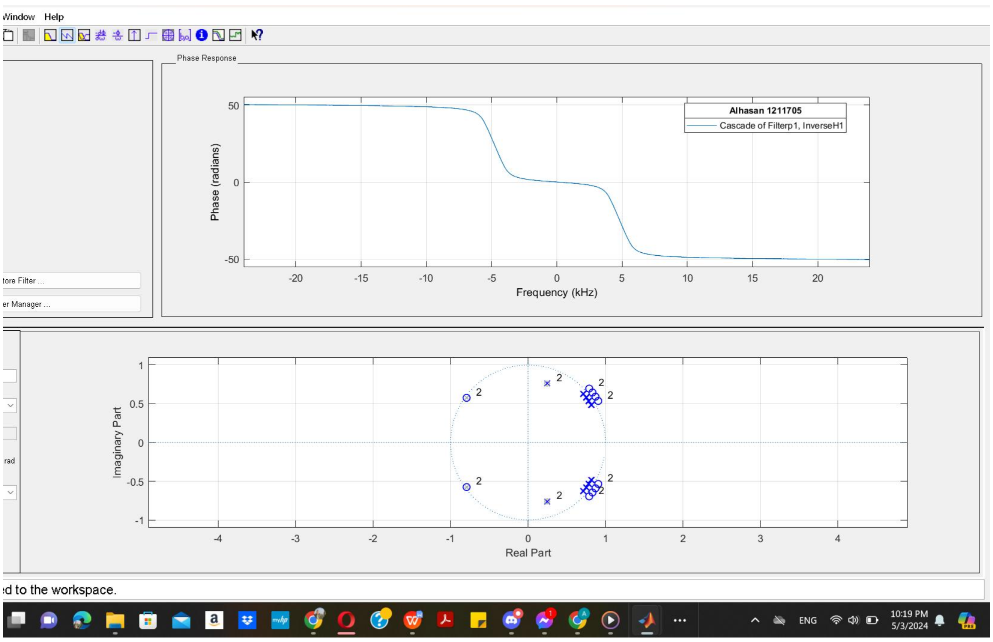
- Zeros & Poles



- Magnitude



- Phase

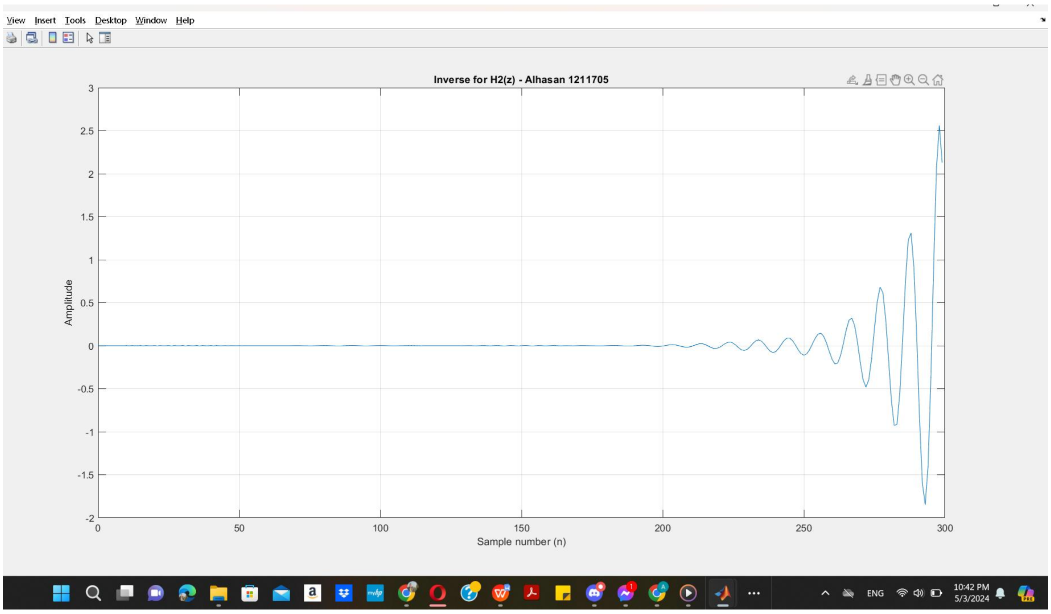


The last figures show the properties of the developed filter H(z), which is cascaded with H1(z), in detail. The Pole-Zero plot, which is shown in the second of these pictures, is essential for comprehending the filter's stability and dynamic response. From it, we may infer that the filter is stable because none of its poles are outside the unit circle. The Magnitude Frequency Response is shown in the third picture, which provides information on how the filter attenuates or amplifies particular frequency components. The Phase Response, which aids in evaluating the phase distortion the filter introduces at various frequencies, is depicted in the fourth picture. Lastly, The output signal result acquired from this section of the analysis is finally shown in the first figure, which is very clear and good and shows the stability and effectiveness of the filter in processing the input signal.

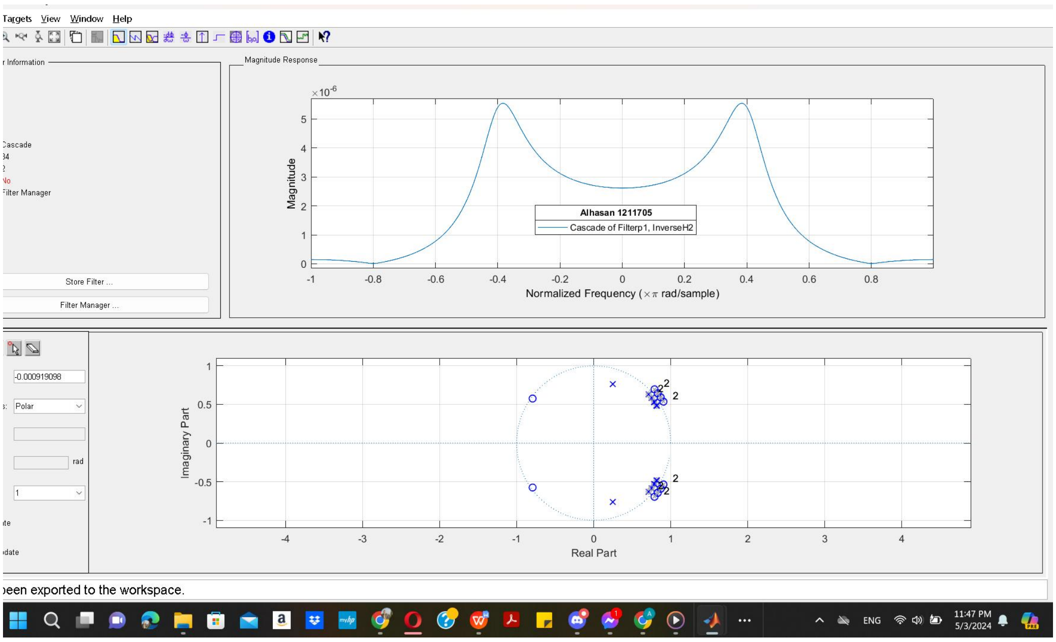
3. Part III:

In order to achieve this correctly, we swap the values of the zeros and poles in this section where we cascade the filter H(z) with the inverse of H2(z).In this part of the study, the filter H(z) will be cascaded with the inverse of H2(z).With this configuration, the effect of H2(z) is eliminated from the combined filter H(z), allowing H1(z) to affect the signal processing.

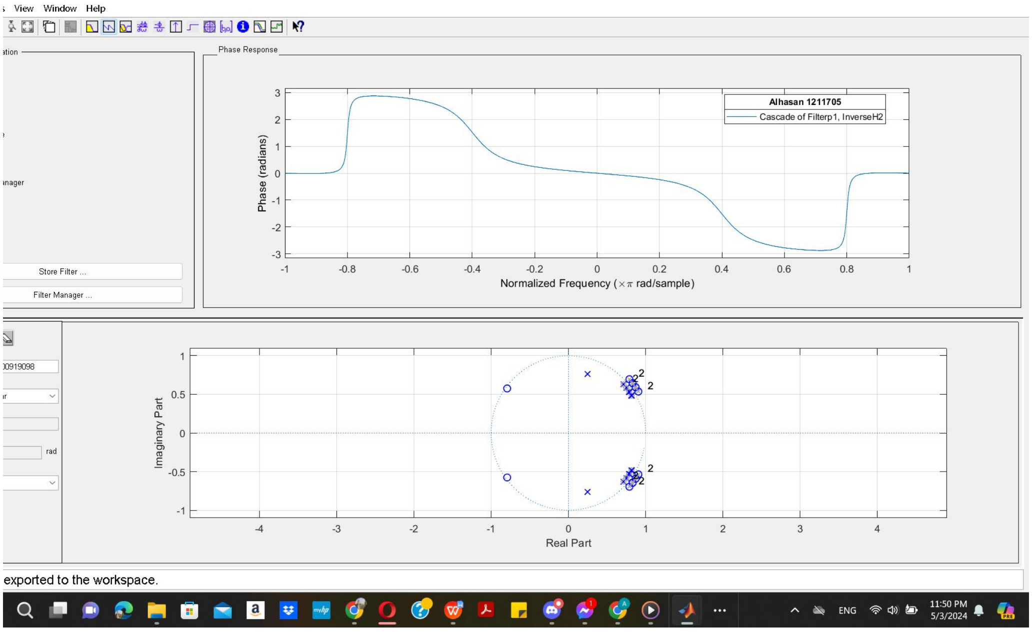
- Inverse of H2



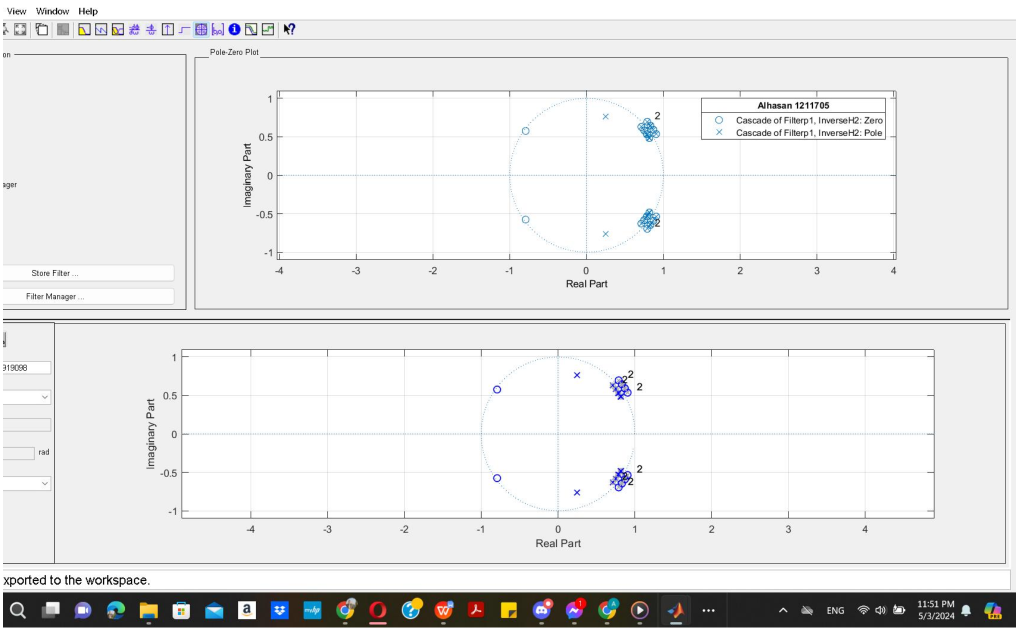
- Magnitude



- Phase



- Poles & zeros



The features of the produced filter H(z), which is cascaded with H2(z), are detailed in the final figures.The second image illustrates the Magnitude Frequency Response, which describes how specific frequency components are amplified or attenuated by the filter. The third image shows the Phase Response, which is useful for assessing the phase distortion the filter introduces at different frequencies.Understanding the stability and dynamic responsiveness of the filter requires an understanding of the Pole-Zero plot, which is depicted in the last of these images. Since none of its poles are outside the unit circle, we can deduce that the filter is stable based on this information.Finally, the first figure displays the output signal result obtained from this section of the study. It is excellently clear and illustrates the stability and efficacy of the filter in processing the input signal.