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1 Introduction

In this lab, we explore the implementation and analysis of a finite impulse response filter on STM32F769I development boards, a foundational tool in digital signal processing. Through theoretical insights and practical experimentation, we aim to understand the behavior of the filter and its performance in real-time signal processing applications.

We will be implementing the system using C and using the oscilloscope to plot the phase and magnitude of the frequency response by performing a frequency sweep. We can then compare the measured frequency response with the numerical and analytical solutions

2 Theory

This lab required the calculation of transfer function. Using transforms yields this equation given that the maximum number of taps my code worked with was 34

$$H[e^{jw}] = \frac{0.2}{1 - 0.8^{34}} \times \frac{1}{1 - 0.8 \cdot e^{-j\omega}} \tag{1}$$

Another potential calculation was for phase correction however, my board did not require this calculation.

3 Results

The results for this lab can be seen in Fig.1 and Fig.2. Fig.1 shows the noise removal using my filter, we can see that most of the noise is removed and it looks much more like the generated square wave than in the pass-through channel. Not all noise is removed however which is why the figure still shows some wiggle after being processed.

In Fig.2 there are two subplots, each containing three lines. One line corresponds to the measured data, one to the numerical solution, and the last one to the analytical solution. All three of these lines line up perfectly.

4 Discussion and Conclusions

Unfortunately, my code was not very good, it was only able to get a maximum of 34 taps in before it broke. I'm not quite sure if more taps would have resulted in a more efficient or accurate filter or simply a filter capable of processing more data.

This filter is a low pass filter with non-linear phase. The filter works pretty well but does not remove all noise from the signal. I assume this is because we can not implement a perfect low pass filter.

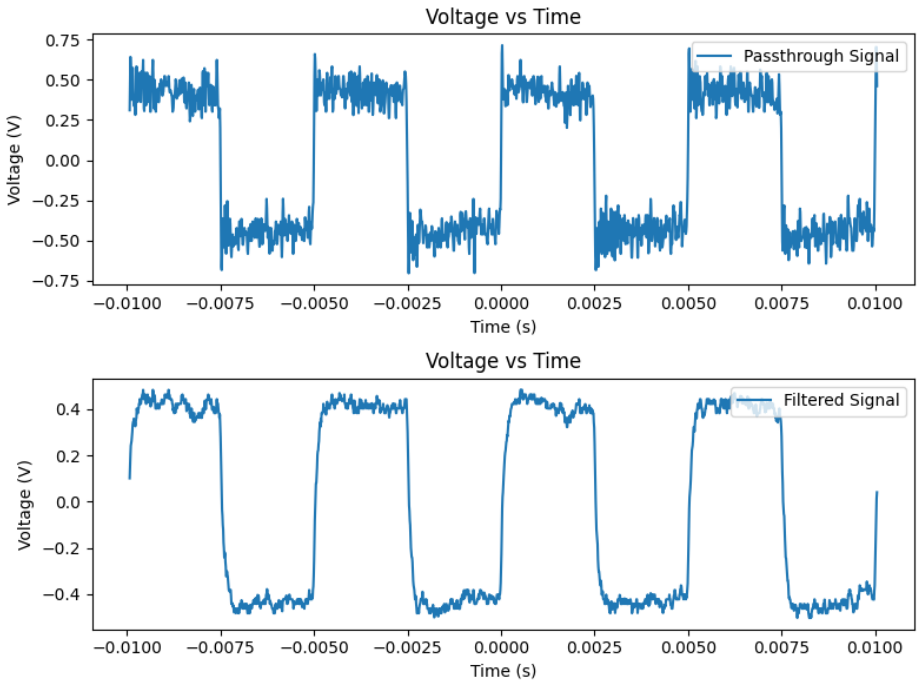

Figure 1: Noise removal of a square wave using an FIR filter

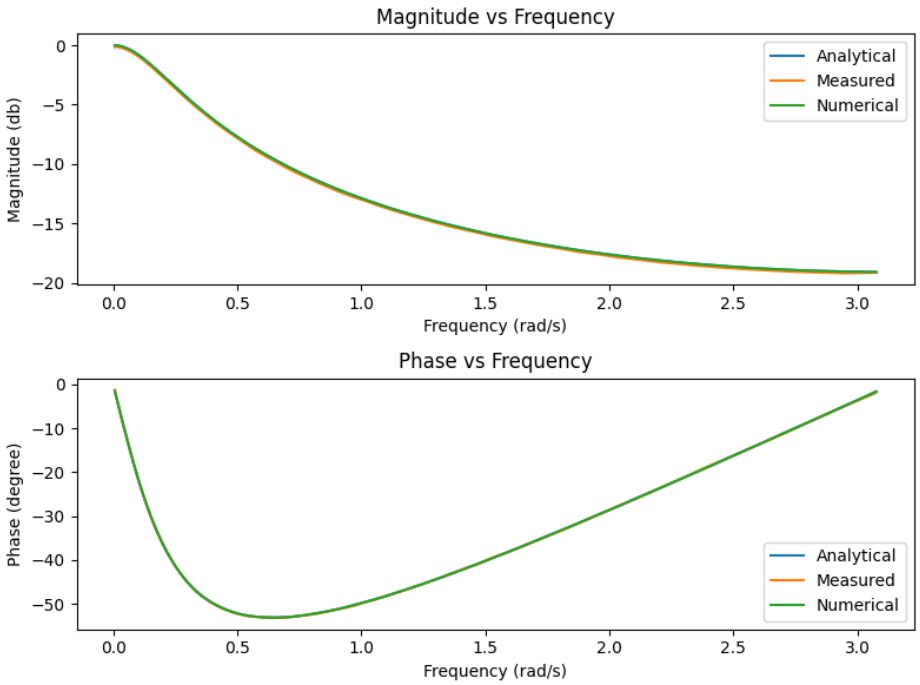

Figure 2: Magnitude and phase of the frequency response using measured, analytical, and numerical data