

Lab 5 – Moving Average Filter

As noted in lecture, the Moving Average filter is a type of Finite Impulse Response (FIR) filter. In this lab you will implement a Moving Average filter on the MSP432P401R launchpad. You will measure the frequency response of your MA filter, and listen to the effect of this filter on an audio clip.

1. Matlab Live Script (lab prep)

The moving average filter operates by taking the arithmetic mean or average of a number of input samples. This is represented by the equation

$$y[n] = \frac{1}{M+1} \sum_{i=0}^M x[n-i]$$

You will implement a MA filter with $M=4$; in other words, the filter will average over 5 samples at a time.

Using Matlab live script, predict the frequency response of the MA filter; plot both the magnitude and phase response. *Use a sampling frequency of 11.7 kHz.* Make note of the 3dB cutoff frequency, and where the nulls occur.

- In the analog filter labs, the Matlab function **bode** was used to compute the frequency response
- For digital filters, use the Matlab function **freqz** to calculate the frequency response. Use Matlab help to see the usage information on this function. You may also use **fvtool** to find the frequency response

2. C-Code (lab prep)

Using the code template from lab 4, add code to implement a MA filter with $M=4$. For the lab prep, write the C-code to implement the filter, and make sure you have at least a clean Build & Compile before coming into the lab. Depending on your programming style, you may wish to sketch some flowcharts and pseudocode before writing your code.

Include a print-out of your C-code in Matlab live script after you have verified that it works in the lab.

3. Measuring the Moving Average Filter

Using the AD2 network analyzer, measure the frequency response of the MA filter. Include a screenshot of the measurement in your report.

Compare the measurement and prediction for the **magnitude response ONLY**, showing both in a Matlab graph (note that the phase response will not match, since there are extra delays introduced in the actual implementation).

What to Hand In ?

- For lab 5, you will need to submit the fully completed and documented Live Script file. There will be a folder on the course website (learn.bcit.ca) for this.
- You do NOT need to submit a formal lab report
- The submission deadline: one week after the end of Lab 5 for your set. The late penalty is -20% per day.