ELEC9721: Digital Signal Processing Theory and Applications

Lab 2 Preparation

(1 mark)

Consider the following filter:

$$H(z) = \frac{-0.0625z^4 + 0.25z^3 + 0.625z^2 + 0.25z^1 - 0.0625}{z^4}$$

1. Calculate the impulse response of the filter.
2. Calculate the magnitude and phase response of the filter.
3. Sketch the magnitude and phase response of the filter.
4. Calculate the DC gain and the -3dB cut-off frequency of this filter.
5. Using Matlab, confirm the results in 1, 3 and 4.

Bring these calculations and sketches with you to the laboratory. In the laboratory, you will filter signals with this filter so before the lab, work out how that can be done. In particular, write come code (with loops) that perform the convolution operation for this (or other) filter with a finite input sequence x[n], i.e. produce a sequence y[n] that satisfies:

$$y[n] = \sum_{m=-\infty}^{\infty} x[m]h[n-m]$$

Note that the infinite sums will of course be finite because both x and h are finite in length. You could consider doing it using the "pseudocode":

create an empty vector to represent the output

create a vector that represents the impulse response

for each data sample

add to the output vector the impulse response stating at that sample, scaled by that data sample

Specifically, familiarise yourself with the following Matlab commands:

- filter
- stem
- subplot
- freqz
- abs
- for/ end; if/ else/ end
- zeros
- fft/ ifft
- .*