ELEC9721: Digital Signal Processing Theory and Applications

Lab 3: FIR Filter Design

Filter Specifications:

- Sampling frequency 8000Hz
- Pass band frequency 1500Hz to 2000Hz
- Stop band frequencies 0 to1000Hz and 2500 to 4000Hz.

1. Show your preparation *2 marks*

2. Design the above filter using 'fir1' matlab command (that is the matlab command for windowing method) using the rectangular window (Matlab rectwin). Plot the magnitude and phase response of this filter keeping the x-axis scaled to Hz. Plot the y axis in log scale. Order = 22. *2 marks*

3. Design the same filter using frequency sampling method using the matlab command fir2, also using a rectangular window. Plot the magnitude and phase response of this filter keeping the x-axis scaled to Hz. Order =22 *2 marks*

4. Design a linear phase FIR filter using Park McClellan method using Matlab (Matlab command firpm). Here you need to find the filter order by trial and error method, checking whether the filter response matches the specifications for different numbers of order. Plot the magnitude and phase response of this filter (i.e. you **should not** use the firpmord function). *2 marks*

   Additional specifications you will need for this design are:
   - Pass band ripple = 1 dB
   - Stop band attenuation = 30dB

5. Calculate by hand the coefficients required for an order 22 filter designed to the above specification, as you did for the preparation exercise *2 marks*