363 - Winter 2017 Due Monday February 20, 2017

Parks - McClellan Design

We will determine the coefficients of a linear phase FIR low pass filter with the same pass bands and stop band as for the earlier Hamming design. This time we have magnitude specifications: no more than ±0.1 dB ripple in the pass bands and at least 40 dB attenuation in the stop band

Coefficients of the filter are determined using Matlab function `firpm`, which is used as described in class. We want the minimum filter length N+1 that will meet specifications. Please note that only a Type 1 filter can do this problem. You must figure out the arguments to present to `firpm` and then apply trial and error to find the minimum allowable N, after using the standard formula to find an approximate value of N. Note there is an example, on the course web site, of using `firpm` to determine coefficients of an FIR bandpass filter.

In determining whether or not a given filter length meets specifications, a good way is, after using `freqzdB` to compute the frequency response, to use Matlab's `max` function to determine the maximum amplitude response in the stop band. When that specification is met, look at the pass band ripple, which should also be met if your weightings are correct.

Hand in, on Feb. 20, an explanation of why you chose the `firpm` parameters (mainly N and the weights) that you used, a printout of the coefficients of `h`, a printout of the diary or m-file showing how the coefficients were determined with `firpm`, a printout of the z-plane plot of the zeroes, and printouts of the magnitude response at all frequencies in [0 , 0.5] and in the passbands and stopband (four frequency response plots, as before). Printout need be handed in only for the successful minimum N.

Your coefficients will be used in the next lab problem, and you will want to make up a header file defining the filter length in conventional integer format and the coefficients in Q15 format. That is eased by doing this at the end of your m-file for filter determination:

```
won=2^15;
hvalsq15=round(won*h)'; %round okay here
fprintf('%d\n\n',N+1);
fprintf('%d,\n',hvalsq15);
```

The coefficients will list in the Matlab work window; they can then be copied/pasted into a text file.

2/8/2017