EE 311 **Feb. 15, 2019**

In Class FIRLS

The following page has the help file from MATLAB® for the `FIRLS` function. Design a 9th order low pass filter using FIRLS which has a sample frequency of 11025 Hz. The ideal filter to use for the design has a pass band from 0 Hz to 1500 Hz and a stop band from1800 Hz to fs/2. After doing your design in MATLAB® plot the magnitude plot for your filter.

```
>> help firls
  firls Linear-phase FIR filter design using least-squares error minimization.
    B=firls(N,F,A) returns a length N+1 linear phase (real, symmetric
    coefficients) FIR filter which has the best approximation to the
    desired frequency response described by F and A in the least squares
    sense. F is a vector of frequency band edges in pairs, in ascending
    order between 0 and 1. 1 corresponds to the Nyquist frequency or half
    the sampling frequency. A is a real vector the same size as F
    which specifies the desired amplitude of the frequency response of the
    resultant filter B. The desired response is the line connecting the
    points (F(k),A(k)) and (F(k+1),A(k+1)) for odd k; firls treats the
    bands between F(k+1) and F(k+2) for odd k as "transition bands" or
    "don't care" regions. Thus the desired amplitude is piecewise linear
    with transition bands.  The integrated squared error is minimized.

    For filters with a gain other than zero at Fs/2, e.g., highpass
    and bandstop filters, N must be even.  Otherwise, N will be
    incremented by one. Alternatively, you can use a trailing 'h' flag to
    design a type 4 linear phase filter and avoid incrementing N.

    % Example of a length 31 lowpass filter.
    h=firls(30,[0 .1 .2 .5]*2,[1 1 0 0]);
    fvtool(h);

    % Example of a length 45 lowpass differentiator.
    h=firls(44,[0 .3 .4 1],[0 .2 0 0],'differentiator');
    fvtool(h);

    % Example of a length 26 type 4 highpass filter.
    h=firls(25,[0 .4 .5 1],[0 0 1 1],'h');
    fvtool(h);

    See also firpm, fir1, fir2, freqz, filter, designfilt.

    Reference page in Help browser
       doc firls
```