Filter design HW

Due: Nov 27, 2017

1) **Least-squares filter design**

Say you want to design a **N=6 point, linear phase, symmetric FIR filter**. You want H(ω) to have the following shape:

H(ω) = 0, at ω = 0, pi/3, and pi

H(ω) = 1, at ω = pi/2 and w = 0.75 pi

   a) Write down the equation A h = d that you can use for filter design. Explicitly write out the values of A, h, and d by hand.

   b) Enter your equations for A, h, and d into matlab (or other software) and find h(n) using a least-squares approach (explicitly writing it out, and using matrix division – not firls)

   c) What type of filter could NOT be designed with an even-length, symmetric FIR filter?

2) Redo the problem above, but use weighted least-squares to give a 10x extra weight to the error at ω = pi. Here, you can use a built-in command like 'lscov' to make life easier (look at the matlab code uploaded in the optimal filter design lecture folder)

What is the filter suppression (power, in dB) at ω = pi, for the weighted and unweighted designs? Did add the weighting make any other aspect of filter performance worse?