DSP HW 2

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1. Please write a Matlab finction ***y = mov_avg_filt(x,n)*** that can filters the signal x by an n-term moving average filter and y is the output.

   Please verify your program by inputing a random sequence composed of 100（Uniformly Distributed）random numbers between 2 and 5. Then run your program by setting n=3 and n=9, respectively, and finally show your opinions about the results.

   Note: Comparison between the two results is needed. You should write a for-loop to finish the function instead of using functions, e.g. *`filter`*, in Matlab.

   Hint: The *`rand`* function in Matlab can produce uniformly distributed random numbers between 0 and 1.

2. (a) Please design a LP Butterworth filter H(s) satisfying the specifications $Gp \geq -3dB$, $Gs \leq -14dB$, wp=10^5 rads/sec, ws=1.5×10^5 rads/sec

   Hint: Four steps: (1) Determine order n, (2) Determine wc, (3) Determine the normalized H(s), (4) Determine the scaled H(s)

   (b) Please finish the design problem in (a) by Matlab.

   Hint: *`buttord`*、*`butter`*、*`tf`* functions in Matlab.

   (c) Plot the spectrums in (a) and (b) to verify your design.

   (d) Why do most conventional engineers focus on designing LP filters? What should we do if we need a BP filter?

3. Filter Applications (濾波器應用) ：

http://140.114.76.148/jang/books/audioSignalProcessing/10.1-filterApplication.asp?title=11-1%20Filter%20Applications%20(濾波器應用)

Please record an audio file (*.wav) in your mother tongue and redo the experiments（1. LP, 2.HP, 3. One-fold echo, 4. Multiple-fold echo） in the above web-page.

Note: The *`filter`* instruction in Matlab is used to implement filtering.

※ Reference: http://140.114.76.148/jang/ Prof. Jyh-Shing Roger Jang（張智星 教授）