Homework #11, EECS 206, W03. Due Fri. Mar. 28, by 11:30AM

Notes

- Review the HW policies on HW1!
- Continuing to write anything on your homework after the 11:30AM due date, or attempting to put your solution into the box any time after 11:30AM is an honor code violation.
- The final exam is Wed. 4/23/03 from 4-6PM.
  - Section 1 will be in 1013 Dow as usual.
  - Section 2 will be in 1610 IOE.
- The time and place for the alternate final exam is Tues. 4/22 10:30-12:30 in 1303 EECS. Students in Section 2 who need to take this alternate final must use the sign up form on the web by April 1. Section 1 students or students with additional scheduling problems must see Prof. Fessler in person by April 1.
- Reading: Text Ch. 6.
- Relevant practice problems on the DSP CDROM: 6.2, 6.9-6.26, 6.29, 6.30, 6.34

Skill Problems

1. [0] Text 6.1. Concept(s): response of FIR filter to complex exponential
   The answer is $y[n] = 1.176e^{-j0.63}e^{j0.4\pi n}$.

2. [0] Text 6.2. Concept(s): response of squaring system to complex exponential
   The answer is $y[n] = A^2e^{j2\omega}e^{2j\omega n}$. This is not of the form $\mathcal{H}^{(\omega)}Ae^{j\omega}e^{j\omega n}$.
   (The nonlinearity changed the frequency.)


7. [10] By factoring, find the coefficients of two first-order FIR filters so that, when cascaded, they yield the following overall frequency response:
   $$\mathcal{H}^{(\omega)} = 2 - 5e^{-j\omega} + 3e^{-j2\omega}.$$ 

8. [20] Consider the cascade system
   $$x[n] \rightarrow \begin{array}{c} h_1[n] \\ \mathcal{H}_2^{(\omega)} \end{array} \rightarrow y[n],$$ 
   where $h_1[n] = \delta[n] - \delta[n-1] + \delta[n-3]$ and $\mathcal{H}_2^{(\omega)} = 1 + 2e^{-j\omega} + e^{-j2\omega}$.
   (a) [5] Determine the overall frequency response $\mathcal{H}^{(\omega)}$ of this system. Simplify your answer as much as possible.
   (b) [5] Determine and plot the overall impulse response $h[n]$ of this system.
   (c) [5] Determine the difference equation for this system.
   (d) [5] Determine the steady-state response of this system to a unit step function input.


10. [10] The 6-periodic signal $x[n]$ having 6-point DFT given by $X[k] = [2, 0, j, 3, -j, 0]$ for $k = 0, 1, \ldots, 5$ is the input to a FIR filter with frequency response $\mathcal{H}^{(\omega)} = 2 - e^{-j\omega}$. Determine the output signal $y[n]$.

Mastery Problems

11. [0] What room is the final exam in?