Homework #10, EECS 206, Fall 2002. Due **Fri. Dec. 6**, by 4:30PM

Notes

- Review the HW policies on HW1!
- **Regrade requests**: All regrades for HW1-7 must be submitted in writing to Prof. Hero or Fessler by 5:00PM on Mon. Dec 2. HW8-10 regrades must be submitted within 3 days of when they are returned to your lab section.
- **Final Exam**: Mon., Dec 16, 4-6 PM, in Chem. 1800.
  An alternate time has been posted on the web page under "exams."
- Reading: Text Ch. 8.
- Relevant practice problems on the DSP CD: 8.1-8.11, 8.15-8.23, 8.57-8.59. This is a partial list; feel free to explore!

Skills and Concepts

- IIR filters

Problems

1. [10] Text 8.5. ($H(z)$, pole zeros, $h[n]$ from diffeq)

2. [20] Text 8.6. (all pass filter)

3. [15] Text 8.11. (inverse z-transforms)

4. [20] Text 8.13. (pz plots vs other characterizations)

5. [10] Text 8.16. (pz plots to frequency response)

6. [20] Text 8.20. (system function to others characterizations)

7. [20] Find a causal IIR filter such that the magnitude of the response to a discrete-time sinusoid with frequency $\pi/40$ is at least 30 times larger than the magnitude of the response to any discrete-time sinusoid with frequency in the range 0.7π to π. As your answer give:
   (a) the coefficients of your filter,
   (b) its order,
   (c) a plot of the magnitude frequency response,
   (d) the values of the magnitude frequency response at $\pi/40$ and 0.7π, and
   (e) the ratio of the magnitude frequency response at $\pi/40$ and the maximum magnitude frequency response in the range 0.7π to π.
   This is an open-ended design problem, representative of what an engineer would need to solve. It is not intended to be difficult or tricky in any way. There are many approaches you might take and many possible solutions. For example, some approaches might involve theoretical formulas and some might use Matlab. However, you should solve this problem *on your own* without help or suggestions from the staff or other students. Solving this problem may take some trial and error, where the "trials"might involve experimentation with a method you have chosen, and if this is not successful, with another approach.
   In problems where there are many possible solutions, engineers generally look for the simplest solution. 10 points extra credit to any student who finds a filter with the smallest order.