Homework #9, EECS 206, Fall 2002. Due **Fri. Nov. 22**, by 4:30PM

Notes

- Review the HW policies on HW1!
- **Final Exam**: Mon., Dec 16, 4-6 PM, in Chem. 1800.
  An alternate time has been posted on the web page under "exams" for those with conflicts.
- Reading: Text Ch. 7.
- Relevant practice problems on the DSP CD: 7.3, 7.4, 7.18, 7.21, 7.25, 7.32, 7.35, 7.46, 7.49

Skills and Concepts

- z-transform of finite length sequence
- represent z-transform in complex-plane
- Find system (transfer) function directly from a diffeq
- Find frequency response from transfer function

Problems

1. [10] Text 7.1. (z-transform of finite sequences)

2. [10] Text 7.3. (diffeq and response from system function)

3. [15] Text 7.4. (diffeq, system function)

4. [10] Text 7.7. (roots and zplane)

5. [10] Text 7.8abdf. (diffeq to $h[n]$ and $H(z)$)

6. [15] A filter has input-output relation

$$y[n] = x[n-1] + \sqrt{2}x[n-2] + x[n-3]\,.$$

   (a) [5] By taking the Z-transform of both sides of this equation to obtain $Y(z) = H(z)X(z)$ identify the system function $H(z)$.

   (b) [5] From the system function of part (a) show that there is a frequency $\hat{\omega}_o$ for which the output of the filter equals zero when $x[n] = A\cos(\hat{\omega}_o n + \phi)$ for any A, ϕ. What is this frequency?

   (c) [5] What is the magnitude and phase of the output $y[n]$ when the input is the sinusoid above with $A = 10$, $\hat{\omega}_o = \pi$ and $\phi = 0$?

7. [15] Text 7.9ace. (Cascade of two $H(z)$'s)

8. [15] Text 7.14. (Find output given $H(z)$ and non-periodic input)
   As noted in the DSP 1st errata on the web page, the problem statement has a typo; it should be

$$H(z) = (1 + z^{-2})(1 - 4z^{-2}) = 1 - \mathbf{3}z^{-2} - 4z^{-4}.$$