Homework #3, EECS 206, Fall 2002. Due **Fri. Sep. 27**, by 4:30PM

Notes

- Review the HW policies on HW1!
- Reading: Sections 2.5, 2.6, 2.8, 3.1-3.4, and Appendix A in textbook, and "Part 3" lecture notes.

Skills and Concepts

- sinusoidal signals
- complex arithmetic
- linear combinations of sinusoidal signals
- phasors

Problems

1. [10] Text 2.8. (Signal from Matlab code.)

2. [10] Text 2.9. (sin+cos)

3. [10] Text 2.10. (sums of cosines / phasors.)

4. [10] Text 2.11. (complex solution)

5. [10] Text 2.17. (sums of cosines / phasors.)

6. [10] Text 2.19. (sums of cosines / phasors.)

7. [10] Prove that if A and B are positive, then $A\cos(t) + B\sin(t) = \sqrt{A^2 + B^2}\ \cos[t - \tan^{-1}(B/A)]$.
   Hint: $\cos(a - b) = \cos(a)\cos(b) + \sin(a)\sin(b)$.

8. [20] Let $x(t)$ and $y(t)$ be the input and output signals, respectively, of a system. Assume that the following input/output relationship describes the system: $y(t) = x(t) - x(t-1)$.
   (a) [10] If $x(t) = A\cos(\omega_1 t + \theta)$ show that the output $y(t)$ can be written as $B\cos(\omega_2 t + \phi)$. Relate B, ϕ and ω_2 to A, θ and ω_1.
   (b) [10] Assume that the input $x(t)$ is periodic with period 4 and $x(t) = 1$ for $0 < t < 2$ and $x(t) = 0$ for $2 < t < 4$. Sketch $x(t)$ and $y(t)$.
   (c) [0] Comment on your results for parts (a) and (b).

9. [35] (a) [15] Convert the following complex numbers from cartesian form to complex exponential form and plot in the complex plane.
   - $z_1 = 1 + 2j$
   - $z_2 = 2 + 3j$
   - $z_3 = 1 - j$

   (b) [10] Evaluate the product of z_1, z_2 and z_3 by:
   - Performing multiplication entirely in cartesian coordinates
   - Performing multiplication entirely with the exponential forms of these complex variables.

   (c) [10] Evaluate the ratio z_1/z_2 by:
   - Performing division by first converting z_1 and z_2 to exponential form.
   - Performing division by multiplying the numerator and denominator of z_1/z_2 by z_2^*.

   (d) [0] Which form is easier for multiplication and division? What about for addition and subtraction?