EECS 551 Fall 1997

PROBLEM SET #6

ASSIGNED: October 23, 1997
DUE DATE: October 30, 1997

Read Chapter 5 of V&K. Also read Section 2.6. Don't need for this week.
This week's theme: Computing continuous-time wavelet bases and transforms.

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1. Compute the continuous-time Haar wavelet transform (wavelet series) of:
   (a) $e^{-t}, t > 0; 0, t < 0$ (b) $\sin(t)$ (c) $\cos(t)$.
   (d) Simplify your answers for very detailed scales (small m).
   (e) Explain why taking a wavelet transform is like taking a derivative.

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2. V&K #4.11 Discrete-time Haar→continuous-time Haar basis.
   Note the infinite product does NOT include the initial continuous-time pulse.

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3. Iterative computation of continuous-time D2 Daubechies scaling function:
   The MATLAB program shown at right
   computes the D2 Daubechies wavelet
   scaling function by iterating the
   2-scale equation. It does NOT
   include the initial continuous pulse.

   a. Type in and run the program.
      PLOT the first four iterations.

   b. Compute and PLOT the DTFT for
      each of the first four iterations.

      This is tricky; you need to scale the time axis so the four iterations each occupy the same time interval. This can be done by UPSAMPLING the first iteration several times, then DOWNSAMPLING by 2 at each iteration.

      The program includes three lines that perform this operation
      (note how to upsample in MATLAB using "ZEROS" and ":").
      PLOT the first four iterations using this, then compute the DTFT using FFT.

   c. Your DTFTs should look aliased! Explain why they AREN'T aliased.

   d. Compare the convergence rates for various frequency bands (low vs. high).
      Which converge fastest? Why?

"The difference between a halo and a noose is about one foot."