EE 567

Homework 2

Due Tuesday, September 10, 2019

Work all 5 problems.

Problem 1.

a. Suppose $x(t)$ has the value 1 in the interval [0,2] and is zero elsewhere. Compute the energy in $x(t)$.

b. Suppose $y(t)$ has the value 1 in the interval [0,1] and has the value -1 in the interval (1,2] and is zero elsewhere. Compute the energy in $y(t)$.

Problem 2.

a. Suppose $x(t) = \sin(t)$ in the interval $[0, 2\pi]$ and is zero elsewhere. Compute the energy in $x(t)$.

b. Suppose $y(t) = A\sin(t)$ in the interval $[0, 2\pi]$ and is zero elsewhere. Compute the energy in $y(t)$.

Problem 3. Determine the power for each of the following signals:

a. $x(t) = 10\cos(100t + \pi/3)$.

b. $y(t) = (10 + 2\sin(3t))\cos(10t)$.

Problem 4. Pulse Coded Modulation (PCM) is to be used to encode a signal. The signal ranges between the values -2 and +2. There are 4 bits or 16 levels (hence 16 code numbers) available. The levels assigned have symmetry like we demonstrated in class. The first three sample values obtained (before quantization) are 0.6, 1.4, and -1.2, respectively.

a. Find the quantized values for the three sample values.

b. Find the corresponding PCM sequences for the quantized values.

Problem 5. Let $s(t) = 10\cos(2\pi ft + \pi/4)$ where $f = 40$ Hz. Let us sample $s(t)$ at the sampling rate of $f_s = 160$ Hz to obtain the discrete time signal $s(nT_s) = 10\cos(2\pi fnT_s + \pi/4)$ where $T_s = 1/f_s$, for $n = 0, 1, 2, \ldots, 40$. Using the PCM example in class as a guide compute the quantized PAM signal and the corresponding PCM codeword assuming you have 8 bits or 256 levels to represent the quantized signal.

Note: In this problem you are to use Matlab or some other programming tool/language. Remember to hand in your software code.