PS #1 , Spring 2015
Signal Processing Using MATLAB, ECE-495/595
Instructor: Balu Santhanam
Date Assigned: 01/22/2015
Date Due: 01/29/2015

In class, we covered MATLAB functions connected with 2D and 3D plotting and functions that allow us to specify figure and axes related properties such as font name and font size. In this exercise, we will try to employ some of these tools.

Generating data with a specified distribution

Our goal is to generate samples of signal that is Laplacian distributed with a PDF given by:

$$f_X(x) = \frac{1}{4\sigma} \exp\left(-|x|/2\sigma\right).$$

We accomplish this task by using the inverse CDF method:

1. First generate samples of a uniform distribution using the MATLAB function `rand.m`. Use the function `hist.m` to confirm that the generated sequence is uniformly distributed.

2. Transform the uniform random variable using the inverse CDF function of the Laplacian. To confirm that we have indeed generated data with the distribution specified we use two MATLAB commands `hist.m` and `cdfplot.m` for plotting the histogram and the empirical CDF associated with the input.

3. Label the plots appropriately using the 2D plot commands given in class using 18pt courier font. Compare the plot of the empirical CDF of the uniform sequence to the empirical CDF of the Laplacian.

Bivariate Laplacian Distribution

In this section we will use the 3D plotting tools such as `surf.m` and surfc.m to study the bivariate Laplacian distribution:

$$f_{X,Y}(x,y) = \frac{1}{4\sigma_x} \exp\left(-|x|/2\sigma_x\right) \frac{1}{4\sigma_y} \exp\left(-|y|/2\sigma_y\right).$$

Towards this goal using an xrange and yrange of `[-2:2]` and using 16pt Helvetica plot the analytical PDF and the CDF of the bivariate Laplacian. Also plot the equiproabable contours for values of the PDF that you specify.