CSE 4214 :: Lab 3

This lab will introduce you to optimal and suboptimal system design.

Optimal and Suboptimal System Design

For on-off keying, express the probability of error in terms of E_b and N_0. Derive the probability of error expression starting from equation (2.43) in the course notes (Version of October 10). Assume optimal system design (except in on-off keying, where $s_1[k]=0$).

In lab 2, you devised a method for simulating digital communication systems, and you simulated the performance of polar NRZ. Using the same method, simulate on-off keying (you may re-use your code from lab 2 if you wish). On the same curve, plot both the simulated and theoretical probabilities of error, for both polar NRZ (from lab 2) and on-off keying (i.e., four curves in total on the plot), with respect to N_0 on a semilog scale (log scale on the y axis). Ensure that the curves are properly labeled.

Repeat the above, replacing the optimal filter h[k] with

$$h[k] = \begin{cases} \sin\left(\frac{\pi k}{n_b}\right), & 1 \le k \le n_b \\ 0 & otherwise \end{cases}.$$

Repeat the probability of error calculation for *both polar NRZ and on-off keying*, using the new h[k]. Also repeat the simulations and generate the same plots. Discuss the effect of the new filter.

Deliverables

Your deliverables for this lab are as follows:

- All MATLAB code, but only if your code changed from lab 2 to lab 3.
- Your plots, along with a discussion of the effects of the new filter.

Deliverables are due at the end of the lab period on October 30, 2009.

Demonstration

In the lab, the TA will ask you to describe your work. You will demonstrate your simulations, and answer any of the TA's questions. The lab must be demonstrated before the end of the lab period on October 30, 2009; otherwise, the demonstration will be marked as "incomplete".

Evaluation

The following three components of this lab will be evaluated separately:

- Written work and plots;
- MATLAB code; and
- Lab demonstration.

Each component is weighted equally, and graded on the following five-point scale:

- 5: Outstanding work demonstrating original thinking
- 4: Satisfies the lab requirements
- 3: Minor issues in satisfying the lab requirements
- 2: Major problems in satisfying the lab requirements
- 1: Work is incomplete
- 0: Work is missing (or student is absent for the demonstration)

Note that the maximum grade for satisfying the basic lab requirements is an “A” (80%).