CSE 4214 :: Lab 2

This lab will introduce you to baseband data transmission. Throughout this lab, assume that bit values 0 and 1 are equiprobable.

Simulation of bit error rate

Write a program in MATLAB which takes $s_0[k]$, $s_1[k]$, $h[k]$, n_b, T_s, N_0, and z as parameters (all of which are explained in the notes), as well as a positive integer n_T representing the number of trials. Note that given n_b, $s_0[k]$, $s_1[k]$, and $h[k]$ are all 1-by-n_b vectors.

A trial consists of the generation of a random bit, modulation, addition of white noise, and detection of the bit. An error occurs if the detected bit disagrees with the transmitted bit. Your program will perform n_T such trials, counting the number of errors n_E that occur.

The program returns two values: the simulated probability of error, n_E/n_T, as well as the theoretical probability of error that was derived in class.

In addition to writing this program, do the following:

- For polar NRZ with $n_b = 4$ and $T_s = 10^{-5}$ s, and using the optimal value of z, find the theoretical values of N_0 corresponding to Pr(error)=0.25, and Pr(error)=0.01.
- Find 8 equally spaced values of N_0 between the two you found in the previous question. For each point (including the two end points, so 10 in total), run your simulation program with $n_T = 1000$.
- On the same curve, plot both the simulated and theoretical probabilities of error with respect to N_0 on a semilog scale (log scale on the y axis).

Deliverables

Your deliverables for this lab are as follows:

- All MATLAB code.
- A written description of how your simulation program works.
- Your plot, along with a discussion of its accuracy.

Deliverables are due at the end of the lab period on October 9, 2009.

Demonstration

In the lab, the TA will give you a particular set of parameters. You will demonstrate the operation of your MATLAB code, and answer any of the TA's questions. The lab must be demonstrated before the end of the lab period on October 9, 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%).