Birla Institute of Technology & Science, Pilani, Rajasthan
First Semester 2019-2020
Lab 9 (Thursday)

Course: EEE F311 Communication Systems
Instructor-in-Charge: S M Zafaruddin

Date:05-11-2019

Objectives

- Q-function and Erf, Erfc
- BER

Task 1

1. A receiver has a noise floor of $N_0 = -140$ dBm/Hz. Power spectral density of signal varies from -160 dBm/Hz to -120dBm/Hz. Plot BER versus SNR for polar and on-off signaling (in the same plot) when the transceiver is matched with bandwidth of 100 Hz. Use direct formula for BER in terms of Q-function and use Matlab function integral to evaluate the integration for Q-function. Comment on the BER performance.

2. Suppose that the integral function is not available in Matlab. Simulate Q-function using an upper bound to plot the BER of polar signaling as done in Task1.1. Confirm the BER plot with Matlab function erfc by plotting both (using upper bound and erfc) in the same figure. Upper bound on the Q-function in the literature: https://ieeexplore.ieee.org/Xplore/home.jsp.

Task 2

1. Transmit sinc pulse stream with polar signaling whose amplitude is 1 and signaling interval 1 sec. At the receiver, AWGN $N(0, \sigma_n^2)$ is added to the received signal. Use Matlab function randn. Assume channel to be distortion-less. Show in real-time the pulse transmitted every second in subplot(2,1,1) and noise received pulses in subplot (2,1,2) by randomly choosing noise variance σ_n^2 as 2 or 0.01. Show the plot for 30 seconds. Use the real-time code.

2. Using Task2-1, count the number of pulses in error when (i) $\sigma_n^2 = 2$ is fixed throughout the transmission and (ii) $\sigma_n^2 = 0.01$ is fixed throughout the transmission, and thus calculate the pulse error rate. Use large number of transmissions to improve the accuracy of simulated pulse rate. Confirm the pulse error rate using the theoretical error rate formula.

Backup Codes

1. Please keep backup of codes and figures by sending to your emails.
2. Make a zip/rar folder of your codes and figures in .jpeg format and upload to (ONLY ONCE): https://www.dropbox.com/request/fiyYsRV0wEu8bm39mxdO

Project Task

We have started individual tasks with a bigger picture: to design an end-to-end simulator. Study the structure module in Matlab. Create a function of source signal as a structure and field values as the signals discussed so far: sinusoidal signal , rectangular pulse, audio file.