ECE 322: Principles of Communication Systems

Spring 2020
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Due: May 7, 2020

Project: Simulation of a communication system that uses M level Quadrature-Amplitude-Modulation (M QAM)

In this project, you will simulate the transmission of a colored image (student.jpg) over a wireless link using M-QAM.

Part A

Using Matlab, create three functions that simulate the following operations:

- *Transmitter* - This function will load the image, covert the image into a sequence of bits, map the input bit stream to symbols using Gray mapping, and perform M-QAM modulation.
- *Channel* - This function will simulate the effect of additive white Gaussian noise on the transmitted signal, at a given signal-to-noise ratio (SNR) level.
- *Receiver* - This function performs demodulation and decoding of the received signal, and computes the received image.

Part B

Using the system you implemented in Part A do the following:

1. For M=4,16,64, and SNR=20db
    a. Provide the scatter plot of the received signal after demodulation.
    b. Compute the probability of error after decoding.
    c. Show in one figure the transmitted and reconstructed image.

    Comment.

2. For the different values of SNR, display in separate figures the probability of error versus SNR curve for M=4,16,64. Also show the theoretically expected probability of error. **Comment.**

3. Provide a brief description of Gray mapping and its advantages.
4. Repeat B2 when Gray mapping is not used. **Comment.**

Part C

1. Form groups of 2-3 students.
2. Each group should submit a brief report describing all steps, providing the code that you produced and stating your observations and comments.
3. Prepare a 15 min presentation of your results and observations, to be delivered by your group during class time on the due date. All group members should participate in the presentation.

NOTES

- You will need to install MATLAB (version 2019a) on your computer from https://software.rutgers.edu/ and the MATLAB Communications Toolbox.
- Please review https://www.mathworks.com/help/comm/gs/compute-ber-for-a-qam-system-with-awgn-using-matlab.html