

Programming Assignment 1

E2-203

Code upload date: January 28, 2024

1. Consider a transmitter communicating with a receiver. The channel is perturbed by additive white Gaussian noise.
 - Set up a Monte Carlo simulation to plot the symbol error probability (SEP) at the receiver as a function of the SNR for MPSK and MQAM (e.g., 8PSK and 16-QAM) constellations. Take sufficient number of samples in the simulations so that the simulation results are accurate up to a symbol error probability (SEP) of 0.00001.
 - Plot the 99 % confidence interval (CI) of the SEP as a function of the SNR in the same figure.
 - Hint: Use MATLAB's `errorbar(.)` subroutine to plot the CI.
 - Please generate the constellations and signals yourselves. Do not entrust it to a blackbox or a MATLAB toolbox function.
 - Write a program that shows the optimal decision regions for the above constellations.
 - Please do the decoding yourselves from first principles. Do not entrust it to a blackbox or a MATLAB toolbox function.
2. Write your code in such a manner that it can simulate the SEP and plot the optimal decision regions for any given four-point constellation.
 - a. Example: What is the SEP of the following constellation: $[0+1i, 3+1i, 1+4i, 2+0i]$

Points to give careful thought to:

- How many samples do you need to arrive at the desired SEP?
- How do you know whether your numerical results are statistically accurate/reliable?
- Can you verify your simulation results, e.g., using analysis?