

EE 6340/EE3861

Assignment 4.

Due: 24-02-2022, Friday before 22:59

This Assignment is a Matlab exercise for which we will need Matlab. The Institute provides an academic license.

We will do simulations for two well-known modulation techniques for BER in Rayleigh, Rician and Nakagami- m narrow band fast fading environments. The baseband equivalent representation is given by $y_k = h_k a_k + v_k$, where a_k and y_k are the baseband equivalent transmitted and received signal, with v_k being noise and h_k being the fading coefficient. Do stepwise as follows in Matlab:

1. Generate random binary data (of length 100000).
2. Map the data to the BPSK signal constellation.
3. Multiply the random fading coefficient and add AWGN noise to this signal. Vary the noise variance to have SNR range between $[-5 \text{ dB}, 10 \text{ dB}]$.
4. Use the noisy signal to detect the transmitted bits per threshold-based rule.
5. Compare the detected bits with the transmitted ones and plot the BER.

Do the same for and 16QAM constellations. Generate the following two plots.

- Figure 1
 1. BER of Rayleigh Fading with BPSK
 2. BER of Rician Fading with BPSK
 3. BER of Nakagami- m Fading with BPSK
 4. BER of AWGN with BPSK
- Figure 2
 1. BER of Rayleigh Fading with 16-QAM
 2. BER of Rician Fading with 16-QAM
 3. BER of Nakagami- m Fading with 16-QAM
 4. BER of AWGN with 16-QAM

Analyse the Figures, and provide insights and interpretations.
