EE3082 – Communication Engineering

Project 2 – Spring 2023

Released: 1/6/2023

Due: 5/6/2023, 23:55.

Use both Matlab and Simulink to complete the project. You must use Simulink to model each modulated transmission (MPAM/MQAM/MPSK/MFSK). You can call your Simulink model from a parent .m file for different values of M and Eb/N0.

Question 1 (60 pts)

Set the transmission bandwidth of the bandwidth limited modulations (MPAM, MQAM, MPSK) as 1 MHz.

(a) (30 pts) Plot Eb/N0 and Bit Error Rate (BER) curves of 16PAM and 16-QAM (Both theoretical and simulated BER). What is the data rate of each transmission? Show the constellation diagrams and bit to symbol mappings of each modulation and discuss which one is better in terms of BER and why?

(b) (30 pts) Plot Eb/N0 and BER curves of 16PSK and 16-QAM (Both theoretical and simulated BER). What is the data rate of each transmission? Show the constellation diagrams and bit to symbol mappings of each modulation and discuss which one is better in terms of BER and why?

Question 2 (40 pts)

Set the data rate of an MFSK (orthogonal, non-coherently detected) transmission as 10 kbps. Show the spectrum of the noisy MFSK signal under Eb/N0 = 10 dB. Compare the theoretical signal bandwidth with the ones observed in spectrum analyzer under BFSK, 4FSK and 8FSK.

Plot Eb/N0 (in dB) and BER graph for BFSK, 4FSK and 8FSK (Both theoretical and simulated BER). For each case, comment on the BER when Eb/N0 = 7 dB, and comment on Eb/N0 when BER is around 1e-3.