Communications Lab

Experiment 3

180030036

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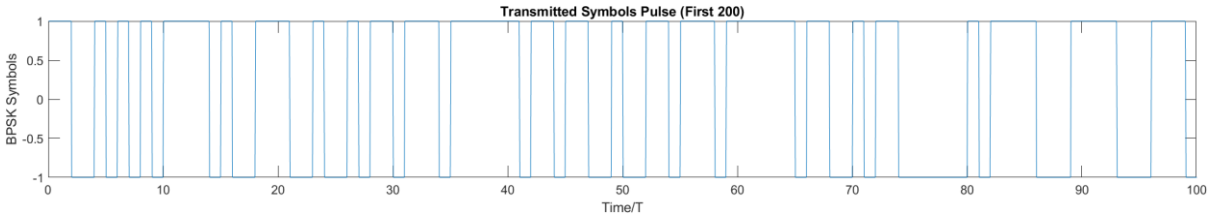
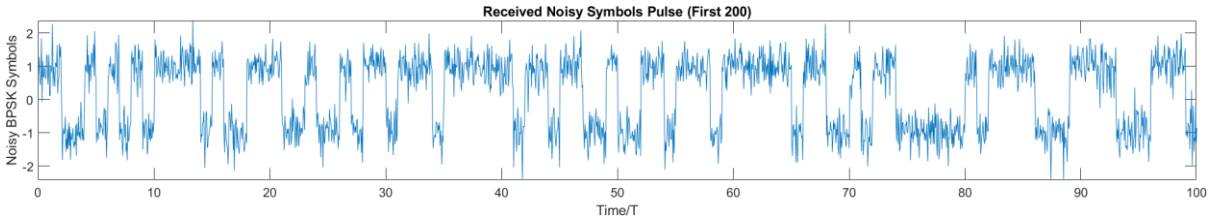
BPSK Communication: Running an example

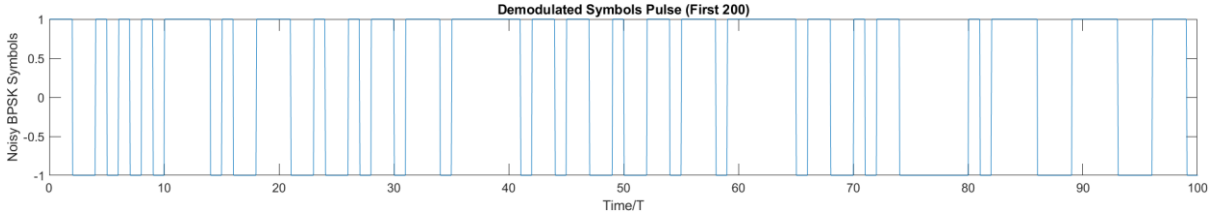
We generate a signal of randomly generated bits and perform BPSK modulation. The modulated signal is as follows (the first 200 symbols):



We then add white Gaussian noise (using an SNR = 5 dBW) to our signal and the resulting noisy signal is as follows:

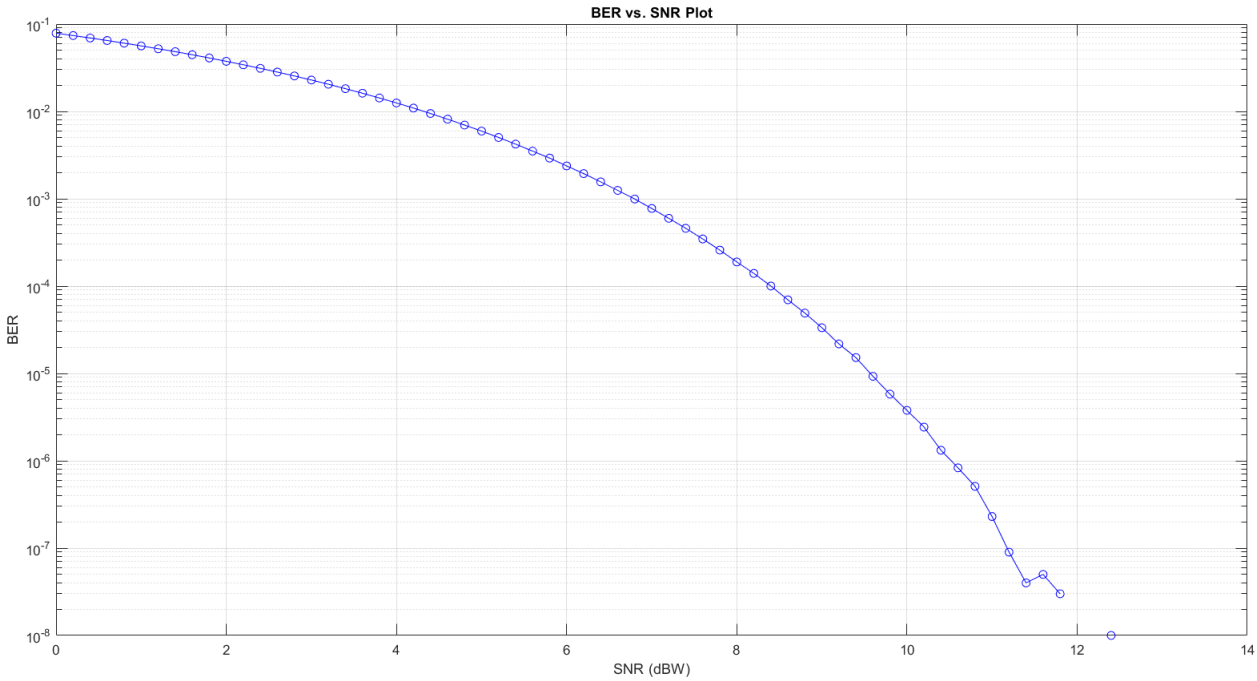


Then we perform demodulation based on the maximum likelihood (ML) rule. The resulting demodulated signal is as follows:



Bit Error Rate (BER) Calculation:

We run a randomly generated message signal of length 100000, for 1000 iterations (we have a resolution of 10^-8) for each value of SNR from 0 to 15 dBW. The resulting bit error rate plot is as follows:

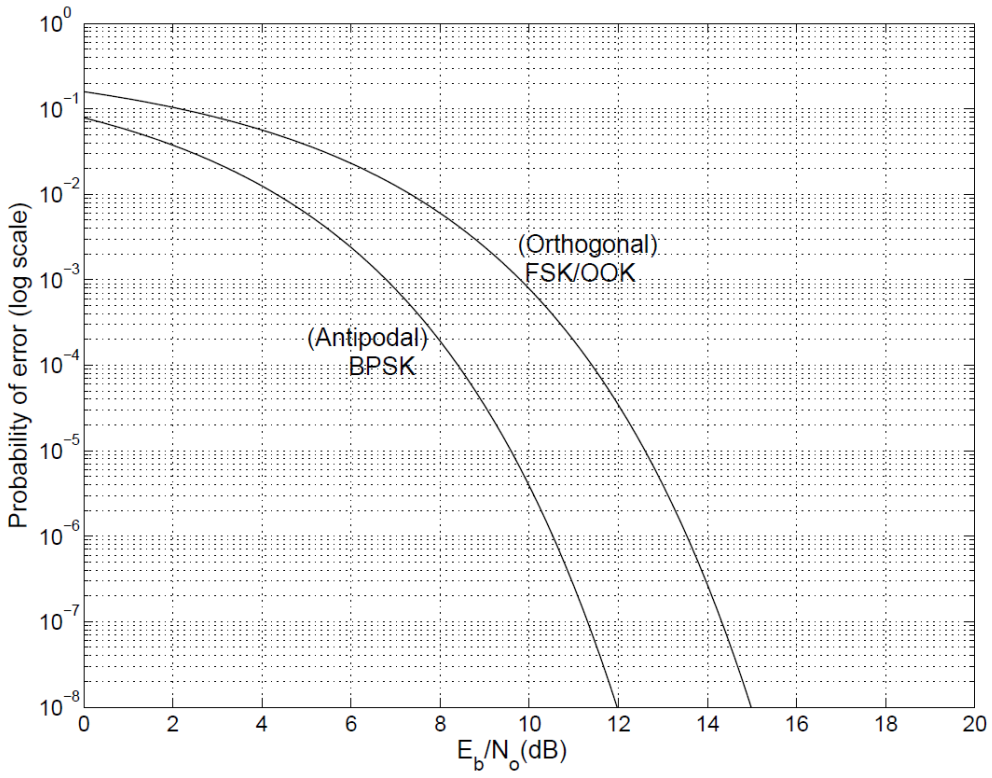


Theoretical Calculation of Error Probability:

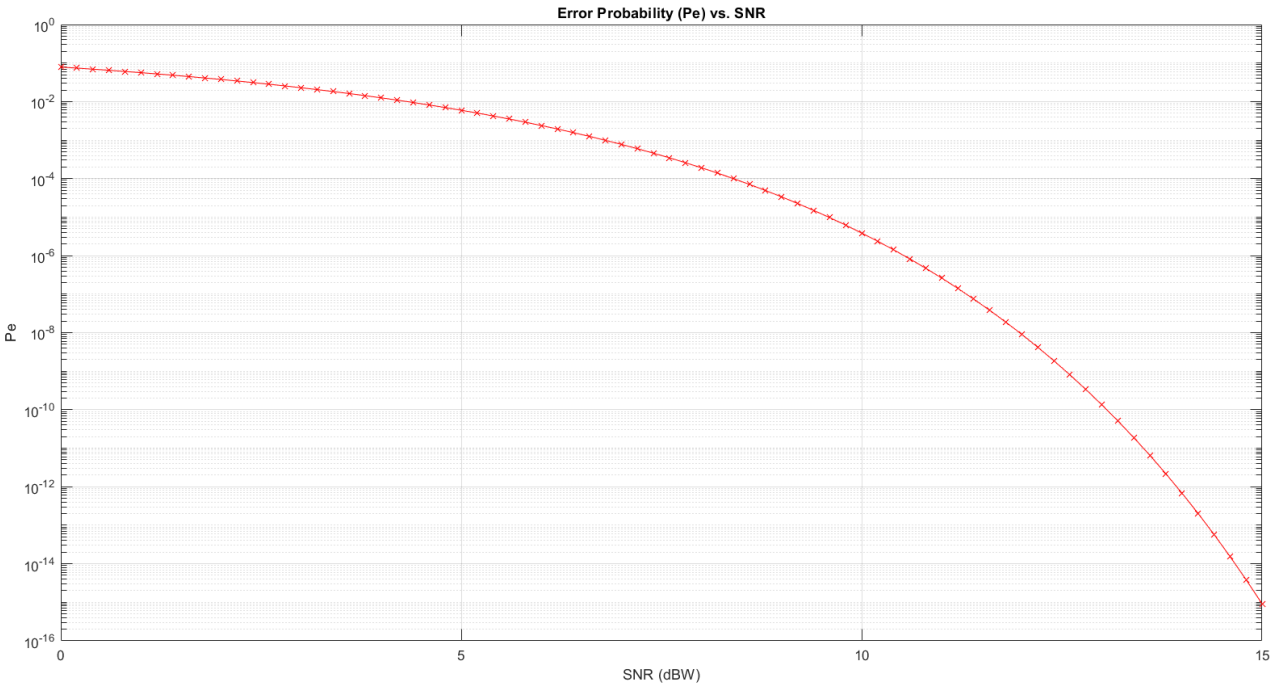
Theoretical value of error probability for our BPSK communication system is equivalent to the BER calculated practically above. The formula for error probability given by the textbook is as follows:

$$P_e = Q\left(\sqrt{\frac{2E_b}{N_o}}\right) = Q(\sqrt{2 * SNR})$$

The graph of error probability vs. SNR given the textbook is as follows (The antipodal curve shows the variation for our case of BPSK):



The plot of error probability vs. SNR which we get using the Q-function is as follows:



To compare the theoretical graph and the practical graph we plot the together. We observe that the curves match really well.