EE 356 Project Report

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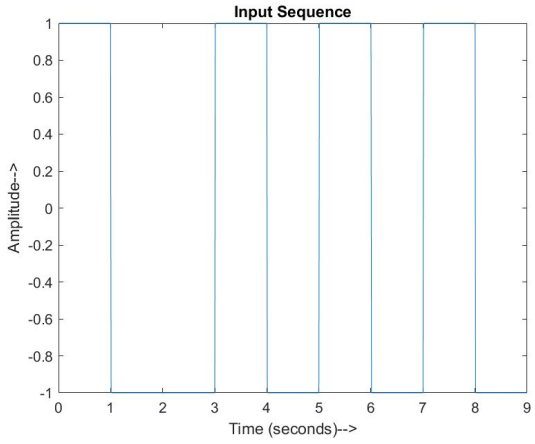
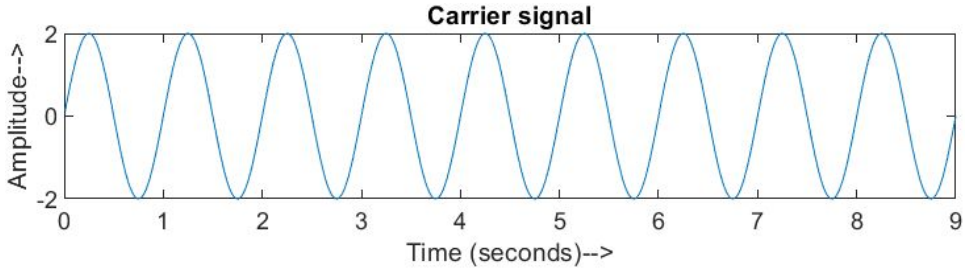
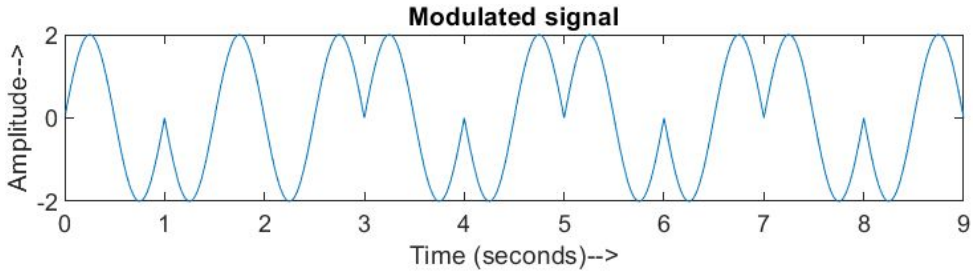
Problem Statement: Performing BPSK modulation and demodulation using the information provided.

The plots for the input sequence, carrier wave, and modulated wave are shown below -

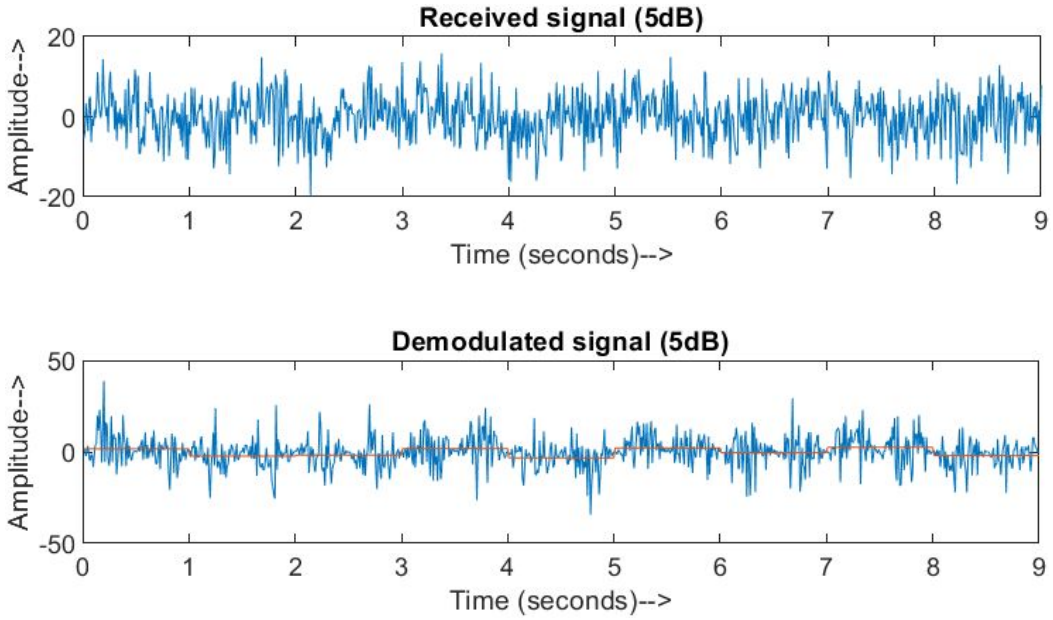




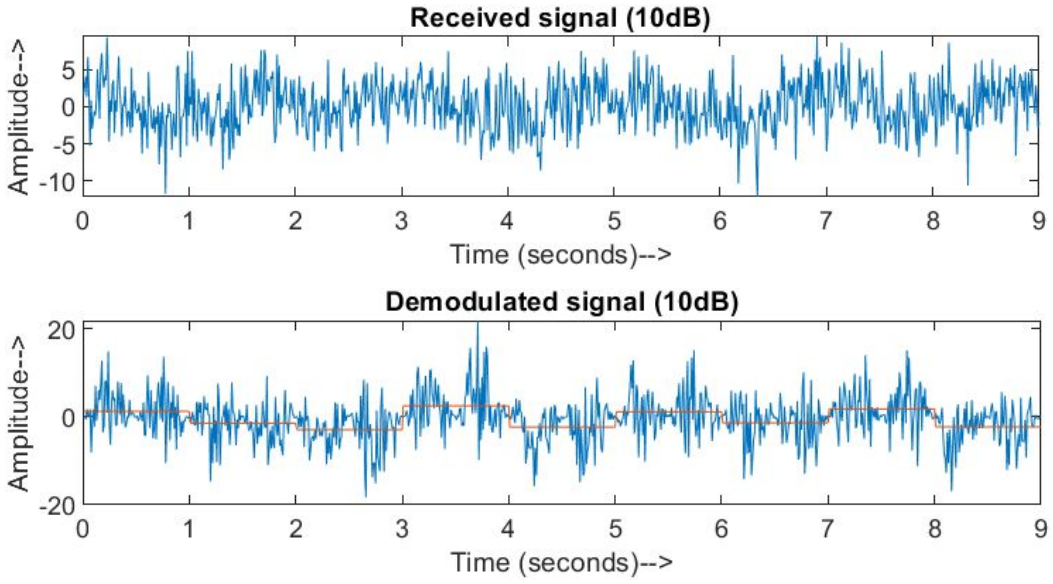


For various values of SNR, the received signal and demodulated signal are given below (the orange line indicates the decoded bit value, positive signify 1, negative signify 0) -

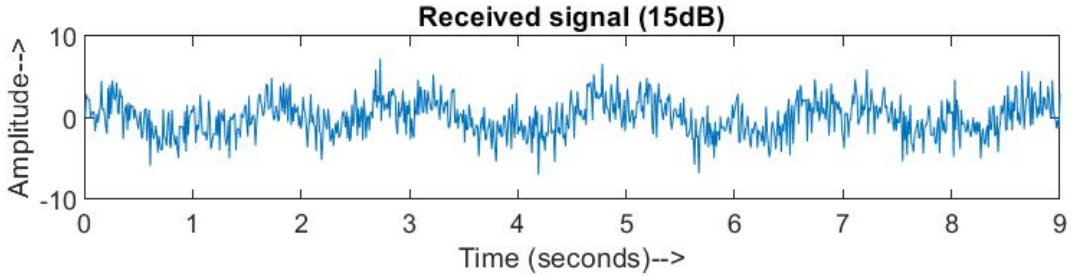
(a) For SNR = 5 dB

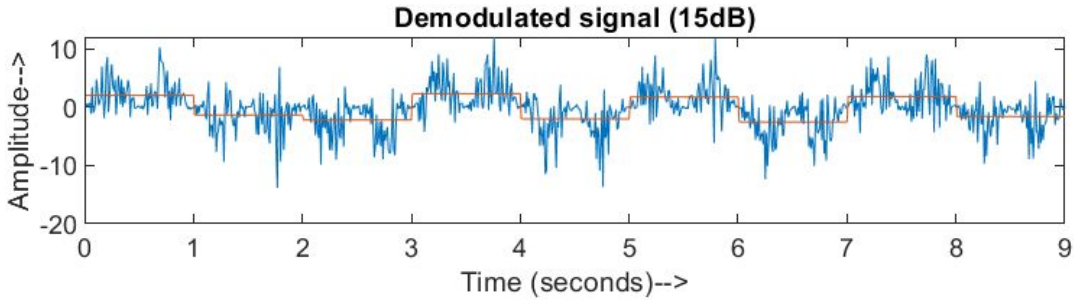


(b) For SNR = 10 dB

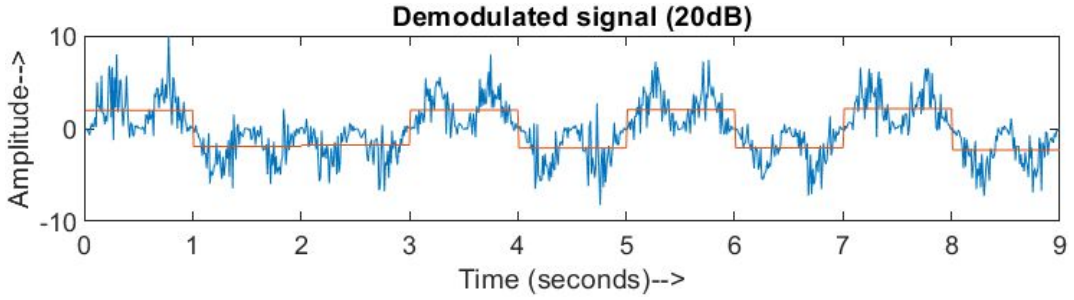


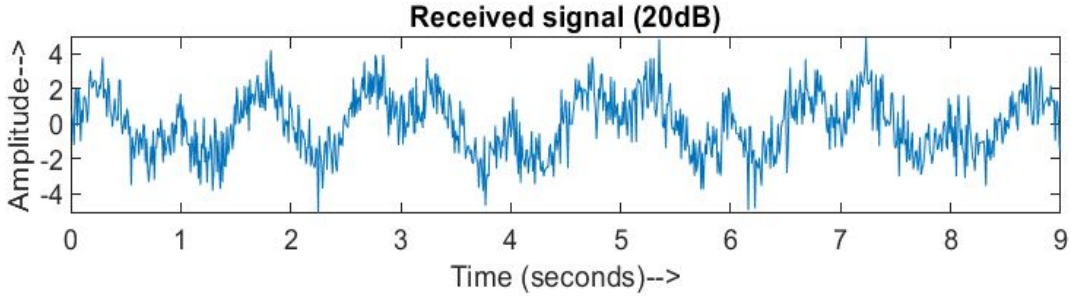
(c) For SNR = 15 dB



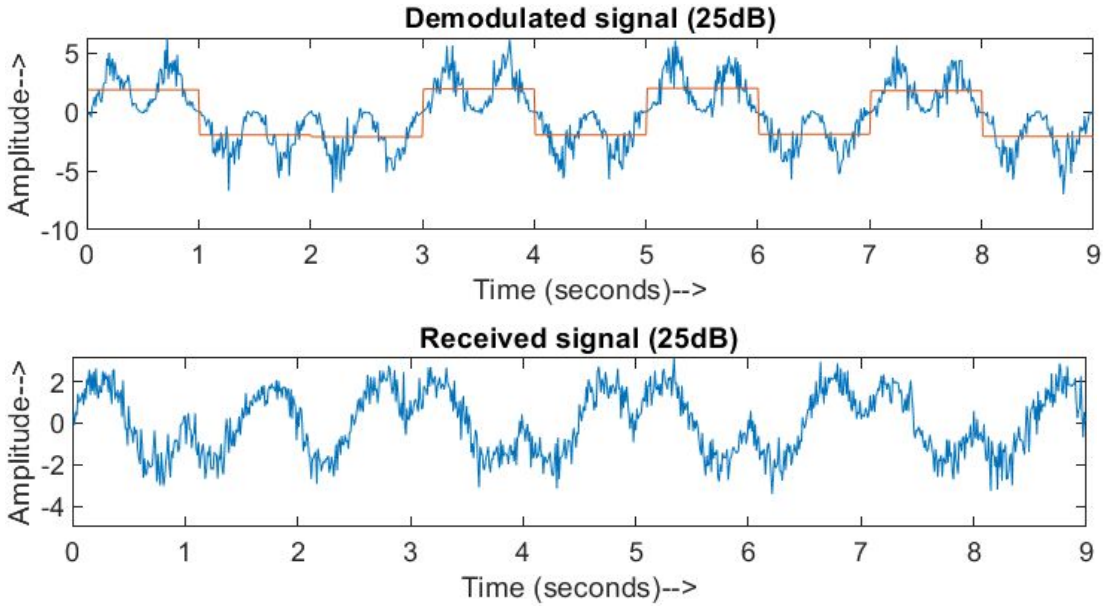


(d) For SNR = 20 dB

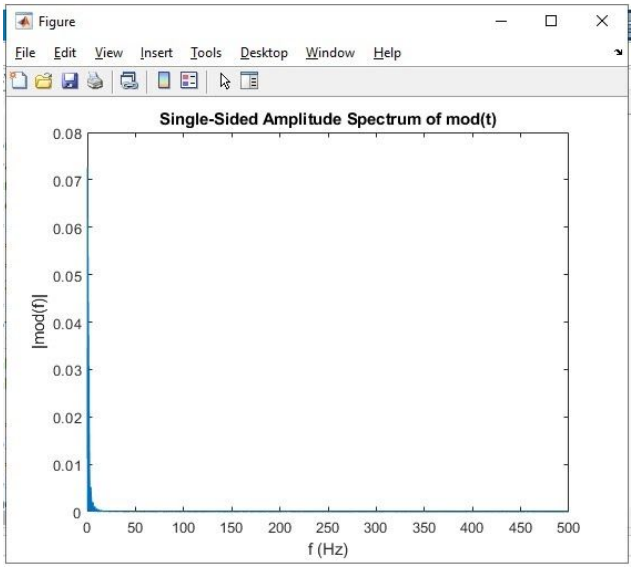




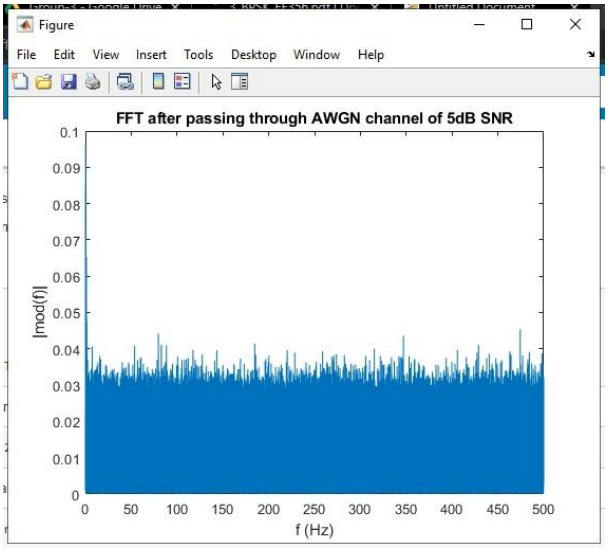
(e) For SNR = 25 dB



The FFT of the modulated signal before we pass it through the channel with AWGN is shown below

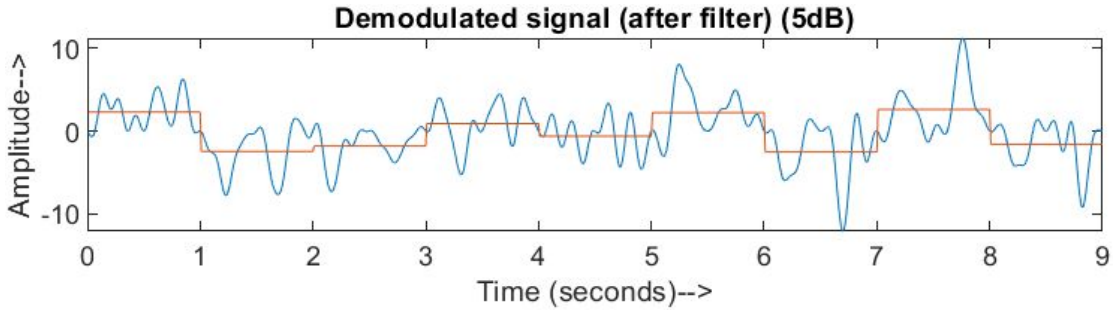


The next plot shows the FFT of the modulated signal after it comes out of the channel with AWGN.

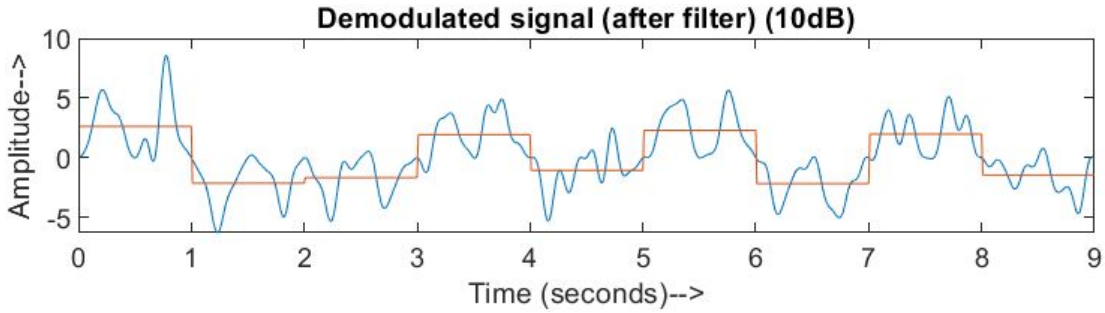


After this, we have used a LPF with a passband frequency of 2 Hz. For 1000 random input sequence, there is only a negligible improvement in the BER. This minor improvement is due to the fact that the BPSK system already has a great performance. The only up is that we get much cleaner waveforms as shown below.

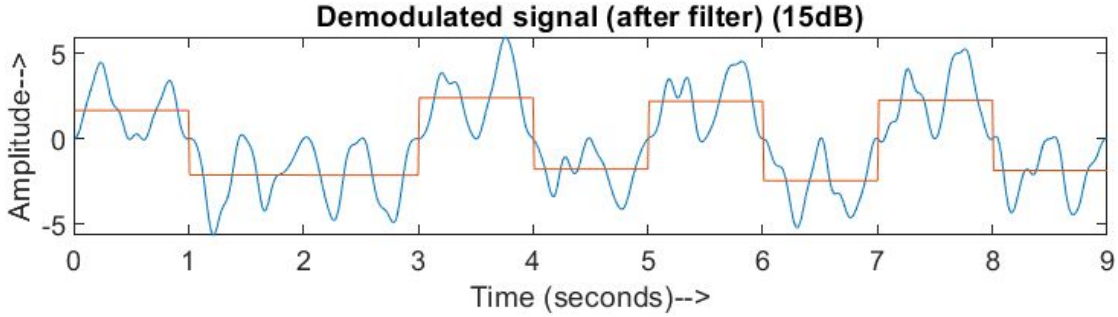
(a) For SNR = *5* dB



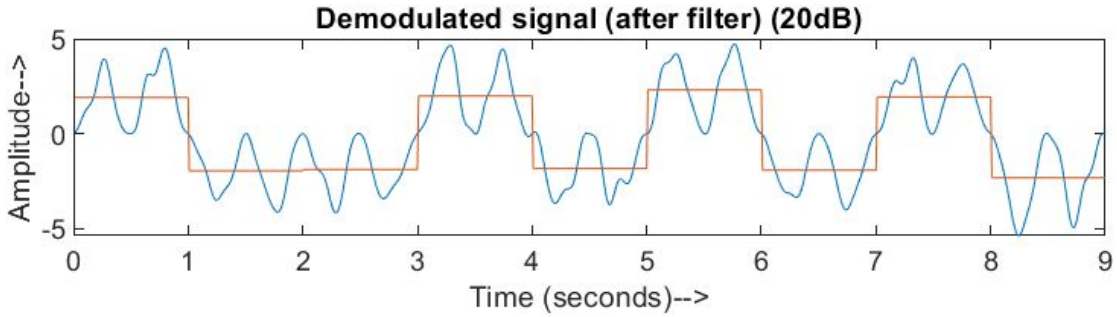
(b) For SNR = 10 dB



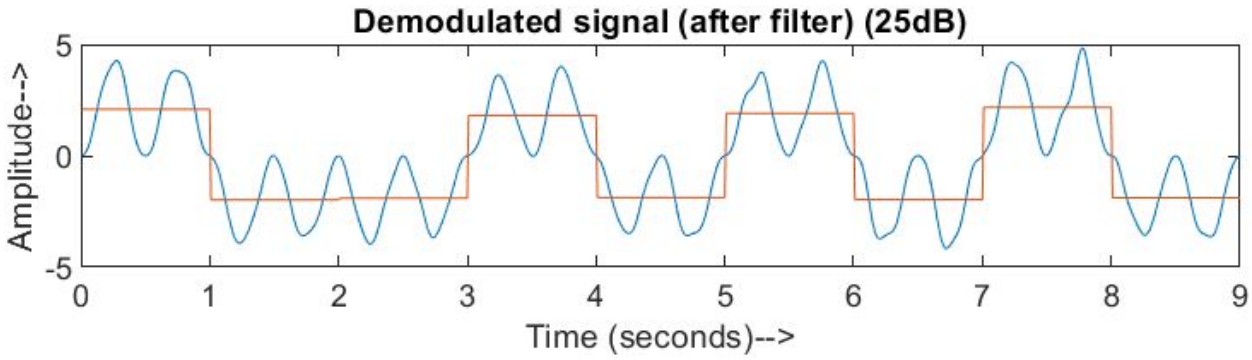
(c) For SNR = 15 dB



(d) For SNR = 20 dB



(e) For SNR = 25 dB



Results

Hence, we observe that the graphs are more accurate for a higher SNR, and after the addition of filter, we get a much cleaner demodulated signal.

For a 1000-bit input sequence, theoretically, the BER is 0.006 i.e. 6 errors in 1000 bits. Before using the filters, the average BER we obtained for 100 iterations, each with a 1000-bit random input sequence, was 0.0065, and after filtering, the average BER, over 100 iterations and each with 1000-bits, we obtained was 0.0055. This shows the effect the filter has on the performance.