Error Performance of BPSK

1. Generate a string of message bits.
2. Encode using BPSK with energy per bit Eb and represent it using points in a signal-space.
3. Simulate transmission of the BPSK modulated signal via an AWGN channel with variance $N_0/2$.
4. Detect using an ML decoder and plot the probability of error as a function of SNR per bit E_b/N_0.

Program name: IMPL_EP_bpsk.m

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% This program is used to calculate the bit error rate (BER)
of BPSK
% modulation scheme at the given energy per bit to noise power
spectral
% density ratio (EbNo).

clear ;       %Clear all variables
close all;    %Close all figures
num_bit=1e6; %Number of bits or symbols
EbNodB=0:1:10; %Range of EbNo in dB
for i=1:length(EbNodB);
    s=2*(round(rand(1,num_bit))-0.5); %Random symbol
generation
    w=(1/sqrt(2*10^(EbNodB(i)/10)))*randn(1,num_bit); %Random
noise generation
    r=s+w;  %Received signal
    s_est=sign(r);  %Demodulation
    sim_BER(i)=(num_bit-sum(s==s_est))/num_bit;%BER
calculation
end
the_Ber =0.5*erfc(sqrt(10.^(EbNodB/10))); % theoretical BER
calculation

semilogy(EbNodB, sim_BER,'-'); %Plotting simulated values
hold on
semilogy(EbNodB,the_Ber,'ko'); %Plotting theoretical values
title('Bit error probability curve for BPSK modulation');
legend('Simulation','Theoretical');
xlabel('EbNo(dB)')
ylabel('BER')
grid on
```

Output