Table of Contents

Hw5

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```
%Student-Number : [9723042]
% University: Amirkabir University of Technology
```

clear recent data

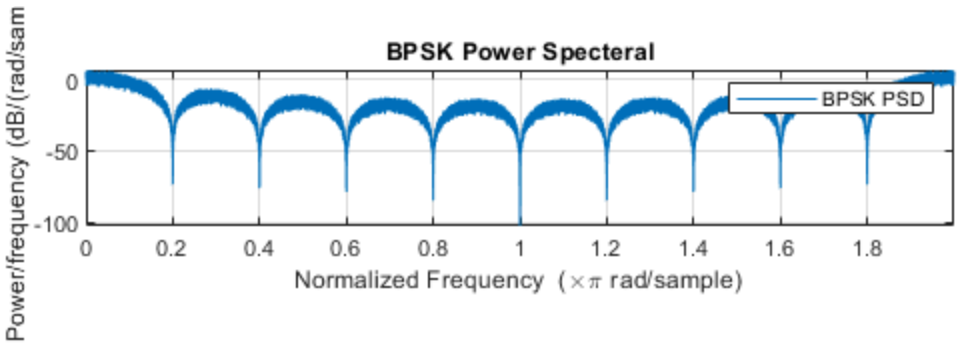
```
clc;
close all;
clear ;
```

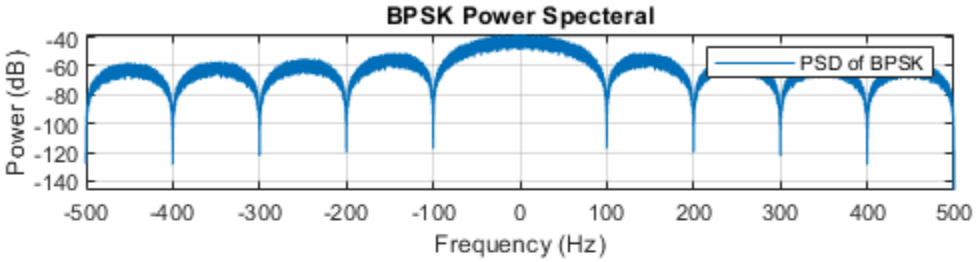
Initialization

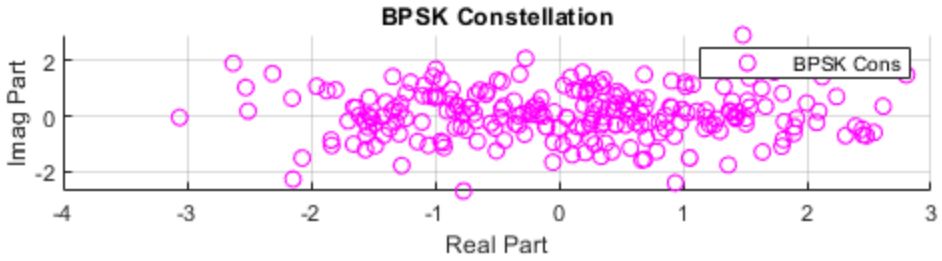
```
N = 1e5 ; % # of bits
data = randi(2,[1 , N]) - 1 ; % random Numbers between 1 and 2
step = 0.1; % Intervals for Eb/N0
EbN0 = 0 : step : 13 ; % Eb / N0 sequence
E = 2*10.^(EbN0/10); %Energy for each EbN0
E = E' ;
M = 10 ; % Sample per Symbol (SPS)
```

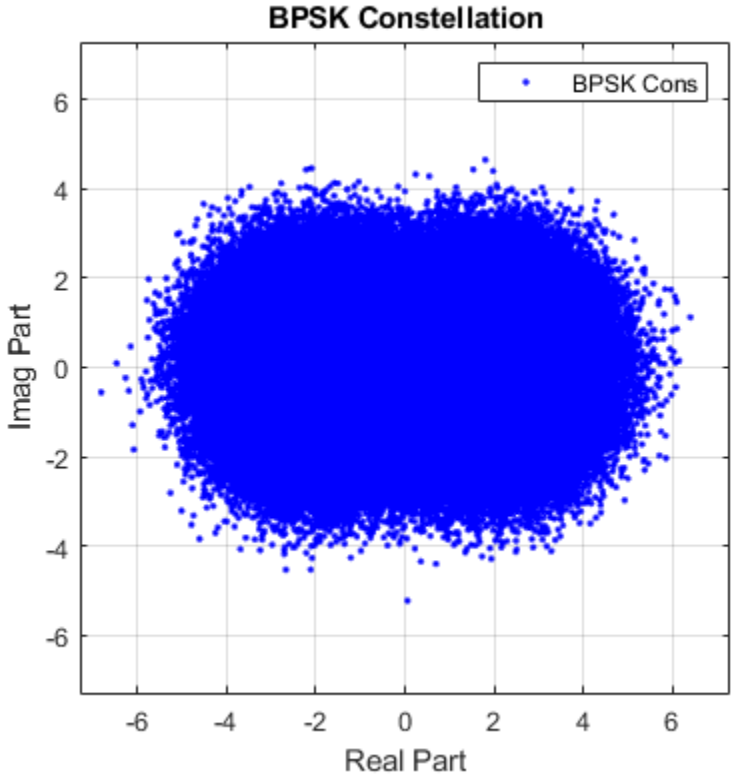
BPSK

```
clc;
[bpsk_optimum, bpsk_theory, bpsk_unideal] = BPSK(N, data, E,
 M); %Function We defined
```


BPSK Power Specteral
BPSK PSD
Power/frequency (dB/(rad/sam
0
-50
-100
0
0.2
0.4
0.6
0.8
1
1.2
1.4
1.6
1.8
Normalized Frequency (×π rad/sample)

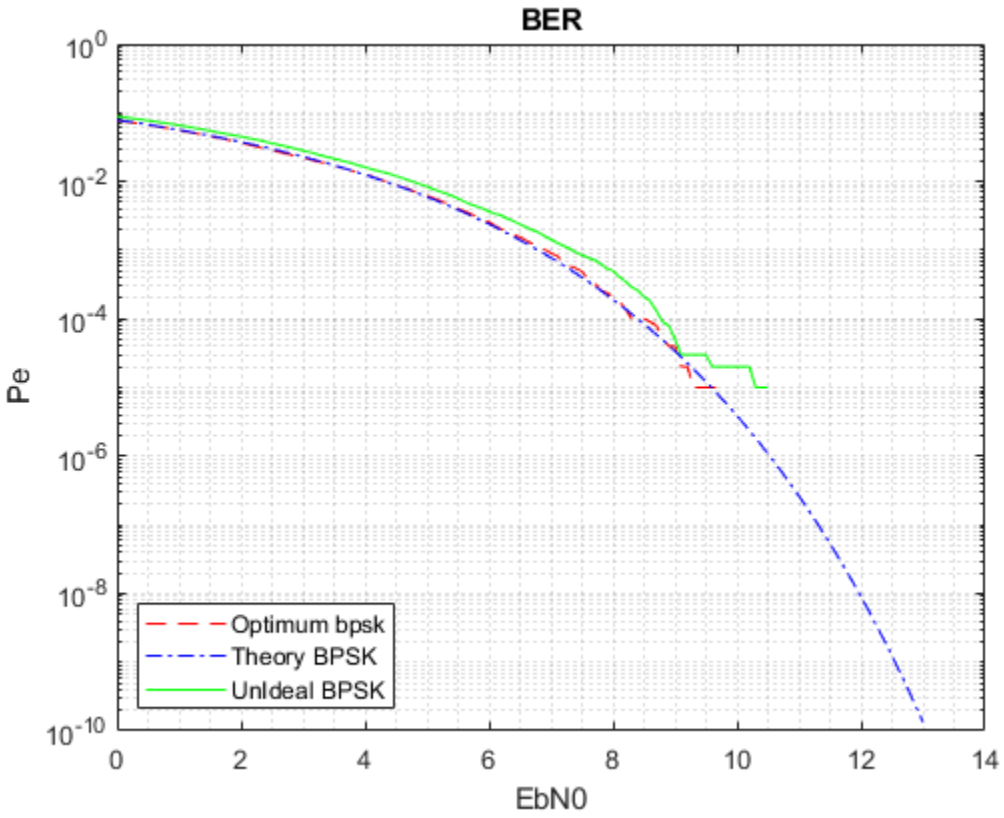

BPSK Power Specteral
PSD of BPSK
Power (dB)
-40
-60
-80
-100
-120
-140
-500
-400
-300
-200
-100
0
100
200
300
400
500
Frequency (Hz)


BPSK Constellation
BPSK Cons
Imag Part
Real Part
2
0
-2
-4
-3
-2
-1
0
1
2
3


BPSK Constellation
BPSK Cons
Imag Part
Real Part
6
4
2
0
-2
-4
-6
-6
-4
-2
0
2
4
6

BPSK Plot

```
clc;
figure(11)
semilogy(EbN0,bpsk_optimum,"-- r");hold on;
semilogy(EbN0,bpsk_theory,"-. b");hold on;
semilogy(EbN0,bpsk_unideal,"- g");
title("BER")
legend('Optimum bpsk' , 'Theory BPSK','UnIdeal BPSK')
legend('Location','southwest')
xlabel('EbN0')
ylabel('Pe')
grid ('Minor');
```

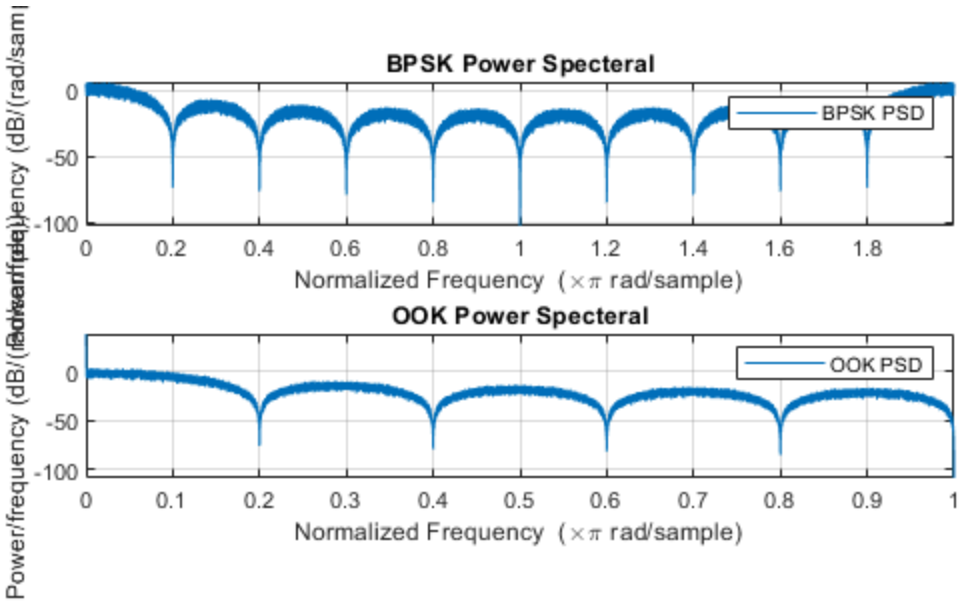


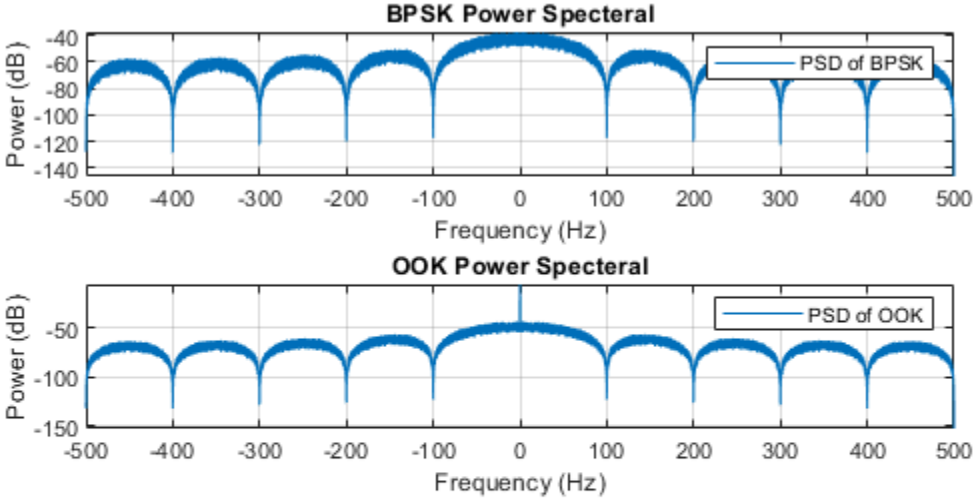
OOK2

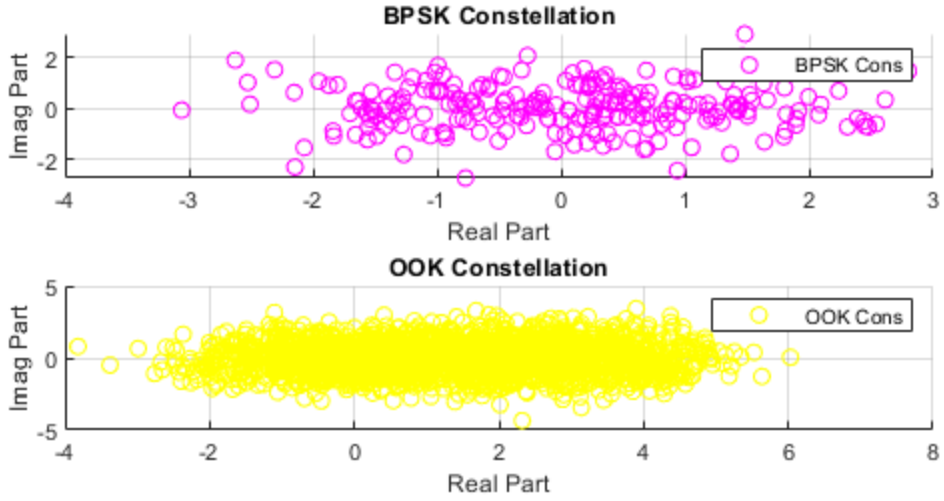
clc; [ook_optimum, ook_theory] = OOK2(N, data, E, M);

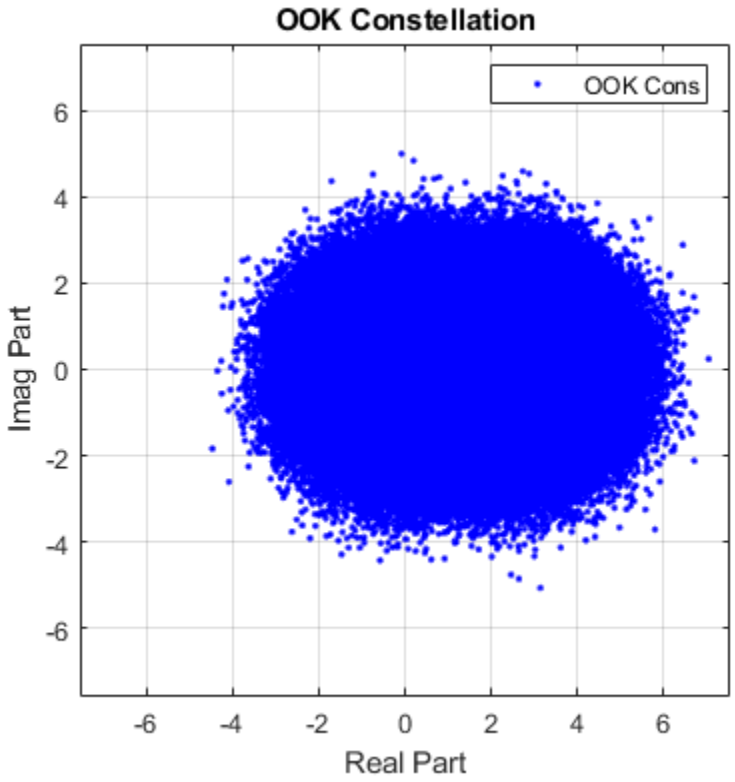
OOK

```
[ook_optimum, ook_theory, ook_unideal] = OOK(N, data, E, M);
```


BPSK Power Specteral
BPSK PSD
Normalized Frequency (×π rad/sample)
OOK Power Specteral
OOK PSD
Normalized Frequency (×π rad/sample)

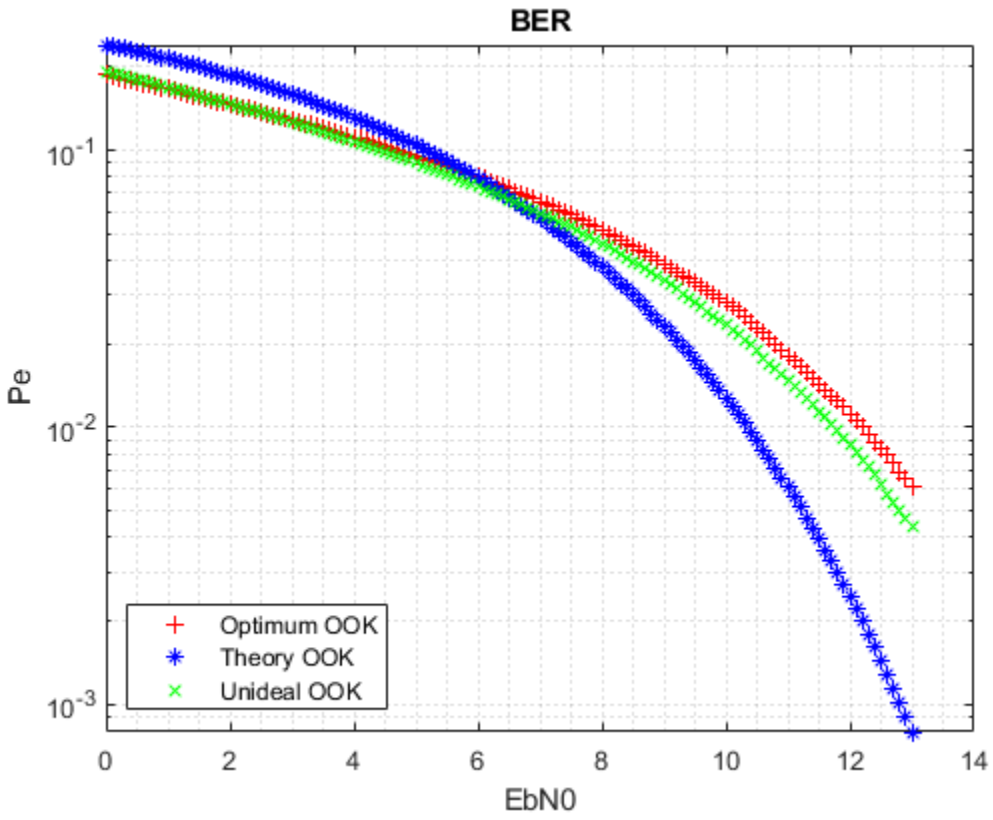

BPSK Power Specteral
PSD of BPSK
Power (dB)
Frequency (Hz)
OOK Power Specteral
PSD of OOK
Power (dB)
Frequency (Hz)


BPSK Constellation
BPSK Cons
Imag Part
Real Part
OOK Constellation
OOK Cons
Imag Part
Real Part


OOK Constellation
OOK Cons
Imag Part
Real Part

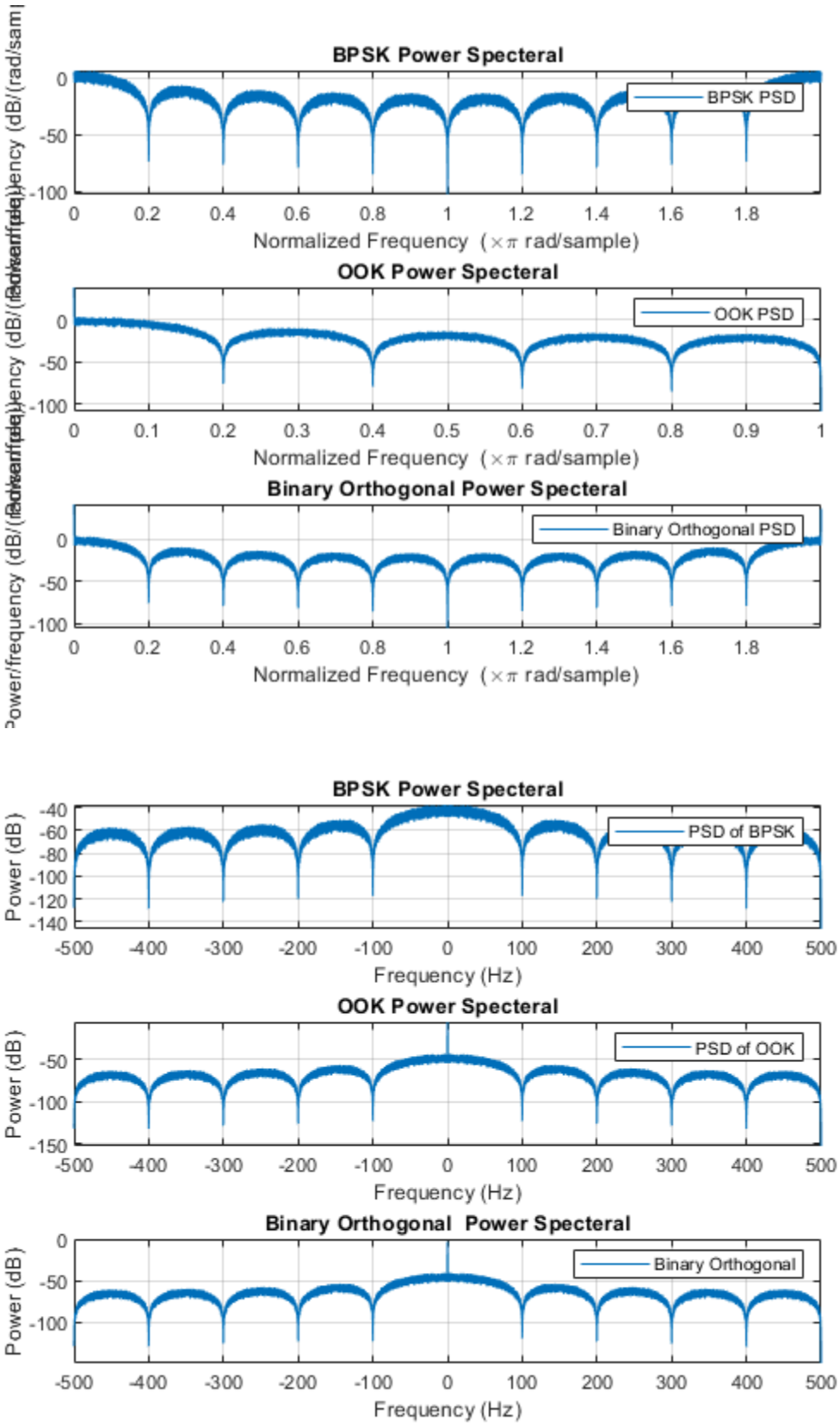
Plotting OOK

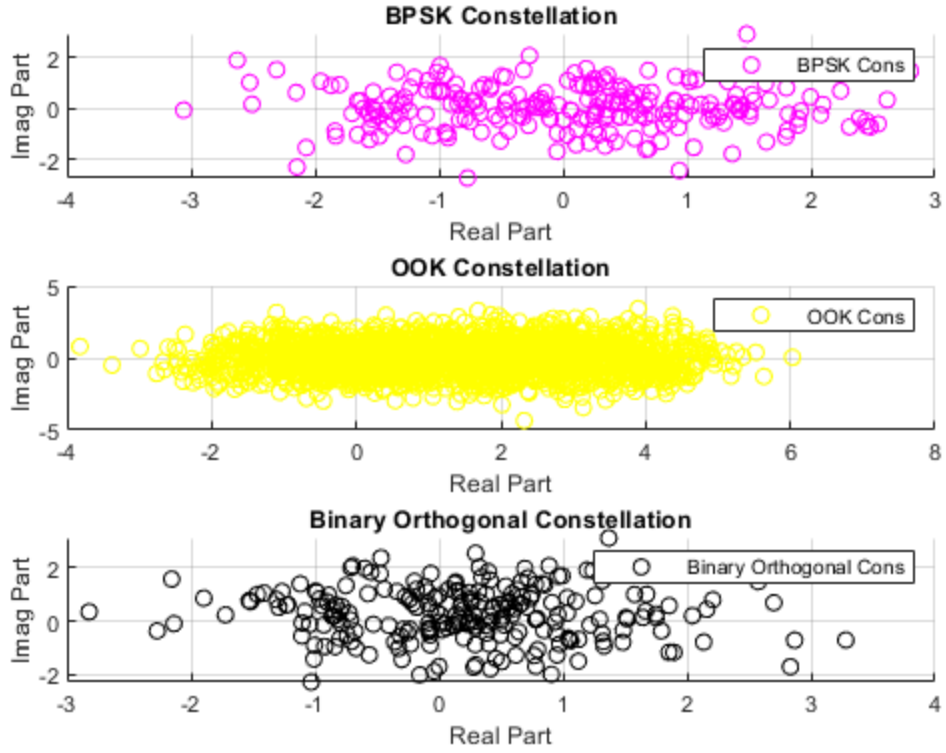
```
figure(12)
semilogy(EbN0,ook_optimum,"+ r");hold on;
semilogy(EbN0,ook_theory,"* b");
semilogy(EbN0,ook_unideal,"x g");
title("BER")
legend('Optimum OOK' , 'Theory OOK','Unideal OOK')
legend('Location','southwest')
xlabel('EbN0')
ylabel('Pe')
grid ('Minor');
```

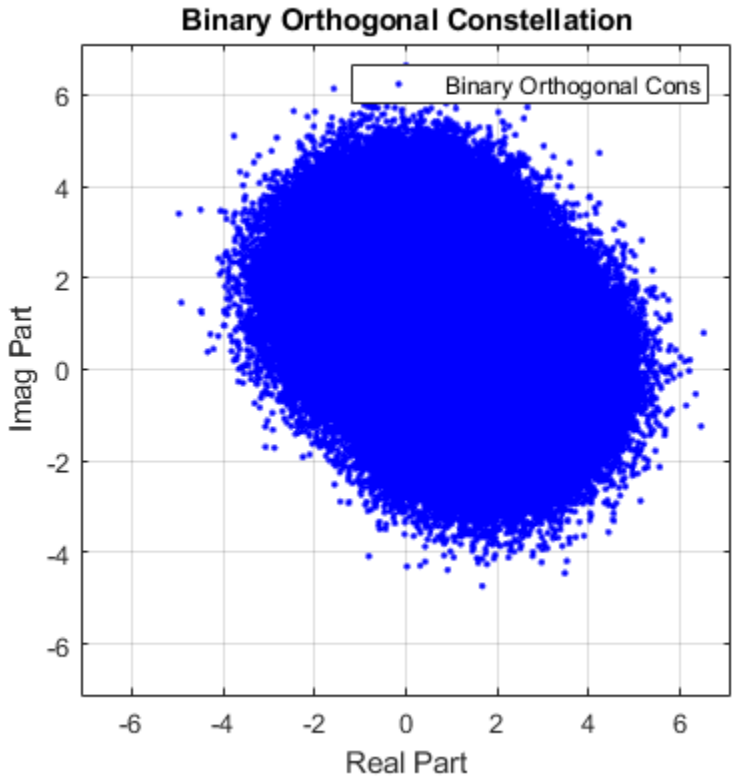


Binary Orthogonal

```
[Bin_Or_optimum, Bin_Or_theory, Bin_Or_unideal] = Bin_Or(N, data, E,
 M);
```

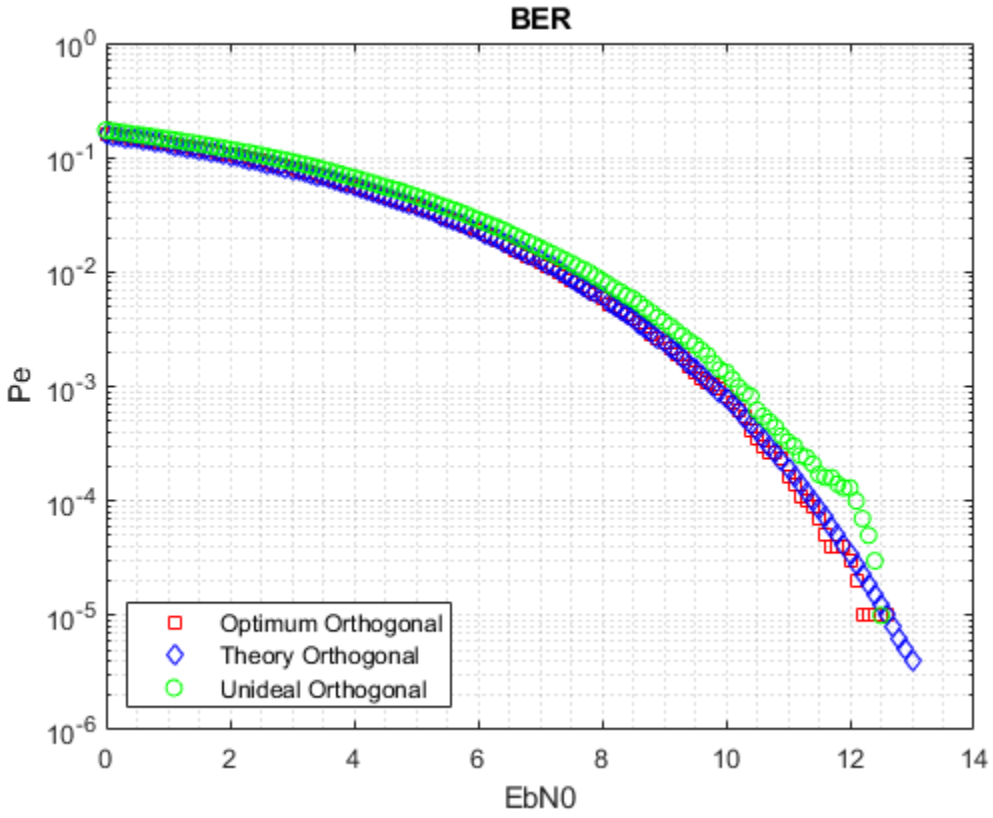

BPSK Power Specteral
BPSK PSD
Normalized Frequency (×π rad/sample)
OOK Power Specteral
OOK PSD
Normalized Frequency (×π rad/sample)
Binary Orthogonal Power Specteral
Binary Orthogonal PSD
Normalized Frequency (×π rad/sample)
BPSK Power Specteral
PSD of BPSK
Power (dB)
Frequency (Hz)
OOK Power Specteral
PSD of OOK
Power (dB)
Frequency (Hz)
Binary Orthogonal Power Specteral
Binary Orthogonal
Power (dB)
Frequency (Hz)


BPSK Constellation
BPSK Cons
Imag Part
Real Part
OOK Constellation
OOK Cons
Imag Part
Real Part
Binary Orthogonal Constellation
Binary Orthogonal Cons
Imag Part
Real Part


Binary Orthogonal Constellation
Binary Orthogonal Cons
Imag Part
Real Part

Plotting Binary_Orthogonal

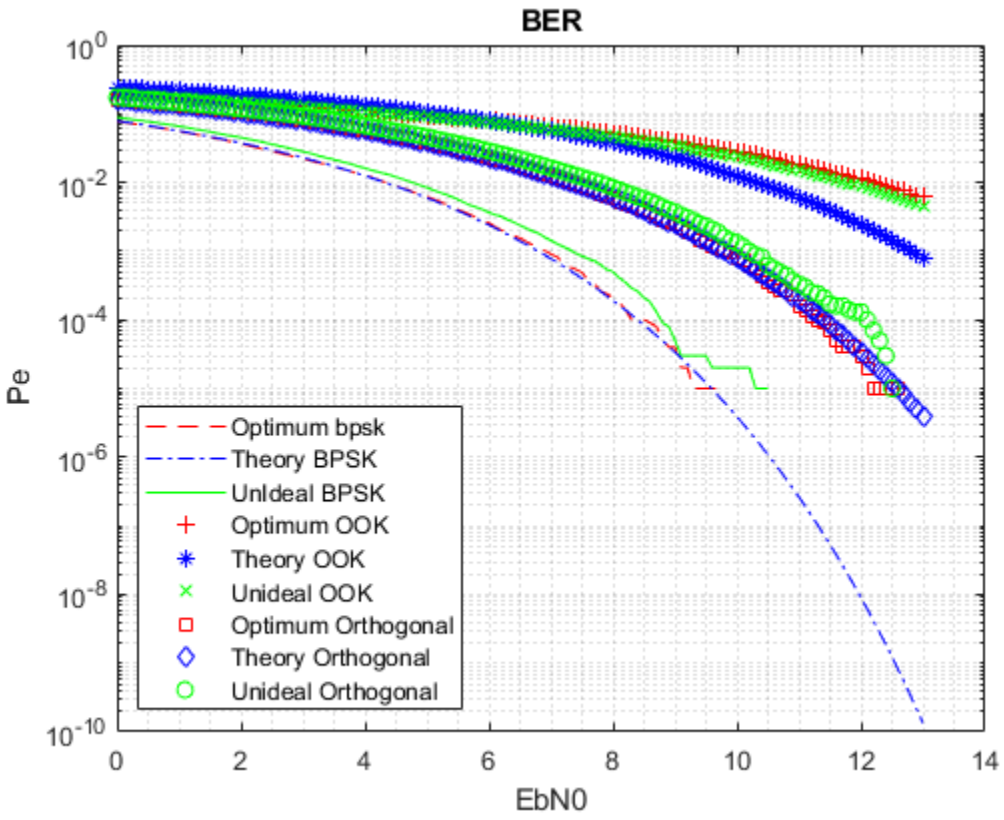
```
figure(13)
semilogy(EbN0,Bin_Or_optimum,"s r");hold on;
semilogy(EbN0,Bin_Or_theory,"d b");
semilogy(EbN0,Bin_Or_unideal,"o g");
title("BER")
legend('Optimum Orthogonal' , 'Theory Orthogonal','Unideal
 Orthogonal')
legend('Location','southwest')
xlabel('EbN0')
ylabel('Pe')
grid ('Minor');
```



Plotting All of them

```
figure(14)
semilogy(EbN0,bpsk_optimum,"-- r");hold on;
semilogy(EbN0,bpsk_theory,"-. b");hold on;
semilogy(EbN0,bpsk_unideal,"- g");hold on;
semilogy(EbN0,ook_optimum,"+ r");hold on;
semilogy(EbN0,ook_theory,"* b");hold on;
semilogy(EbN0,ook_unideal,"x g");hold on;
semilogy(EbN0,Bin_Or_optimum,"s r");hold on;
semilogy(EbN0,Bin_Or_theory,"d b");hold on;
```

```
semilogy(EbN0,Bin_Or_unideal,"o g");hold on;
title("BER")
legend('Optimum bpsk' , 'Theory BPSK','UnIdeal BPSK','Optimum OOK'
 ,...
    'Theory OOK','Unideal OOK','Optimum Orthogonal' , 'Theory
 Orthogonal'...
    ,'Unideal Orthogonal')
legend('Location','southwest')
xlabel('EbN0')
ylabel('Pe')
grid ('Minor');
```



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