# MÔ PHỎNG Hệ thống sử dụng điều chế qpsk qua kênh rayleigh

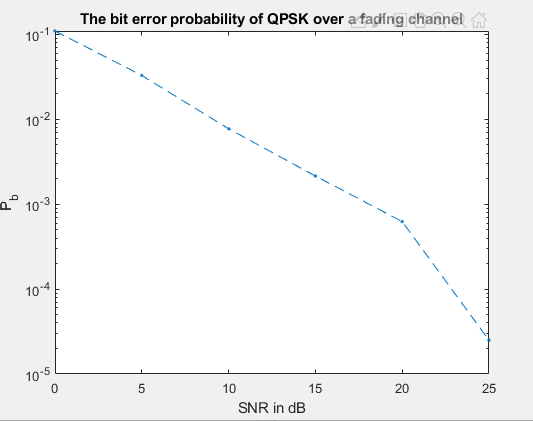
Hàm receiver.m

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| function chann\_1=receiver(SNR\_db,S\_m,FS,x,S,g);  Es=var(S);  Eb=Es/2;  N\_0=Eb/10^(SNR\_db/10);  N0=sqrt(N\_0/2)\*(randn(size(FS))+j\*randn(size(FS)));  NFS=(FS+N0)./g;  for i=1:length(FS)  d=abs(S\_m-NFS(i));  md=min(d);  if md==d(1)  R(2\*i-1)=0;  R(2\*i)=0;  elseif md==d(2)  R(2\*i-1)=0;  R(2\*i)=1;  elseif md==d(3)  R(2\*i-1)=1;  R(2\*i)=1;  elseif md==d(4)  R(2\*i-1)=1;  R(2\*i)=0;  end  end  c=0;  for i=1:length(x)  if R(i)~=x(i)  c=c+1;  end  end  chann\_1=c; |

Hàm Main của Bai2\_1.m

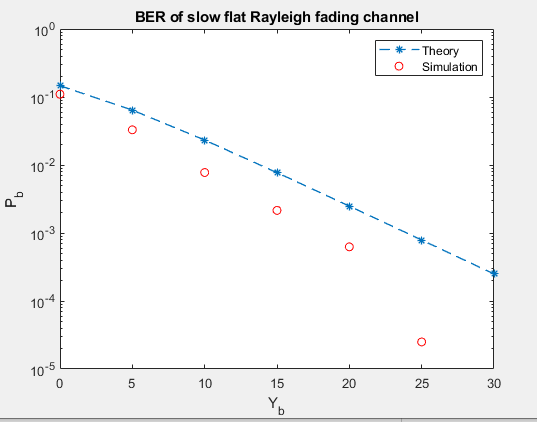
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| clear;  x = round(rand(1,100000));  for i = 1:2:length(x)  if x(i)==0 & x(i+1)==0  S((i+1)/2)=exp(j\*pi/4);  elseif x(i)==0 & x(i+1)==1  S((i+1)/2)=exp(j\*3\*pi/4);  elseif x(i)==1 & x(i+1)==1  S((i+1)/2)=exp(j\*5\*pi/4);  elseif x(i)==1 & x(i+1)==0  S((i+1)/2)=exp(j\*7\*pi/4);  end  end    S=S(1:20000);  x=x(1:40000);  f\_m=91;  b=1/2;  N1=9;  N2=N1+1;  f1=f\_m\*sin(pi/2/N1\*((1:N1)-1/2));  c1=sqrt(2\*b/N1)\*ones(size(f1));  th1=rand(size(f1))\*2\*pi;  f2=f\_m\*sin(pi/2/N2\*((1:N2)-1/2));  c2=sqrt(2\*b/N2)\*ones(size(f2));  th2=rand(size(f2))\*2\*pi;  f\_s=270800;  T\_symb=1/f\_s;  t=(0:length(S)-1)\*T\_symb;  g1=g(c1,f1,th1,t);  g2=g(c2,f2,th2,t);  g=g1+j\*g2;  FS=g.\*S;  theta\_m=[pi/4,3\*pi/4,5\*pi/4,7\*pi/4];  S\_m=exp(j\*theta\_m);  for i=1:length(S)/4  gS\_m(4\*i-3:4\*i)=S\_m.\*g(4\*i-3:4\*i);  end  SNR\_db=0:5:30;  for i=1:length(SNR\_db)  c(i)=receiver(SNR\_db(i),S\_m,FS,x,S,g);  end  BER=c/length(x);  save Bai2\_1 BER;  semilogy(SNR\_db,BER,'.--');  title('The bit error probability of QPSK over a fading channel');  xlabel('SNR in dB');  ylabel('P\_b'); |

Kết quả:



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| clear;  b=1/2;  SNR\_db=0:5:30;  Y\_b=2\*b\*10.^(SNR\_db/10);  p\_b=(1-sqrt(Y\_b./(1+Y\_b)))/2;  k=semilogy(SNR\_db,p\_b,'\*--');  set(k,'LineWidth',1);  hold on;  load Bai2\_1 BER;  semilogy(SNR\_db,BER,'ro');  hold off;  title('BER of slow flat Rayleigh fading channel');  xlabel('Y\_b');  ylabel('P\_b');  legend('Theory','Simulation'); |

Kết quả:



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| --- | --- | --- | --- | --- | --- |
| SNR (dB) | 0 | 5 | 10 | 15 | 20 |
| lý thuyết | 0.1464 | 0.0641 | 0.0232 | 0.0077 | 0.0024 |
| BER mô phỏng | 0.1099 | 0.0328 | 0.0077 | 0.0021 | 0.0006 |