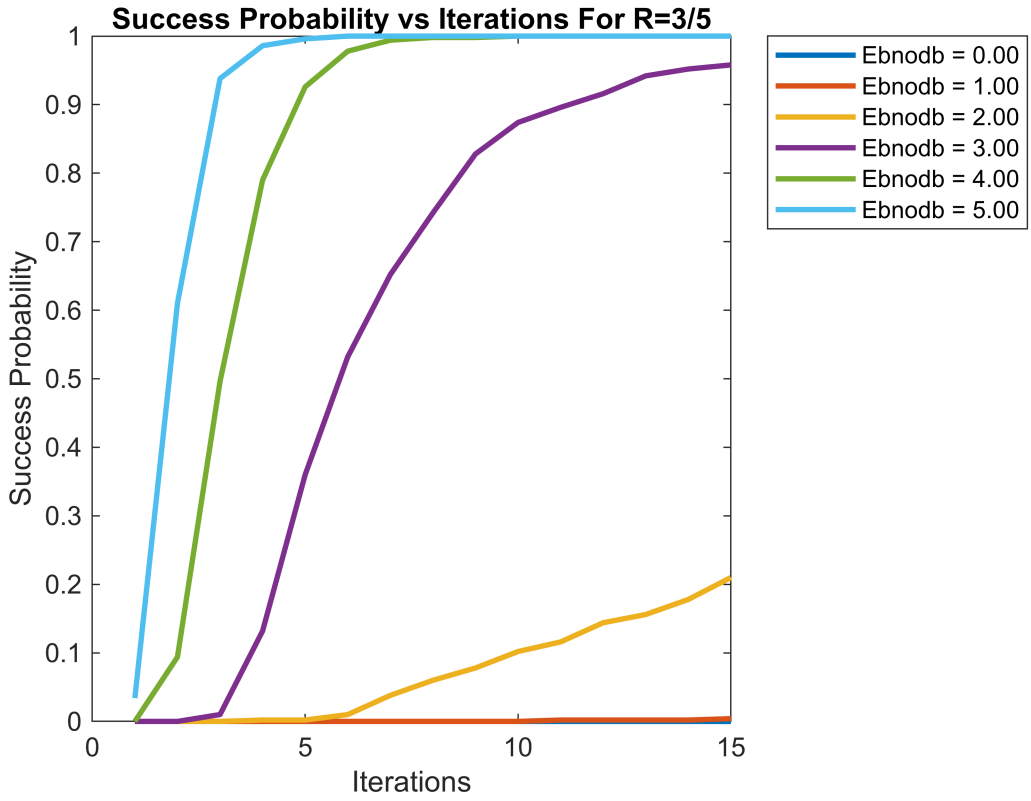
```
EbNodB = 0:1:5;

baseGraph5GNR = 'NR_2_6_52'; % load 5G NR LDPC base H matrix, use both NR_2_6_52
and NR_1_5_352
%R = [1/4, 1/3, 1/2, 3/5];
R=3/5;
% vary this in the set {1/4, 1/3, 1/2, 3/5} for 2_6_52 and in the range {1/3, 1/2,
3/5 and 4/5} for 1_5_352
[B,Hfull,z] = nrldpc_Hmatrix(baseGraph5GNR); % Convert the base H matrix to binary
H matrix
[mb,nb] = size(B); kb = nb - mb; % 5G NR specific details
itmax=15;

success_iteration = zeros(length(EbNodB), itmax);

for codeRate = R
    kNumInfoBits = kb * z; % Number of information bits
    k_pc = kb-2; nbRM = ceil(k_pc/codeRate)+2; % Some 5G NR specific details
    nBlockLength = nbRM * z; % Number of encoded bits


    % Next three lines are some 5G NR specific details
    H = Hfull(:,1:nBlockLength);
    nChecksNotPunctured = mb*z - nb*z + nBlockLength;
    H = H(1:nChecksNotPunctured,:); % this is the binary H matrix

    Nchecks = size(H,1); % Number of CNs (we have denoted this as U = N - K in the
class)
    n=length(H(1,:));%Number of VNs
    u=length(H(:,1));%Number of CNs
    k=n-u;%Number of message bit
    %making adjacency list for VN

    %Loop for all the EbNo
    err_index=1;
    for jEb=EbNodB

        EbNo = 10^(jEb/10);
        sigma = sqrt (1/ (2*codeRate*EbNo));
        %sigma=0;
        %BER_th = 0.5*erfc(sqrt (EbNo) );
        Nerrs = 0;
        %Number of simulations
        N=500;
        for Nsim = 1 : N  %Loop for Number of Simulation
            b = randi([0 1],[kNumInfoBits 1]); % Generate information (or message)
bit vector
            encoded_message = nrldpc_encode(B,z,b'); % Encode using 5G NR LDPC base
matrix
            encoded_message = encoded_message(1:nBlockLength)';
```

```
tc= randn(nBlockLength,1);

s = 1 - 2 * encoded_message; %BPSK bit to symbol conversion modulation
r = s + sigma * tc; %AWGN channel
r=r';
L=H;

temp=zeros(1,n);
     for i=1 : u
        for j = 1:n
            if(H(i,j)~=0)
                L(i,j)=r(1,j);
            end
        end
    end

for it=1:itmax

    for i=1 : u
        totalsign=1;
        for j = 1:n
            if(H(i,j)~=0)
                totalsign=totalsign*sign(L(i,j));
            end
       end

        min1=10000;
        min1ind=1;
        for j = 1:n
            if(H(i,j)~=0)
                if(min1>abs(L(i,j)))
                    min1=abs(L(i,j));
                    min1ind=j;
                end
            end
        end



        min2=10000;
        for j = 1:n
            if(H(i,j)~=0)
                if(min2>abs(L(i,j)) && j~=min1ind)
                    min2=abs(L(i,j));
                end
            end
        end
        for j = 1:n
            if(H(i,j)~=0)
               if(j==min1ind)
```

```
                            L(i,j)=totalsign*sign(L(i,j))*min2;
                        else
                            L(i,j)=totalsign*sign(L(i,j))*min1;
                        end
                    end
                end
            end


            for i=1:n
                colsum=r(1,i);
                for j=1:u
                    colsum=colsum+L(j,i);
                end
                temp(1,i)=colsum;
                for j=1:u
                    if(H(j,i)~=0)
                        L(j,i)=colsum-L(j,i);
                    end
                end
            end

          decoded_codeword=zeros(1,n);
          decoded_codeword= temp<0;


        if(decoded_codeword == encoded_message' )
           success_iteration(err_index, it) = success_iteration(err_index, it) +
1;
        end
      end

      end
      err_index = err_index + 1;
  end

end

for i = 1:length(EbNodB)
 plot(1:1:itmax, success_iteration(i, :)/N, 'DisplayName',sprintf('Ebnodb = %.2f',
EbNodB(i)), LineWidth=2);
 hold on;
end
legend('show','Location','bestoutside');
title('Success Probability vs Iterations For R=3/5');
xlabel('Iterations');
ylabel('Success Probability');
hold off;
```




```
function [B,H,z] = nrldpc_Hmatrix(BG)

load(sprintf('%s.txt',BG),BG);
B = NR_2_6_52;
[mb,nb] = size(B);
z = 52;
H = zeros(mb*z,nb*z);
Iz = eye(z); I0 = zeros(z);
for kk = 1:mb
    tmpvecR = (kk-1)*z+(1:z);
    for kk1 = 1:nb
        tmpvecC = (kk1-1)*z+(1:z);
        if B(kk,kk1) == -1
            H(tmpvecR,tmpvecC) = I0;
        else
            H(tmpvecR,tmpvecC) = circshift(Iz,-B(kk,kk1));
        end
    end
end
[U,N]=size(H); K = N-U;
```

```
P = H(:,1:K);
G = [eye(K); P];
Z = H*G;
end

function cword = nrldpc_encode(B,z,msg)
%B: base matrix
%z: expansion factor
%msg: message vector, length = (#cols(B)-#rows(B))*z
%cword: codeword vector, length = #cols(B)*z


[m,n] = size(B);


cword = zeros(1,n*z);
cword(1:(n-m)*z) = msg;


%double-diagonal encoding
temp = zeros(1,z);
for i = 1:4 %row 1 to 4
    for j = 1:n-m %message columns
        temp = mod(temp + mul_sh(msg(((j-1)*z+1):(j*z)),B(i,j)),2);
    end
end
if B(2,n-m+1) == -1
    p1_sh = B(3,n-m+1);
else
    p1_sh = B(2,n-m+1);
end


cword((n-m)*z+1:(n-m+1)*z) = mul_sh(temp,z-p1_sh); %p1
%Find p2, p3, p4
for i = 1:3
    temp = zeros(1,z);
    for j = 1:n-m+i
        temp = mod(temp + mul_sh(cword(((j-1)*z+1):(j*z)),B(i,j)),2);
    end
    cword((n-m+i)*z+1:(n-m+i+1)*z) = temp;
end


%Remaining parities
for i = 5:m
    temp = zeros(1,z);
    for j = 1:n-m+4
        temp = mod(temp + mul_sh(cword(((j-1)*z+1):(j*z)),B(i,j)),2);
    end
```

```
    cword((n-m+i-1)*z+1:(n-m+i)*z) = temp;
end


end

function y = mul_sh(x,k)
if (k==-1)
    y = zeros(1,length(x));
else
    y = [x(k+1:end) x(1:k)];
end
end
```