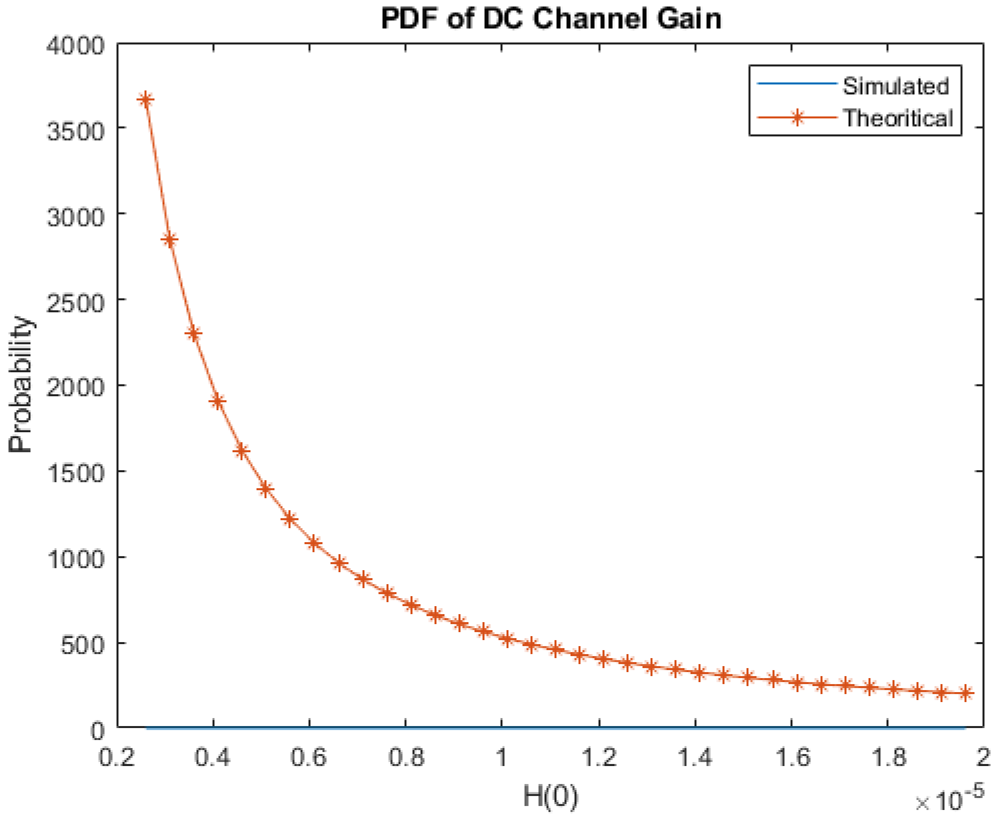
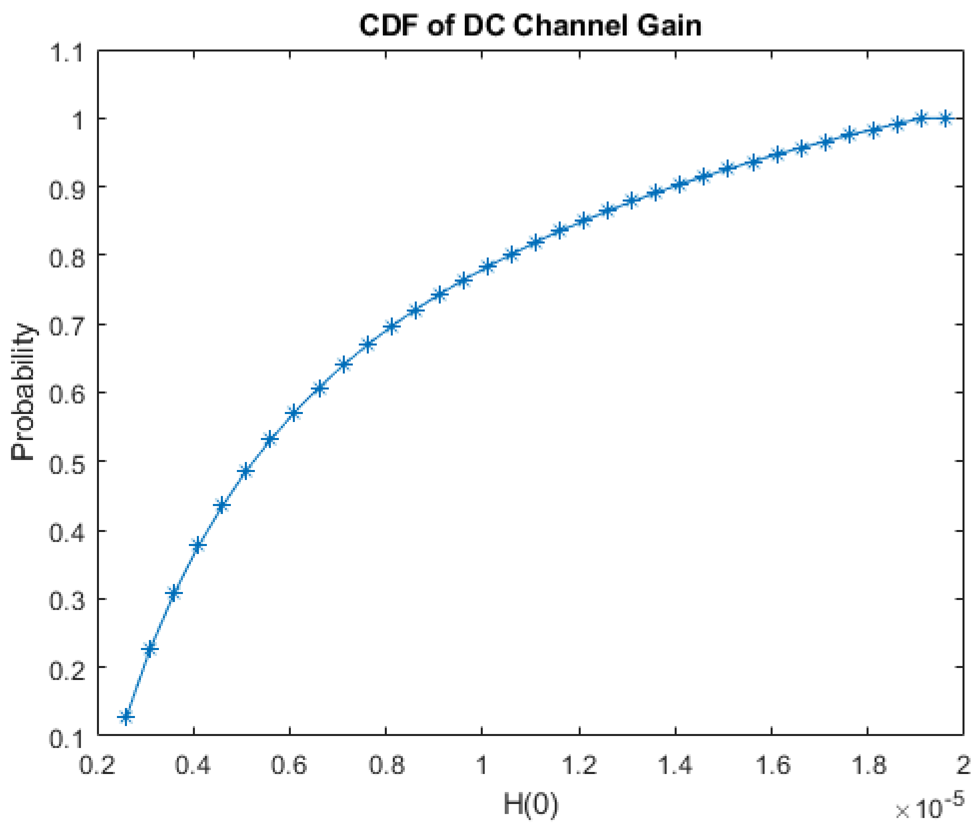
```
close all;
clear variables;

% Taking values from the Paper https://ieeexplore.ieee.org/stamp/
stamp.jsp?tp=&arnumber=1205458&tag=1

% Distance b/w Tx & Rx.(Meter Square)
A = 0.0001;

% Half-Power Semi-Angle (Degree)
THETA = 50;
THETA = deg2rad(THETA);

% Order of the Lambertian Emissison
m = -1*(log(2)/log(cos(THETA)));

% Gain of Optical Filter
Ts = 1;

% Field of View at the Receiver (Degree)
Psi_c = 60;
Psi_c = deg2rad(Psi_c);

% Refractive Index
n = 1.5;

% Height of Tx from base (Meter)
height = 2.5;

% Number of Rx Samples at different Distances
samples = 200000;

% Radius of the Cone
radius = height*tan(THETA);

% Location of Rx on 2D Co-ordinate system with center at (0,0)
[x,y] = randcircle(samples, height*tan(THETA));

% Angle of Irradiance (Degree)
D  = sqrt((x.^2+y.^2));
% for i=1:1:samples
Phi = atan(D./height);
% end

% Angle of Incidence (Degree)
Psi = Phi;

% Distance between Transmitter and Receiver (Meter)
% d = height*tan(Phi);
d = sqrt(D.^2 + height^2);

% H(0) Channel DC Gain
```

```
G = zeros(1,samples);
H = zeros(1,samples);
const1 = (1/(2*pi)* A * Ts);

for i=1:1:samples
    if Psi(i) > Psi_c
        G(i) = 0;
        H(i) = 0;
    else
        G(i) = const1 * (n*n)/(sin(Psi_c)*sin(Psi_c));
        H(i) = (G(i)*(m +1)*(height^(m+1)))/((d(i))^((m+3)));
%         H(i) = ;
    end
end
count=1;
H = sort(H);
interval = min(H):0.0000005:max(H);
for i=1:1:length(interval)
    max = interval(i)+0.0000005;
    min = interval(i) - 0.0000005;
    interval1(i) = 0;
    for j=count:1:samples
        if(H(j)>= min && H(j)< max)
            interval1(i) = interval1(i) + 1;
            count=count +1;
            interval2(i)= count;
        else
            break;
        end
    end
    interval1(i) = interval1(i)/samples;
    interval2(i) = interval2(i)/samples;
end
```

PDF Theoritical

```
theoreticalPDF = theoriticalPDF(interval,const1,height,radius,m);
plot(interval,interval1,'-');
hold on
plot(interval,theoreticalPDF,'-*');
hold off
title("PDF of DC Channel Gain");
ylabel("Probability");
xlabel("H(0)");
legend("Simulated","Theoritical");
figure
plot(interval,interval2,'-*')
title("CDF of DC Channel Gain");
ylabel("Probability");
xlabel("H(0)");
```

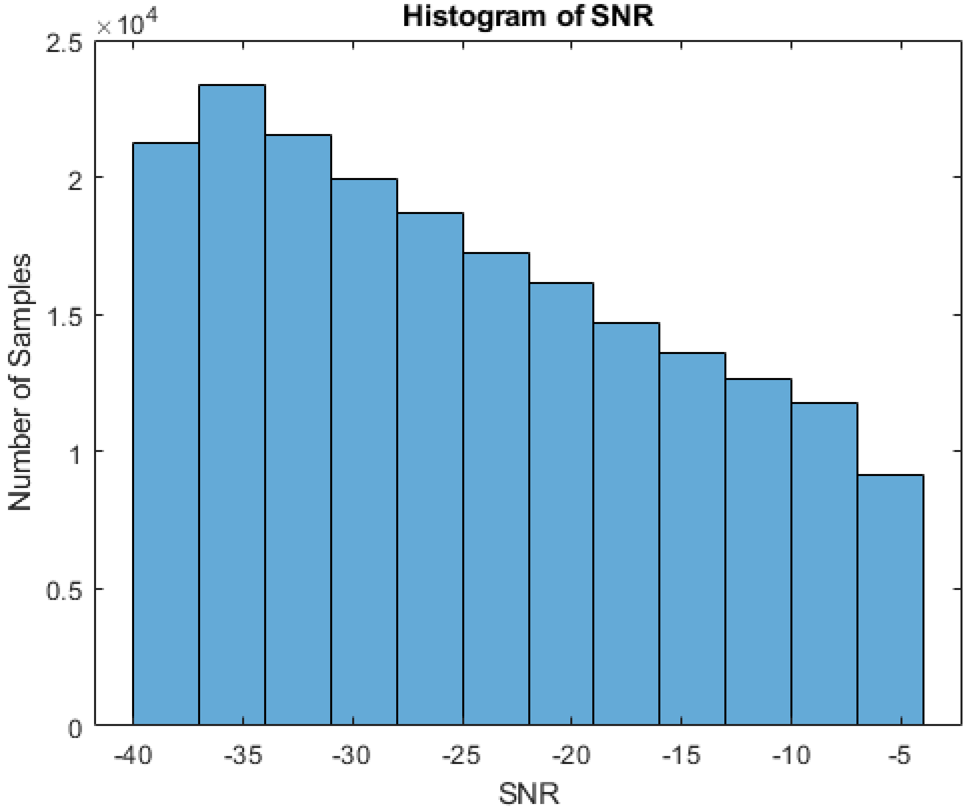

PDF of DC Channel Gain
Simulated
Theoritical
Probability
H(0)
4000
3500
3000
2500
2000
1500
1000
500
0
0.2
0.4
0.6
0.8
1
1.2
1.4
1.6
1.8
2
×10-5

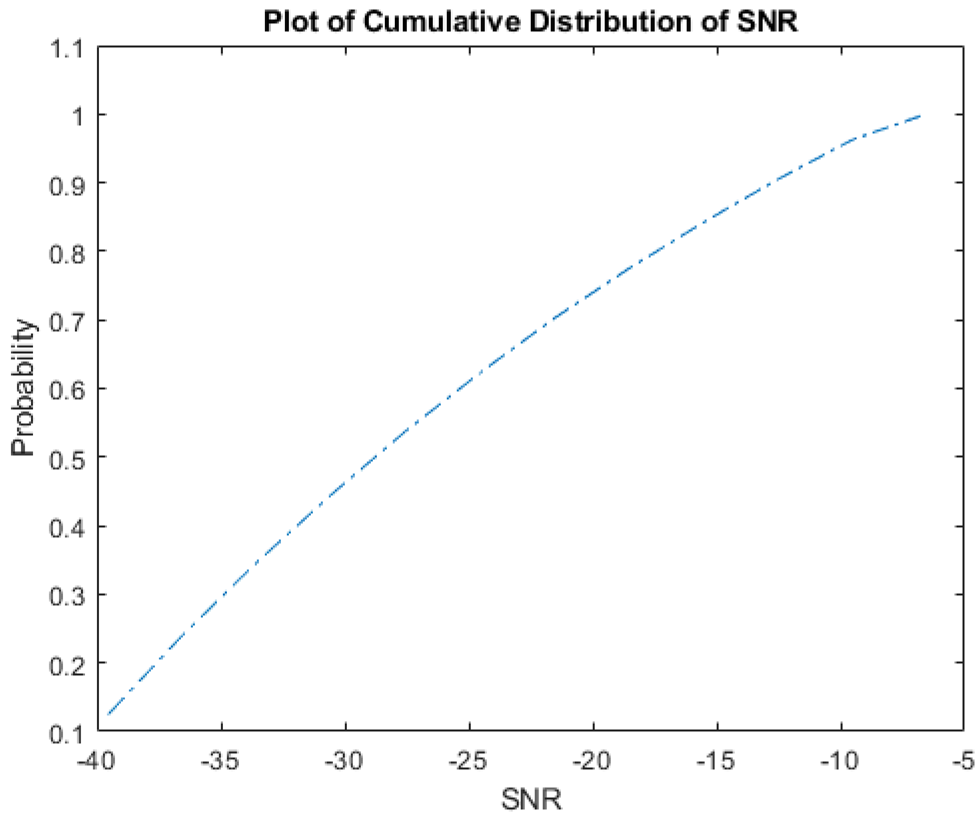

CDF of DC Channel Gain
Probability
H(0)
1.1
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0.2
0.4
0.6
0.8
1
1.2
1.4
1.6
1.8
2
×10-5

SNR Calculation:

```
% Transmit Power
Pt=0.004; % in Watts

% O/E Conversion
R = 0.53; % A/W

% Bandwidth in hertz
B = 22000;

% Elementary Charge in Columbs
q = 1.6*(10^-19);

% Background PSD
Pbg = 10^-9;

% Received Power
Pr = (H.^2).*(Pt);

% SNR
SNR = 10*log10(((R^2)*Pr.^2)/(B*q*R*Pbg));

% Histogram
count=1;
MIN = SNR(1);
MAX = SNR(length(SNR));
min = MIN - 3;
max = MIN + 3;
i=1;
while count < length(SNR)
    interval4(i) = (min + max)/2;
    interval3(i) = 0;
    for j=count:1:samples
        if(SNR(j)>= min && SNR(j)< max)
            count=count +1;
            interval3(i)= count;
        else
            break;
        end
    end
    interval3(i) = interval3(i)/samples;
    i=i+1;
    max = max + 3;
    min = min + 3;
end

figure
histogram(SNR,12);
xlabel("SNR")
ylabel("Number of Samples")
title("Histogram of SNR")
figure
```

```
plot(interval4,interval3,'-.');
title("Plot of Cumulative Distribution of SNR")
ylabel("Probability");
xlabel("SNR");
```





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