Appendix

Code of vertical handover

```
clc, clear,close all

%%%%network1

%%dt distance between bts1 in network1 &bts2 in network2 assume=2000m==2km

dt=2000;

%radius of cell in meter

  R=1500;

%%dref is the distance between the AP and a reference point (m)

dr=1;

%%PTx is the transmit power of the network AP or bts in dBm

P_tx=21;

%%PLref is the path loss at the reference point in dB hata model

PL_ref=119.8960%

 % beta is the path loss exponent

beta=3.5;

%%X6is a Gaussian distributed random variable with a mean of zero and a standard deviation 6 in dB.

x=4.3;

ns=0;%cont no of usr  stay in network

nh=0;%cont for no of usr moverd to anther network

%svc=0;%cont sucss voice call

%sdc=0;%cont sucss data call

%s=cont for  number of  cycle

s=2;

for k=1:s

%c=no of usr

   c(k)=input ('enter number   of usr :');

   % Generation of random distance for user

   d=fix(R*rand(1,c(k)));
```

```
    disp('distance between  MT&BS in network1')
   disp(d);
    for i=1:c(k)
 RS(i)=P_tx-PL_ref-10*beta*log10(d(i)/dr)+x;
    end
disp(' the RSS serving for number for user')
disp(RS);
%%%NETWORK2
%%calculate RSS(T)
%d2 distance
d2=dt-R;
disp('the distance between MS in edge cell& bst2 in network2');
disp(d2)
%%dref is the distance between the AP and a reference point (m)
dr2=1;
%%PTx is the transmit power of the network AP or bts in dBm
P2_tx=50 ;
%%PLref is the path loss at the reference point in dB hata model
PL2_ref=118.4449;%height of bs 50m d=d2 fc=700mhz
% beta is the path loss exponent
beta2=3.5;
ga=5;%gain
co=7;
%%X6is a Gaussian distributed random variable with a mean of zero and a standard deviation 6 in dB.
x2=4.3;
%hysisrers value 1 to 3 db
hy=3;
RSS_t=P2_tx-PL2_ref+ga-co;
```

```
disp(' THE  RSS TAGER')
disp(RSS_t)
 for i=1:c(k)
    G=RS(i)+hy;
 %-90 db threshod serving
 if RS(i)<-90&& RSS_t>G
     disp ('*********handover to another network*************')
 nh=nh+1;
 else
 disp ('********stay in the network*************')
ns=ns+1;
 end
end
y(k)=nh;
z(k)=ns;
disp('NO of usr  stay in  network=')
 disp(ns);
 disp('NO of usr  handover to another   network=')
 disp(nh);
 nhp(k)=y(k)/c(k);
 %b(k)=svc;%number of voice call
 %g(k)=sdc;%number of data call

 %-------------------------------------------------------------------------
 %bbu
s1=3;
 for k1=1:s1
  bbut(k1) =input ('enter  total number of bbu in pool 220,180,151:');
    bbuv(k1) =input ('enter  no of bbu reseved for voice (180,160,135)  :');
```

```
    bbud(k1)=bbut(k1)-bbuv(k1);
      bbu_v =input ('enter  no of bbu max reseved for  one  voice call (9bbu or 7bbu or  3bbu)  :');
       bbu_d =input ('enter  no of bbu max reseved for  one  data call (4bbu or 2bbu or  1bbu)  :');
chv(k1)=fix(bbuv(k1)/bbu_v);
bbuv_r=ceil((bbuv(k1)/bbu_v)-fix(bbuv(k1)/bbu_v));
disp('**** the BBUV empty***');
disp(bbuv_r);
chd(k1)=fix(bbud(k1)/bbu_d);
bbud_r=ceil((bbud(k1)/bbu_d)-fix(bbud(k1)/bbu_d));
disp('**** the BBUD empty***');
disp(bbud_r);
%disp(ct);
disp('NO OF VOICE CALL=')
disp(svc);
disp('NO OF DATA CALL=')
disp(sdc);
 if  svc<= chv(k1)
   disp('******sucufull  all  voice call******');
 else
    disp('blocked call***!!!! ')
    v=svc-chv(k1)
    b_v(k1)=v/svc;

 end
  if sdc<= chd(k1)
   disp('*****sucufull  all data call******')
  else
     disp('blocked data call ***!!!!!')
     bd=sdc-chd(k1)
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```
     b_d(k1)=bd/sdc;
  end
 end
disp(b_v);
disp(b_d);
s2=3;
 for k2=1:s2
  bbut(k2) =input ('enter  total number of bbu in pool 220,180,150:');
    bbuv(k2) =input ('enter  no of bbu reseved for voice (180,160,135)  :');
     bbud(k2)=bbut(k2)-bbuv(k2);
       bbu_v2 =input ('enter  no of bbu max reseved for  one  voice call (9bbu or 7bbu or  3bbu)  :');
        bbu_d2 =input ('enter  no of bbu max reseved for  one  data call (4bbu or 2bbu or  1bbu)  :');
chv2(k2)=fix(bbuv(k2)/bbu_v2);
bbuv_r=ceil((bbuv(k2)/bbu_v2)-fix(bbuv(k2)/bbu_v2));
disp('**** the BBUV empty***');
disp(bbuv_r);
chd2(k2)=fix(bbud(k2)/bbu_d2);
bbud_r=ceil((bbud(k2)/bbu_d2)-fix(bbud(k2)/bbu_d2));
disp('**** the BBUD empty***');
disp(bbud_r);
%disp(ct);
disp('NO OF VOICE CALL=')
disp(svc);
disp('NO OF DATA CALL=')
disp(sdc);
 if  svc<= chv(k2)
    disp('******sucufull  all  voice call******');
 else
     disp('blocked call***!!!! ')
```

```
    v2=svc-chv(k2)
    b_v2(k2)=v2/svc;
 end
 if sdc<= chd(k2)
   disp('*****sucufull  all data call******')
 else
     disp('blocked data call ***!!!!!')
     bd2=sdc-chd(k2)
     b_d2(k2)=bd2/sdc;
 end
end
s3=3;
 for k3=1:s3
  bbut(k3) =input ('enter  total number of bbu in pool 220,180,150:');
   bbuv(k3) =input ('enter  no of bbu reseved for voice (180,160,135)  :');

    bbud(k3)=bbut(k3)-bbuv(k3);
      bbu_v3 =input ('enter  no of bbu max reseved for  one  voice call (9bbu or 7bbu or  3bbu)  :');
       bbu_d3 =input ('enter  no of bbu max reseved for  one  data call (4bbu or 2bbu or  1bbu)  :');
chv3(k3)=fix(bbuv(k3)/bbu_v3);
bbuv_r=ceil((bbuv(k3)/bbu_v3)-fix(bbuv(k3)/bbu_v3));
disp('**** the BBUV empty***');
disp(bbuv_r);
chd3(k3)=fix(bbud(k3)/bbu_d3);
bbud_r=ceil((bbud(k3)/bbu_d3)-fix(bbud(k3)/bbu_d3));
disp('**** the BBUD empty***');
disp(bbud_r);
%disp(ct);
disp('NO OF VOICE CALL=')
```

```
disp(svc);
disp('NO OF DATA CALL=')
disp(sdc);
 if  svc<= chv(k3)
   disp('******sucufull  all  voice call******');
 else
    disp('blocked call***!!!! ')
    v3=svc-chv(k3)
    b_v3(k3)=v3/svc;
 end
  if sdc<= chd(k3)
   disp('*****sucufull  all data call******')
  else
     disp('blocked data call ***!!!!!')
     bd3=sdc-chd(k3)
     b_d3(k3)=bd3/sdc;
  end
 end
end
disp(b_v3);
disp(b_d3);
ns=0;
  nh=0;
  %svc=0;
  %sdc=0;
k=k+1;
 if s>2% for end
    break
 end
```

```
%% PLOTTING GRAPHS
plot( chv,b_v,'-ks');
title('relation between CHV & blocking probablity');
      xlabel('Number of channel for voice');
      ylabel('blocking probablity for voice');
grid
 hold on
plot( chv2,b_v2,'r*-');
hold on
plot( chv3,b_v3,'bo-');
legend('BBU=9' ,   'BBU=7'   , 'BBU=3' ) ;
figure
plot(chd,b_d,'ks-');
title('relation between sdc & blocking probablity');
      xlabel('Number of channel for data');
      ylabel(' blocking probablity for data ');
      grid
     hold on
     plot(chd2,b_d2,'b*-');
     hold on
      plot(chd3,b_d3,'ro-');
     legend('BBU=4' ,   'BBU=2'   , 'BBU=1' ) ;
```

%code for hata model

```
%calculate  hata path loss lhata with varying height of base station
fc=700;%fc 150to1500MHz
a1=fc-0.7;
a2=fc-0.8;
 a_hm=(1.1*log10(a1))-( 1.56*log10(a2 ));
%         hb is the height of the base station in meters, between 30 and 200m.
```

```
for i=1:5

hb(i)=input('enter height of the base station in meters(30to 200) :')

%    Suburban k=2[ log10( fMHz /28 )]^2 +5.4

   %Small city k=0

k=2*( log10( fc /28 ))^2 +5.4;

%dKm is Link transmission distance, which is the cell radius  between 1km and 20 km.

d=input('enter the cell radius :')

lhata(i)=(69.55+(26.16*log10(fc))-(13.82*log10(hb(i)))-(a_hm)+(44.9-
(6.55*log10(hb(i))))*log10(d)-(k));

end

plot (hb,lhata,'ko-');

title('relationship between path loss&height of base station');

        xlabel('height of base station in meter');

        ylabel(' L hata [dB] ');
```