Introduction to Wireless and Mobile Networking

Hw1 – Report

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I.MatLab Code

1. Parameter setting

```
% Parameter setting
T      = 27 + 273.15;
B      = 10e6;
P_T    = 33 - 30; % input power = 33 dBm
G_T_dB = 14;
G_R_dB = 14;
H_BS   = 1.5;      % height of Base station
H_B    = 50;       % height of building
H_MS   = 1.5;      % height of mobile station
H_T    = H_BS + H_B;
H_R    = H_MS;
```

2. Functions

(1) Number ↔ dB

```
% transfer to dB
function dB = todB(x)
dB = 10*log10(x);
end
```

```
% transfer from dB
function x = fromdB(dB)
x = 10.^(dB/10);
end
```

(2) Two-ray-ground model

```
% two-ray-ground-model
function G_d = G_two_ray_ground(H_t, H_r, d)
G_d = (H_t * H_r)^2 ./ (d .^ 4);
end
```

(3) Thermal Noise

```
% My Thermal Noise
function N_T = myThermalNoise(Temperature,Bandwidth)
k = physconst('Boltzmann');
N_T = k*Temperature*Bandwidth;
end
```

(4) SINR

```
% SINR in dB
function SINR = mySINR_dB(S, I, N)
SINR = 10*log10(S/(I+N));
end
```

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3. Modeling

(1) only path loss : two-ray-ground model

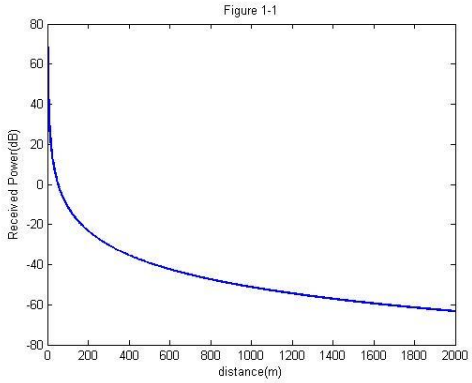
```
% start modeling
d_max = 2000;
d = 0:1:d_max ;
G_C = G_two_ray_ground(H_T, H_R, d);
G_C_dB = todB(G_C);
P_R_dB = P_T + G_T_dB + G_R_dB + G_C_dB;
```

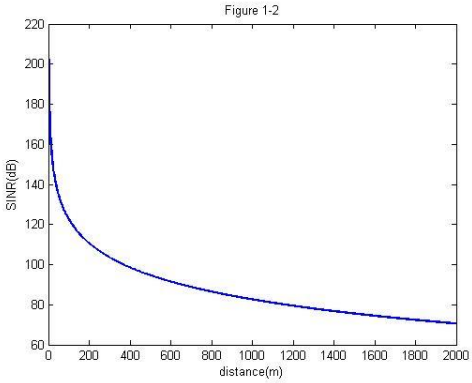
(2) adding log-normal shadowing

```
% start modeling
d_max = 2000;
d = 0:1:d_max;
G_C = G_two_ray_ground(H_T, H_R, d);
G_C_dB = todB(G_C);
S = normrnd(0,6,1,(d_max + 1)); % R = normrnd(mu,sigma,m,n) m-by-n matrix
P_R_dB = P_T + G_T_dB + G_R_dB + G_C_dB + S;
```

II.Questions

1. *Consider the **path loss** only radio propagation (without shadowing and fading). Use Two-ray-ground model as the propagation model for your simulation.*
   - *1-1. Please plot a figure with the received power of the mobile device (in dB) as the y-axis and the distance (in meter) between the BS and the mobile device as the x-axis.*
   - *1-2. According to 1-1, please plot a figure with **SINR** of the mobile device (in dB) as the y-axis and the distance between the BS and the mobile device (in meter) as the x-axis.*





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2. *Consider both the **path loss** and **shadowing** (without fading). Apply log-normal shadowing to model the shadowing effect. The path loss model should be the same as 1-1.*
   - 2-1. *Please plot a figure with the received power of the mobile device (in dB) as the y-axis and the distance (in meter) between the BS and the mobile device as the x-axis.*
   - 2-2. *According to 2-1, please plot a figure with **SINR** of the mobile device (in dB) as the y-axis and the distance between the BS and the mobile device (in meter) as the x-axis.*