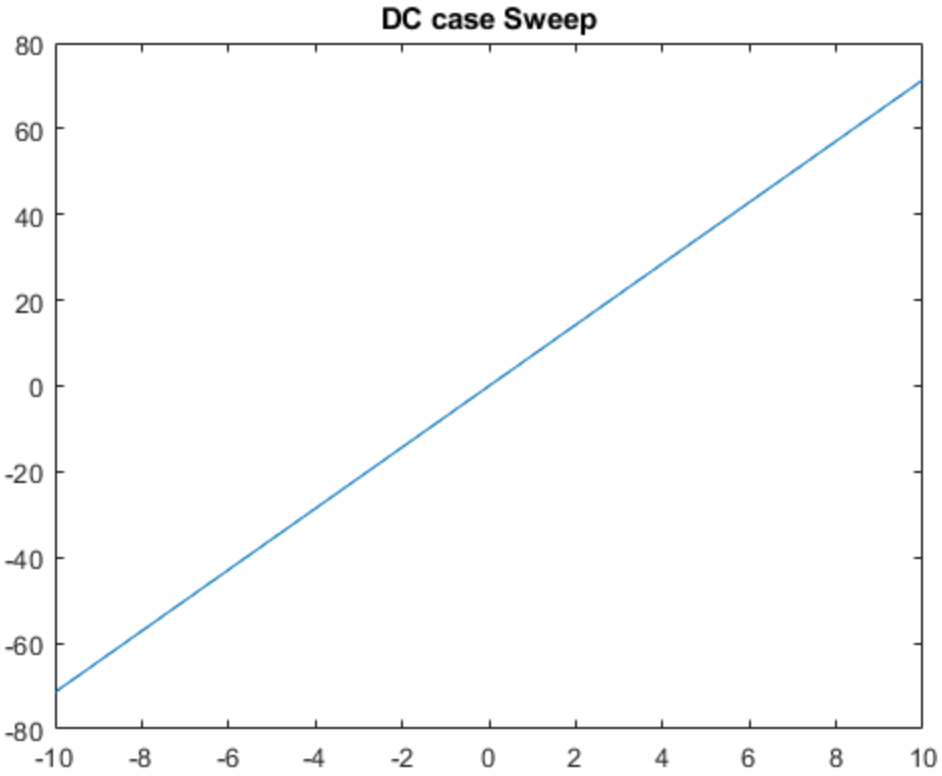
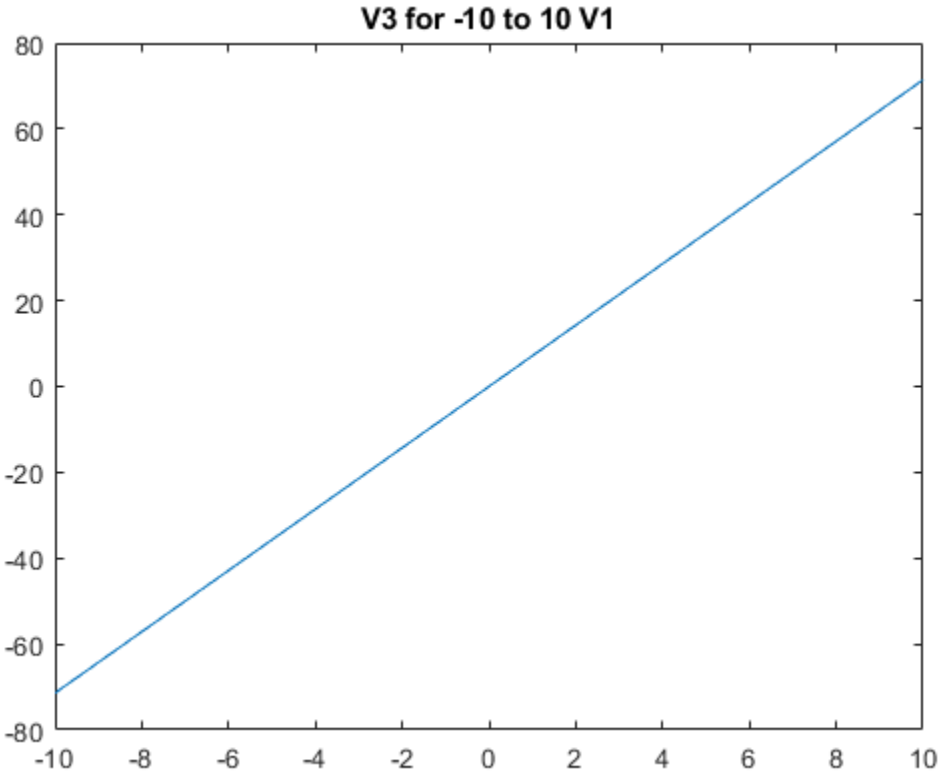
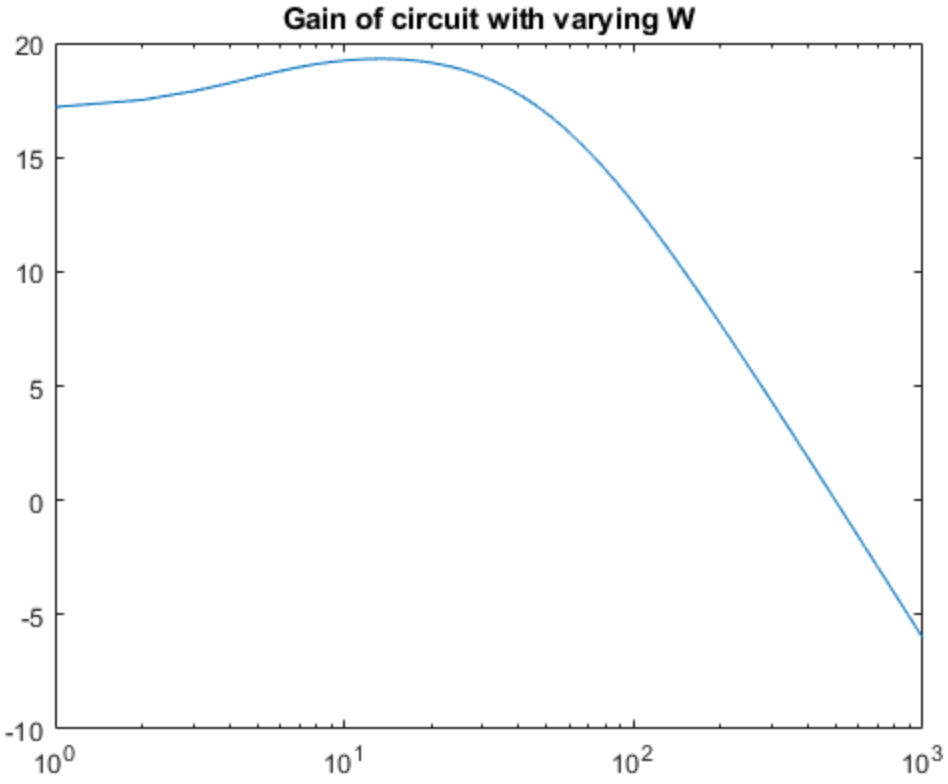
```
clear all
% Patrobas Adewumi
% 100963608
% ELEC 4700
% assignment4
% MNA Building and circuit sim

R1 = 1;
C1 = 0.25;
R2 = 2;
L1 = 0.2;
R3 = 10;
a = 100;
R4 = 0.1;
Ro = 1000;

% Formulation of the matrix
%    V1    V2     V3          V5       IL3
% G = [-1/R1, 0,     0,          0,      0; ...%N1
%      1/R1 , -1/R2, 0,          0,      0; ...%N2
%      0,     0,     -1/R3,      0,      0; ...%N3
%      0,     0,     -a/(R3*R4), -1/R4,  0; ...%N4

C = [  0, 0,   0, 0, 0, 0, 0; ...
     -C1,C1,   0, 0, 0, 0, 0; ...
       0, 0, -L1, 0, 0, 0, 0; ...
       0, 0,   0, 0, 0, 0, 0; ...
       0, 0,   0, 0, 0, 0, 0; ...
       0, 0,   0, 0, 0, 0, 0; ...
       0, 0,   0, 0, 0, 0, 0];

G = [     1,              0,  0,    0,  0,     0,             0; ...
      -1/R1, (1/R2 + 1/R1), -1,    0,  0,     0,             0; ...
          0,              1,  0,   -1,  0,     0,             0; ...
          0,              0, -1, 1/R3,  0,     0,             0; ...
          0,              0,  0,    0, -a,     1,             0; ...
          0,              0,  0, 1/R3, -1,     0,             0; ...
          0,              0,  0,    0,  0, -1/R4, (1/R4 +1/Ro)];


V1 = 10;
F = [V1; 0; 0; 0; 0; 0; 0];

w = 0;
V = (G+1i*w*C)\F;


for k =1:21
    vp = -10 +k -1;
    F(1,1) = vp;

    V(:,:,k) = (G+1i*w*C)\F;
```

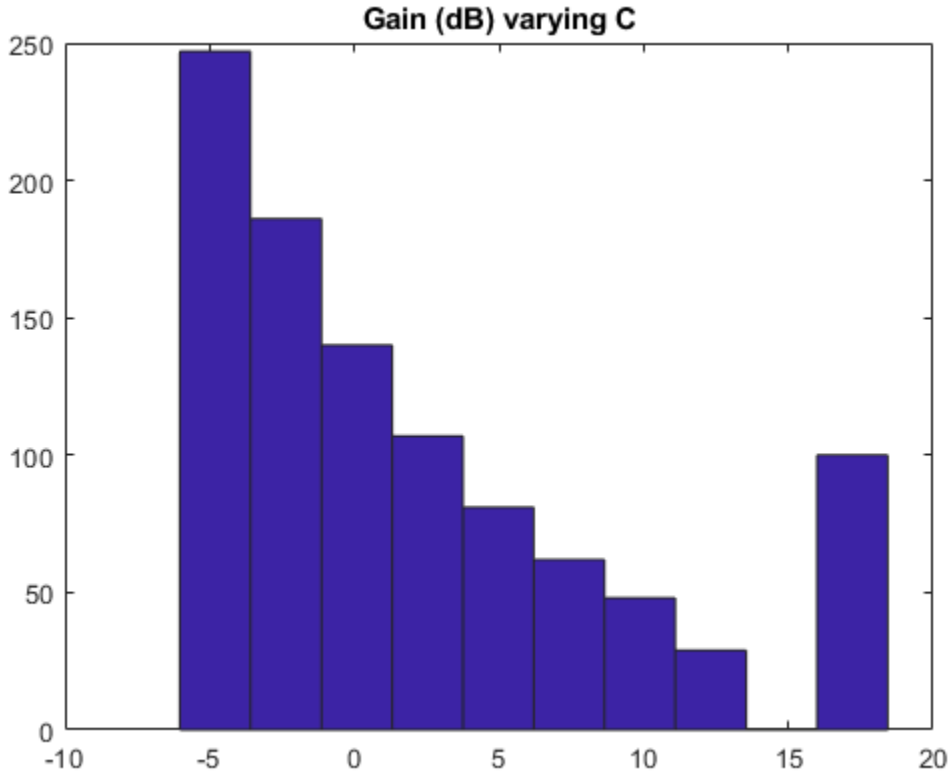
```
end

Vo(1,:) = V(7,1,:);
V3(1,:) = V(4,1,:).*R3;

figure(1)
plot(-10:1:10,Vo)
title('DC case Sweep')

figure(2)
plot(-10:1:10,V3)
title('V3 for -10 to 10 V1')


% AC case plot
F(1,1) =10;
for w = 1:1000
    V(:,:,w) = (G+1i*w*C)\F;
end

clear Vo
Vo(1,:) = V(7,1,:);

Vo1 = 20*log10(Vo/V1);

figure(3)
semilogx(1:1000,Vo1)
title('Gain of circuit with varying W')

% random pertubation on C
w = pi;
std = 0.05;
for i = 1:100
    Cnew = normrnd(C1,std);
    C(2,1) = -Cnew;
    C(2,2) = Cnew;

    V(:,:,i) = (G + 1i*w*C)\F;
end

clear Vo
Vo(1,:) = V(7,1,:);
Vo1 = 20*log10(Vo/V1);

figure(4)
hist(real(Vo1(:)))
title('Gain (dB) varying C')
```

Warning: Imaginary parts of complex X and/or Y arguments ignored


DC case Sweep
80
60
40
20
0
-20
-40
-60
-80
-10
-8
-6
-4
-2
0
2
4
6
8
10


V3 for -10 to 10 V1
80
60
40
20
0
-20
-40
-60
-80
-10
-8
-6
-4
-2
0
2
4
6
8
10


Gain of circuit with varying W
20
15
10
5
0
-5
-10
10^0
10^1
10^2
10^3


Gain (dB) varying C
250
200
150
100
50
0
-10
-5
0
5
10
15
20

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