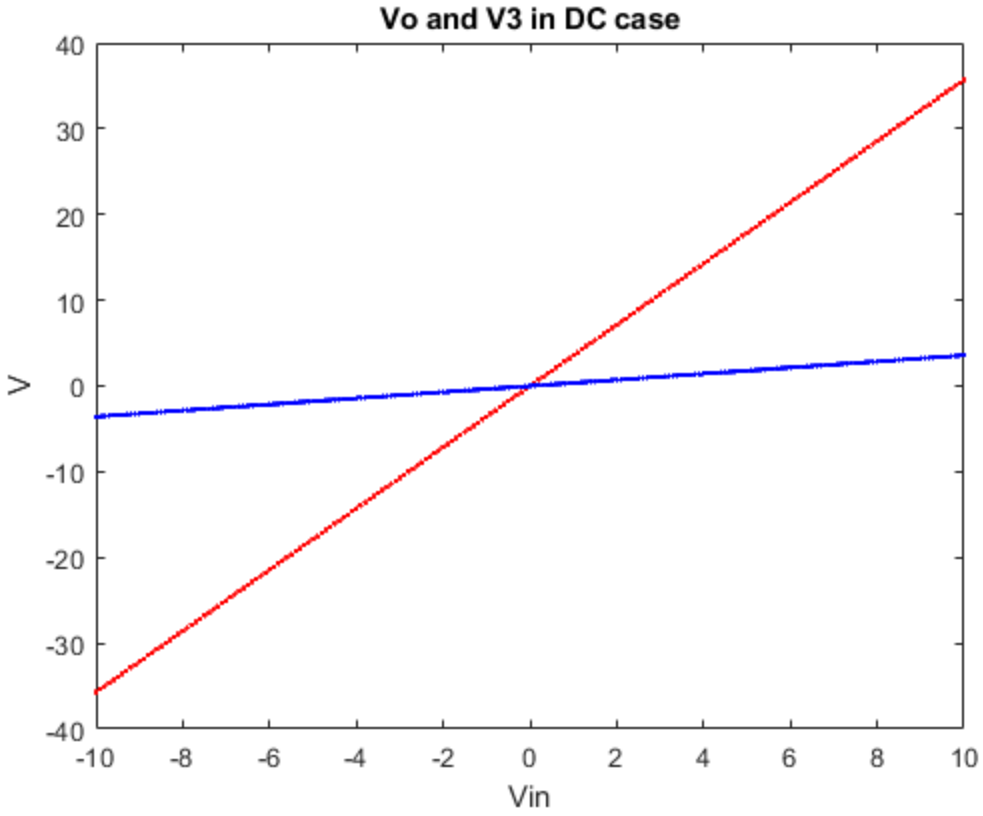
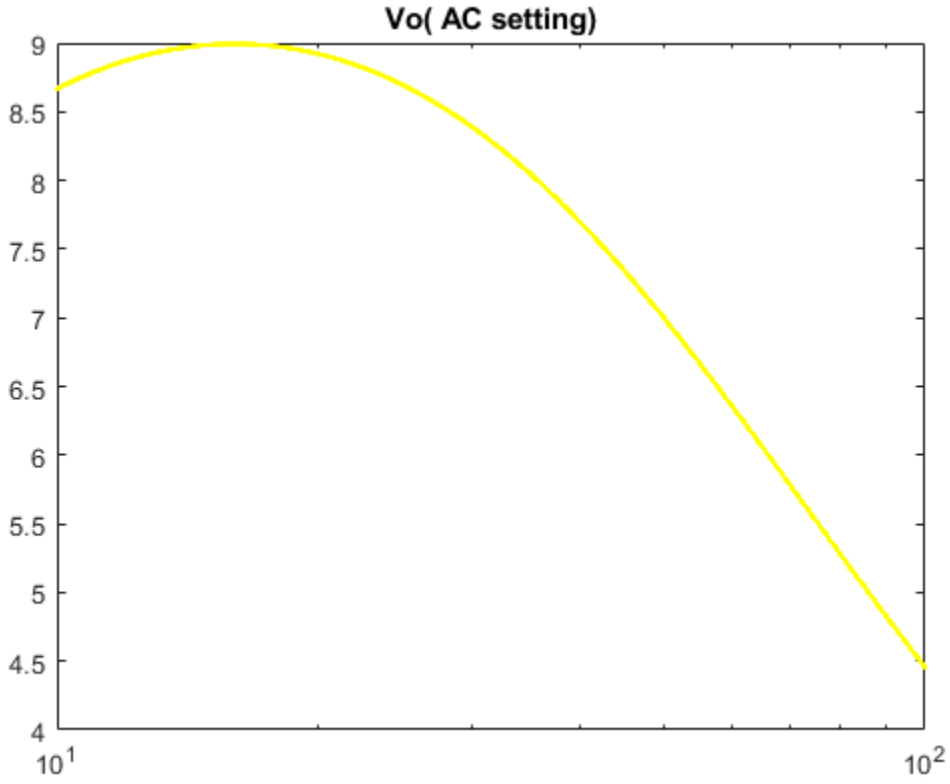
Assignment 4 - Circuit Modeling

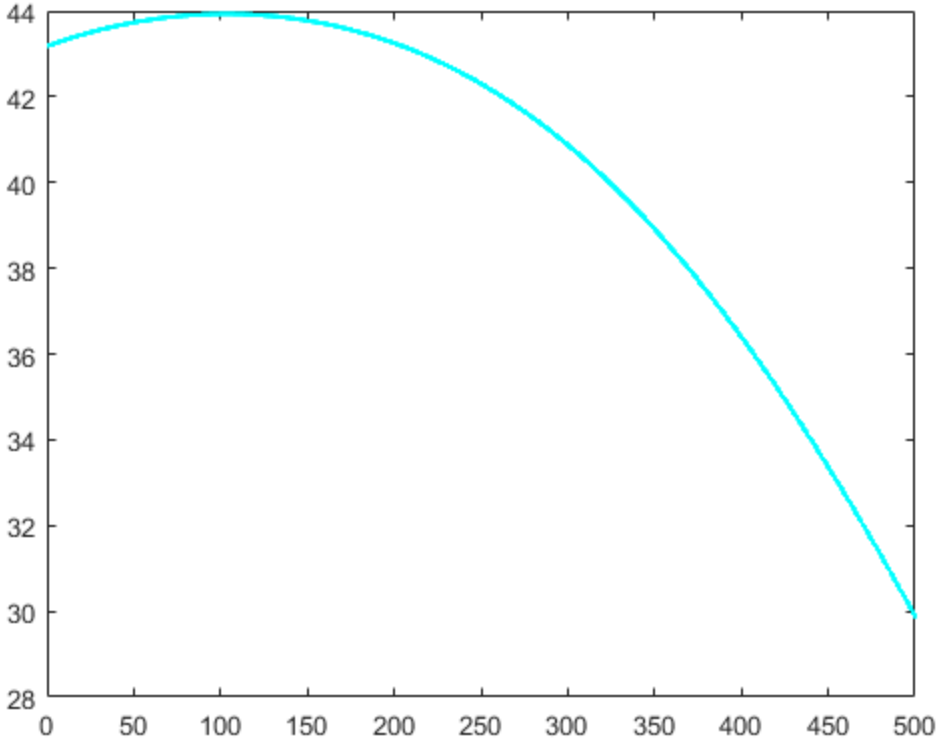
For Part 1, we are DC sweeping V1 from -10 to 10 and plotting V0. Then we AC sweep and plot V0 as a function of w. Next, we plot the AC gain as a function of random pertubations on C.

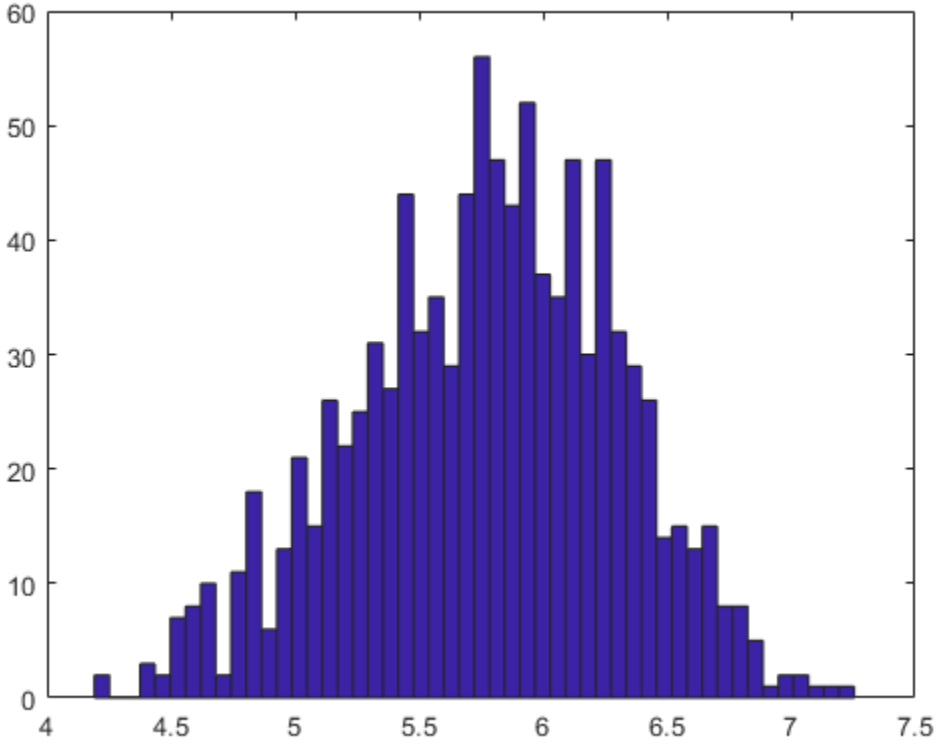
```
close all
clear

R1 = 1;
G1 = 1/R1;
c = 0.25;
R2 = 2;
G2 = 1/R2;
L = 0.2;
R3 = 10;
G3 = 1/R3;
a = 100;
R4 = 0.1;
G4 = 1/R4;
Ro = 1000;
Go = 1/Ro;

C = [0 0 0 0 0 0 0
    -c c 0 0 0 0 0
    0 0 -L 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
    -G2 G1+G2 -1 0 0 0 0
    0 1 0 -1 0 0 0
    0 0 -1 G3 0 0 0
    0 0 0 0 -a 1 0
    0 0 0 G3 -1 0 0
    0 0 0 0 0 -G4 G4+Go];

Vdc = zeros(7,1);
Vac = zeros(7,1);
F = zeros(7,1);

f1 = figure;
f2 = figure;
f3 = figure;
f4 = figure;


for v = -10:0.1: 10
    F(1,1) = v;
    Vdc = G\F;
```

```
    set(0, 'CurrentFigure', f1)
    plot(v, Vdc(7,1), 'r.')
    hold on

    plot(v, Vdc(4,1), 'b.')
    hold on
    title('Vo and V3 in DC case')
    xlabel('Vin')
    ylabel('V')

end
w = logspace(1,2,500);
F(1) = 1;
for o = 1:length(w)

    Vac = (G+C*1j*w(o))\F;
    set(0, 'CurrentFigure', f2)
    semilogx(w(o), abs(Vac(7,1)), 'y.')
    hold on
    title('Vo( AC setting)')

    dB = 20*log(abs(Vac(7,1))/F(1));
    set(0, 'CurrentFigure', f3)
    plot(o, dB, 'c.')
    hold on
end
cs =  0.25 + 0.05.*randn(1,1000);
VOg = zeros(1000,1);
for m = 1:length(VOg)
    c = cs(m);
    C(2,1) = -c;
    C(2,2) = c;
    Vac = (G+C*1j*pi)\F;
    VOg(m,1) = abs(Vac(7,1))/F(1);
end
set(0, 'CurrentFigure', f4)
hist(VOg,50);
```


Vo and V3 in DC case
40
30
20
10
0
-10
-20
-30
-40
V
-10
-8
-6
-4
-2
0
2
4
6
8
10
Vin


Vo(AC setting)
9
8.5
8
7.5
7
6.5
6
5.5
5
4.5
4
10^1
10^2


44
42
40
38
36
34
32
30
28
0
50
100
150
200
250
300
350
400
450
500


60
50
40
30
20
10
0
4
4.5
5
5.5
6
6.5
7
7.5

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