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% ELEC4700

% Assignment 4

% Part 1

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R1=1;

c=0.25;

R2=2;

L=0.2;

R3=10;

alpha=100;

R4=0.1;

Ro=1000;

G=[R3 -1 0 0 0;R3 0 -1 0 0;alpha*Ro/(R4+Ro) 0 0 -1 0;1 0 (1/R1+1/R2) 0 0;0 0 0 0 1];

C=[0 0 0 0 0;L 0 0 0 0;0 0 0 0 0;0 0 c 0 -c/R1;0 0 0 0 0];



figure(1)

title('plot of DC sweep');

for V1=-10:1:10

    FDC=[0;0;0;V1/R1;V1];

    DC=G\FDC;

    plot(V1,DC(4),'r*');
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```
    hold on
    plot(V1,DC(2),'b*');
    hold on
end
xlabel('V1');
ylabel('Vo (red) & V3 (blue)');


figure(2)
title('plots from AC case of gain (Vin=1)');
for w=logspace(-2,4,1000)
    FAC=[0;0;0;1/R1+c*w*1i;1];
    left=G+C*w*1i;
    AC=left\FAC;
    Vo=abs(AC(4));
    subplot(1,2,1),semilogx(w,Vo,'g*');
    title('Vo vs. log10(w)');
    hold on
    grid on
    subplot(1,2,2),semilogx(w,20*log10(Vo),'b*');
    title('(Vo/V1)dB vs. log10(w)');
    hold on
    grid on
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end



w=pi;

n=500;

iC=zeros(1,n);

gain=zeros(1,n);

for m=1:n

    iC(m)=normrnd(0.25,0.05);

    nC=[0 0 0 0 0;L 0 0 0 0;0 0 0 0 0;0 0 iC(m) 0 -iC(m)/R1;0 0 0 0 0];

    nFAC=[0;0;0;1+iC(m)*w*1i;1];

    nleft=G+nC*w*1i;

    nAC=nleft\nFAC;

    nVo=abs(nAC(4));

    gain(m)=20*log10(nVo);

end

figure(3)

title('histogram of gain');

histogram(gain);
```

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