
DSP Homework 7 Matlab Code

```
T = 1/20000;
Omega_g = 2*pi*7000*T;    Omega_s = 2*pi*9000*T;
Lh = 141;
K = 10*Lh;
k = (0:K-1);
Omegak = k*2*pi/K;

Omega_PC = 2*pi*1500*T;    Omega_PR = 2*pi*3000*T;
parablenth = Omegak.*(Omegak>=0 & Omegak<=Omega_PR);
% Omega_PC = 2*pi*750*T;    Omega_PR = 2*pi*1500*T;
% parablenth = Omegak.*(Omegak>=Omega_g & Omegak<=Omega_PR);

sawPer = 1000*2*pi/20000;
xsawPer = Omegak.*(Omegak > Omega_PR);

sinfn = (.7943-.707)*sawtooth(1/sawPer*xsawPer) + .7;
% sinfn = ((xsinPer - Omega_PC).^2).*sawtooth(1/sinPer*xsinPer)
% + .7943;
plot(xsawPer, sinfn);

figure;
xsauce = [0 Omega_PC Omega_PR]; ysauce = [.7943 .8915 .7943]; psauce =
    polyfit(xsauce,ysauce,2);
xu=linspace(0,Omega_PR,10);
parabola = [polyval(psauce,parablenth)];
plot(parablenth, parabola)

Q = 1.0*(Omegak<=Omega_PR) + 1.0*(Omegak>=Omega_PR & Omegak <= Omega_g)
    + ...
    .01*(Omegak>Omega_g & Omegak <= Omega_s) + 10.0*(Omegak>=Omega_s);
Q(fix(K/2)+2:end) = Q(round(K/2):-1:2);

Hd = (0.*(Omegak>Omega_g) + parabola.*(Omegak>=0 & Omegak<=Omega_PR) ...
    + sinfn.*(Omegak >= Omega_PR & Omegak <=
    Omega_g)).*exp(-1j*k*pi*(Lh-1)/K);
Hd(fix(K/2)+2:end) = conj(Hd(round(K/2):-1:2));
l = (0:Lh-1)'; a = exp(1j*l*Omegak)*Q.'/K; b =
    exp(1j*l*Omegak)*(Hd.*Q/K).';
a = real(a); b = real(b);
A = toeplitz(a); h = (A\b);
n = (0:Lh-1)';
subplot(211);
stem(n,h);
Omega = linspace(0,pi,1001);
H = polyval(h,exp(1j*Omega)).*exp(-1j*(Lh-1)*Omega);
subplot(212);
plot(Omega,20*log10(abs(H)))
deltap = 2*max(abs(abs(H(Omega>=Omega_g))-1))
deltas = max(abs(H(Omega<=Omega_s)))
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figure;
plot(Q);

Morder = length(h);
[hMax,hMaxIndex] = max(h)
% scale = abs((2^(16-1)-50)/h(hMaxIndex-1))
scale = abs((2^15)/(abs(sum(h)))));
    %Q notation
scale = 2.^nextpow2(scale)
hInt = floor(h*(scale));

figure;
subplot(211);
stem(n,hInt);
Omega = linspace(0,pi,1001);
H = polyval(hInt,exp(1j*Omega)).*exp(-1j*(Lh-1)*Omega);
subplot(212);
plot(Omega,20*log10(abs(H)))
deltap = 2*max(abs(abs(H(Omega>=Omegap))-1))
deltas = max(abs(H(Omega<=Omegas)))

    fid = fopen('K22_Project_Framework/coef.h','w');
    fprintf(fid,'#define Korder %i \n',uint8(Morder));
    fprintf(fid,'int h[Korder] = { \n');
    for Korder = 1:Morder-1
        fprintf(fid,'%i,\n', hInt(Korder));
    end
    fprintf(fid,'%i }; \n', hInt(Korder));
    fclose(fid);

save('bpg.mat','hInt');

deltap =

    2.0000

deltas =

    0.8923

hMax =

    0.5498

hMaxIndex =

    71

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scale =

65536

deltap =

7.6277e+04

deltas =

5.8485e+04

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