clc;

clear all;

close all;

JsfHead=gFJsfReadHeader('1000.jsf',1);

[Head,Data]=gFJsfRead0080(JsfHead,0,0);

Data1=abs(Data);

i=1:999

t=i\*40\*10.^(-6); % sampling time 40 us

% figure(1); %plot of envelop data(absolute of analytical data)

% plot(t,Data1(:,1));

% hold on;

% plot(t,Data1(:,2));

% hold on;

% plot(t,Data1(:,3));

% hold on;

% plot(t,Data1(:,5));

% hold on;

% plot(t,Data1(:,6));

% hold on;

% plot(t,Data1(:,7));

% title('Envelope data');

% xlabel('time in sec');

% ylabel('amplitude');

d=(1500\*t)/2 % depth

% figure(2); %plot depth vs the acoustic data

% plot(d,Data1(:,2160));

% hold on;

% plot(d,Data1(:,2));

% hold on;

% plot(d,Data1(:,3));

% hold on;

% plot(d,Data1(:,4));

% title('Envelope data');

% xlabel('Depth m');

% ylabel('amplitude');

fs=25000;

Data21=real(Data);

Data2=Data21./4; % scaling factor of 4

[R,C]=size(Data2);

t=0:1/fs:(R-1)/fs;

figure(40);

plot(t,Data2(:,20));

%S=hilbert(Data);

%%%%%%%%%%%%

d=designfilt('bandpassiir','FilterOrder',20,'HalfPowerFrequency1',2000,'HalfPowerFrequency2',10000,'SampleRate',25000);

%[b a]=butter(10,[0.16 0.8],'bandpass');

S=filtfilt(d,Data2(:,1:2162));

figure(41);

plot(t,S(:,20));

[R,C]=size(S);

t=0:1/fs:(R-1)/fs;

hx = hilbert(S(:,2160)); % change here

inst\_amp = abs(hx);

f\_instphase= diff(unwrap(angle(hx)))/((1/fs)\*2\*pi);

figure(3);

%plot(d,f1);

d=(t(1:length(f\_instphase))\*750);

d=d';

plot((t(1:length(f\_instphase))\*750),f\_instphase); %hilbert transform

xlabel('Depth in m');

% ylabel('frequency in Hz');

% title('Instantaneous frequency');

%

%%%%%%%%original chirp signal generation

% fs=25000; %sampling frequency

% %%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%

% f0=2000;% starting frequency of the chirp

% f1=10000; %frequency of the chirp at t1=1 second

%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%

% x = chirp([0:1/fs:0.02],2000,0.02,10000);

% M = length(x);

% n=(-(M-1)/2:(M-1)/2)';

% w = exp(-n.\*n./(2\*sigma.\*sigma));

% xw = w(:) .\* x(:);

% t=0:1/fs:0.02;

% figure(4);

% subplot(121);

% xw=20000\*xw;

% plot(t,(xw));

% [pxx,f] = pwelch(xw,50,25,1024,fs);

% figure(4);

% subplot(122);

% plot(f,pxx);

% xlabel('Frequency [Hz]');ylabel('PSD [dB re. 1 µPa ^2 /Hz]');

% %%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%plot real pat of signal

[R,C]=size(Data2);

t=0:1/fs:(R-1)/fs;

% figure(5);

% subplot(121);

% for j=1:1

% plot(t,Data2(:,j));

% hold on;

% end;

% title('Real part of the signal');

% xlabel('time in sec');

% ylabel('amplitude');

%

% i=1:999

% subplot(122);

% for j=1:1

% plot(i,Data2(:,j));

% hold on;

% end;

% title('Real part of the signal');

% xlabel('index');

% ylabel('amplitude');

%

%%%%%%%%%%%%%%%%%%

NFFT=512;

S1fft=abs(fft(S(:,20),NFFT));

F=linspace(0,fs/2,(NFFT/2)+1);

figure(43);

subplot(121);

plot(F,S1fft(1:length(F)));title('Spectrum of filtered Signal');xlabel('Frequency in Hz');ylabel('FFT coeficient');

%%%%%%%%%%%%%%%%%%%%

NFFT=512;

S1fft=abs(fft(Data2(:,20),NFFT));

F=linspace(0,fs/2,(NFFT/2)+1);

figure(42);

subplot(121);

plot(F,S1fft(1:length(F)));title('Spectrum of raw Signal');xlabel('Frequency in Hz');ylabel('FFT coeficient');

% figure(6);

% subplot(122);

% plot(F,S1fft(1:length(F)));title('Spectrum of water sediment interface');xlabel('Frequency in Hz');ylabel('FFT coeficient');

%%%%%%%%%%%%%%%%%%%%%5

[pxx,f] = pwelch(Data2(:,666),100,50,1024,fs);

figure(50);

subplot(121);

plot(f,20\*log10(pxx/10^-6));

title('PSD of transmitted Signal');

xlabel('Frequency [Hz]');ylabel('PSD [dB re. 1 µPa ^2 /Hz]');

%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%55

[pxx,f] = pwelch(S(:,666),100,50,1024,fs);

subplot(122);

plot(f,20\*log10(pxx/10^-6));

title('PSD of water sediment interface Signal');

xlabel('Frequency [Hz]');ylabel('PSD [dB re. 1 µPa ^2 /Hz]');

%%%%%%%%%%%%%%

% [b a]=butter(2,[0.08 0.4],'bandpass');

% S=filter(b,a,Data2(:,1:2162));

% [R,C]=size(S);

%%%%%%%%%%%%%%%%%%%%%%%%

[pxx,f] = pwelch(Data2(335:567,666),100,50,1024,fs);

figure(8);

subplot(121);

plot(f,20\*log10(pxx/1));

title('PSD of original Signal after bandpass filter');

xlabel('Frequency [Hz]');ylabel('PSD [dB re. 1 µPa ^2 /Hz]');

% %%%%%%%%%%%%%%%%%%%%%%%%%%%%%5

% NFFT=1024;

% S1fft=abs(fft(Data2(:,1),NFFT));

% F=linspace(0,fs/2,(NFFT/2)+1);

% subplot(122);

% plot(F,S1fft(1:length(F)));title('Spectrum of original Signal');xlabel('Frequency in Hz');ylabel('FFT coeficient');

% %%%%%%%%%%%%%%%%%%%%%%%%

% [pxx,f] = pwelch(S(410:460,1),50,25,1024,fs);

% figure(9);

% subplot(121);

% plot(f,pxx);

% title('PSD of filtered water sediment interface Signal');

% xlabel('Frequency [Hz]');ylabel('PSD [dB re. 1 µPa ^2 /Hz]');

% % %%%%%%%%%%%%%%%%%%%%%%%

% NFFT=1024;

% S1fft=abs(fft(S,NFFT));

% F=linspace(0,fs/2,(NFFT/2)+1);

% figure(11);

% subplot(122);

% plot(F,S1fft(1:length(F)));title('Spectrum of filtered Signal');xlabel('Frequency in Hz');ylabel('FFT coeficient');

% %%%%%%%%%%%%%%%%%%%%%%%%%

% [pxx,f] = pwelch(S(480:525,1),45,22,1024,fs);

% figure(12);

% subplot(121);

% plot(f,20\*log10(pxx/10^-6));

% title('PSD of original Signal');

% xlabel('Frequency [Hz]');ylabel('PSD [dB re. 1 µPa ^2 /Hz]');

% % % hx = hilbert(S);

% % % inst\_amp = abs(hx);

% % % f1 = diff(unwrap(angle(hx)))/((1/fs)\*2\*pi);

% % % figure(2);

% % % plot(t(1:length(f1)),f1)

% % % xlabel('Time in sec');

% % % ylabel('frequency in Hz');title('Instantanious frequency');

% % %

% % % %%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%

% % %

% % % [pxx,f] = pwelch(S,50,20,1024,fs);

% % % figure(3);

% % % subplot(122);

% % % plot(f,10\*log10(pxx/10^-6));

% % % xlabel('Frequency [Hz]');ylabel('PSD [dB re. 1 µPa ^2 /Hz]');

% %

% %

% % %%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%

% % corref=corr(Data2);

% % corref1=corrcoef(Data2);

% % imagesc(corref); % plot the matrix

% % % set(gca, 'XTick', 1:n); % center x-axis ticks on bins

% % % set(gca, 'YTick', 1:n); % center y-axis ticks on bins

% % % set(gca, 'XTickLabel', L); % set x-axis labels

% % % set(gca, 'YTickLabel', L); % set y-axis labels

% % title('Correlation Coefficient', 'FontSize', 14); % set title

% %colormapmap); % set the colorscheme

% % enable colorbar

% % %Ensemble size selection using varience value

% % % ES=input('Entre value of ensemble size');

% ES=40;

% b = mod(C,ES) consider for overall area

% Num=C-b;

% Data\_new=S(:,1:Num);

% Dr=Num/ES;

% coldist = (size(Data\_new,2)./Dr)\*ones(1,Dr);

% D=mat2cell(Data\_new,R,coldist);

% allined = cellfun(@(x) alline(x,ES),D,'UniformOutput',false);

%%%%%%%%%Plot allined signals

% plot(allined(1:2E-3\*fs,1));

% hold on

% plot(allined(1:2E-3\*fs,2));

% hold on

%consider for overall area

% k=1;

% for i=1:54

% a=allined{1,i};

% a=mean(a');

% b(k,1:999)=a;

% k=k+1;

% end

%upto this

% for i=1:5

% for j=1937:1:1941

% final(:,i)=S(:,j);

%

% end;

% end;

%

% Snew=S(:,542); % calculation of average of the 10 pings

%Savg= mean(Snew');

%Savg=Savg';

% Savg=Snew;

% %figure(13);

% %plot(1:999,Savg);

% %%%%%%%%%%%%%%%%%%%%%%%%

% t=0:1/fs:(R-1)/fs;

% hx = hilbert(Savg); % hilbert of 1st ping

% inst\_amp = abs(hx);

%

% f\_avginstphase= diff(unwrap(angle(hx)))/((1/fs)\*2\*pi);

% figure(333);

% % plot(d,f1);

% plot((t(1:length(f\_instphase))\*750),f\_avginstphase); %hilbert transform

% xlabel('Depth in m');

% ylabel('frequency in Hz');

% title('Instantaneous frequency');

%

% %title('Instantaneous frequency of 20 averaged pings');

% tm=(t(1:length(f\_avginstphase))\*750);

% tm=tm';

% %%%%%%%%%%%%%%%%%

%figure(666)

% plot(tm(306:468,1),f\_avginstphase(306:468,1));

%%%%%%%%%%%%%%%%%

% x=tm(306:468,1);

% y=f\_avginstphase(306:468,1);

% N=length(x);

% X=[ones(N,1),x];

% Y=y;

% phi=inv(X'\*X)\*X'\*Y;

% %figure(5000);

% %plot(x,y,'bs',[0.5 5],phi(1)+phi(2)\*[0.5 5],'-r');

% phi1=lsqcurvefit(@(x,xdata) myLinExample(x,xdata),[1;1],x,y);

%figure(5001);

%plot([0 20],phi1(1)+phi1(2)\*[0.5 5],':g');

%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%5

% [b,bint,r,rint,stats]= regress(f\_avginstphase(306:468,1),tm(306:468,1));

% figure(21);

% plot(tm(306:468,1),f\_avginstphase(306:468,1));

%%%%%%%%%%%%%%%% frequency analysis of average signal

% NFFT=1024;

% S1fft=abs(fft(Savg(437:450,1),NFFT));

% F=linspace(0,fs/2,(NFFT/2)+1);

% figure(14);

% subplot(121);

% plot(F,S1fft(1:length(F)));

% title(' Spectrum of averaged water sediment interface');xlabel('Frequency in Hz');ylabel('FFT coeficient');

% %%%%%%%%%%%%%%%%%%%%%%%%%%%%%

% [pxxbu,fbu] = pwelch(Savg(437:450,1),10,5,1024,fs);% spetrun of top layer of sediment

% [pxxbl,fbl] = pwelch(Savg(480:500,1),20,12,1024,fs); %spectrum of bottom layer of sediment

% figure(15);

% bldb=20\*log10(pxxbl/10^-6)

% budb=20\*log10(pxxbu/10^-6);

% plot(f,20\*log10(pxxbu/10^-6));

% hold on;

% plot(f,20\*log10(pxxbl/10^-6));

% title('PSD of averaged upper water sediment interface and bottom sediment Signal');

% xlabel('Frequency [Hz]');ylabel('PSD [dB re. 1 µPa ^2 /Hz]');

%

%%%%%%%%%%%%%%%%

% diff=bldu-bldb;

% A = cellfun(@(allined) mean(allined,2), allined,'UniformOutput',false);

% A\_mat=cell2mat(A);

% [r,c]=size(A\_mat);

% %

% firstgr=Savg(17e-3\*fs:20e-3\*fs);

% figure(103);

% spectrogram(firstgr);

% % %%%%%%%%%Plot averaged signals

% figure

% for i=1:c

% plot(abs(A\_mat(:,i)));

% hold on

% end

% %

% % %%%%%%%%%Reflection coefficients

%Etx=1\*10^9;

% Etx=31697863849222269704.04

% %%%%% francoise garrison eqn for calculation of absorption coefficient

% f=6; %%%Centre frequency In khz

% temp=25; %%%%Average temperature

% W\_depth=15; %%%%% SBES Data

% [ abs\_coeff ] = fga(W\_depth,temp,f);

% alpha=abs\_coeff

%

% for i=1:1 %%%C IS NUMBER OF COLUMNS i.e averaged pings

% rs1(:,i)=firstgr;

% Ers1(i)=sum(rs1(i).^2);

% Ers1\_DB=db(Ers1,'power');

% R(i)=(2\*W\_depth\*sqrt(Ers1(i)))./sqrt(Etx).\*exp(-2\*alpha\*W\_depth);

% R\_Db(i)=20\*log(R(i))

% end

% % %m=mean(R\_Db)

% %

% % x=1:ES:(ES\*c);

% % t=0:0.5/92:0.5

% % figure(1)

% % g=plot(t,R\_Db);

% % set(g,'linewidth',2);

% % xlabel('Time')

% % ylabel('Reflection Coefficients(Db)')

% %%%%%%%%%%%%%%%%%

% seg1=Savg(437:450,1);

% seg2=Savg(480:500,1);

% [pxx,f] = pwelch(seg1,80,40,1024,fs);

% figure(5);

% subplot(121);

% plot(f,10\*log10(pxx/10^-6));

% xlabel('Frequency [Hz]');ylabel('PSD [dB re. 1 µPa ^2 /Hz]');

% figure(16); % spectrogram of top layer of sediment

% spectrogram(seg1,13,8,1024,fs);

% figure(17); %spectrogram of bottom layer of sediment

% spectrogram(seg2,20,10,1024,fs);

%

% % %m=mean(R\_Db)

% %

% % x=1:ES:(ES\*c);

% % t=0:0.5/92:0.5

% % figure(1)

% % g=plot(t,R\_Db);

% % set(g,'linewidth',2);

% % xlabel('Time')

% % ylabel('Reflection Coefficients(Db)')

% %%%%%%%%%%%%%%%%%

% seg1=Savg(437:450,1);

% seg2=Savg(480:500,1);

% % [pxx,f] = pwelch(seg1,80,40,1024,fs);

% % figure(5);

% % subplot(121);

% % plot(f,10\*log10(pxx/10^-6));

% % xlabel('Frequency [Hz]');ylabel('PSD [dB re. 1 µPa ^2 /Hz]');

% figure(16); % spectrogram of top layer of sediment

% spectrogram(seg1,13,8,1024,fs);

% figure(17); %spectrogram of bottom layer of sediment

% spectrogram(seg2,20,10,1024,fs);