GWSC 2022 小组汇报

刘文中

February 18, 2022

Team Members

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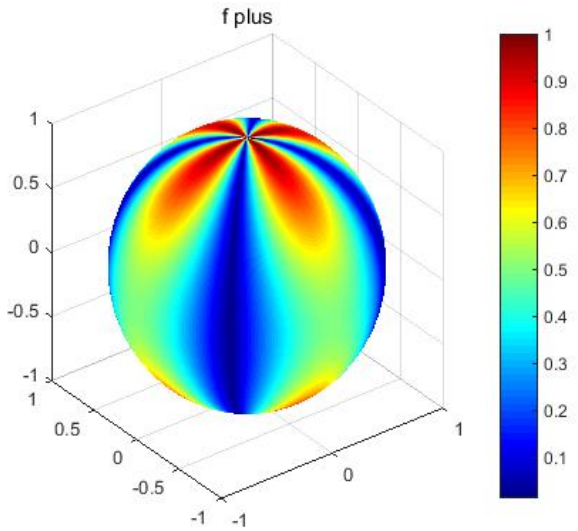
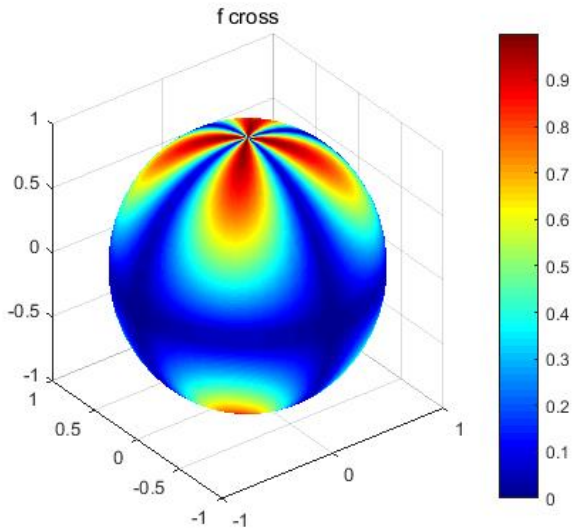
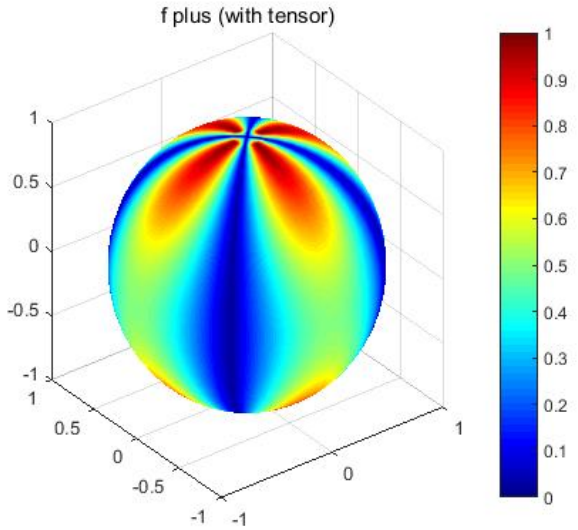
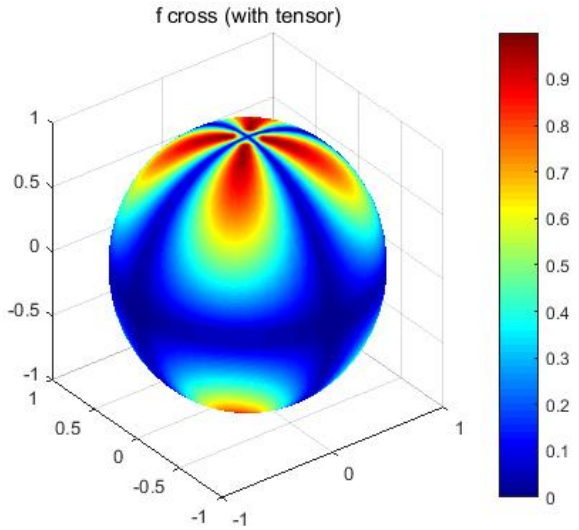
github 仓库：https://github.com/octogen4/GWSC22-Team1

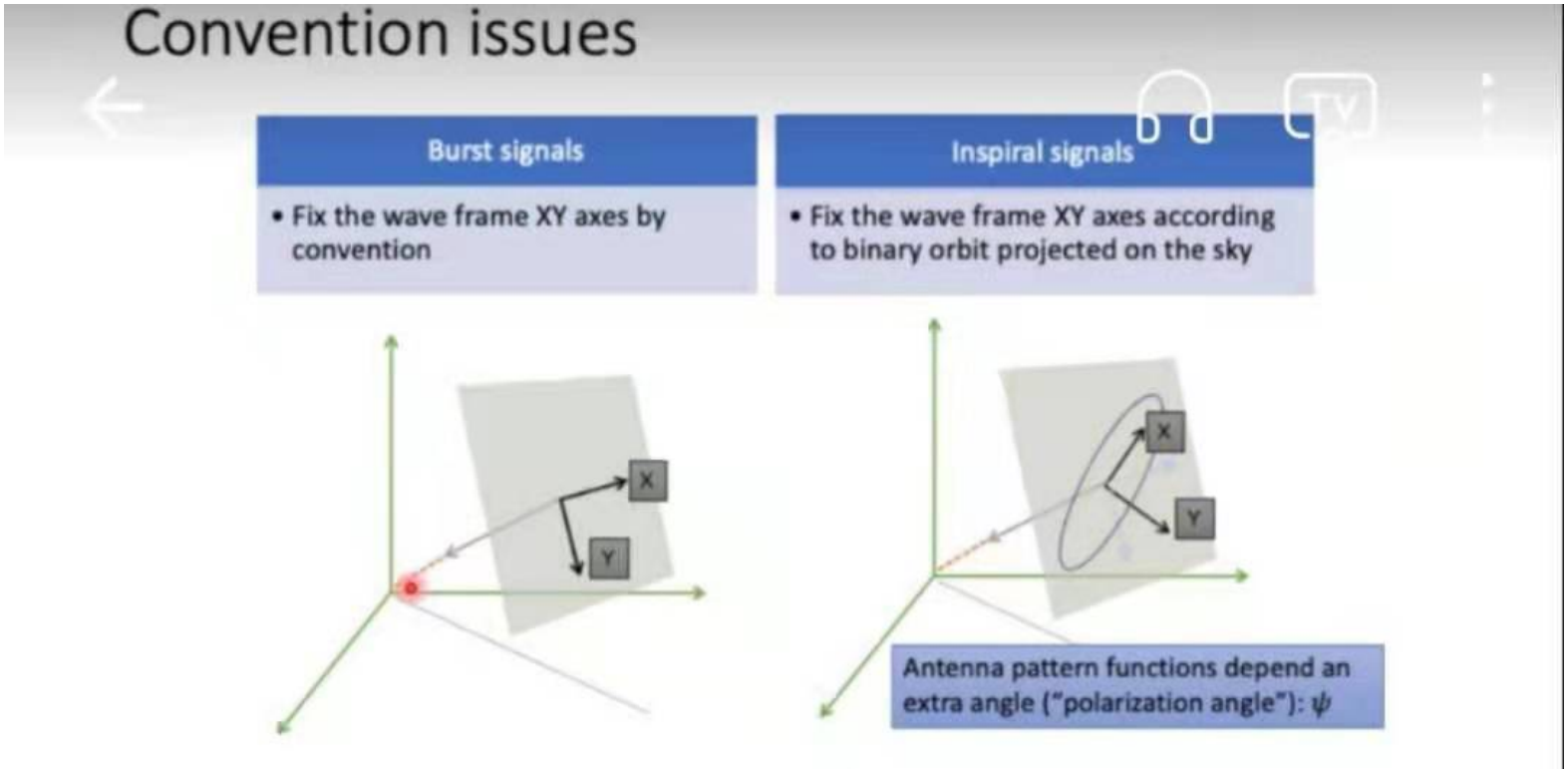
1. Antenna pattern functions of L-shaped ground detectors:









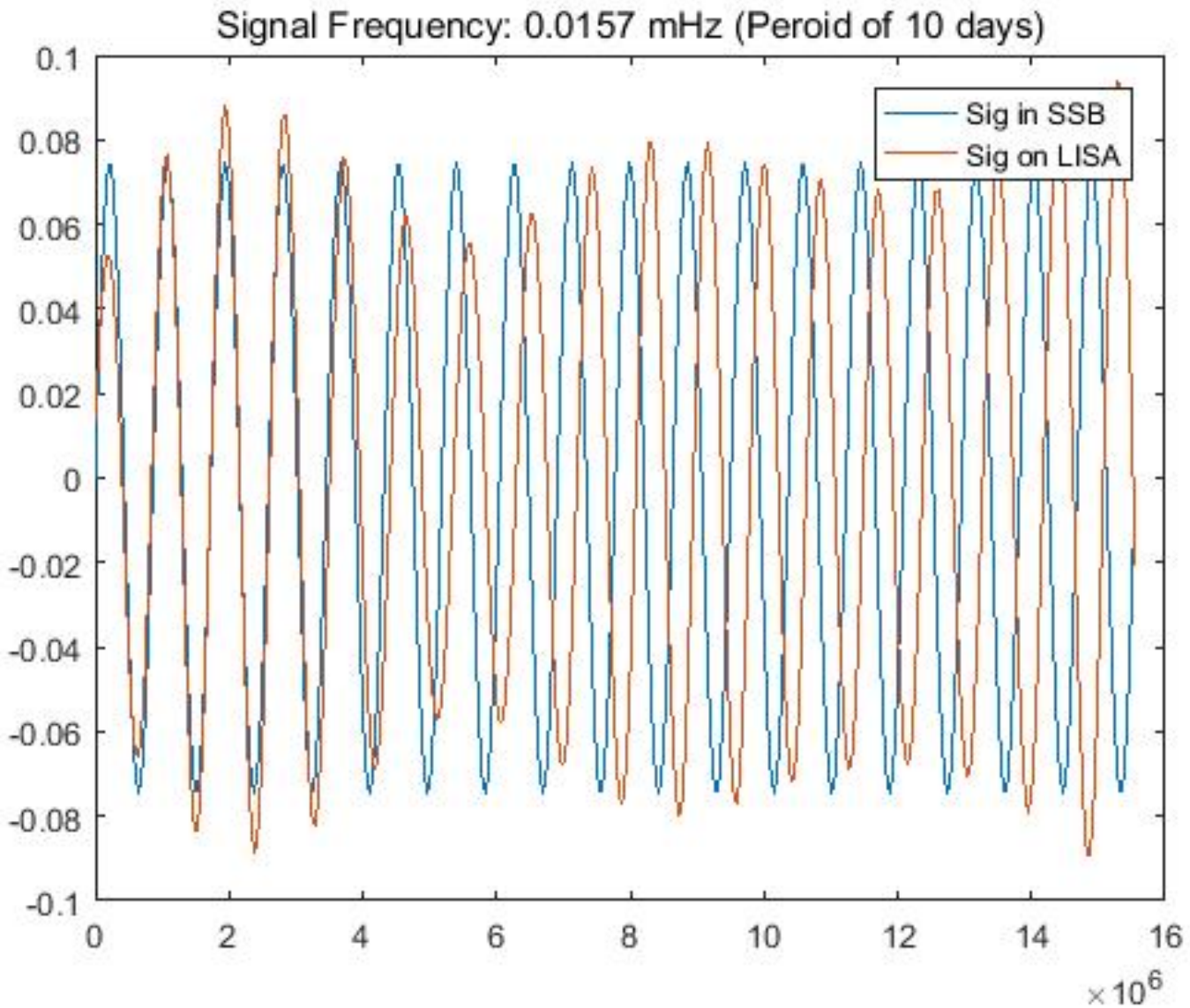

Convention issues
Burst signals
• Fix the wave frame XY axes by convention
Inspiral signals
• Fix the wave frame XY axes according to binary orbit projected on the sky
X
Y
X
Y
Antenna pattern functions depend an extra angle ("polarization angle"): ψ

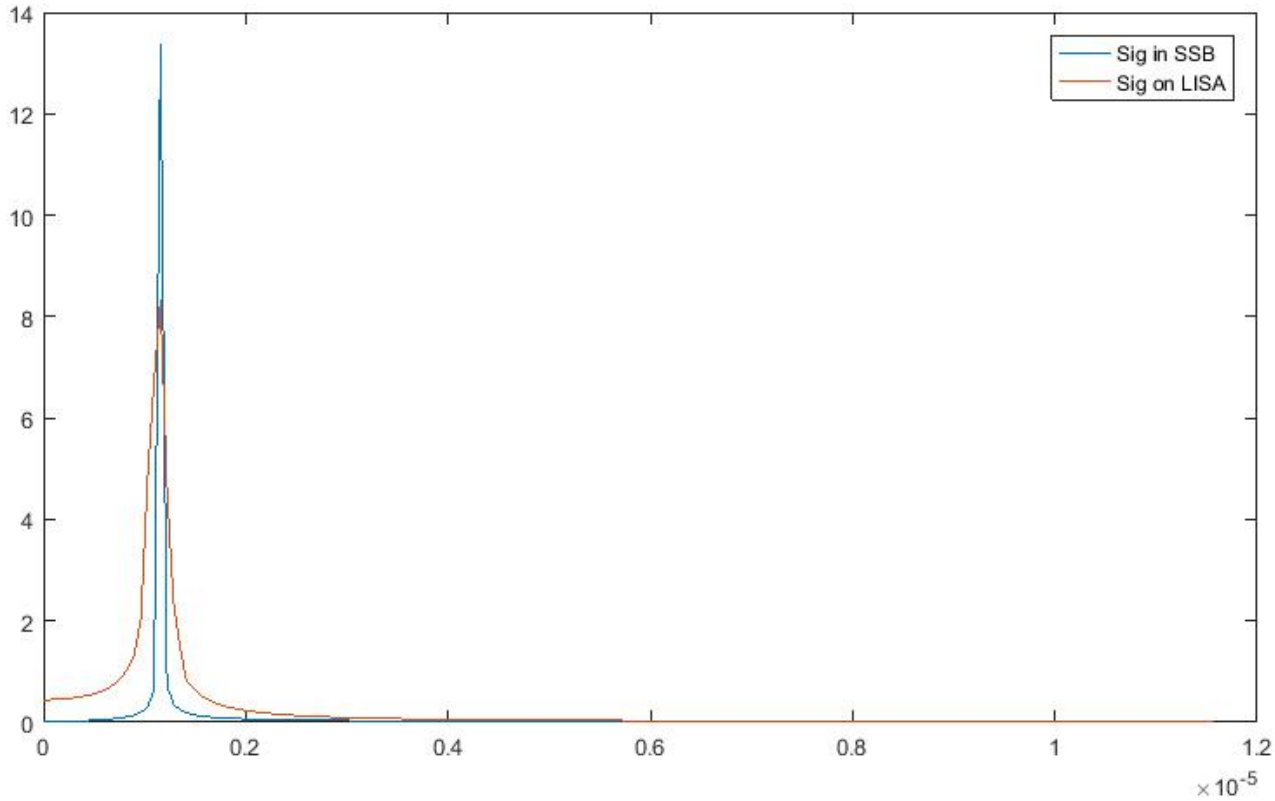
./fig/gif

2. Antenna patterns for LISA

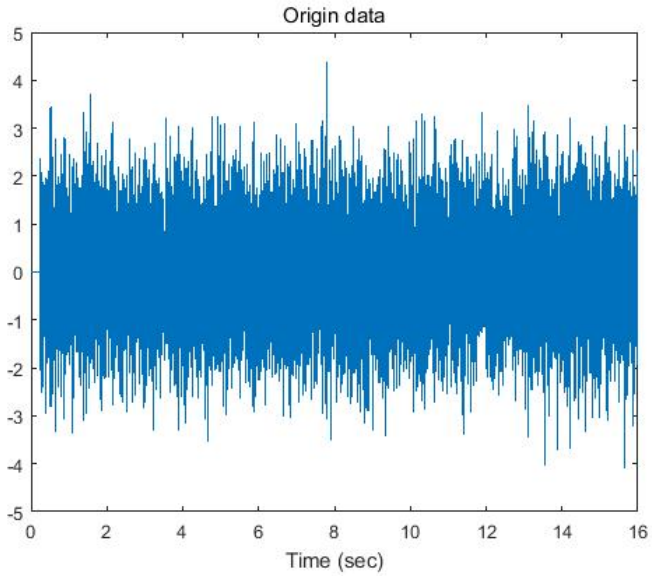
`./fig/gif`

Response strain signal

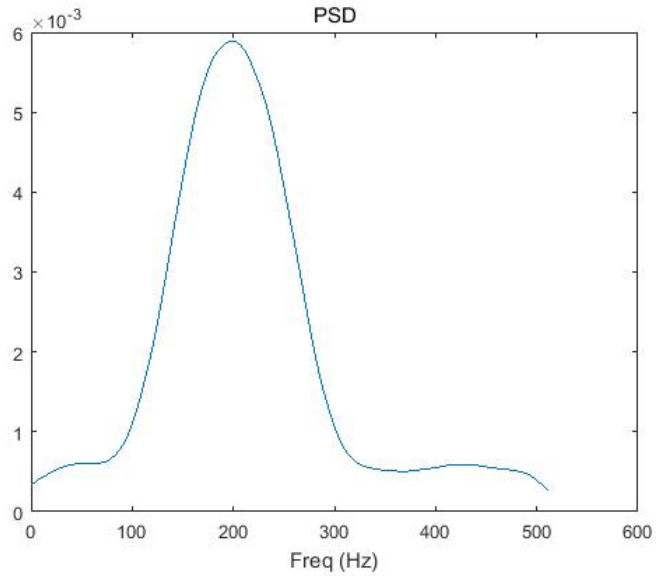



Sig in SSB
Sig on LISA
14
12
10
8
6
4
2
0
0
0.2
0.4
0.6
0.8
1
1.2
×10^-5

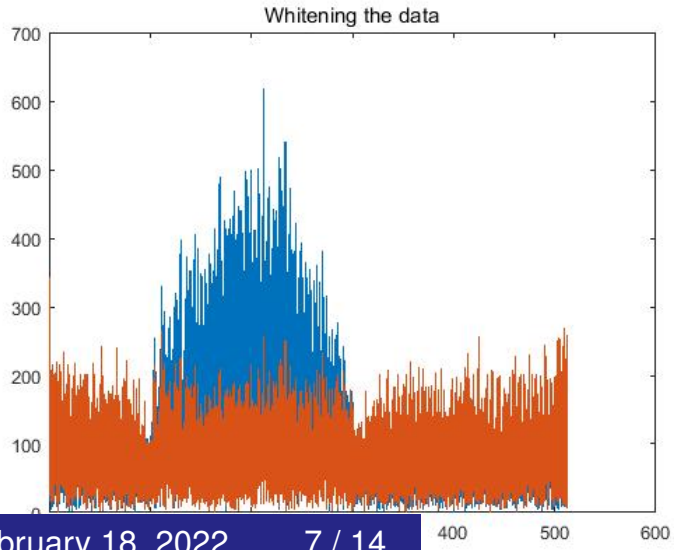
Lab Topic3, Data Whitening

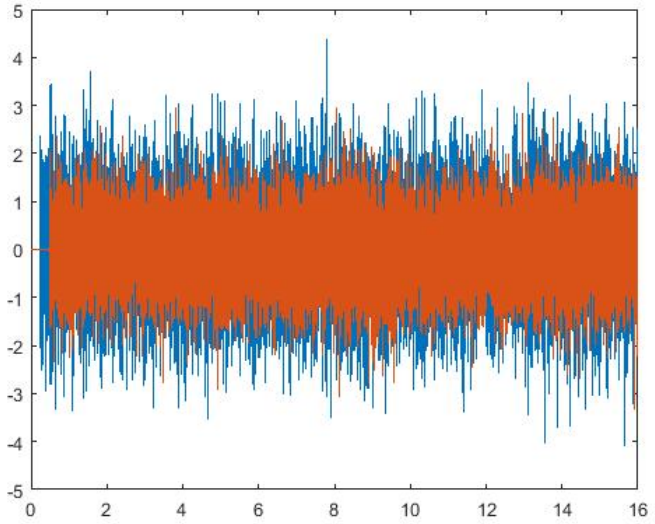


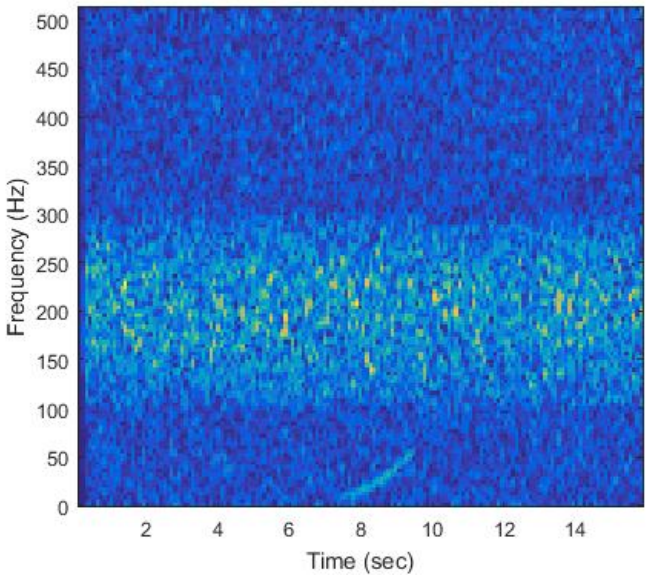
(a) Origin data

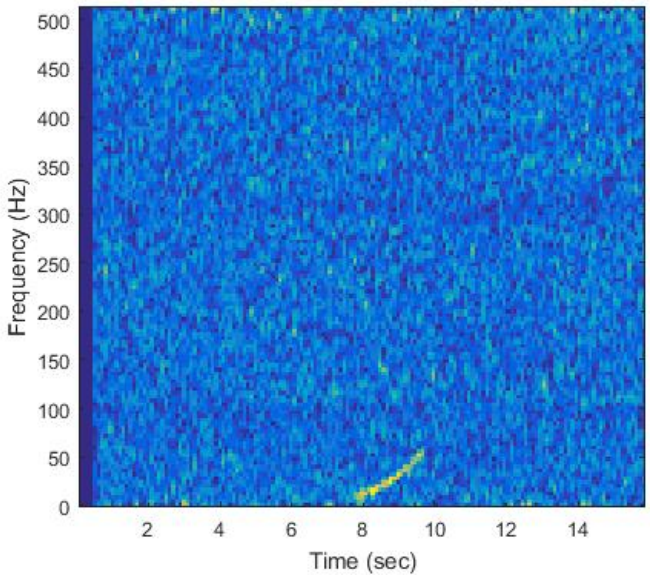


(b) PSD






Frequency (Hz)
500
450
400
350
300
250
200
150
100
50
0
2
4
6
8
10
12
14
Time (sec)


Frequency (Hz)
500
450
400
350
300
250
200
150
100
50
0
2
4
6
8
10
12
14
Time (sec)

Lab Topic4, Significance

```
% Read data from files
y = load('data1.txt');
dataVec=y';
sampFreq=1024;
%% Supply PSD values
% This is the noise psd we will use.
noisePSD = @(f) (f>=100 & f<=300).*(f-100).*(300-f)/10000 + 1;

%% Generate  data realization
a1=10;a2=2;a3=3;
glrt_data = glrtqcsig(dataVec,sampFreq,noisePSD,[a1, a2, a3]);

nSamples = length(dataVec);
timeVec = (0:(nSamples-1))/sampFreq;
```

(a)

```
32 -    val1=0;
33 -    val2=0; % significance=val1/val2
34 -    trialTime =1000;
35 -    for i=1:trialTime
36 -        val2=val2+1;
37 -        h0dataVec = statgaussnoisegen(nSamples,[posFreq(:),psdPosFreq(:)],100,sampFreq);
38 -        glrt_h0 = glrtqcsig(h0dataVec,sampFreq,noisePSD,[a1, a2, a3]);
39 -        if(glrt_h0>glrt_data)
40 -            val1=val1+1;
41 -        end
42 -    end
43
44 -    significance = val1/val2;
45 -    disp(significance);
```

```
命令行窗口
不熟悉 MATLAB?请参阅有关快速入门的资源。
>> testglrtqcsig
    0.0649

>> testsignificance
>> testsignificance
    0.8140
```

(b)

Lab Topic5

编辑器 - F:\matlab_pro\GWSC22-Team1\LWZ\Lab5\test_crcbqcpso_colpsd.m

test_crcbqcpso_colpsd.m | crcbqcpso_colpsd.m | +

```
28 -    [dataY, sig] = crcbgenqcdata_colpsd(dataX,snr,[a1,a2,a3]);
29 -    noisePSD = @(f) (f>=50 & f<=100).*(f-50).*(100-f)/625+1;
30
31      %figure;
32      %plot(dataX,dataY); hold on;
33      %plot(dataX,sig);
34
35      % Input parameters for CRCBQCHRPPSO
36 -    inParams = struct('dataX', dataX,...
37                        'dataY', dataY,...
38                        'dataXSq',dataX.^2,...
39                        'dataXCb',dataX.^3,...
40                        'psdfun', noisePSD,...
41                        'rmin',rmin,...
42                        'rmax',rmax);
43      % CRCBQCHRPPSO runs PSO on the CRCBQCHRPFIIFUNC fitness function. As an
44      % illustration of usage, we change one of the PSO parameters from its
```

编辑器 - F:\matlab_pro\GWSC22-Team1\LWZ\Lab5\crcbqcpso_colpsd.m

test_crcbqcpso_colpsd.m | crcbqcpso_colpsd.m | +

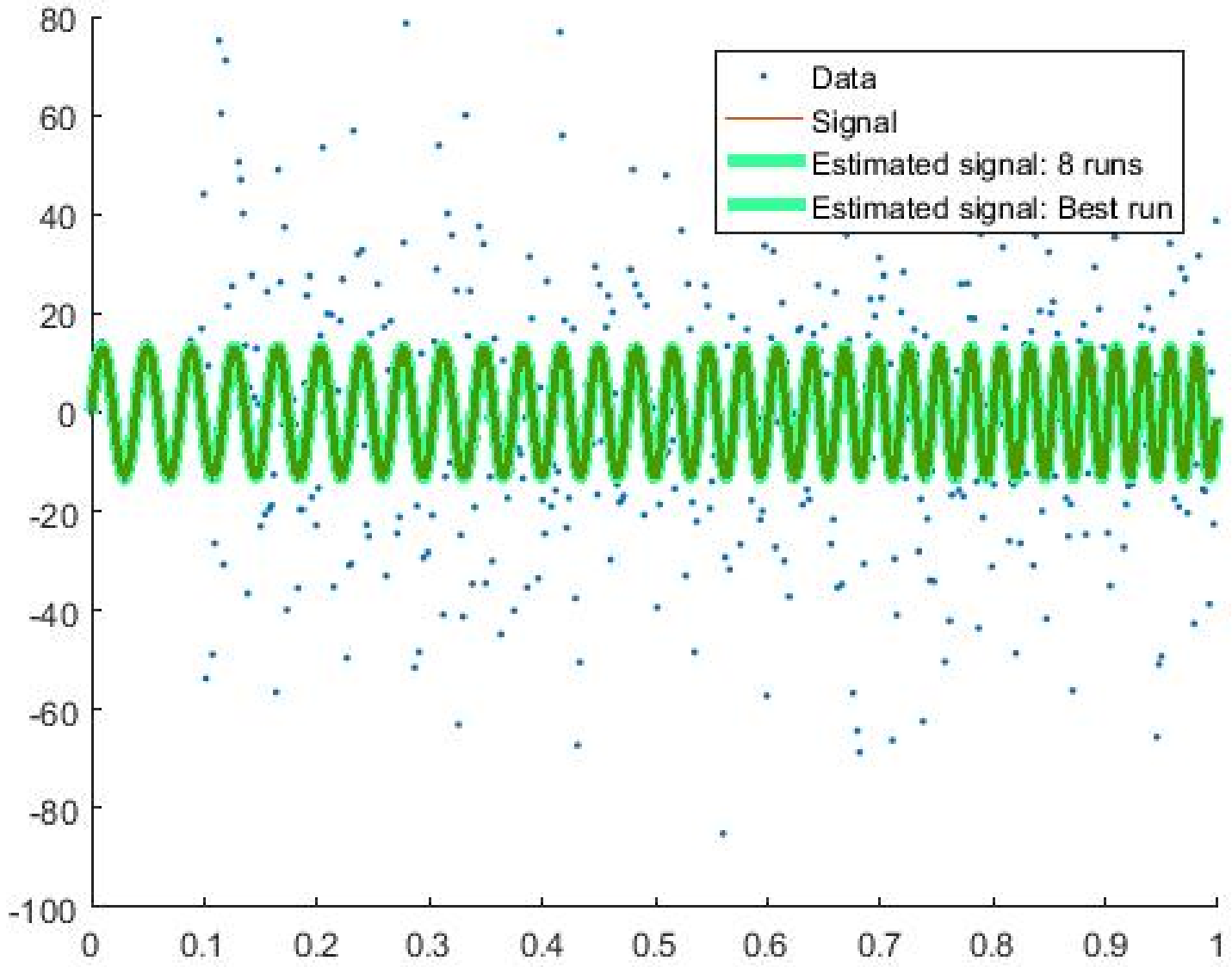
```
        %estSig = crcbgenqcsig(inParams.dataX,1,qcCoefs);
        %estAmp = inParams.dataY*estSig(:);
        %estSig = estAmp*estSig;

-       nSamples = length(inParams.dataX);
-       sampTime = inParams.dataX(end)-inParams.dataX(1);
-       sampFreq = floor(nSamples/sampTime);
-       dataLen = nSamples/sampFreq;
-       kNyq = floor(nSamples/2)+1;
-       posFreq = (0:(kNyq-1))*(1/dataLen);
-       psdPosFreq = inParams.psdfun(posFreq);

-       estSig = crcbgenqcsig_colpsd(inParams.dataX,qcCoefs);
-       [estSig,~] = normsig4psd(estSig,sampFreq,psdPosFreq,1);
-       estAmp = innerprodpsd(inParams.dataY,estSig,sampFreq,psdPosFreq);
-       estSig = estAmp*estSig;
```

```
% Signal to noise ratio of the true signal
snr = 10;
% Phase coefficients parameters of the true signal
a1 = 25;
a2 = 3;
a3 = 4;

% Search range of phase coefficients
rmin = [1, 1, 1];
rmax = [180, 10, 10];
```

行窗口

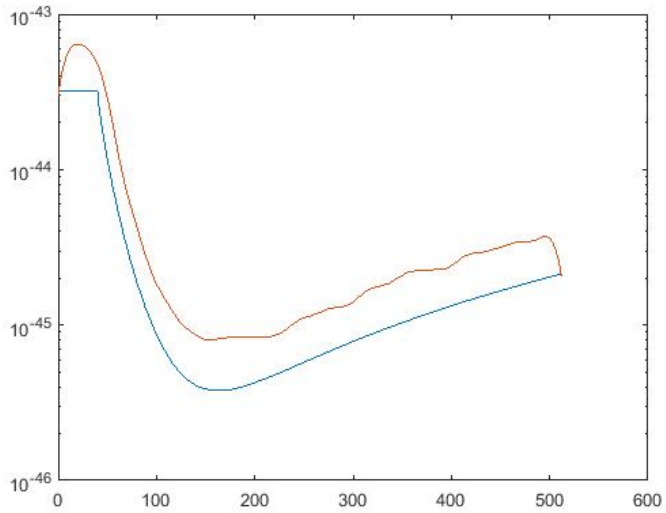
悉 MATLAB?请参阅有关快速入门的资源。

```
>> testsignificance
    0.8140

>> test_crcbqcpso_colpsd
Starting parallel pool (parpool) using the 'local' profile ... connected to 2 workers.
Estimated parameters: a1=25.2014; a2=2.419; a3=4.4485
>>
```

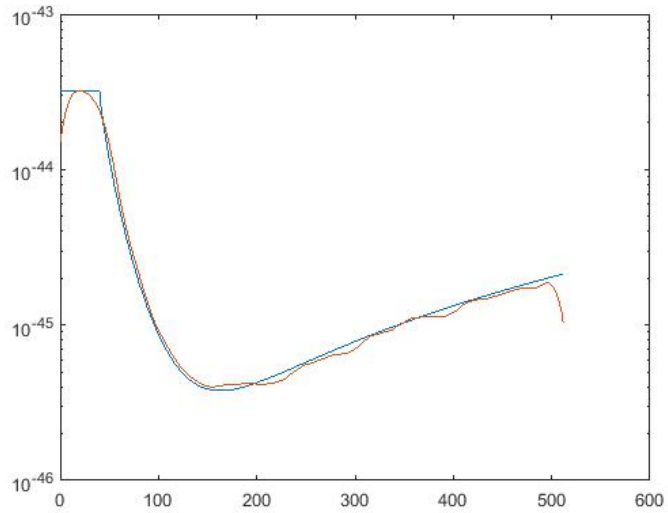

Data
Signal
Estimated signal: 8 runs
Estimated signal: Best run
80
60
40
20
0
-20
-40
-60
-80
-100
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1

Issue on lab6

PSD calculated by pwelch should be devieded by 2 to keep the SNR unshifted



(a)



(b)