

Calculate LR for Quadratic chirp signal

We will calculate the Likelihood ratio (LR) after maximization over amplitude for a quadratic chirp in noise with a given Power Spectral Density (PSD).

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We will reuse codes that have already been written. Path to folder containing signal and noise generation codes.

```
addpath ../../TOPIC1/CODES/  
addpath ../../TOPIC3/CODES/
```

Parameters for data realization

Number of samples and sampling frequency.

```
nSamples = 2048;  
sampFreq = 1024;  
timeVec = (0:(nSamples-1))/sampFreq;
```

Supply PSD values

This is the noise psd we will use.

```
noisePSD = @(f) (f>=100 & f<=300).*(f-100).*(300-f)/10000 + 1;  
dataLen = nSamples/sampFreq;  
kNyq = floor(nSamples/2)+1;  
posFreq = (0:(kNyq-1))*(1/dataLen);  
psdPosFreq = noisePSD(posFreq);
```

Generate data realization

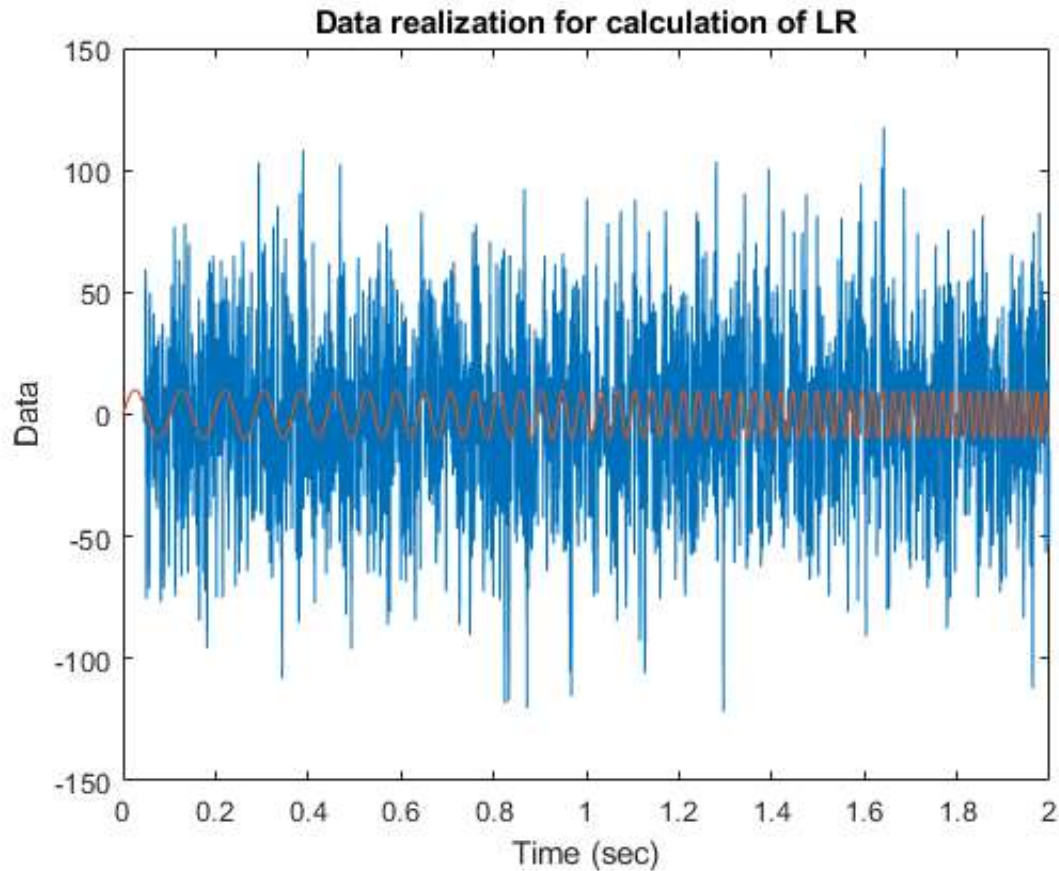
Noise + SNR=10 signal. **Note:** The signal in the data realization has parameters that are different from the ones at which the LR is evaluated below.

```
noiseVec = statgaussnoisegen(nSamples,[posFreq(:),psdPosFreq(:)],100,sampFreq);  
sig4data = crcbgenqcsig(timeVec,1,[9.5,2.8,3.2]);  
% Signal normalized to SNR=10  
[sig4data,~]=normsig4psd(sig4data,sampFreq,psdPosFreq,10);  
dataVec = noiseVec+sig4data;  
figure;
```

```

plot(timeVec,dataVec);
hold on;
plot(timeVec,sig4data);
xlabel('Time (sec)')
ylabel('Data');
title('Data realization for calculation of LR');

```



Template for LR

We will obtain the LR (after amplitude maximization) for the given data realization at the following parameter values.

```

a1=10;
a2=3;
a3=3;
A = 1;

```

Generate the template vector for the above parameters.

```

sigVec = crcbgenqcsig(timeVec,1,[a1,a2,a3]);
%We do not need the normalization factor, just the signal normalized to
%have snr=1 (i.e., the template vector)
[templateVec,~] = normsig4psd(sigVec,sampFreq,psdPosFreq,1);

```

Calculate LR

```
llr = innerprodpsd(dataVec,templateVec,sampFreq,psdPosFreq);  
llr = llr^2;  
disp(llr);
```

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