ExerciseOneDCM: Introduction

Two samples of simulated data are given in home-page files

ExerciseFailWhitenData1.dat
ExerciseFailWhitenData2.dat

The model

$$s(t) = s_1(t) + s_2(t) \tag{1}$$

used in creating these simulated data is the sum of two sinusoids

$$s_1(t) = a_1 \sin(2\pi f_1 t) \tag{2}$$
$$s_2(t) = a_2 \sin(2\pi f_2 t). \tag{3}$$

The amplitudes are $a_1 = a_2 = 0.05$. The frequencies are fixed to $f_1 = P_1^{-1}$ and $f_2 = P_2^{-1}$, where the periods are $P_1 = 2.39$ and $P_2 = 2.41$.

In exercise **ExerciseFailWhiten**, the pre-whitening DFT technique model solution program **ExercisePreWhiten.py** is applied to the above two simulated data samples. The control file **dft.dat** input values are $K_1 = 1$, $K_3 = 0$, $P_{\min} = 2$ and $P_{\max} = 3$. This DFT analysis **fails** for the first sample **ExerciseFailWhiten1.dat**, because the P_1 and P_2 periods **are not detected**. However, the same DFT analysis **succeeds** for the second sample **ExerciseFailWhiten2.dat**, because the P_1 and P_2 periods **are detected**. This raises a very interesting question about the Discrete Chi-Square Method (DCM):

Can DCM detect periods $P_1 = 2.39$ and $P_2 = 2.41$ from both samples?

ExerciseOneDCM: Problem

Get
ExerciseFailWhitenData1.dat
ExerciseFailWhitenData2.dat
files from the course home-page. Perform DCM analysis using **dcm.py**.

Give the following names to your control files
OneDCM1.dat for **ExerciseFailWhiten1.dat**. Use **Tag=OneDCM1**
OneDCM2.dat for **ExerciseFailWhiten2.dat**. Use **Tag=OneDCM2**

Perform the two analyses by using only these two commands
cp OneDCM1.dat dcm.dat
python dcm.py
and
cp OneDCM2.dat dcm.dat
python dcm.py

Send your control files (**OneDCM1.dat** and **OneDCM2.dat**), and periodogram files (**OneDCM1z.eps** and **OneDCM2z.eps**) to the assistant. Answer to these three questions in your e-mail to the assistant.

1. Does DCM detect the correct P_1 and P_2 periods values from both files? Yes or No?
2. Give your P_1 and P_2 results for **ExerciseFailWhiten1.dat**. Use an accuracy of two decimals.
3. Give your P_1 and P_2 results for **ExerciseFailWhiten2.dat**. Use an accuracy of two decimals.

Tip: DCM periodograms should resemble those in Figures 1 and 2.

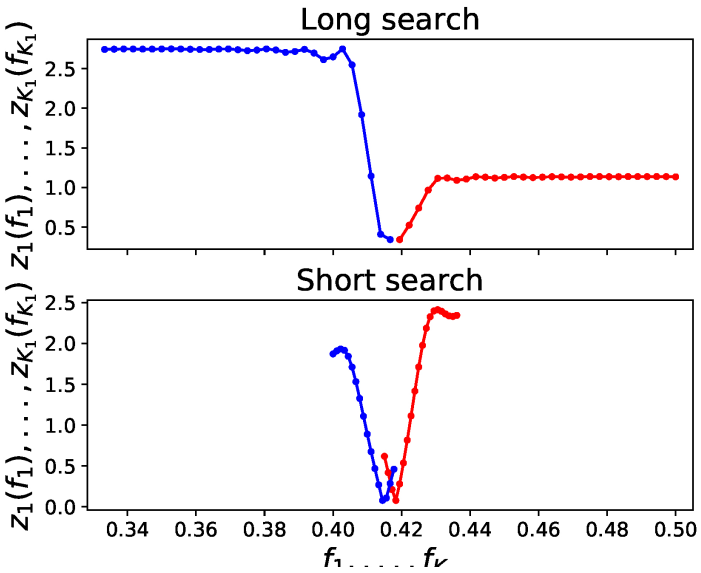

Figure 1: **ExerciseFailWhiten1.dat** periodograms.

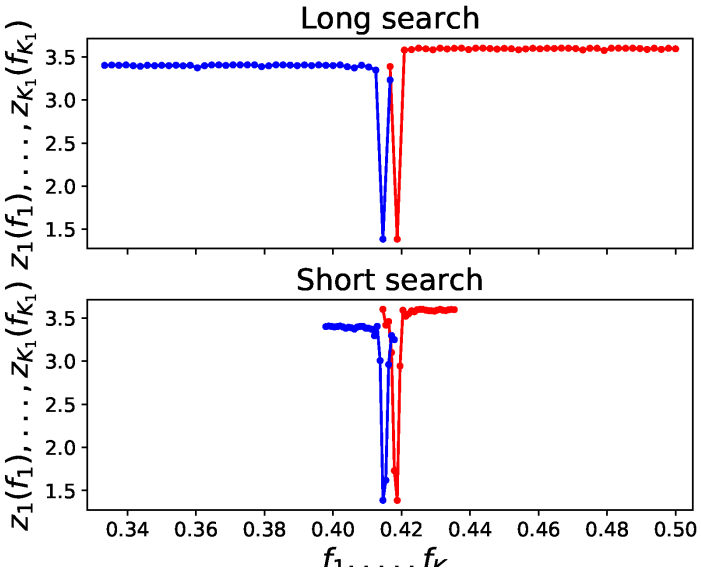

Figure 2: **ExerciseFailWhiten2.dat** periodograms.