ExerciseTag

Before you begin !!!

- Copy **cp dcm.dat origdcm.dat**
In this way, you can always
- Copy **cp origdcm.dat dcm.dat**
back to its original form after this exercise. If you lose the original version of **dcm.dat**, just download it again from the home-page after this exercise.

Introduction

Control file **dcm.dat line 1** gives parameter **Tag**. Here are some examples of how to use this parameter **Tag**. Try to repeat these **Analysis111.dat** and **Analysis212.dat** procedures in your own directory **/DCMtest**.

Analysis111.dat

- Copy **cp dcm.dat Analysis111.dat**
- Edit file **emacs Analysis111.dat** to the form, where the seven first lines are

```
1  = Tag          = Analysis111
2  = RealData     = 1
3  = file1        = TestData.dat
4  = dummy        = -99.999
5  = K1           = 1
6  = K2           = 1
7  = K3           = 1
...
```

- Copy **cp Analysis111.dat dcm.dat**
- Run **python dcm.py**
- DCM analyses real data (**RealData=1**) from file **file1=TestData.dat**. The orders of $g(t)$ model are $K_1 =$ **K1 = 1**, $K_2 =$ **K2 = 1** and $K_3 =$ **K3 = 1**. Note that **Tag=Analysis111** is used to refer to model orders $K_1 = 1$, $K_2 = 1$ and $K_3 = 1$ that were used in this DCM analysis. In this way, the output file names can be used later to infer, what was done in this particular case.
- Output figures are
Analysis111z.eps = Periodogram

Analysis111gdet.eps = Model shown in **Figure 1**
- Output files are
Analysis111Params.dat = Analysis results
Analysis111Residuals.dat = Residuals file
Analysis111Model.dat = Model file
Analysis111AllBeta.dat = Free parameter file

The following information is printed on the screen

```
                                    n               500
                                   T1 1.9547820000e-03
                                   DT 3.9958894740e+00
                                   my -1.2567031722e+00
                                   sy 2.2066570834e+00
                                sigma 2.6888315618e-02
                                   K1                 1
                                   K2                 1
                                   K3                 1
                                    p                 5
                                 PMIN 1.0000000000e+00
                                 PMAX 2.0000000000e+00
                                   nL                60
                                   nS                30
        CHI2 3.4958696831e+06   gives ZMIN 8.3616621351e+01
           R 1.1643992049e+02   gives ZMIN 4.8257625405e-01
  ..........................................................
                  F1 8.7692272400e-01 +/- 9.6022270000e-03
                  P1 1.1403513361e+00 +/- 1.2715225179e-02
                  A1 1.9093439624e+00 +/- 4.1984988818e-02     SN      71.01
              T1MIN1 3.3379702082e-01 +/- 3.0471197063e-02
              T1MIN2              ... +/-              ...
              T1MAX1 9.0397268888e-01 +/- 2.4113584473e-02
              T1MAX2              ... +/-              ...
..........................................................
                   i             BETA[i]
                   1         F1  8.76923e-01 9.60223e-03
                   2        B11  2.42276e-01 1.65628e-01
                   3        C11 -9.23419e-01 4.54670e-02
                   4         M0  2.34464e+00 1.55737e-02
                   5         M1 -3.52472e+00 2.25005e-02
```

Same information is also stored into file **Analysis111Params.dat**. Best one signal model has period $P_1 = 1.14 \pm 0.01 =$ **P1** and peak to peak amplitude $A_1 = 1.91 \pm 0.04 =$ **A1**. Chi-square is $\chi^2 = 3.50 \times 10^6 =$ **CHI2**.

Analysis212.dat

- Copy **cp Analysis111.dat Analysis212.dat**

- Edit **emacs Analysis212.dat** to the form, where the seven first lines are

```
1  = Tag         = Analysis212
2  = RealData    = 1
3  = file1       = TestData.dat
4  = dummy       = -99.999
5  = K1          = 2
6  = K2          = 1
7  = K3          = 2
```

- Copy **cp Analysis212.dat dcm.dat**
- Run **python dcm.py**
- Again, DCM analyses real data (**RealData=1**) from **file1=TestData.dat**. The orders of $g(t)$ model are $K_1 =$ **K1 = 2**, $K_2 =$ **K2 = 1** and $K_3 =$ **K3 = 2**. Here, **Tag=Analysis212** refers to model orders $K_1 = 2$, $K_2 = 1$ and $K_3 = 2$ used in this DCM analysis. Again, you can no infer later, what was done in this particular case.
- Output figures are

Analysis212z.eps = Periodogram shown in **Figure 2**. Note that the short search blue periodogram $z_2(f_2)$ goes "out of view". This graphical bug was corrected in the next **dcm.py** version used in **Paper II** and **Paper III**.
Analysis212gdet.eps = Model shown in **Figure 3**
Analysis212fA.eps = Frequency and amplitude correlation shown in **Figure 4**. Note that this figure was not created in one signal analysis of **Analysis111.dat**, because there were no frequencies or amplitudes to compare.
- Output files are

Analysis212Params.dat = Analysis results
Analysis212Residuals.dat = Residuals file
Analysis212Model.dat = Model file
Analysis212AllBeta.dat = Free parameter file

The following information is printed on the screen

```
     n              500
    T1 1.9547820000e-03
    DT 3.9958894740e+00
    my -1.2567031722e+00
    sy 2.2066570834e+00
 sigma 2.6888315618e-02
    K1                2
    K2                1
    K3                2
     p                9
  PMIN 1.0000000000e+00
  PMAX 2.0000000000e+00
    nL               60
```

```
                                   nS                30
        CHI2 6.9449706625e+04   gives ZMIN 1.1785559522e+01
           R 4.7862226187e+00   gives ZMIN 9.7838873856e-02
  ....................................................
                  F1 8.5373650900e-01 +/- 1.0361695000e-03
                  P1 1.1713215840e+00 +/- 1.4218095182e-03
                  A1 1.3892117343e+00 +/- 1.6516398671e-02     SN      51.67
              T1MIN1 2.7018742473e-01 +/- 2.6036192667e-03
              T1MIN2                ... +/-               ...
              T1MAX1 8.5584821670e-01 +/- 1.8927145076e-03
              T1MAX2                ... +/-               ...
  ....................................................
                  F2 4.1936974100e-01 +/- 5.6842880000e-03
                  P2 2.3845306474e+00 +/- 3.2090755730e-02
                  A2 8.1687164389e-01 +/- 3.0742626177e-03     SN      30.38
              T2MIN1 9.0182415953e-02 +/- 2.4983447435e-02
              T2MIN2                ... +/-               ...
              T2MAX1 1.2824477396e+00 +/- 8.9380695695e-03
              T2MAX2                ... +/-               ...
....................................................
                   i              BETA[i]
                   1         F1  8.53737e-01 1.03617e-03
                   2         F2  4.19370e-01 5.68429e-03
                   3        B11 -9.16438e-02 1.06766e-02
                   4        C11 -6.88534e-01 6.87577e-03
                   5        B21 -3.97702e-01 7.83852e-03
                   6        C21 -9.30293e-02 2.70665e-02
                   7         M0  1.66419e+00 2.22487e-02
                   8         M1 -1.43955e+00 4.00126e-02
                   9         M2 -1.12540e+00 1.31680e-02
```

Same information is also stored into file **Analysis212Params.dat**. Best two signal model has periods $P_1 = 1.171 \pm 0.001 =$ **P1** and $P_2 = 2.38 \pm 0.03 =$ **P2**. Peak to peak amplitudes are $A_1 = 1.39 \pm 0.02 =$ **A1** and $A_2 = 0.817 \pm 0.003 =$ **A2**. Chi-square is $\chi^2 = 6.94 \times 10^4 =$ **CHI2**.

ExerciseTag: Problem

- **Before you begin!!!**
- Copy **cp dcm.dat origdcm.dat**.
In this way, you can always
copy **cp origdcm.dat dcm.dat**
back to its original form after this exercise.
- Copy **cp dcm.dat Analysis211.dat**
- Edit **only some of the seven first lines** of **Analysis211.dat** to perform DCM analysis of **TestData.dat**, where $g(t)$ model orders are $K_1 = 2$, $K_2 = 1$ and $K_3 = 1$.
- Select your **Tag** using the same logic as in the above two examples **Analysis111.dat** and **Analysis212.dat**.
- **Note**: Your **python dcm.py** analysis takes a few minutes, because two signal DCM analysis of **Rounds=20** bootstrap samples takes some time. There may sometimes be some **python** error messages that you can ignore.
- Send your file **Analysis211.dat** and the following parameter values
$P_1 =$ **P1**
$P_2 =$ **P2**
$A_1 =$ **A1**
$A_2 =$ **A2**
$\chi^2 =$ **CHI2**
to the assistant. Use two decimal accuracy. Do not send your period and amplitude error estimates, because these errors will be different in every case. You do not have to answer why this happens, but it is good to figure out the reason for this.

Bonus point question: Is it possible to check from **Paper I** that your result for χ^2 is correct? Use less than one hundred words in your answer.

Figure 1: **Analysis111gdet.eps**

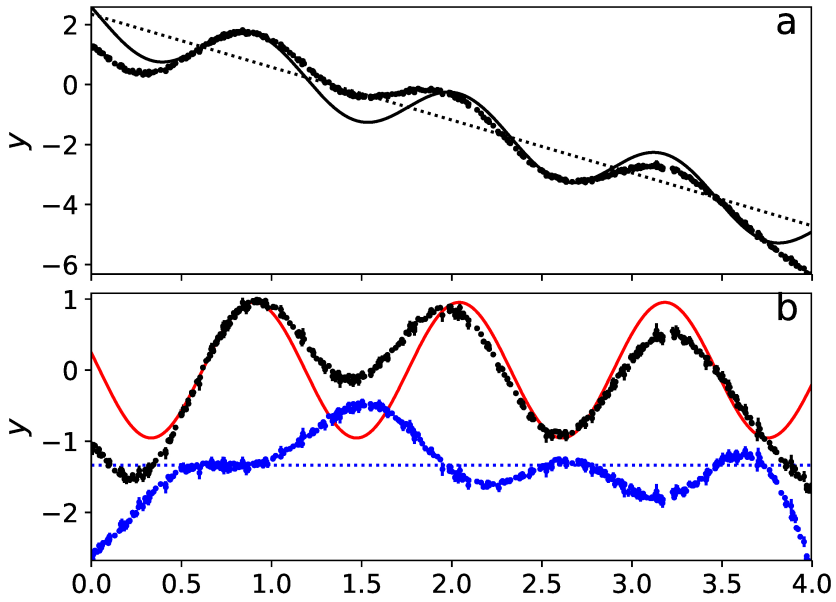


Figure 2: **Analysis212z.eps**

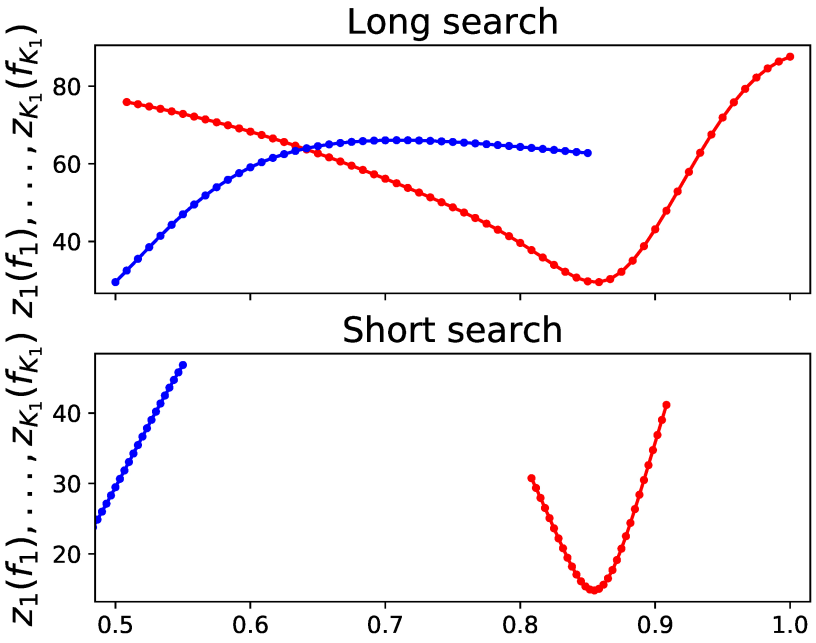


Figure 3: **Analysis212gdet.eps**

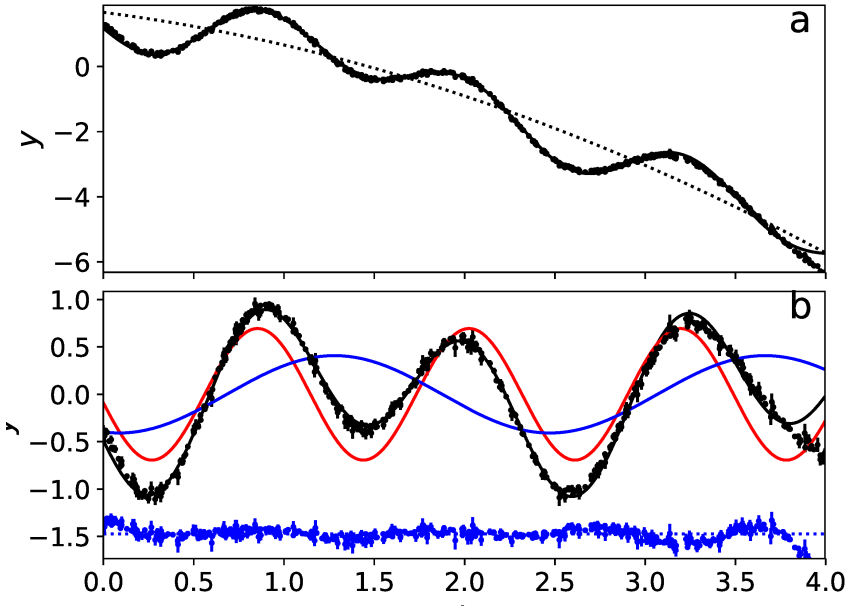


Figure 4: **Analysis212fA.eps**

