Laboratory work 10
Sunspot cycle reconstruction free from any constraints and assumptions

Performance – October 16, 2017
Due to submit a performance report – Wednesday, October 18, 10 p.m.

The objective of this laboratory work is to reconstruct a dynamical process using experimental data on the basis of methods that do not need any prior assumptions about the process. Important outcome of this exercise is getting skill to choose the most effective method in conditions of uncertainty.

This laboratory work is performed in the class by students as in teams of 2-4 on October 16, 2017 and the team will submit one document reporting about the performance till Wednesday, October 18, 10 p.m. Within your group, you may discuss all issues openly, and discuss and debate until you reach a consensus.

Important information
Please read charts for problem formulation
Topic_4_Process reconstruction free from any constraints and assumptions.pdf

***Here is the recommended procedure*:**

1. Download monthly mean sunspot numbers from Canvas.
Sunspot.mat
files/Week_3_October_16_20_2017/Lab10/data for lab/

Format of data:
1 column - year
2 column – month
3 column – monthly sunspot number

2. Apply 13-month running mean to monthly sunspot numbers.
13-month running mean $\bar{R}$

$$\bar{R} = \frac{1}{24}R_{i-6} + \frac{1}{12}(R_{i-5} + R_{i-4} + \cdots + R_{i-1} + R_i + R_{i+1} + \cdots + R_{i+5}) + \frac{1}{24}R_{i+6}$$

Comment:
First six months in the available data are averaged to get the smoothed estimates. The same with last six months of data.

3. Develop 13-month optimal running mean of monthly mean sunspot numbers.
Consult charts, page 25
Please use smoothing coefficient $\beta = 0.01$

4. Plot monthly sunspot numbers, 13-month running mean and 13-month optimal running mean. Make visual analysis of estimation results. Analyze 13-month optimal running mean produce inverse oscillations.

5. Chose better smoothing method by comparing deviation and variability indicators.

Performance report

1. Performance report should contain all the items listed

2. The code should be commented. It should include:
- Title of the laboratory work, for example
% Converting a physical distance to a grid distance using least-square method
- The names of a team, indication of Skoltech, and date, for example,
%Tatiana Podladchikova, Skoltech, 2017
Main procedures also should be commented, for example
%13-month running mean
…here comes the code

3. If your report includes a plot, then it should contain: title, title of x axis, title of y axis, legend of lines on plot.