

Laboratory work 9
Process reconstruction free from any constraints and assumptions

Performance – Friday, April 29, 2016
Due to submit a performance report - Thursday, May 12, 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 on April 29, 2016 and the team will submit one document reporting about the performance till Thursday, May 12, 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

Format of data:

1 column - year

2 column – month

3 column – date in matlab format

to convert to date in a understandable format use matlab command
datestr(data(:,3))

4 column – monthly sunspot number

2. Apply 13-month running mean to monthly sunspot numbers.

13-month running mean \bar{R}

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

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
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, 2016
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.