

FITDATA

USER'S MANUAL

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1 Introduction

Program code and the documentation released under the GNU Public License version 2.

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If you encounter any problems or bugs when using the program or if you have any question or reports and suggestions, please contact the author at [michal.prinosil \(at\) fsv.cvut.cz](mailto:michal.prinosil@fsv.cvut.cz).

1.1 About the program

Program FitData is a simple tool for processing of measured data from experiments (e.g. tensile test, three point bending, etc.). It serves for adjustment the initial idle branch of data (Figure 9) and for smoothing of these data (Figure 13).

This program was created in software MATLAB¹ (version 2010b). For successful start of the program, there are two options. Either you the full of MATLAB installed on your computer, or you have to install MCR compiler (MATLAB Compiler Runtime) for version 2010b or newer².

1.2 Acknowledgment

The author would like to thank his supervisor Petr Kabele for his support and advice during the software development. This work was carried out with financial support of the Czech Ministry of Culture, as part of the project no. DF11P01OVV008.

¹ <http://www.mathworks.com>

² <http://www.mathworks.com/help/toolbox/compiler/f12-999353.html>

2 Program control

2.1 Starting program

How to start this program depends on your software. If you have MATLAB software, open the FitData.m file in it and run it. If you have not MATLAB, you have to install MCR compiler and then you could run the FitData.exe file.

If you successfully start the program, you can see the “Control” window. At the beginning, only “Load data” and “Exit” buttons are available (Figure 1).

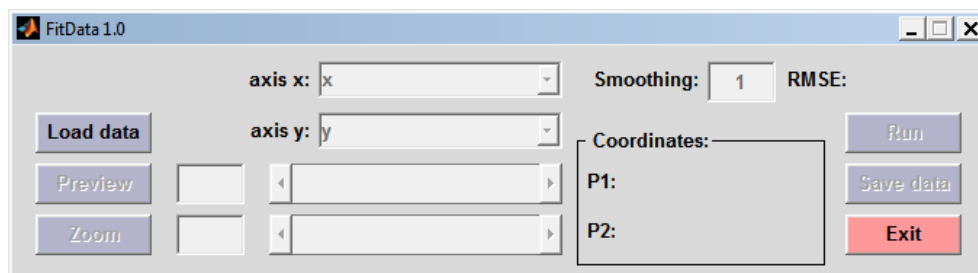


Figure 1: Main menu of the program

2.2 Input data

First of all, you have to load the data into the program. The input file has to be in ASCII format, it could have a header and the data should be separated in columns with “,” (comma) or space and decimal point must be represented by “.” (dot). For loading press “Load data” button (Figure 3) and through the new window (Figure 4) choose the file with input data.

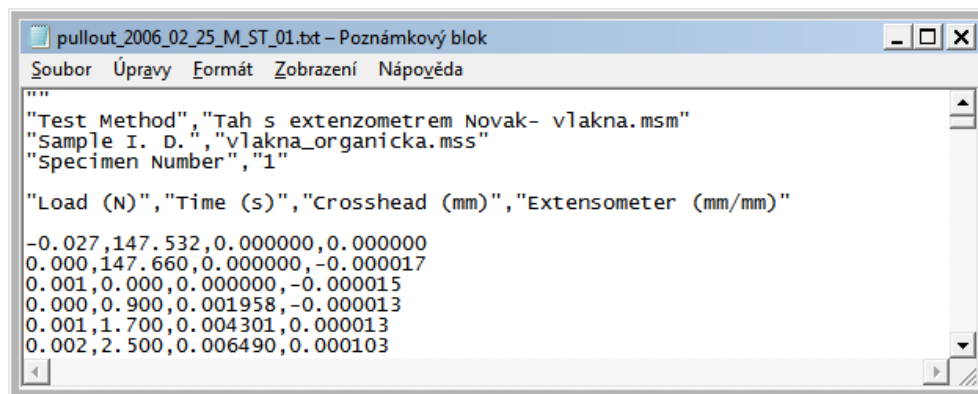


Figure 2: Input file (with a header)

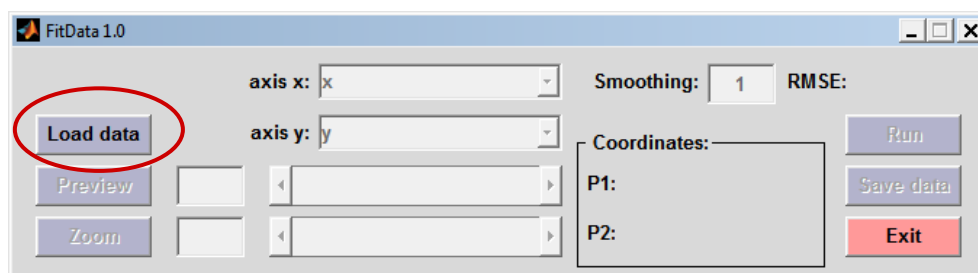


Figure 3: Input data

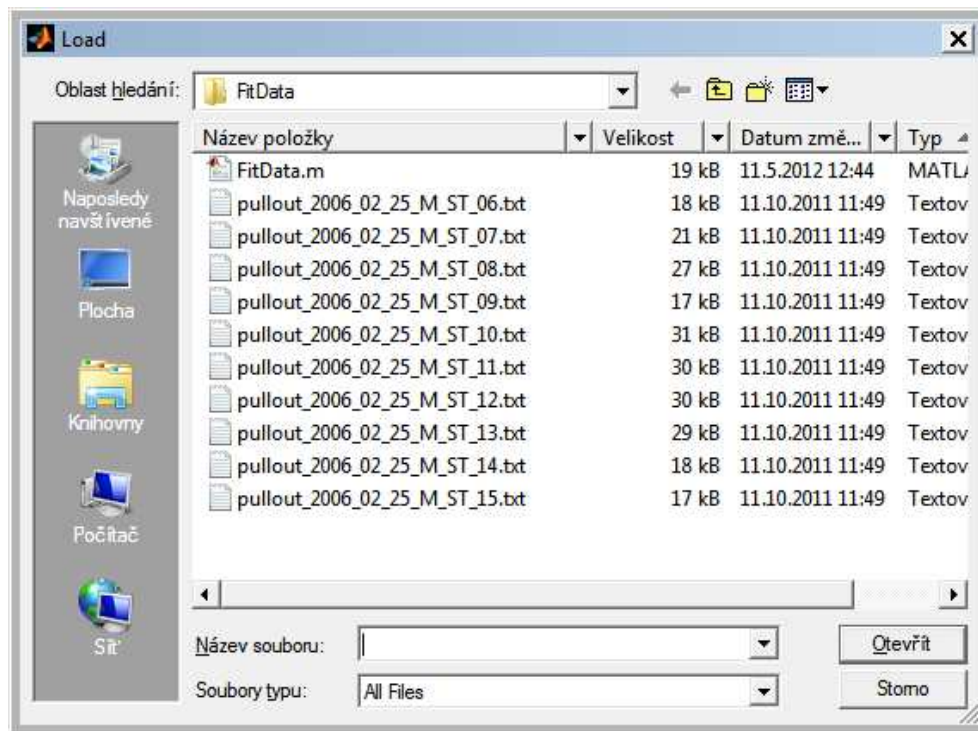


Figure 4: Choosing the input file

2.3 Data selection

After loading the data, popup menus for choosing columns of data and button “Run” for starting calculation are unlocked (Figure 5).

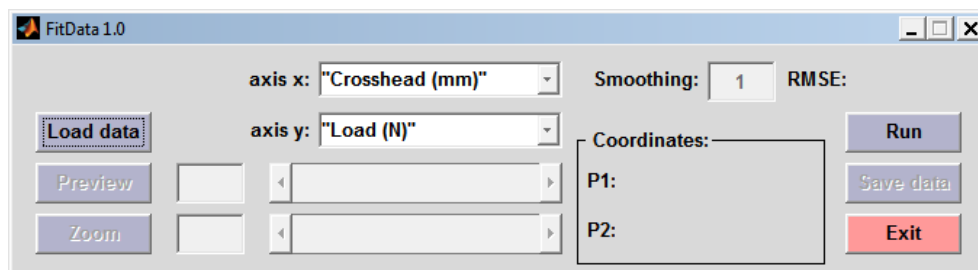


Figure 5: Main menu after loading data - file with a header

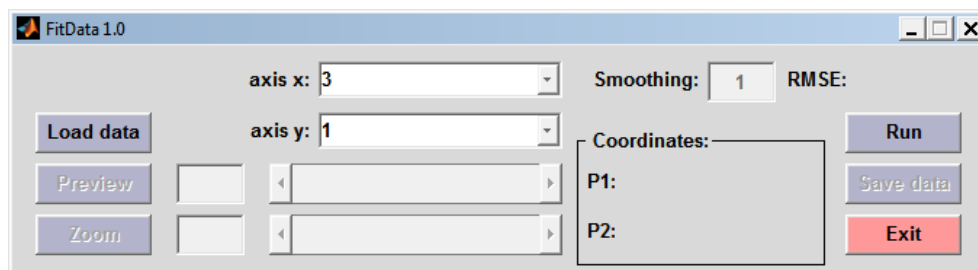


Figure 6: Main menu after loading data - file without a header

Then you have to choose the columns which represent data for *axis x* and for *axis y*. If the input file has a header, the data from header will appear in popup menus for selection of columns (Figure 5). Whether the file has not a header, in popup menus will appear numbers of columns (Figure 6). If you change any of these values (columns), the program itself plot the

results in new window “Graph” (Figure 7). If you agree with original selection, then you have to press the “Run” button. After that you have all controls available.

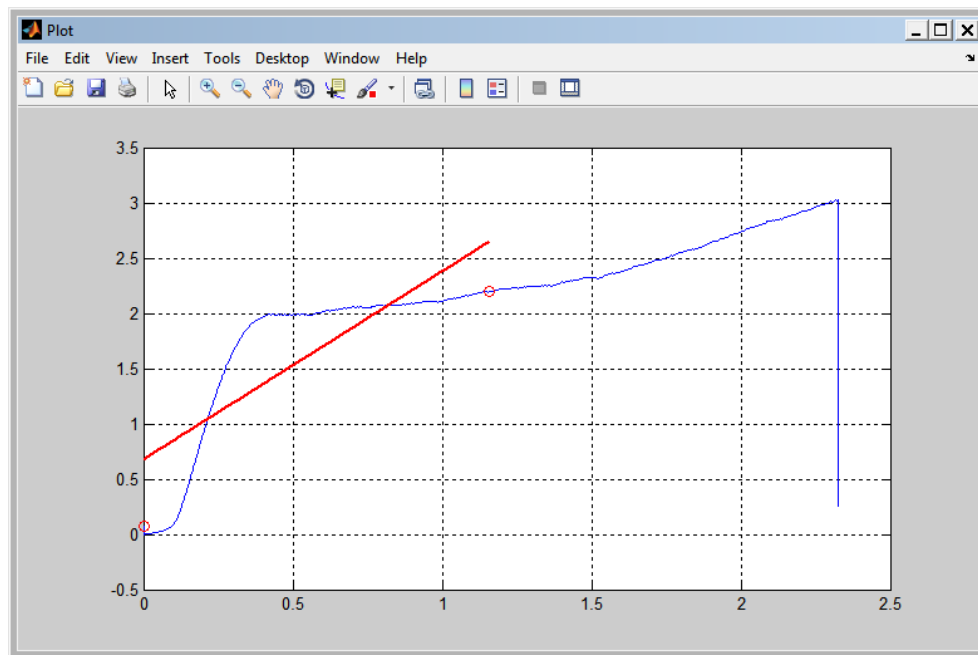


Figure 7: Graph window

2.4 Program control

In the “Plot” window you can see the blue curve representing the data (selected columns). On this line you can see two red circles which represent boundaries between that the interpolation is performed. The red line represents linear regression using least square method between these points. “Root mean square error” (RMSE) is calculated from differences between value of the original line and the regression curve between circles (see 2.7) and is shown on the right side of the main menu.

You can change position of circles on the blue line by using slide bars or edit texts. Slide bars could be changed by using the drag and drop method or by using the arrows. In the edit texts, the numbers of points are written, which represent locations of circles. You can rewrite these numbers and the appropriate circle immediately changes its position due to your choice.

If you want to see the result (graph with modified initial branch), press the “Preview” button (Figure 8). Final graph (red curve) shows in "Plot" window (Figure 9).

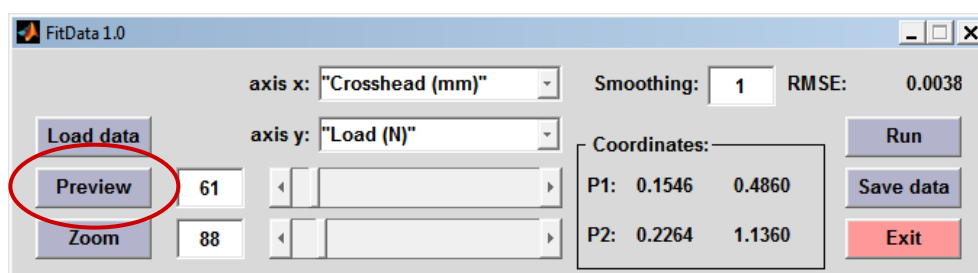


Figure 8: Main menu - all controls available

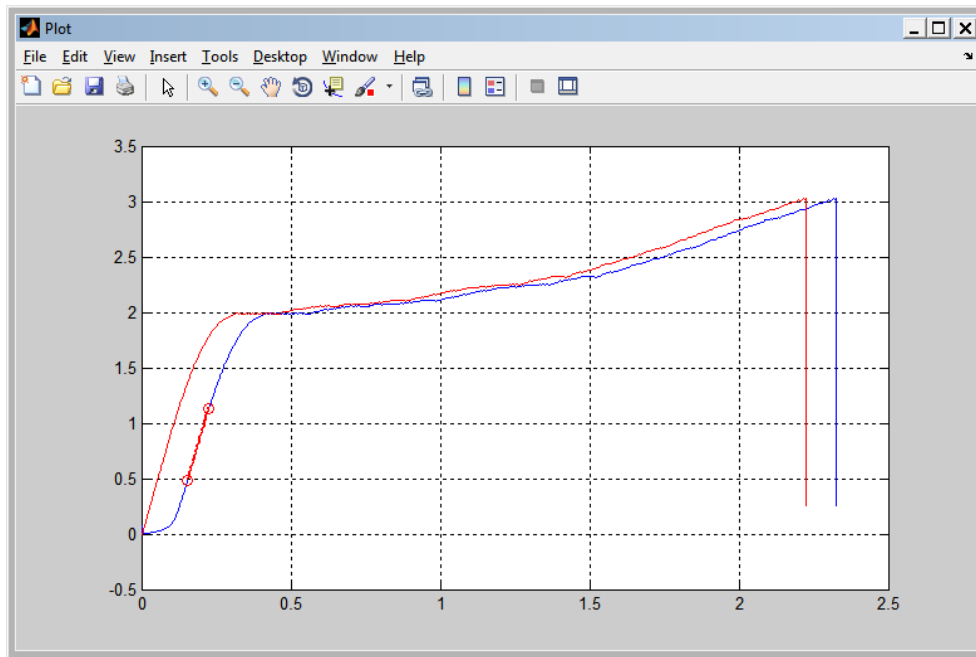


Figure 9: Graph window - preview of the results

For a better fitting, you can look on the area within the points by pressing the “Zoom” button (Figure 10).

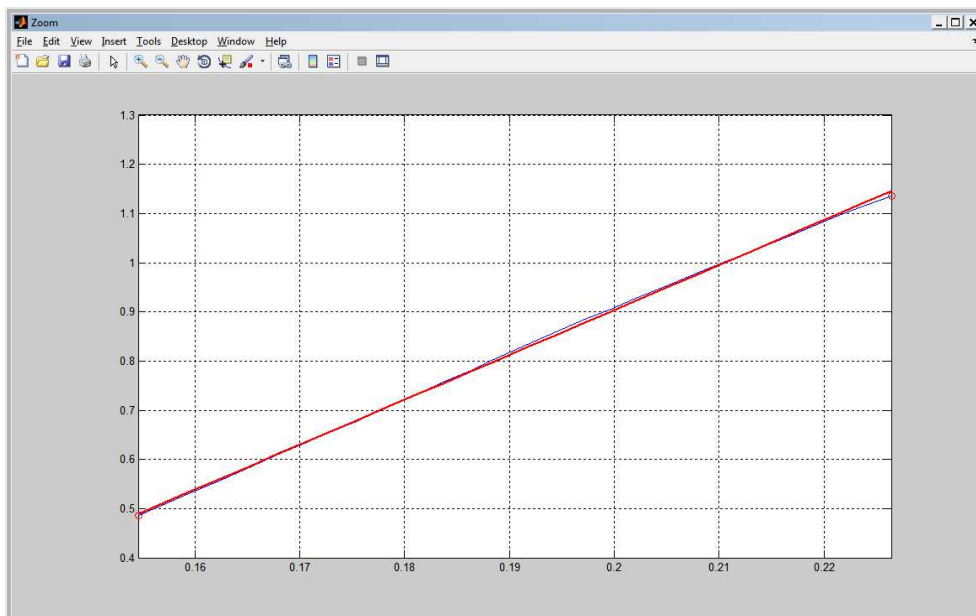


Figure 10: Zoom window

2.5 Export data

If you are satisfied with the final curve, you can save the result to a file. This is simply done by pressing the “Save” button. The data (points of the final curve) are saved into the text file.

2.6 Smoothing

If you have a graph oscillating around the mean value (Figure 11), you can use this function for smoothing your data. You should write the number of points used for smoothing in edit text (Figure 12). If you do not use this function, let the value equal to 1. After you have written the number, you can see the original and the smoothed curve (Figure 13) and then you can work with modified data (Figure 14).

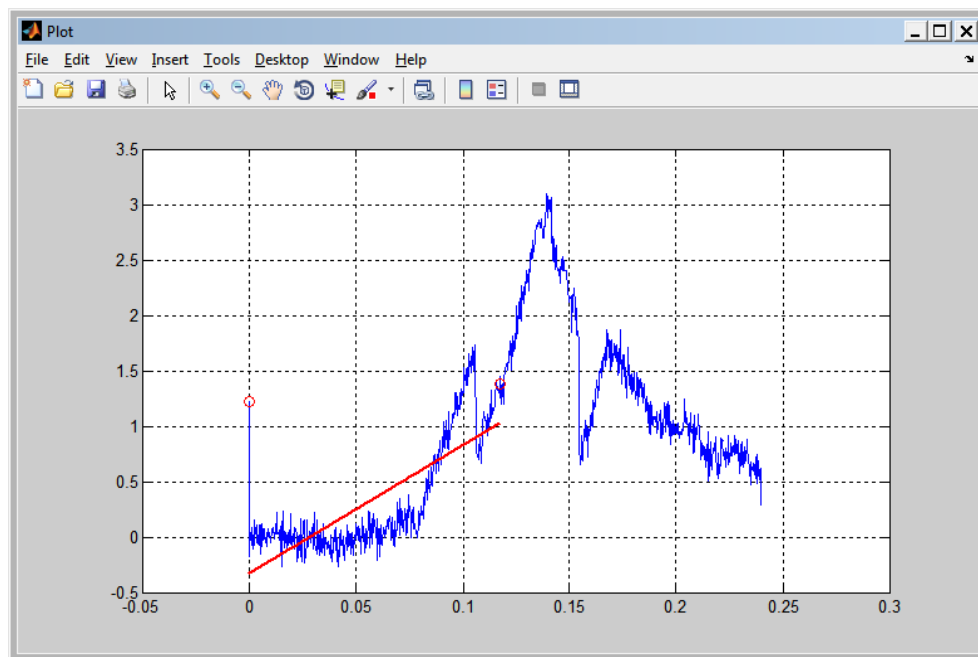


Figure 11: Original unsmooth graph

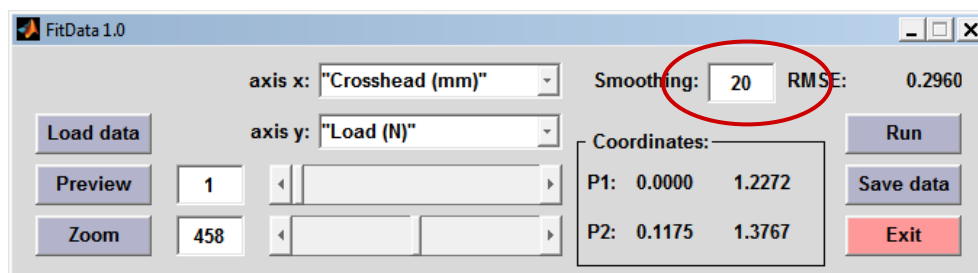


Figure 12: Main menu - smoothing

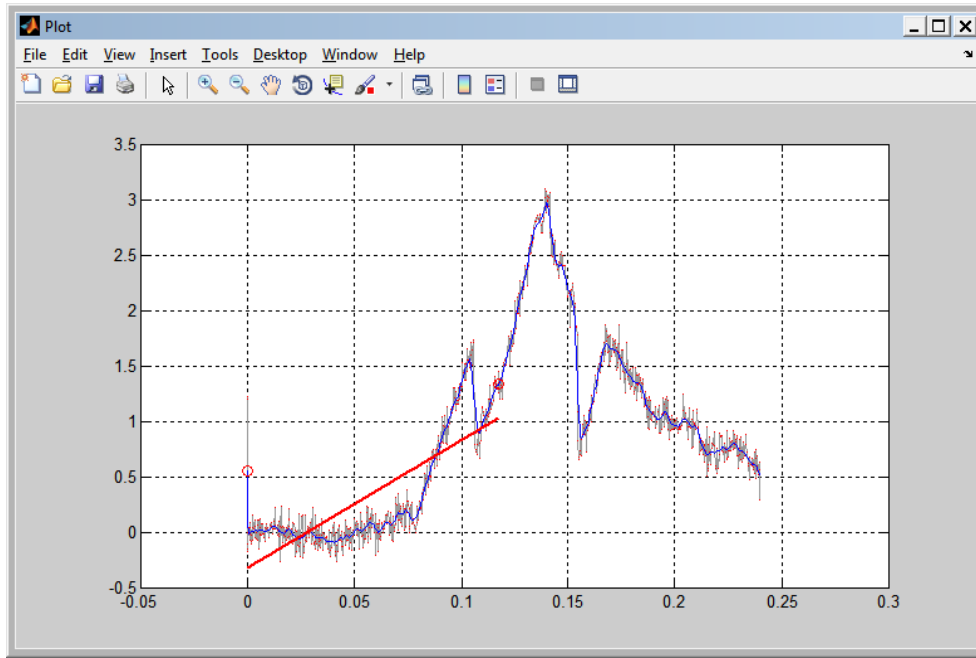


Figure 13: The original and the smoothed data

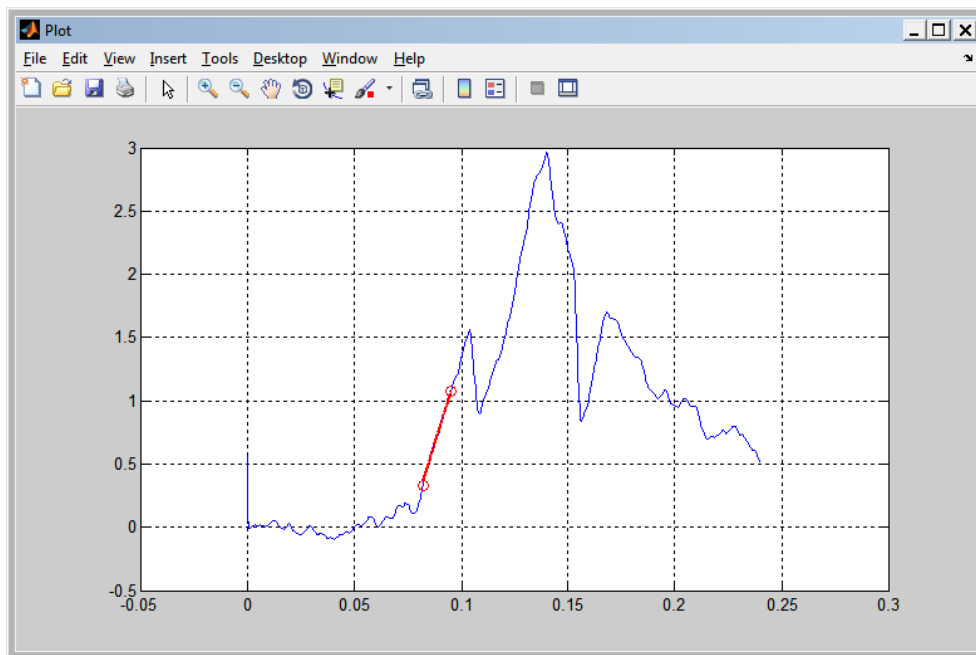


Figure 14: Smoothed data - the final state

2.7 Calculation of the error

This function indicates which fit corresponds to original data. In this program the "Root Mean Squared Error" (*RMSE*) is calculated:

$$RMSE = \sqrt{MSE}$$

where *MSE* is the mean square error (residual mean square).

$$MSE = \frac{SSE}{v}$$

SSE is sum of squares due to error (summed square of residuals) and *v* is calculated as:

$$\nu = n - m$$

where n is the number of data points and m is the number of fitted coefficients.

The value of SSE corresponds to the total deviation of the original data from the fit to the original data:

$$SSE = \sum (y_i - \hat{y}_i)^2$$

where y_i are values of the original data and \hat{y}_i are values of fit to the original data.

Value of RMSE closer to zero indicates a better fit.