

Exercise 9: Adjustment Calculation - part IV

- Non-linear adjustment problem -

Group:	Surname, First name:	Matriculation number:	Signature*:
* With my signature I declare that I was involved in the elaboration of this homework.			
Submission until: 12.01.2025			

Objective

This exercise deals with the adjustment of the parameters of an appropriate functional model which is represented by a time series as depicted in Figure 1.

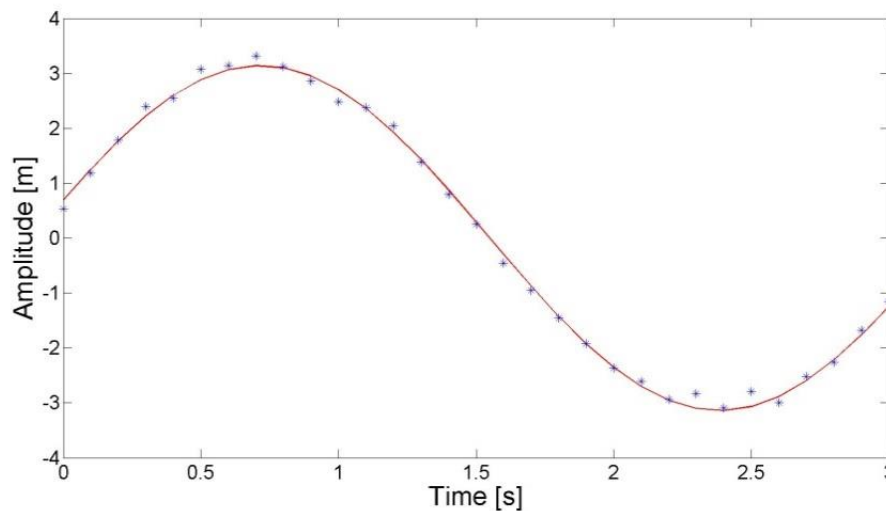


Figure 1: Given time series and adjusted sin curve

Task 1:

The time series depicted in Figure 1 is given in the file "*Exercise9Task1.txt*". The $y(t)$ values are measurements and the time t is regarded as error free. The objective of this task is the determination of the unknown parameters of the chosen functional model via least-squares adjustment applying matrix notation. The measurements are uncorrelated and were obtained with a standard deviation of $\sigma_{y_i} = 0.15$ m.

- Set up an appropriate functional model as well as the observation equations.
- Set up the stochastic model.
- Choose appropriate values for the break-off conditions ϵ and δ and justify your decision.
- Solve the normal equation system and determine the adjusted parameters as well as their standard deviations.
 - Plot the time series and the resulting adjusted function.
- Calculate the residuals as well as their standard deviations.
 - Plot the residuals in an appropriate way and decide if the measurements contain blunders.
 - Justify your decision.
- Calculate the adjusted observations as well as their standard deviations.

Task 2 (Homework):

In the file "*Exercise9Task2.txt*" is given a series of measurements, where the first column represents the x values and the second column the $y(x)$ values. The $y(x)$ values were observed with the same standard deviation and are uncorrelated. The x values are regarded as error free.

- Plot the x and $y(x)$ values.
- Setup a functional model that describes the behavior of the measurements.
- Which parameters are observations, error-free or unknown parameters?
- Why it is a non-linear adjustment problem? Please give a short explanation.
- Determine the unknown parameters via least-squares adjustment.
- Plot the residuals and evaluate the adjustment results.