

Exercise 2: Time Series Analysis – Part II

- Cross correlation function -

Group:	Surname, Given Name:	Matriculation number:	Signature*:
* With my signature I declare that I was involved in the elaboration of this exercise.			
Deadline: 27.11.2025			

Test Certificate

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Objective

This exercise deals with time series analysis in the time-domain, where the cross correlation between different time series will be calculated in order to determine the influence of a time series onto another one.

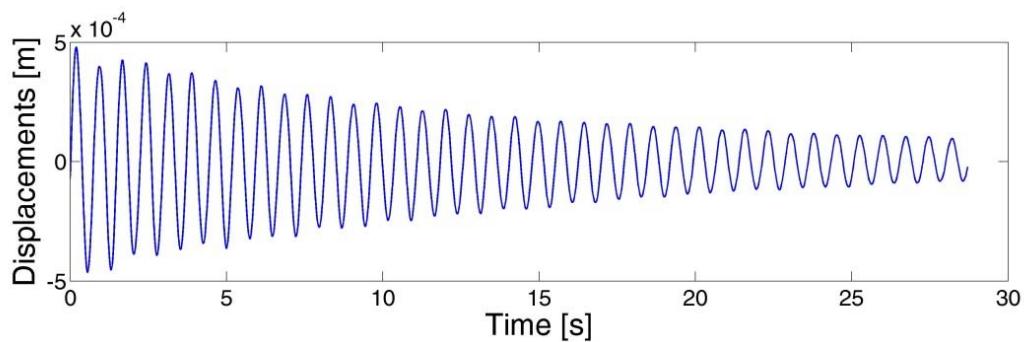


Figure 1: IBIS-S measurements

Task 1: Cross Correlation Function

- Load the two time series given in “*exercise2-1.txt*”, where the first column represents the time axis and the others two columns the $y_1(t)$ and $y_2(t)$ values
- Plot the two time series in one figure
- Write or find an Octave/MatLab function for calculating the cross correlation between two time series
- Plot the cross correlation function and interpret the results

Task 2:

- Load the two time series given in “*exercise2-2.txt*”, where the first column represents the time axis and the others two columns the $y_1(t)$ and $y_2(t)$ values
- Plot the two time series in one figure
- Calculate the cross correlation between these two time series
- Plot the cross correlation function and interpret the results

Task 3:

- During a deformation monitoring the temperature and inclination of one point along a bridge were measured at the same time every 5 minutes. The measurements are given in the files “*temperature.txt*” and “*inclination.txt*”
- Plot both time series in one figure
- Calculate the cross correlation between these two time series
- Plot the cross correlation function and interpret the results

Task 4:

- During a deformation monitoring the oscillation of one point along a bridge was measured at the same time using TLS and the ground-based radar interferometer IBIS-S. The measurements are given in the files “*tls.txt*” and “*ibis.txt*”. The positive axis of the TLS and IBIS-S was aligned towards zenith.
 - Plot both time series in one figure
- Determine the time shift between these two time series using the cross correlation function
 - Plot the cross correlation function and interpret the results
- Correct the time axis of the TLS measurements according to the results of the cross correlation
 - Plot both time series in one figure
- Furthermore the acceleration of the same point along the bridge was observed using an accelerometer. The measurements are given in the file “*accelerations.txt*”. The positive axis of the accelerometer was aligned towards the ground.
 - Plot the time series of the IBIS-S, the corrected TLS and accelerometer measurements in one figure
 - Determine the time shift of the time series of the accelerometer measurements in comparison to the other two time series
 - Correct the time axis of the accelerometer measurements according to the results of the cross correlation
 - Plot all three time series in one figure and interpret the results