

Kinematic Measurement Systems Summer Semester 2019

Lab 3 *(Individual Laboratory)*

Kinematic Tachymeter Measurement

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First name	Last name	Student ID	Signature

Testat	1. Control	Resubmission until	2. control

1 Introduction

In the past years guidance of construction machines at construction sites has gained importance. Today, it is impossible to work without these systems at large construction sites, e.g. highways or tunnels, if the building companies want to work efficient and in time. Especially paver, curb and gutter applications need a high accuracy for the measurements of their 3D-positions. Today, this is reachable with robot tachymeters. For kinematic measurements several points have to be considered, e.g. the synchronization errors and the time delay between the measurement and the availability of the position in the control system (dead time).

2 Task

In this task you should compute the synchronization error for the tachymeter Trimble 5601. For doing so, you have to perform measurements using the linear calibration unit in the measurement cellar. With this linear unit it is possible to simulate movements of a target on a given trajectory. By means of the formulas and the measurement data, the synchronization error, for the used tachymeter Trimble 5601, has to be calculated.

The following steps have to be done:

- Every Student has to measure with the Trimble 5601. The output of the measurements will be the time stamp, the measuring elements (angles, distances). Additionally the coordinates and the lateral deviation to the reference trajectory (rail of the linear unit) will be provided.
- You have to conduct two kinematic measurements (forward and backward) with the same velocity. Subsequently, a forward and backward drive has to be realized with a different velocity (minimum factor is two).
- Before the computation of the synchronization error, you have to calculate the moving average of the lateral deviations (choose a useful filter depth). You also need the velocity which can be computed using the distances between the measured coordinates and the time stamps. For each drive you have to calculate the mean velocity. For this, delete the first and last seconds of each drive.
- Visualize your measurement data in graphs and calculate the synchronization error of the used tachymeter. Correct the measured elements using the presented formulas (interpolate the distances between the time stamps) and compute the corrected coordinates.

3 Elaboration

- The labsheet must be submitted as hard copy.
- Please describe the complete procedure using the following structure:
 1. Aim of the lab
 2. Detailed explanation of the procedure with all used formulas
 3. Results (required figures, mean lateral deviations, mean velocities, calculated synchronisation errors, corrected coordinates)
 4. Analysis and discussion on the results
- Required figures:
 - XY Coordinates of the prism
 - Lateral deviations and smoothed lateral deviation (in one figure) for each drive
 - Velocities
 - Corrected coordinates and original measured coordinates for each drive
- Every student has to load up his self- programmed software (Matlab, C, C++, ...) to ILIAS.

4 Remarks

The Trimble 5601 has a sampling rate of 400 ms.