

## Exercise 5: Propagation of observation errors - part III

- Propagation of variances and covariances -

Group:	Surname, First name:	Matriculation number:	Signature*:
* With my signature I declare that I was involved in the elaboration of this homework.			
Submission until: <b>01.12.2024</b>			

### Objective

This exercise deals with the propagation of variances of correlated and uncorrelated observations for one or several unknown parameters.

### Task 1:

The angles  $\alpha_1$  and  $\alpha_2$  as well as the distances  $s_1$ ,  $s_2$  and  $s_3$  of the rectangle, depicted in Figure 1, were observed.

- Calculate the distance between point 2 and 4 and its standard deviation.

$$\begin{array}{ll}
 s_1 = 824,62 \text{ m} & m_{s_1} = 1,2 \text{ cm} \\
 s_2 = 1026,98 \text{ m} & m_{s_2} = 1,9 \text{ cm} \\
 s_3 = 802,00 \text{ m} & m_{s_3} = 3,6 \text{ cm} \\
 \alpha_1 = 68,3582 \text{ gon} & m_{\alpha_1} = 1,5 \text{ mgon } (15'') \\
 \alpha_2 = 52,9212 \text{ gon} & m_{\alpha_2} = 4,1 \text{ mgon } (41'')
 \end{array}$$

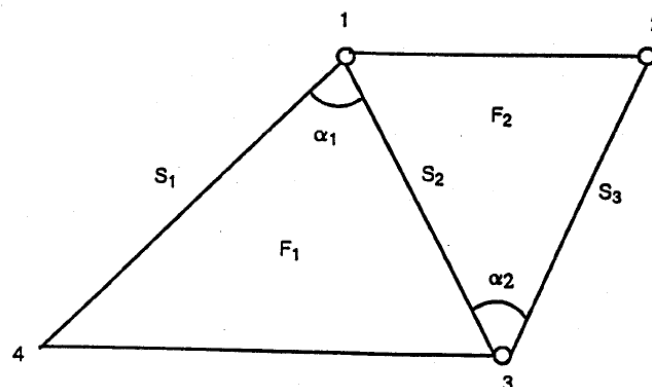


Figure 1: Observed rectangle

## Task 2 (Homework):

A car is moving on a straight line in two dimensions (2D) with a constant velocity. The following quantities were observed in two individual positions, as depicted in Figure 2, with the accompanied standard deviations:

- azimuth angles  $\alpha_1 = 35.1550$  gon and  $\alpha_2 = 55.1200$  gon, with  $\sigma_\alpha = 0.001$  gon
- distances  $s_1 = 20.005$  m and  $s_2 = 30.001$  m, with  $\sigma_s = 1$  mm
- time  $t_1 = 9.7$  s and  $t_2 = 23.1$  s, with  $\sigma_t = 0.1$  s

Your tasks are:

- Estimate the velocity of the object  $v$ , as well as the standard deviation  $\sigma_v$ . Explain clearly all the steps you needed for the results.
- Estimate the position of the object (coordinates  $y_3$  and  $x_3$  in 2D) at the time  $t_3 = 30$  s as well as the standard deviations  $\sigma_{y_3}$  and  $\sigma_{x_3}$ .

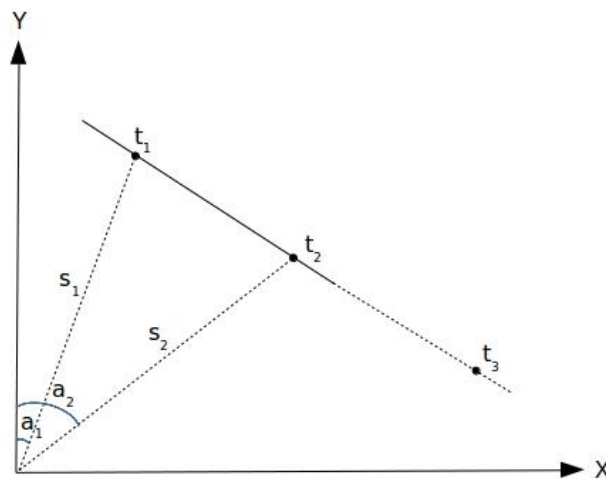


Figure 2: Movement of a car in 2D