Non-linear Least Square Estimation Problem

Lab assignment #2 (worth 10%; deadline: Friday, October 11 at 11:59pm)

Learning objectives

After completing this lab assignment students should be able to:

- Understand the fundamental principles of LSE
- Program practical Non-linear LSE problem using Python
- Be familiar with common techniques in python

Preliminary Task – (25 Marks)

Similarly to Lab Assignment 1, each group must fill in the **certificate of work**, which is in the given notebook of this lab assignment (5 marks). Each group is responsible for maintaining a clean Git repository similar to the Bookkeeping tasks from Assignment 1, E.g., clear project structure, consistent version control, include only necessary files etc. (10 marks). Make sure the code is readable, E.g., consistent naming conventions, proper commenting, clear code structure, consistent Indentation and Spacing etc. (10 marks)

Task 1 – LSE Implementation (75 Marks)

The company Deep-AutoLab is designing a self-driving car, and one of the fundamental techniques is the ability of tracking vehicles in term of their positions. Therefore, they plan to build an algorithm of Single Point Positioning (SPP) using the measurements from Global Navigation Satellite System (GNSS) and apply the Least Square Estimation to obtain the solution. To build this algorithm:

- Please go through the Linear LSE section in the notebook 'Assignment 2' and complete the related questions.
- Please read the background of `SinglePointPositioning` carefully at the beginning of the Non-linear LSE section and complete the questions.
- Every team is required to use *Git* to collaborate on this assignment and ensure proper distribution of work.
- For groups of 3, you can omit the questions from the steps 11-14 in Linear LSE section and step 12-13 in Non-linear LSE section. These questions worth 20 marks and you will be graded out of 80 marks in total.

Submission Materials

All the listed materials **must** be submitted in the *Lab Assignment 2 D2L* dropbox by the deadline. **Late** and **incomplete** submissions will result in a deduction of marks.

- A zip file of the `Lab_Assignment2` folder, which should include a *.ipynb* file, 3 .xlsx files.
- A link to the group GitHub repository

As stated from *"Additional Lab Information"*, please remember that:

- Each member is **required** to make at least one commit and push to the group repository. Failure to do so will result in a 1% **individual** course grade deduction.
- The D2L submission dropbox will close 24 hours after the deadline. All submissions in this 24-hour window are subject to a 20% lab grade deduction.
- There must not be any commits to the `Lab_Assignment2` folder in your GitHub repository after the deadline, or there will be a 20% lab grade deduction.

Acknowledgement

1. The dataset used in this lab assignment is adopted from the ENGO 625 Advanced GNSS Theory course. ***Please do not share or distribute this dataset outside of the class***.