ECE533

Satellite Navigation and Sensor Fusion

Assignment 1

Objectives:

The objective of the assignment is to estimate the position of a car using GPS. The problem must be solved using the Least Square Estimation (LSE) algorithm. There are two data files provided with this assignment: sat_data_V1A1.csv and motion_V1.csv. Sat_data_V1A1.csv contains the position of the satellites in the ECEF frame, pseudo-ranges and other information. You should use P-range L1 data as GPS observations. You are free to use other related data provided in the file. Motion_V1.csv contains true position and velocity of the car in the ECEF frame.

Note that, to solve the estimation problem you should also estimate the receiver clock bias. No bias drift is included in the measurements. The output of the LSE should be the position of the car in the ECEF.

Requirements:

Minimum requirements:

- Design and implement an LSE in MATLAB to solve the estimation problem
- Plot the estimated position of the car (latitude and longitude)
- Plot the estimation error and show that the error lies within the estimated 1 sigma error standard deviation (which can be calculated using the PDOP). You can consider the nominal pseudo-range standard deviation as 10 m.
- Plot the PDOP vs time and comment on the plot.
- Plot the residue

Assessment:

The program must be written up in a technical report. A typical report will be about 10 pages long.

Program: 40% of the total mark. Clearly, a fully operational program will attract more marks. Also, the well-commented code will be rewarded.

Report: 30% of the total mark. A report must contain an introductory section describing the background, a section explaining methods used in the assignment, a discussion section and concluding remarks.

Presentation: 30% of the total mark. An ideal presentation will be of 10 minutes (8 minutes of presentation + 2 minutes of Q&A). The date of the presentation will be communicated after the due date of the assignment.

Of the final assessment of the course, this assignment is worth 10%. The approximate minimum investment of student time should be 10-15 hours (depending on the level of mastery of MATLAB and GNSS study materials).

Penalties for late submission: -2 marks X number of days overdue

Penalties for plagiarism will be severe. In other words, submissions with substantially similar reports or programs will be marked at a much lower level than they would otherwise and will be reported to the Academic Section/DOAA.

Submission:

The submission is to be submitted in Google Classroom, and must be structured as follows:

1. The complete submission should include: (a) the report (in PDF format), (b) the Matlab m-file source code(s).
2. They should be compressed into one zip file (YourFullName_StudentNo_V#.zip), where V# is the version number of Matlab used. The Matlab version should also be specified in the report.
3. If there is the need to explain the submission and it is not appropriate to be included in the report, put it in a file "Notes.txt" and add it to the zipped file.
4. By organising the submissions in this way, the assessment will be made solely based on the submitted zip file.

SKB