

Assignment of Individual Semester Work

Navigation algorithm and Kalman Filtering

Task:

- 1) Implement the navigation solution (mechanization of the navigation equations) in the Matlab Environment according to the provided equations described in the file “Nav-assignment-v1-2022.pdf” available on Moodle.
- 2) Implement the Kalman Filter model for the estimation of Position, Velocity, and Attitude in Matlab environment and evaluate it based on flight data provided on Moodle in the file: “B(E)3(9)M38IMA_Data_Individual_Semester_Work.mat”. The model can be found also in the file: “Nav-assignment-v1-2022.pdf”.

The results of the KF will be presented as a figures that will contain following graphs:

- a. Position estimate in geographical frame (lat, lon, alt) and corresponding GNSS based position
- b. Velocity in North-East-Down and corresponding GNSS based velocity
- c. Attitude (roll, pitch, and yaw angles) obtained from:
 - i. Accelerometer data,
 - ii. Gyroscope data pure integration procedure with bias compensated,
 - iii. KF using state vector.
- d. Kalman gain (all elements per a state vector component into one subplot), subplots in individual figures for dP, dV, dA, dba, dbg.
- e. Innovations/Residuals and their histogram logically sum up.
- f. Progression of the covariance matrix P (diagonal elements).

Data: *B(E)3(9)M38IMA_Data_Individual_Semester_Work.mat*

Description of data: *IMA_Data_Structure.pdf*

Model and theory: *Nav-assignment-v1-2022.pdf*, lectures about Navigation principles and Kalman filtering.

Consultations:

- B3(9)M38INA – Tuesdays from 9:15 (room: C3-54)
- BE3(9)M38INA – Fridays from 9:15 (room: C4-s151)

Deadlines for semester work:

- B3(9)M38INA – **no later than April 19th**
- BE3(9)M38INA – **no later than April 22nd**

Notes:

- The individual work is possible to solve in groups of maximally two students.
- All students should be able to explain any part of the code/model/equations.
- All materials are available on Moodle in the section: Individual Semester Work.
- Recordings are available on MS-Teams, team: B(E)3(9)M38INA(1)