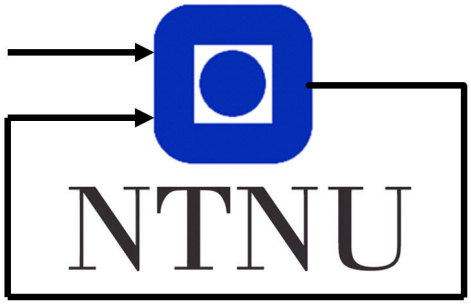
LaTeX Lab Report Template

Group 42
Martin Albertsen Brandt
Martin Eek Gerhardsen

November 27th 2019



Department of Engineering Cybernetics

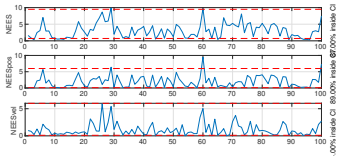
Abstract

This report will highlight and discuss the results of the three graded assignments for the course TTK4250 Sensor Fusion. The code implemented was tested and tuned for both simulated and real datasets.

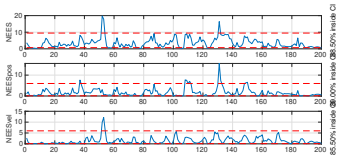
Contents

1 Introduction

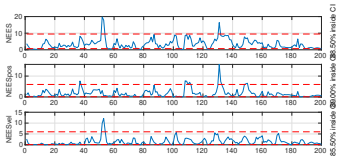
2 Graded Assignment 1



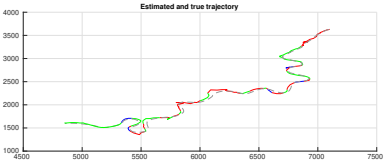
(a)



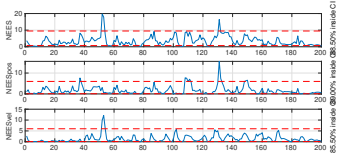
(b)



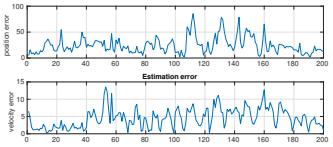
(c)



(d)



(e)



(f)

3 Graded Assignment 2

An error-state Kalman filter (ESKF) for a GPS-aided fixed wing UAV was implemented in MATLAB. The implementation is based on the standard formulation in [1]. But most notably, IMU sensor correction matrices has been added to counteract any mounting errors, scaling errors and orthogonality errors in the accelerometer and rate gyro. Furthermore, leverarm componsation for the GNSS receiver is also implemented.

3.1 INS for simulated fixed wing UAV

The ESKF was first tuned to a simulated dataset. The GNSS measurement standard deviation was tuned to 0.4 in each degree of freedom. The measurement noise covariance is therefore $R = 0.16I^2$. For the accelerometer the measurement noise covariance and bias driving noise covariance was tuned to be $q_a = (4 \times 10^{-2})^2$ and $q_{ab} = (1 \times 10^{-3})^2$ respectively. Similarily for the rate gyro the measurement noise covariance and bias driving noise covariance was tuned to be $q_\omega = (8 \times 10^{-4})^2$ and $q_{\omega b} = (1 \times 10^{-6})^2$ respectively. Finally the time constants in the Gauss-Markov bias processes were both tuned to be $T_b = 1 \times 10^{-8}$ s.

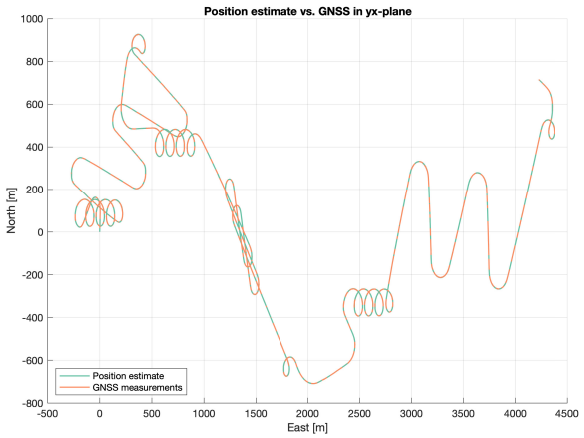
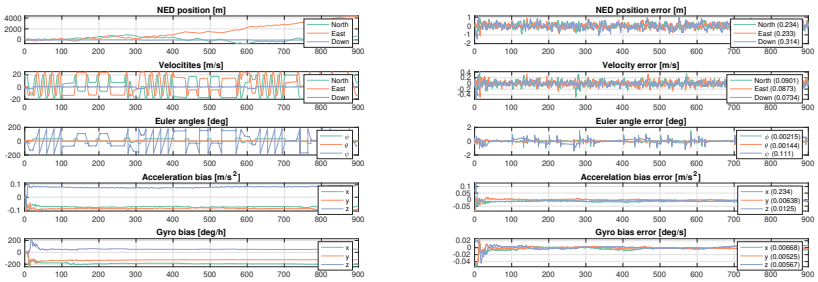


Figure 2

3.2 INS for real fixed wing UAV



(a) (b)

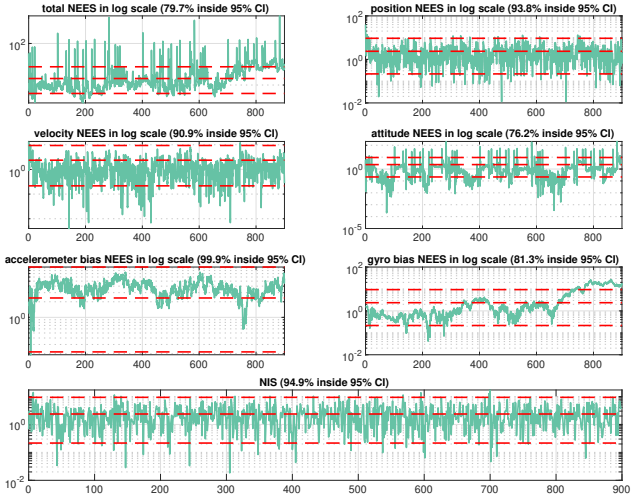


Figure 4

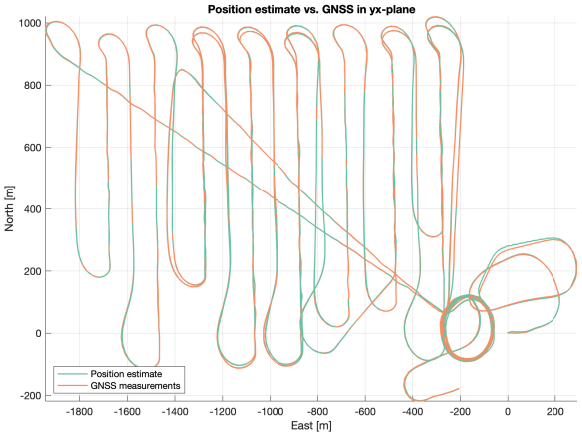


Figure 5

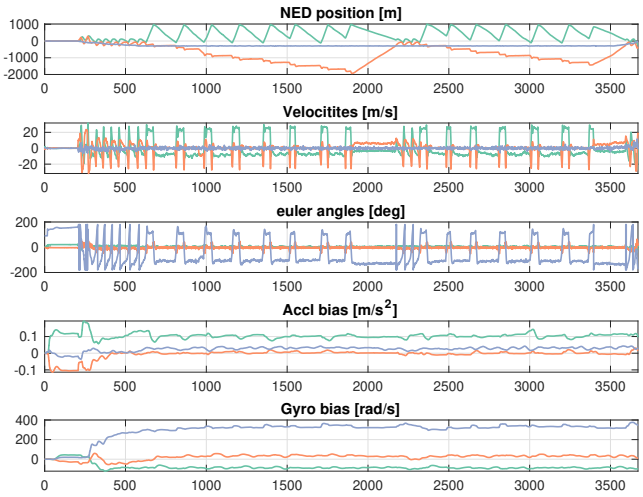


Figure 6

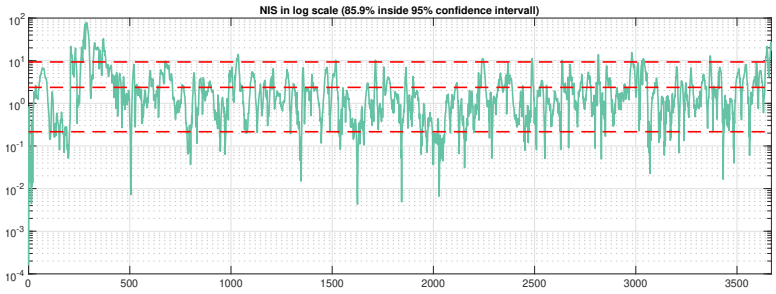


Figure 7

4 Graded Assignment 3

5 Conclusion

References

[1] J. Solà. *Quaternion kinematics for the error-state KF*. `http://www.iri.upc.edu/people/jsola/JoanSola/objectes/notes/kinematics.pdf`. 2017.