Exercise 2

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Part A

i)

In this task we simulated a moving vehicle with a generated signal, and used a kalman filter on it to estimate some values. The fact that the signal is generated makes it possible for us to verify the accuracy of the kalman filter and to compare the output with the true signal. The lenght of the signal was set to 250 seconds and the sampling frequency to 50Hz.

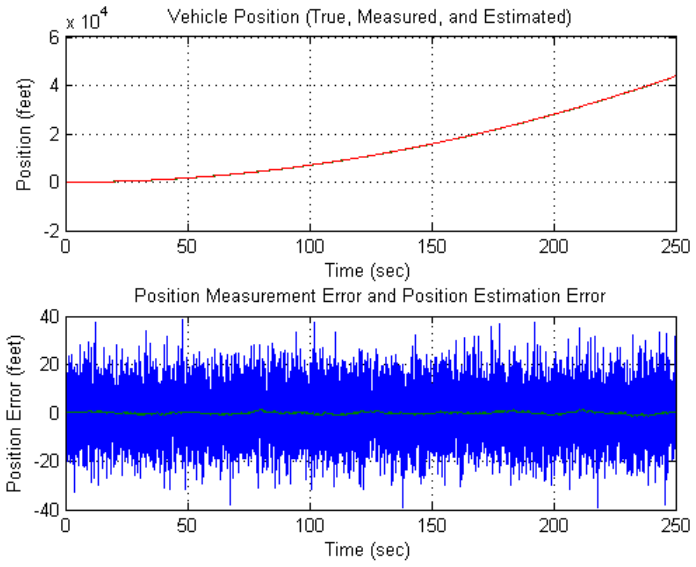


Figure 1: Position graphs

Even though random noise was added to the signal the kalman filter managed to make a good estimation. The measurement error is between 20 and 40 feet as seen from figure 1. It is high compared to the estimation error which is close to 0.

The systems seems to be working quite well beacuse the estimated and true values are so close to each other, which is expected.

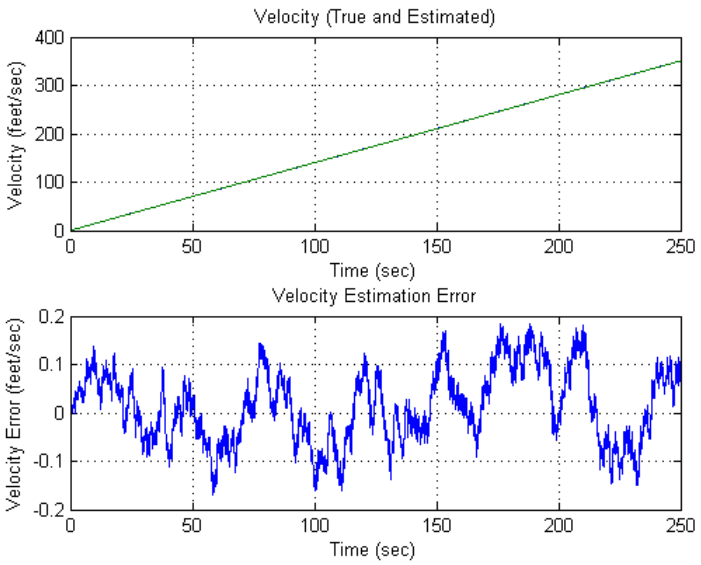
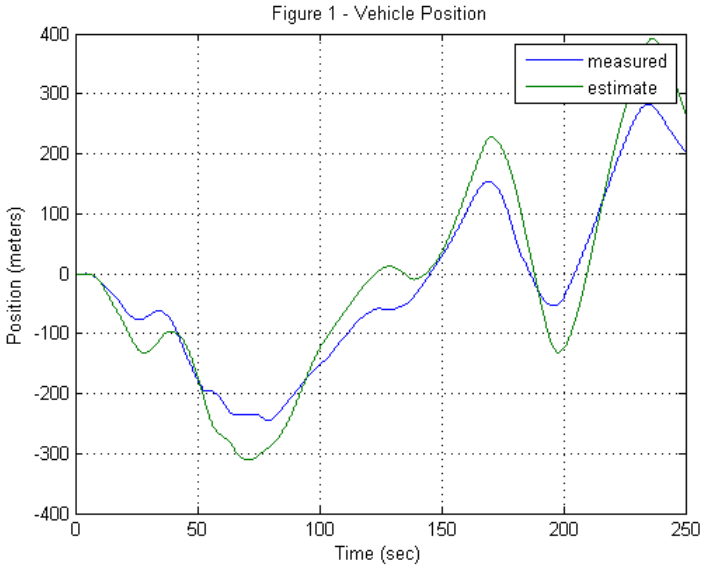


Figure 2: Velocity graphs

ii)

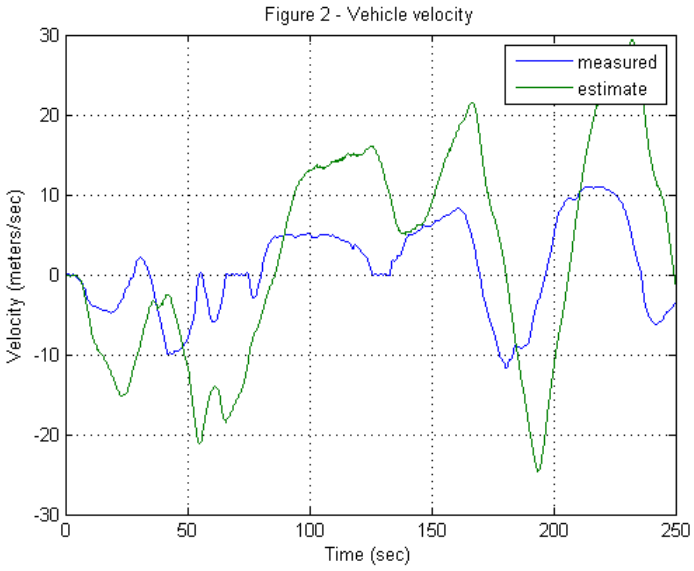
In this task the simulation data is replaced by the data consisting of measurements from a moving vehicle. There is no reference data wihtout noise as in the previous task, which means that the result can only be compared to the measurements.

The data was sampled at 50Hz and 250 seconds long.



The position estimation follows the measurement closely, which confirms the accuracy of the kalman filter. This is because the position measurements should

be reliable to begin with. The velocity estimation result is interesting because the



graph has the same shape as the measurement but with different phase and scale. My conclusion is that the increased scale represents the actual velocity, but the difference in phase might be incorrect. I assume that the measurement contains some delay and that a correct prediction would compensate for that.

The matlab script for the kalman filter was obtained from [1]

References

[1] Dan Simon. Kalman Filtering. http://aug-roma.wdfiles.com/local–files/progetti:arpinpero/Kalman_filtering.pdf, 2001. Visited 20.10.2018.