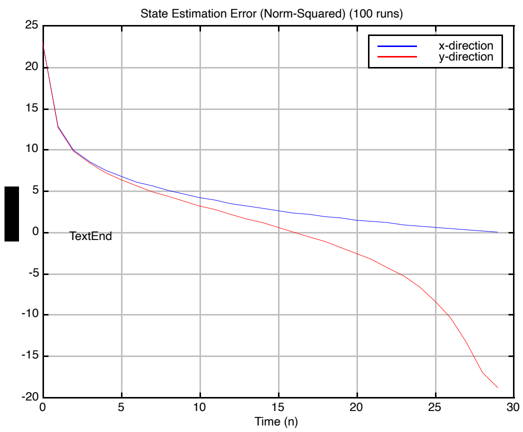
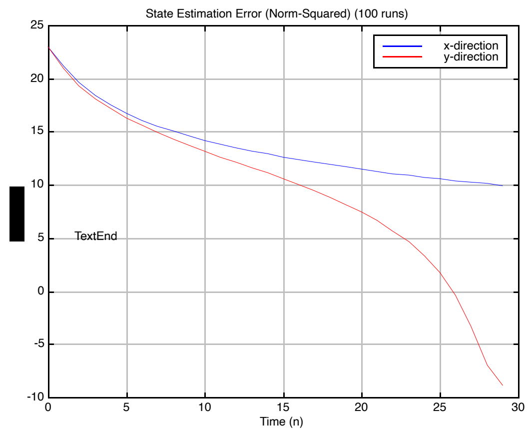
Solution #7: Kalman Filtering

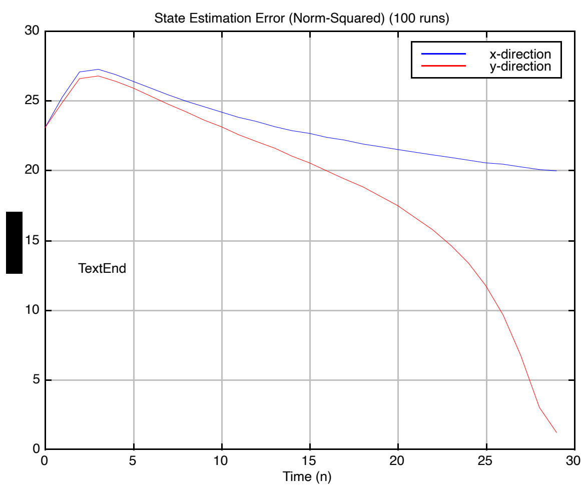
1. (a)



$\sigma_v^2 = 10^3$



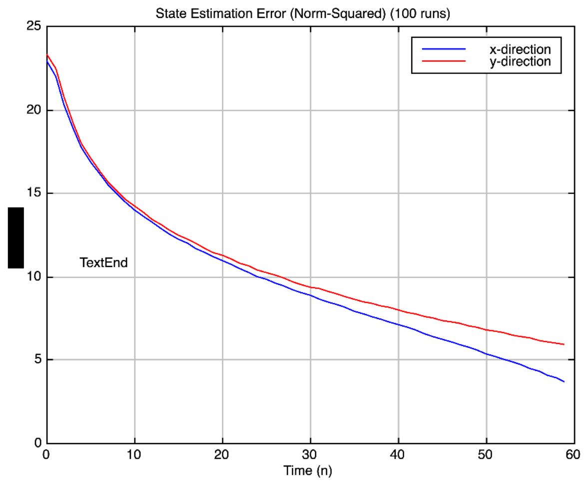
$\sigma_v^2 = 10^4$



$\sigma_v^2 = 10^5$

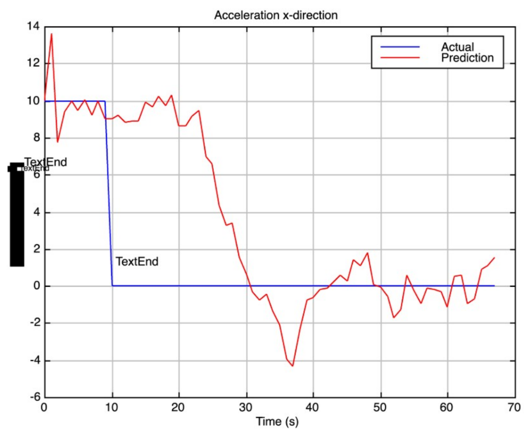
As we increase the measurement noise variance, we expect (and see) a higher MSE.

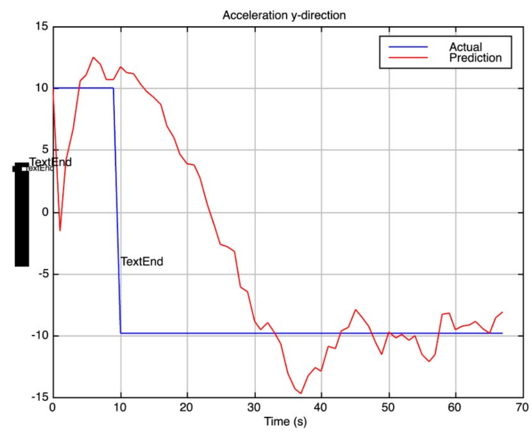
(b) In this experiment, we added a random initial estimation error which varies from –10 to +10 for each state element, i.e. initial range estimates are ±10m, initial velocity estimates are ±10, and initial acceleration estimates are ±10 m/s^2. All other parameters remain the same except for our measurement sample period which is T = 0.5s..

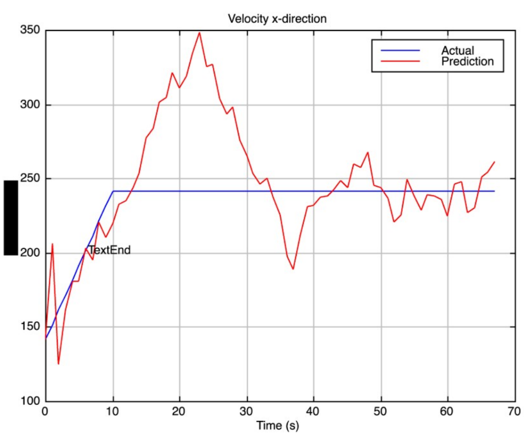


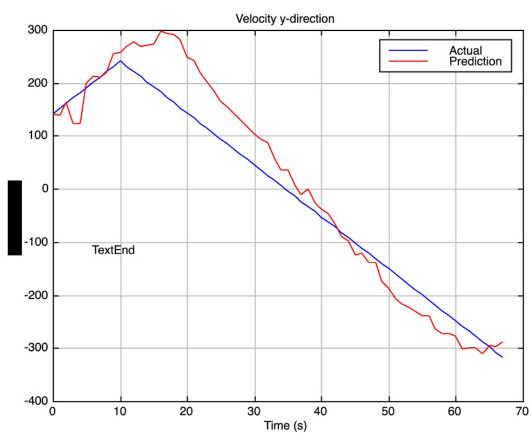
We note that the MSE is roughly the same as in 1(a).

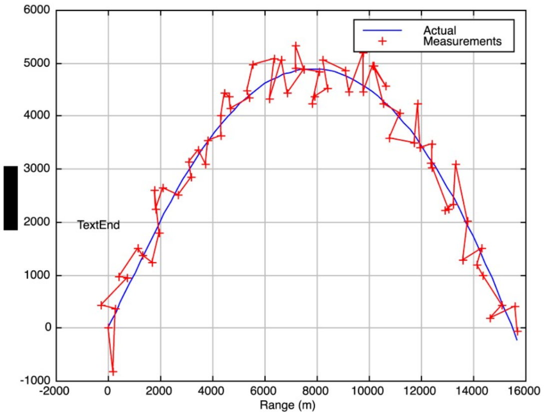
(c) In this experiment, we assume a +10 m/s^2 acceleration in both x- and y-directions for the first 10s. Afterward we have 0 m/s^2 acceleration in the x-direction and –9.8 m/s^2 in the y-direction. All other parameters remain the same except we have $\sigma_w^2 = 1$.

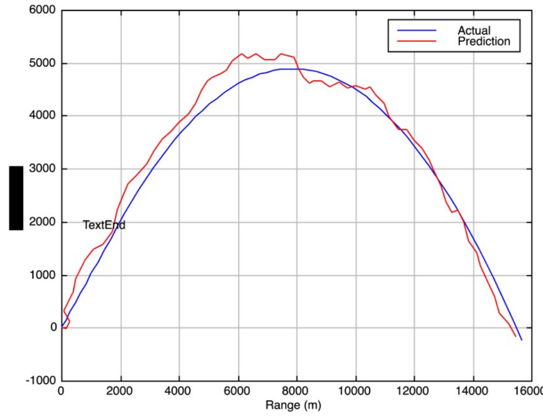









Actual
Measurements
TextEnd
Range (m)


Actual
Prediction
TextEnd
Range (m)