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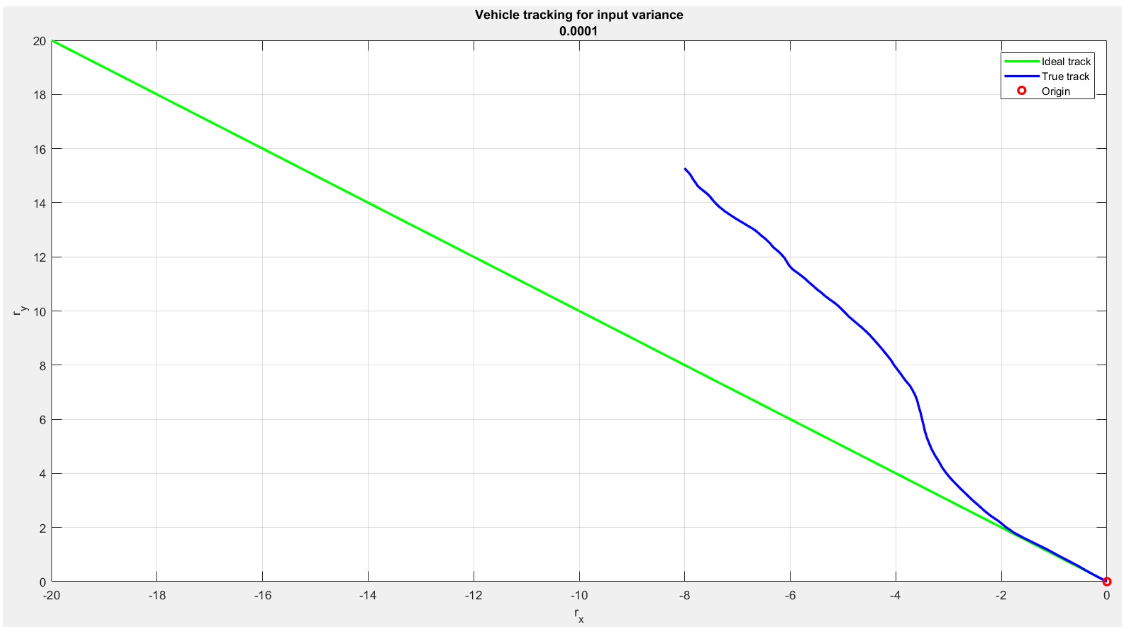
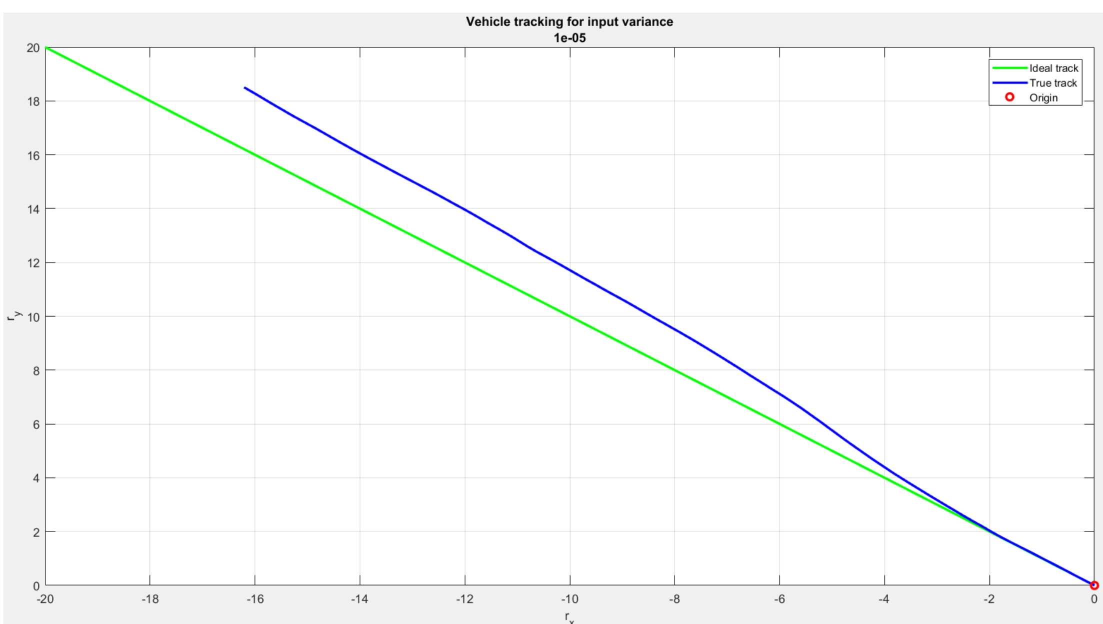
Final project/ ECE 864

Kalman Filter:

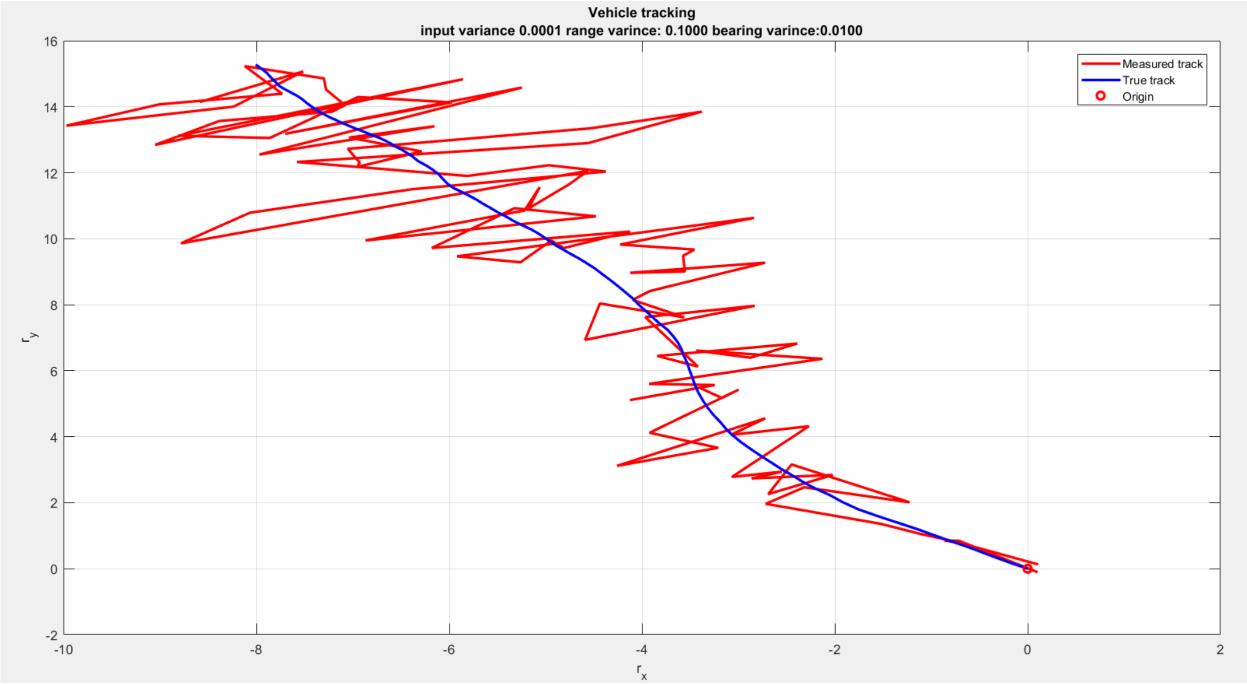
A) Ideal vs. True Track: Here I regenerated the figure 13.22 of the book via σ_u^2 = 0.0001. You can see in the long run the true track diverges from the idea track because of changing in its speed:



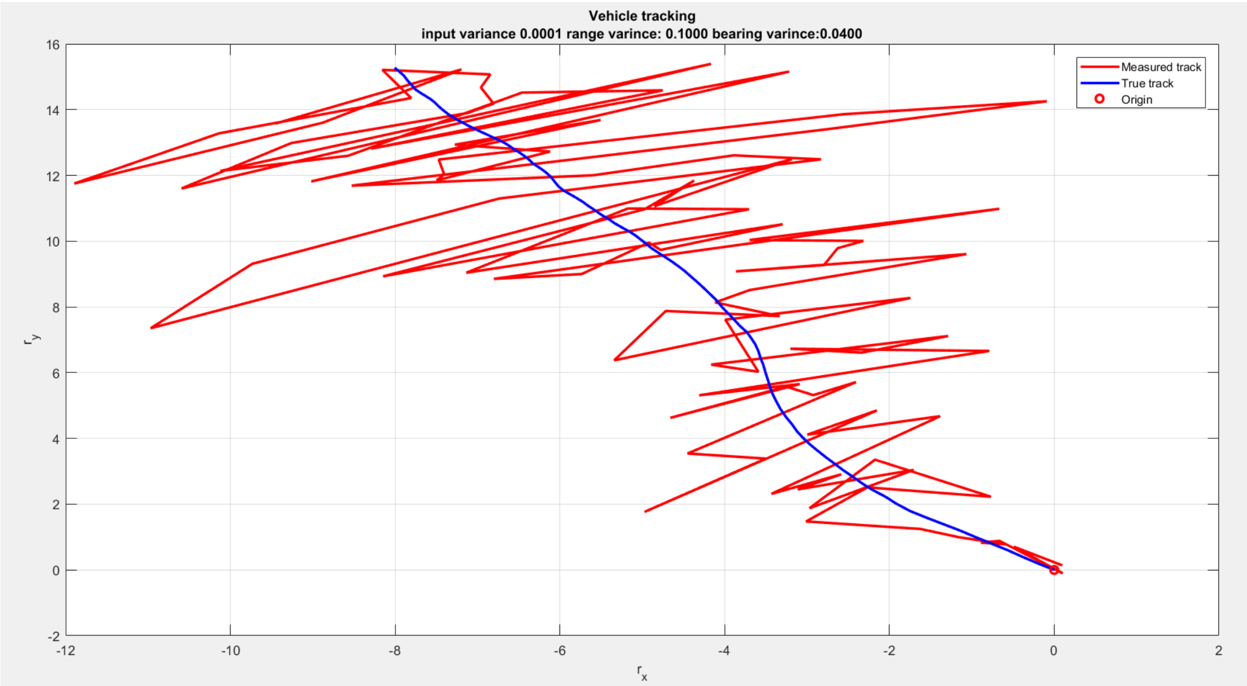
Now, I change σ_u^2 = 0. 00001. Hence, the true track almost remains close to the ideal track:



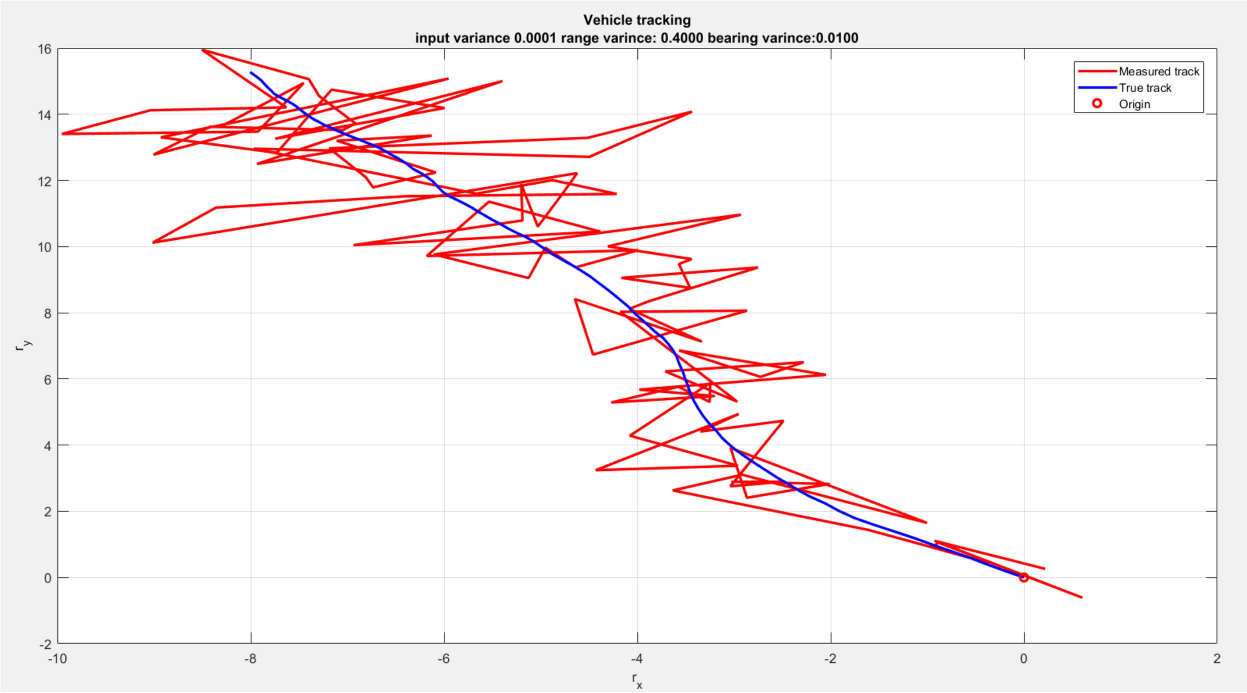
B) Observed/Measured vs. True Track: You see the figure, which is corresponding to figure 13.24 of the book. From now on, $\sigma_u^2 = 0.0001$. I first set $\sigma_R^2 = 0.1$, $\sigma_\beta^2 = 0.01$.



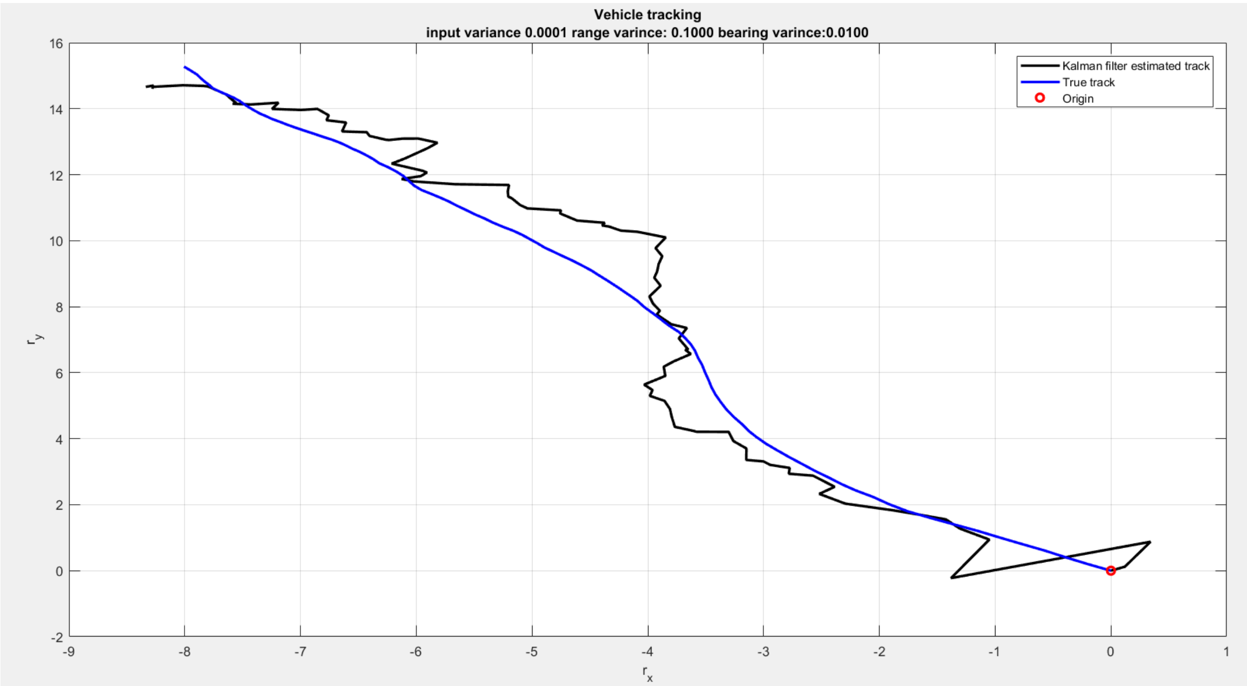
Obviously, bearing variance or σ_β^2 has more effect than range variance σ_R^2. The reason is simple. Because small changes in the bearing can change the position of a vehicle with a sharp degree. Hence, it is more important. Below you see the change and how bad the observation will be when I change σ_β^2 from 0.01 to 0.04. Other parameters are kept same:



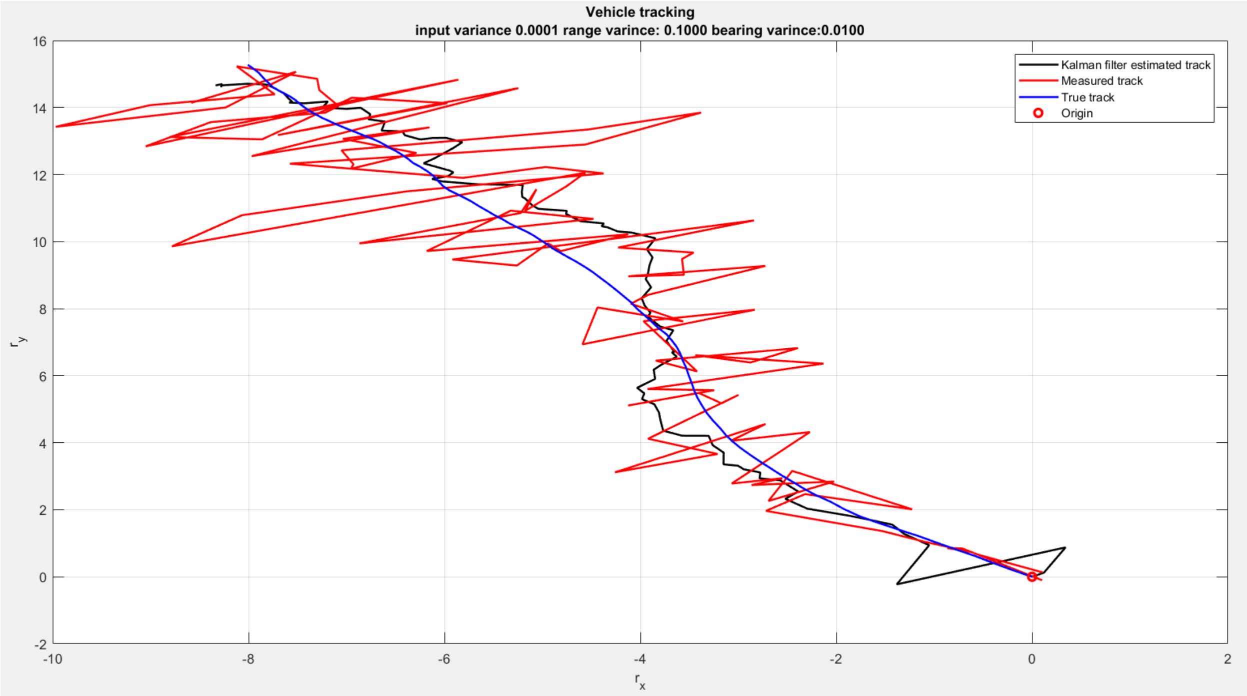
Nevertheless, When I again put $\sigma_\beta^2 = 0.01$, and change σ_R^2 from 0.1 to 0.4, the result is not so bad:



C) Kalman Filter Estimate vs. True Track: If I repeat the simulation several times the whole track estimation does not have a major change, and the Kalman filter properly estimates the true track, which is what I expect. The output of the true track and estimated version of the Kalman filter is in the below image:



D) Kalman Filter Estimate vs. Observed/Measured Track vs. True Track: Simply, combine the figure of parts C and B together to address this question:



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I also implemented the online version of Kalman filter estimation, which is interesting. You can run the last section to see the result. There is another short video file with this report file that is capture by me for the online Kalman filter.