

Homework #7

1) Implement the Humvee Kalman filter we discussed in class on Thursday, 1 March 2018. As a reminder, the system model for that filter is:

$$\mathbf{X}(k+1) = f(\mathbf{X}(k)) + G(k) \mathbf{W}(k) = \begin{bmatrix} x(k) + TV(k) \cos \theta(k) \\ y(k) + TV(k) \sin \theta(k) \\ V(k) \\ \theta(k) \end{bmatrix} + \begin{bmatrix} 0? \\ 0? \\ w_V \\ w_\theta \end{bmatrix}$$

and the measurement model is

$$\mathbf{Y}(k+1) = \begin{bmatrix} x(k+1) \\ y(k+1) \\ V(k+1) \\ \theta(k+1) \end{bmatrix} + \begin{bmatrix} v_x \\ v_y \\ v_V \\ v_\theta \end{bmatrix}$$

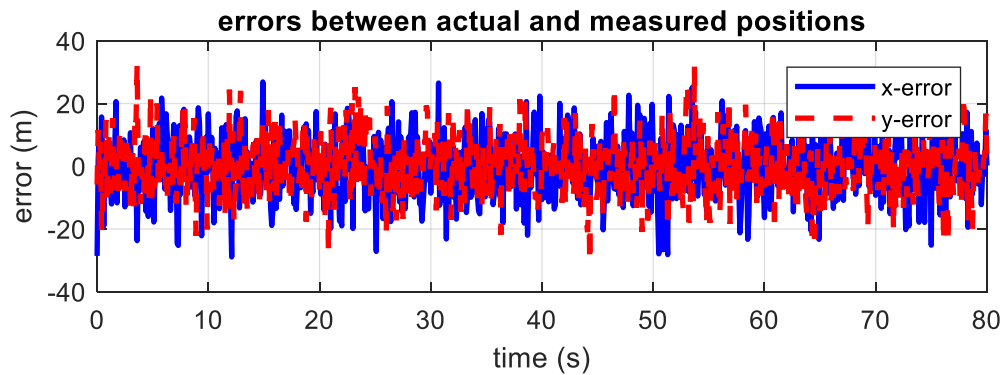
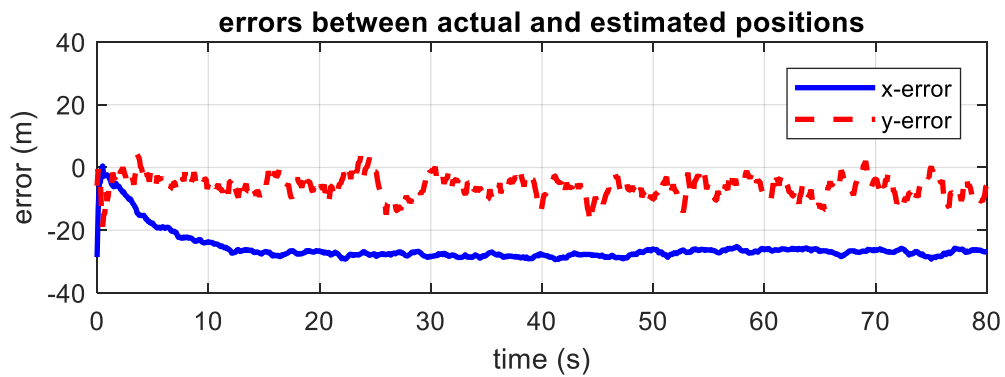
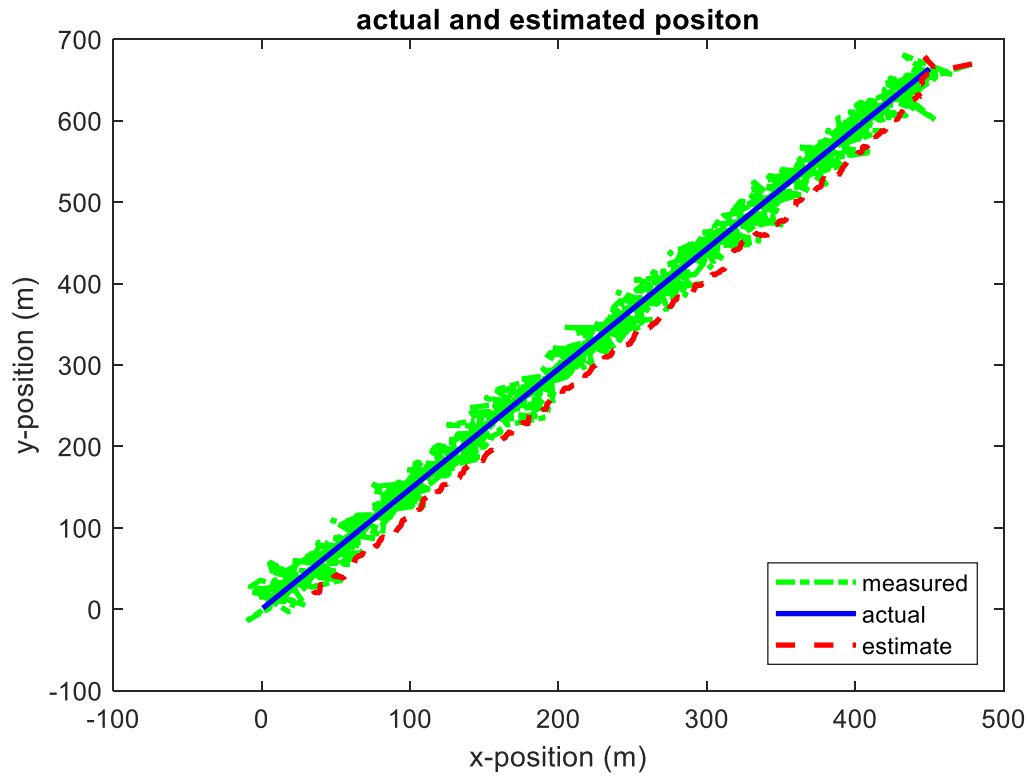
Use the same position initial conditions on your filter that you used in Homework 6. Set the initial estimate of speed to 10 m/s and the initial estimate of heading to 180 deg. Use the position variances of Homework 6. Use a speed measurement standard deviation of 1 mph and a heading standard deviation of 1 degree. Test your filter with all three of the Humvee trajectories. For each of the trajectories, generate plots like the ones below.

The objective of this homework is to gain experience designing and implementing an extended Kalman filter. To that end, you don't need to spend time trying to optimize tuning. I mainly want you to get the filter running, and producing reasonable results.

Compare the performance of this filter to the one you used in Homework 6. Use the results from only the Humvee3 trajectory in the comparison.

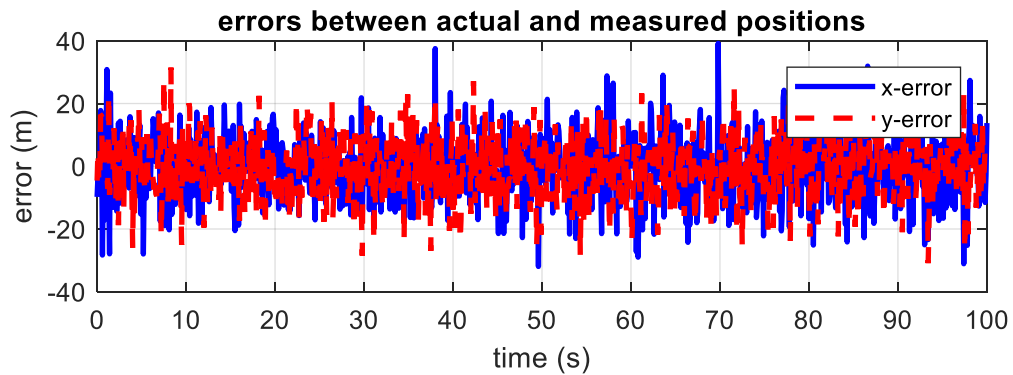
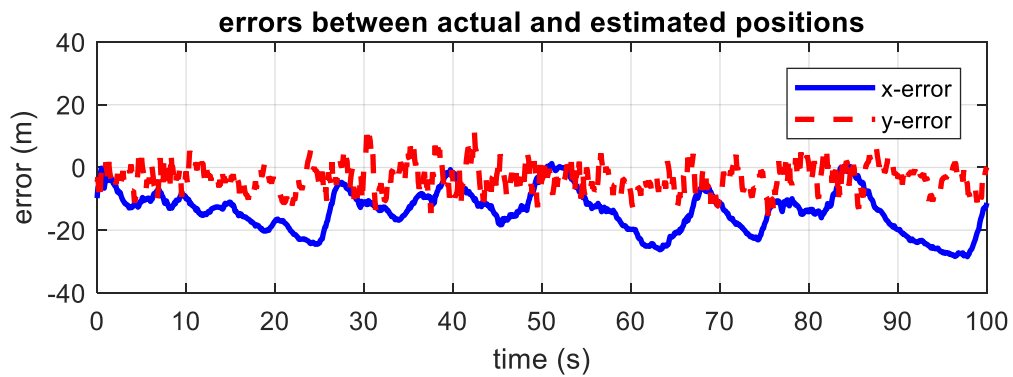
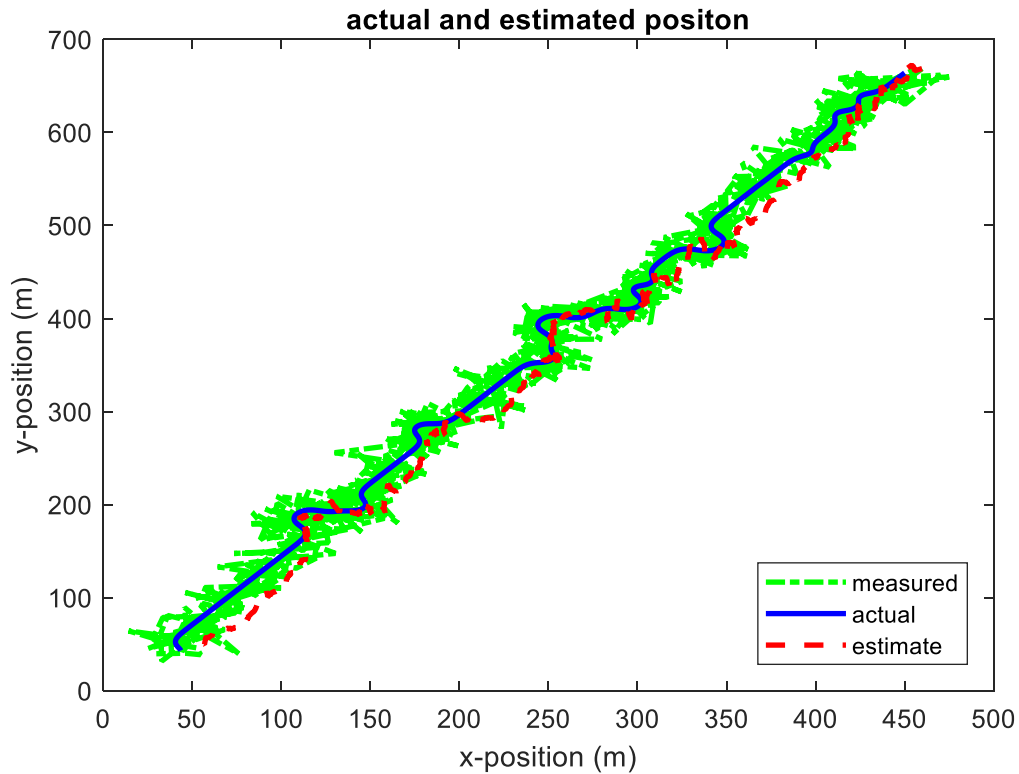
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Trajectory 1 (humvee1.mat)



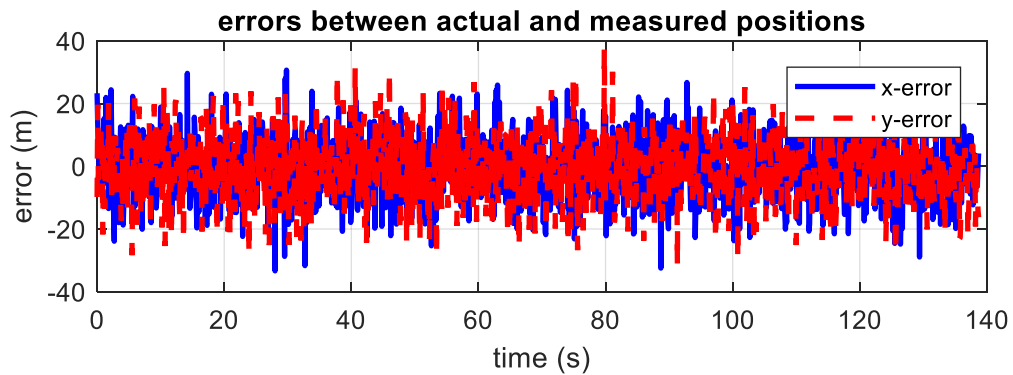
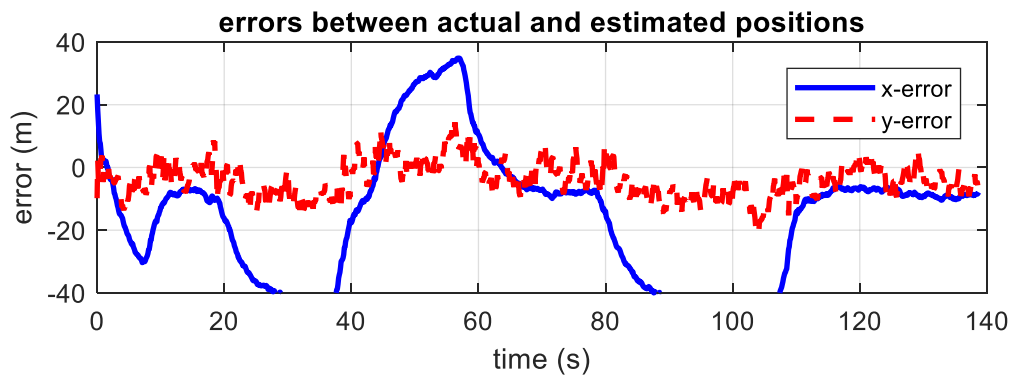
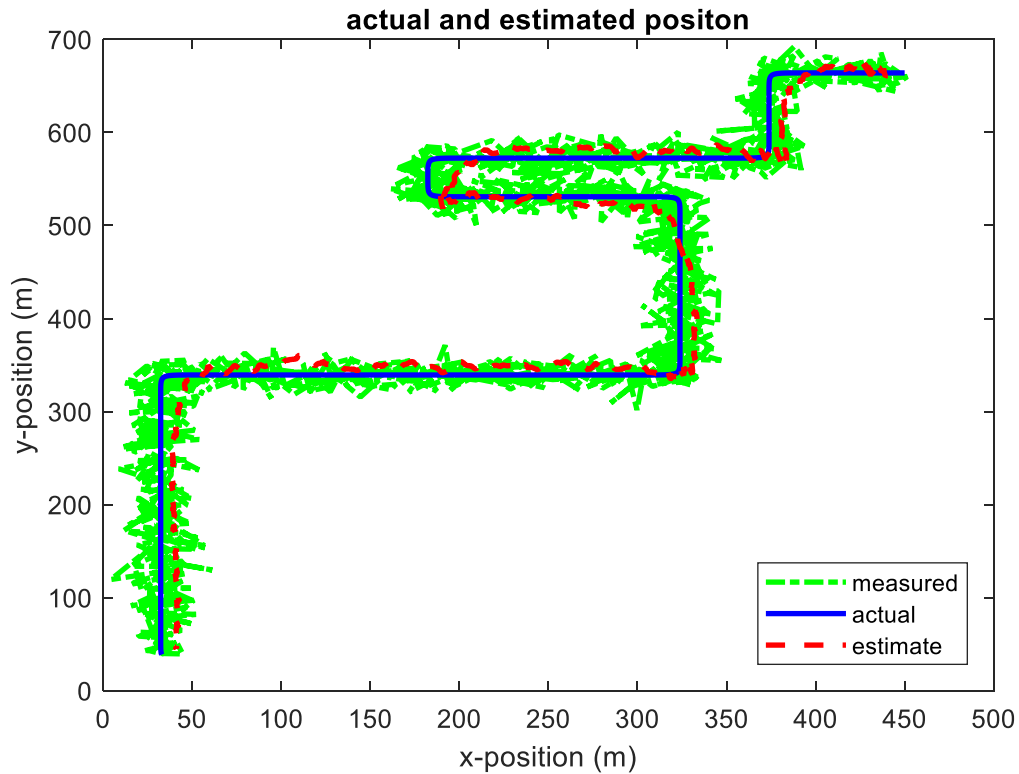
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Trajectory 2 (humvee2.mat)



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Trajectory 3 (humvee3.mat)



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Comparison

