ASSIGNMENT #6

DR. SANKALP K. BHAN

Due Date: 03/05 @ 6:00 pm.

1. Academic Integrity

This is a individual assignment. I am in Norway, but I will still try to respond if you post on Canvas. Please try to attend the recitations to get help on this.

2. Kalman Filtering

Apply a Kalman filter (TVKF) using the built-in Kalman filter block. Develop a discrete time Kalman filter (using Matlab Simulink's Kalman Filter block) that estimates the true values of the states of the vehicle given the available measurements. Plot the TVKF's estimates of the states versus the raw values of the states. The states that you need to estimate are:

$$\phi, \theta, u, v, w, z, p, q, r.$$

Compare the Kalman filter's state-estimation performance to that of naive integration. Do this by justifying your comparisons with real UAV data, and moving the UAV with your hands, without running the propellers.

3. Wiener Filtering

Apply a steady-state Wiener filter by solving the continuous time algebraic Riccati equation for a steady-state solution. Do this after you get the TVKF filter working. The steady-state Kalman filter implements a static observer gain. You will select the static observer gain using the *lqr* command, except you will modify the arguments to solve the state-estimation problem. Add the Wiener filter estimates to the plots from the previous section. Add the Wiener filter to your comparisons performed in the previous section. **You may not use a built-in Simulink block in your final implementation of the Wiener filter (but you could certainly use it to check your answer or help you reverse engineer a correct implementation).**

4. What to turn in

Please submit files individually into Canvas (no-more Zips please).

(1) All Simulink models, codes, pertaining to this work
(2) In your report plot and list the states, inputs, outputs to your models and your filters, as well as the observer gains, process noise covariances, and measurement noise covariances that you used in your designs.
(3) Explain your design and how and why you chose to test in on your UAV
(4) Plan to demonstrate your performance in class on 03/05

E-mail address: s.bhan@wustl.edu