

Final Problem Set

AA 279D, Spring 2018

Due: June 11, 2018 (Monday) at 6:30 pm

Notes:

This is the last assignment for the quarter. You will be expected to perform a few final tasks before wrapping up your project report.

Submission Instructions

Submit your final project report as a PDF file to the course Canvas website. Note that the due date corresponds to the end of our course's allotted final exam period. Be sure to indicate any substantial changes to the document in the revision history.

Problem 1. Filter Integration

To finish up the course project, you will use the filter developed in Problem Set 7 to provide state knowledge to one of the control laws from Problem Set 6. Recall that the control laws were originally acting on ground truth state information; we wish to see how performance is affected when navigation errors are introduced. To this end, follow these steps:

- (a) Select at least one control law you wish to analyze from Problem Set 6.
- (b) Alter the control law state input by corrupting the ground truth with some representative noise. The bias and covariance of this noise should match the expected behavior of your estimator, similar to the process you used to generate your first set of measurements in Problem Set 7, Problem 2. How does your controller perform? What are the main differences compared to the original implementation?
- (c) Now use the extended Kalman filter from Problem Set 7 to feed the control law its state input. You should send the ground truth through your true sensor model, then feed this to the filter before passing the estimated state to the controller. Note that you must now account for the introduction of control inputs in the prediction step of your EKF. How does the controller perform?

For both of the simulations in parts (b) and (c), you should provide comprehensive performance metrics. These include parameters like the time to convergence (i.e. when the error falls below a certain threshold), control tracking error/navigation error and their statistics at steady state, comparison of pre- and post-fit residuals, control input history, ΔV consumption, etc. Be sure to discuss how performance compares with your expectations.

Problem 2. Wrap Up

Finish up any lingering tasks from previous problem sets. These may include the control law and filter designs from Problem Sets 6 and 7, as well as any unaddressed comments from earlier assignments. Recall that portions of your classmates' work are available on the Canvas page if you are in need of references for high-quality work.

It should be stressed that we are looking for A+ level material in your final reports. Given any extra time, consider ways you may go above and beyond the methods described in class to make your project stand out.

You have all been analyzing some very interesting missions this quarter and we are eager to see the culmination of your efforts! Thanks for your hard work.