AA279C Homework 3

Due Friday, May 18, 2018

1 Attitude Sensors

Describe the attitude sensors onboard your chosen spacecraft. You should find the specifications either for the actual sensors used or similar/representative sensors from the literature. Convert whatever specifications you find into a set of covariance matrices that can be used in your MEKF. Document how you derived at your covariance matrices from the published specifications. Finally, write MATLAB code to generate simulated noisy measurements from each sensor. The simulated measurements should have the correct error statistics.

2 Static Attitude Estimation

Using the simulated sensor measurements you have generated, perform static attitude estimation by solving Wahba's problem. Perform Monte Carlo simulations (i.e. many trials with randomly generated measurements) and compare the performance of at least two different algorithms.

3 Recursive Attitude Estimation

Implement an MEKF like the one we discussed in class. Test it using simulated time history data generated using your spacecraft dynamics model and the sensor models you have developed. For now, simulations should be performed in a slow (few degrees per second) uncontrolled tumble. Test using many random initial conditions. You should investigate and document the following:

1. What sample rate should you run your filter at? This should be based on your mission requirements (maximum slew or spin rate).
2. How do the errors from your filter compare to the static estimates computed previously?
3. Is your estimator consistent? Make sure that the covariance estimates generated by the filter are consistent with the actual state errors.
4. Explore the convergence behavior of your filter by initializing it with different state and covariance values. How good must your initial guess be? How long does it take the filter to converge to a its steady state accuracy?