Orientation Estimation in the MATLAB Flight Simulator

Due Apr 27 by 11:59pm **Points** 100 **Submitting** a text entry box

Orientation Estimation

Learn About Orientation Algorithms

The objective of this assignment is to write a state-estimator that can estimate the quaternion orientation of the airplane. *Carefully* study the chapter "Background for Estimating Orientation" in the book Autonomous Flight in Unmanned Airplanes (AutonomousFlight.pdf). You are welcome to use any orientation estimation strategy you would like. Perhaps the easiest algorithm is found in the book chapter "Accurate and Computationally Simple Orientation Estimation". You may also want to consider orientation algorithms in the scientific literature. For example, you may want to consider searching the Internet for the following:

1. Madgwick filter
2. Quaternion orientation estimation
3. MARG estimation
4. Wikipedia: unscented Kalman filter
5. Mahoney filter
6. MARG data fusion
7. AHRS filter

There is not a unique correct solution; this problem has been solved in many different ways.

The following file contains data collected from flying NED_The_C++_Flight_Simulator with a RC controller:

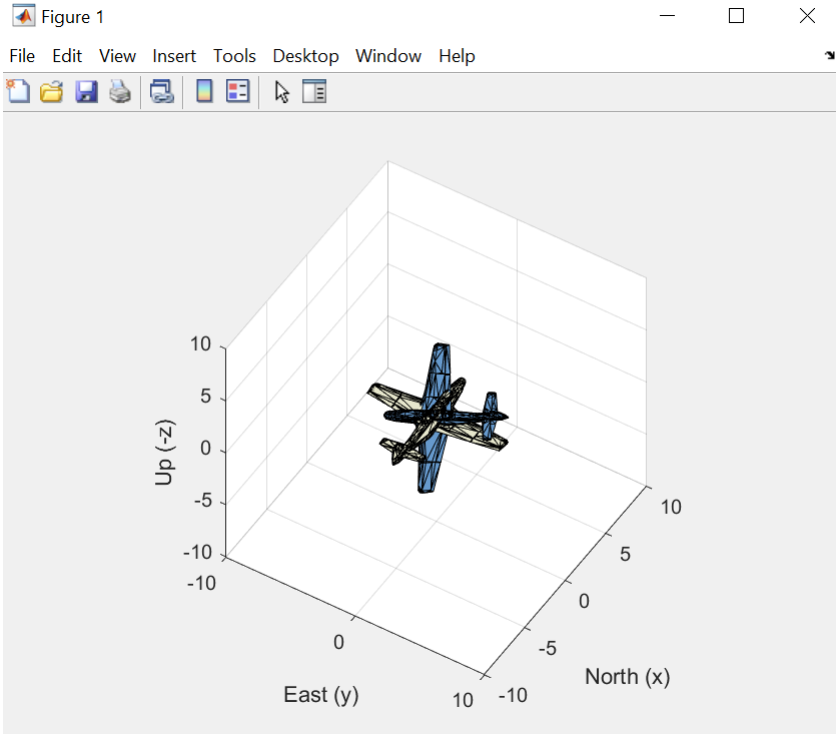
AirplaneSimulatorData.csv (https://byui.instructure.com/courses/232306/files/107111572?wrap=1)
(https://byui.instructure.com/courses/232306/files/107111572/download?download_frd=1)

Download the file, and put it in the same folder with the following additional files:

1. **runme_estimateQuaternions.m (https://byui.instructure.com/courses/232306/files/109497226?wrap=1)**
   (https://byui.instructure.com/courses/232306/files/109497226/download?download_frd=1)
2. **DrawAirplane.m (https://byui.instructure.com/courses/232306/files/109496834?wrap=1)**
   (https://byui.instructure.com/courses/232306/files/109496834/download?download_frd=1)
3. **DrawAirplane_ghost.m (https://byui.instructure.com/courses/232306/files/109492840?wrap=1)**
   (https://byui.instructure.com/courses/232306/files/109492840/download?download_frd=1)
4. **ImportSimulatorData.m (https://byui.instructure.com/courses/232306/files/107111716?wrap=1)**
   (https://byui.instructure.com/courses/232306/files/107111716/download?download_frd=1)
5. **function_QuaternionEstimator.m (https://byui.instructure.com/courses/232306/files/112768116?wrap=1)**
   (https://byui.instructure.com/courses/232306/files/112768116/download?download_frd=1)

Your assignment is to write the code for the function: "function_QuaternionEstimator.m". You may also need to modify a few lines of code in the runme_estimateQuaternions.m file.

Open the runme_estimateQuaternions.m file and run it. In the box that pops up, select the AirplaneSimulatorData.csv file and click OK. A window should appear with an animated blue-gray airplane that continues changing its orientation. A second white "ghost" airplane also appears, but should not move.



Your job is to write an estimation algorithm that calculates the estimated quaternion orientation for the "ghost" airplane. Your estimates should cause the ghost airplane to nearly match the orientation of the blue-gray plane.

Testing your code:

You can test your code using the following tester:

tester_estimateQuaternions.m (https://byui.instructure.com/courses/232306/files/111491820?wrap=1) ⬇ **(https://byui.instructure.com/courses/232306/files/111491820/download?download_frd=1)**

Put the tester file in the same folder as the other files. Run the tester to check that everything is calculated correctly.

What to Submit

Demonstrate your working code to your instructor to get credit for this assignment. In addition submit the following items:

1. Copy and paste the code from your completed function_QuaternionEstimator.m file into the text entry box.
2. In the comments box, put the lines of code that you modified in your runme_estimateQuaternions.m.

The instructor should be able to run your code to verify that it works.