Reading

- Read Section 2 and 3 the note "Quadrotor Dynamics and Control" (Document "Week_1 Beard Quadrotor Notes")
- Read "Week_2 Appendix D".

Coding

Throughout the class, at the end of this quarter, we should be able to develop a complete flight simulator for quadcopters. Please read the instructions carefully before sending me your homework.

By 11:59 pm on the date that the homework is due, please send me an email containing the following two key components:

- A short report (in pdf) on what you have found out after finishing the coding. This report should be brief. Think about the weekly (or monthly) report you send to your advisor. The items can be organized as bullet points. Focus your key findings, results, and insights. If you had any difficulty, you can also tell me about that in your repot.
- The link of a movie (or multiple movies if there are more than one) of the screen showing the working simulator.
- The email should have "MAE 275" in the title so that I won't miss it (Please continue to include MAE 275 in all our future communications. I receive a lot of emails every day. Having "MAE 275" in the title can help me to find your email.). Also, please don't send me the movie files directly through email. You should upload them in some online storage site, such as Google Drive, Dropbox, or Box, and include the link(s) in the email. You don't need to send me the code.
- Please try not to submit your homework late.
- You are highly encouraged to discuss with your classmates about the homework.

Coding Assignment 1 (Based on Section 2 "Kinematics and Dynamics")

The objective of this assignment is to help you to comprehend what you have learned in Section 2. You will need to use the results you have gotten for HW2 in order to complete this assignment.

1. Read the document "Week_2 Appendix D" carefully to understand how S-functions work.
2. Download "HW3_Assignment1_Code" (inside "Homeworks" folder) from Canvas.
    a. You need to first change the "defineVehicleBody" function of the "drawAircraft" file in order to change the aircraft configuration from a fixed wing aircraft to a quad (you can simply copy what you have for HW2).

   b. Next, you need to go to the "param" file to assign appropriate parameters, such as the mass, the moments and products of inertia, and the initial conditions for each state, for your quad.
   c. Finally, you need to change the "mdlDerivatives" function of the "mav_dynamics" file in order to properly implement the quad equations of motion given in the note.
3. Assume that the inputs to the block are forces and moments applied to the quad in the body frame. Run the Simulink model. Verify that the equations of motion are correct by individually setting the forces and moments along each axis to a nonzero and convincing yourself that the motion is appropriate.

Coding Assignment 2 (Based on Section 3 "Forces and Moments")

The objective of this assignment is to help you to comprehend what you have learned in Section 3. You will need to use the results you have gotten for the first coding assignment in order to complete this assignment.

1. Download "HW3_Assignment2_Code" (inside "Homeworks" folder) from Canvas.
   a. Similar to what you have done for the first assignment, change the "drawAircraft", "mav_dynamics" and "param" file. You can simply copy what you have for the first assignment here. But please remember to add a few more parameters in the "param" file, for instance, k_1, k_2, and l, the length of the arm. You may also want to remove all the unnecessary scripts related to aerodynamic coefficients.
   b. Modify the "forces_moment" file that implement the relationship between forces/torques and motor commands.
2. Verify you simulation by setting the control commands to different values. Observe the response of the quad. Does it behave as you think it should?