Additional ADCS Activities

Here are some more ADCS activities to try after you have completed the lab! These are optional but may help you when doing your final project. If you have time, try to at least consider what they're asking you to do and why it may be important to do these things for your final project.

Using Magnetic North

In real space systems, you will not be slewing off of any arbitrary initial angle: you will go off of a reference. Often, this reference is magnetic north. Let's find out how to calculate magnetic north.

You can use cross products:

1. Using the accelerometer to determine the direction of gravity.
2. Find the direction of the Earth's magnetic field using the magnetometer.
3. Take the cross product of down and the mag field to get East.
4. Take the cross product of East and down to get North.

Or by maximizing the magnetic field:

1. Find the resultant vector of the magnetometer readings.
2. Plot or print the magnitude of this.
3. Rotate the CubeSat in the plane to find the maximum value.

Alter your code to take a picture off of a reference angle from magnetic North instead of manually setting a reference.

Confusing your sensors

Let's try and find the weaknesses of using our sensors on their own.

1. Shake your CubeSat while you are turning to give more readings to the accelerometer.
2. Does the activity of a magnetic source affect the magnetometer?

3. Has the amount you need to turn increased to increase the amount of gyroscopic drift? Something like a full 180 turn should work.

Complimentary Filter

1. Try and code a basic complementary filter like we described in lecture to improve your results. Remember, the equation was:
    a. $angle = 0.98\ (prev\ angle + gyroData\Delta t) + (0.02)(accData)$
2. So, in essence, you are just weighing and adding the two estimates for each angle that you have already calculated!
3. You can continue to change the constants (0.98 and 0.02) to tune the filter, as long as they add up to 1. Which do you trust more? Why?

Now you should understand why we combine sensor readings!