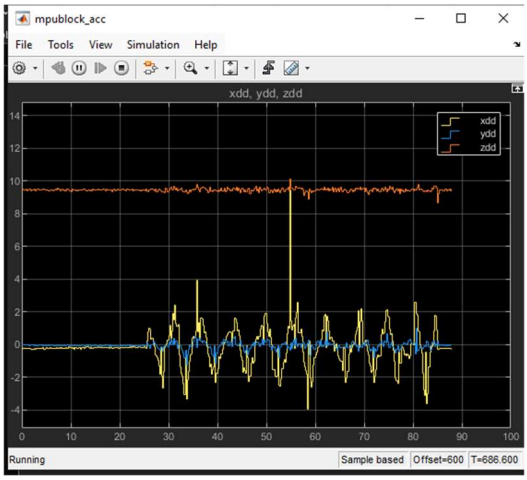
ME456 LAB 06: STATE FLOW AND SENSOR FUSION

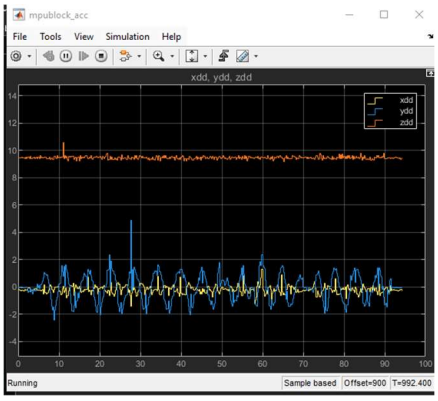
Exercise 2.1: Attach screenshots of scopes that show the signals reading from MPU6050 block.

Accel Scope w/ 3 states & legend names

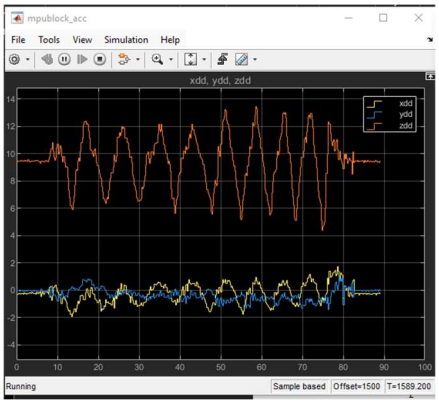
- $\ddot{x}$ activation:



- $\ddot{y}$ activation:



- $\ddot{z}$ activation:



Ang Rate Scope w/ 3 states & legend names

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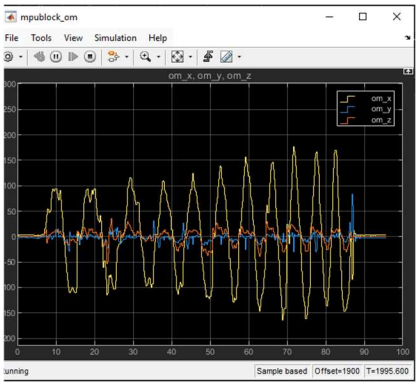
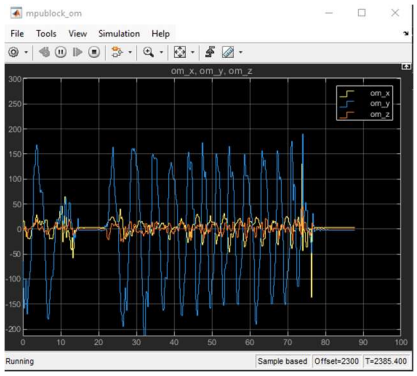
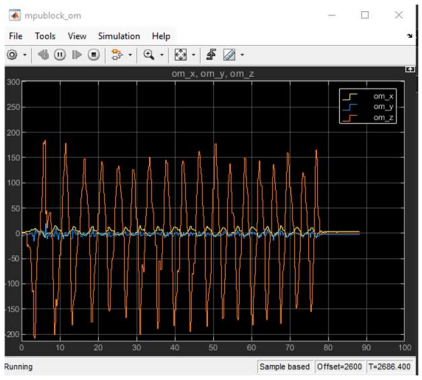
- ω_x activation: 

- ω_y activation: 

- ω_z activation: 

Exercise 3.1: find the scale factor for gyro

Suppose we are selecting the full scale range of 4g, what is the scale factor for this scale range?

Scale factor: _8192 _____

Exercise 4.1: identify rotation axis for pitch, yaw and roll

4.1 Place the sensor on the desk as shown in Figure 7, and answer the question that which is the rotation axis (x,y,z) for roll, pitch and yaw movement

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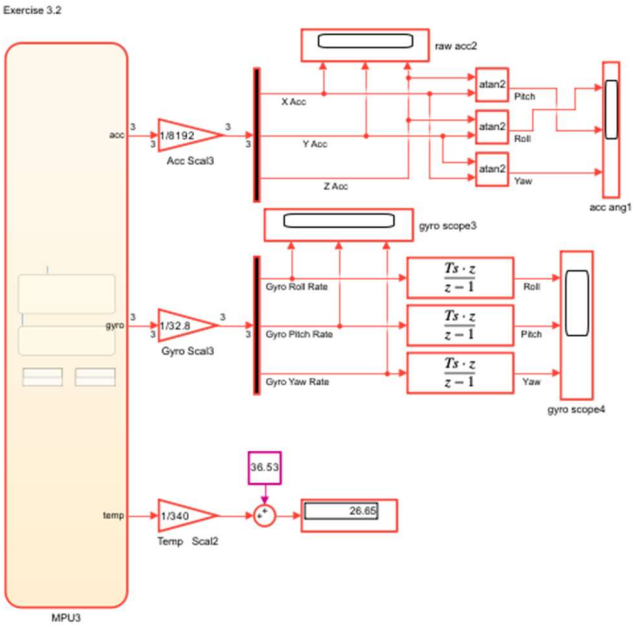
_y___ axis is the rotation axis of pitch movement ?
__x__ axis is the rotation axis of roll movement ?
___z_ axis is the rotation axis of yaw movement ?

Exercise 4.2: Compare sensors

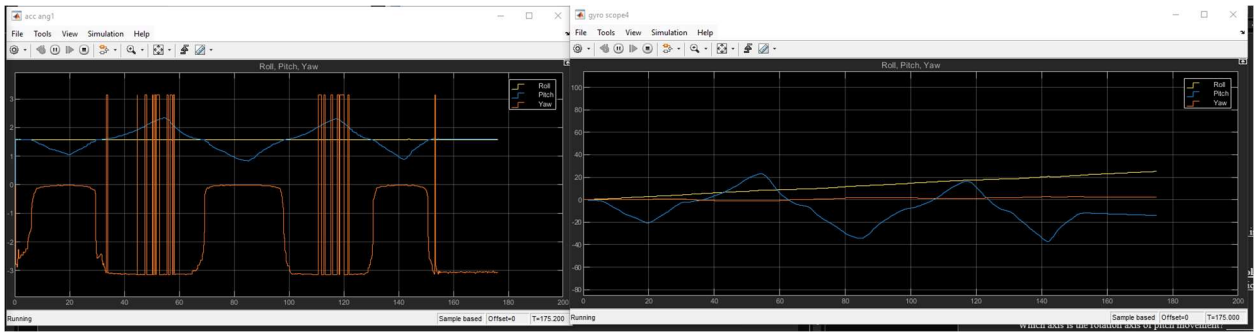
4.2. Attach a screenshot of your Simulink model and attach screenshots of your scopes showing you can activate angle readings from both the gyro and accelerometer (or pass off with the TA).

- Simulink Model:



Screenshot of Accelerometer's angle scope (with 3 angle states & legend names) and Gyroscope's angle scope (with 3 angle states & legend names) side by side both activating the same angle

- Pitch activation:



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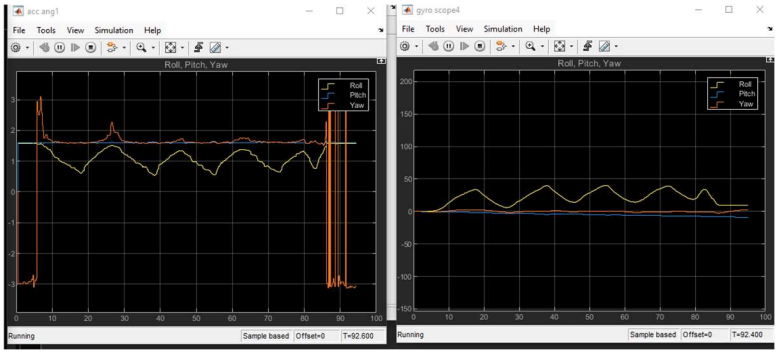
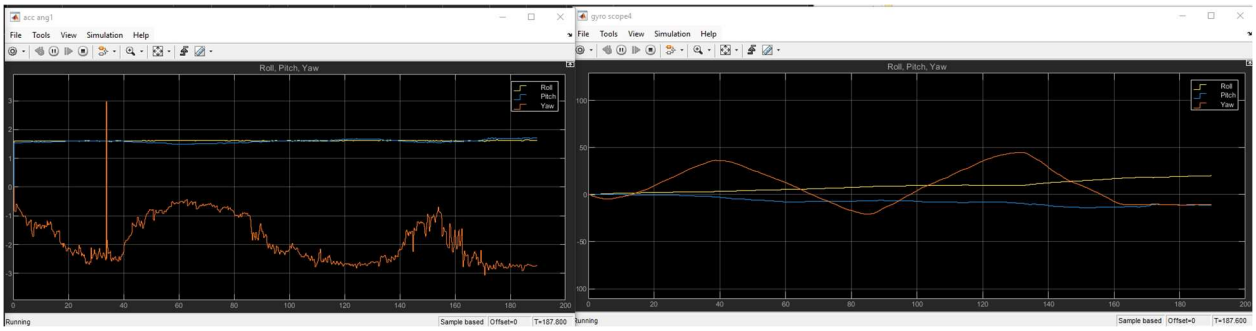
- Roll activation: 

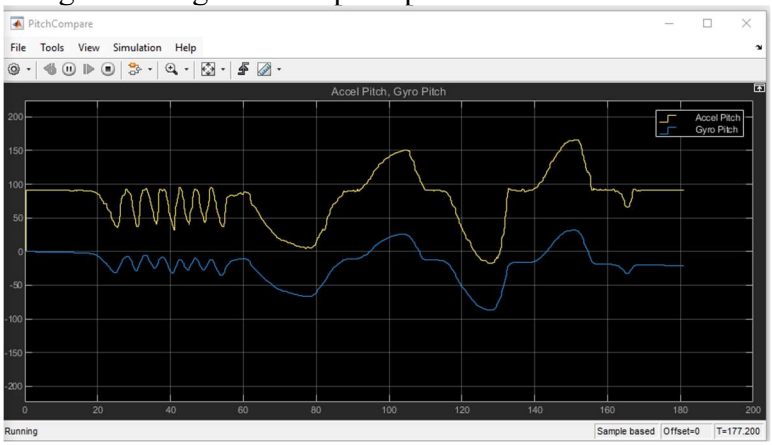
- Yaw activation:



Exercise 5.1: Describe difference:

5.1 Describe the differences between the Acclerometer and Gyro pitch angle outputs (~3 sentences w.r.t. noise, drift, and bias)

-Differences: The signals are nearly the same, but there is an initial bias that offsets the two signals for all time. The Gyroscope angle (due to its calculations using an integrator) also drifts slightly over time. Furthermore, the accelerometer angle signal has higher noise with its signal having more frequent perturbations.



Exercise 5.2:

Show the results in the scope comparing the responses of complementary filtered signal and original signals from gyro and accelerometer.

-Scope (accelerometer, gyro, and fusion signals with legend):

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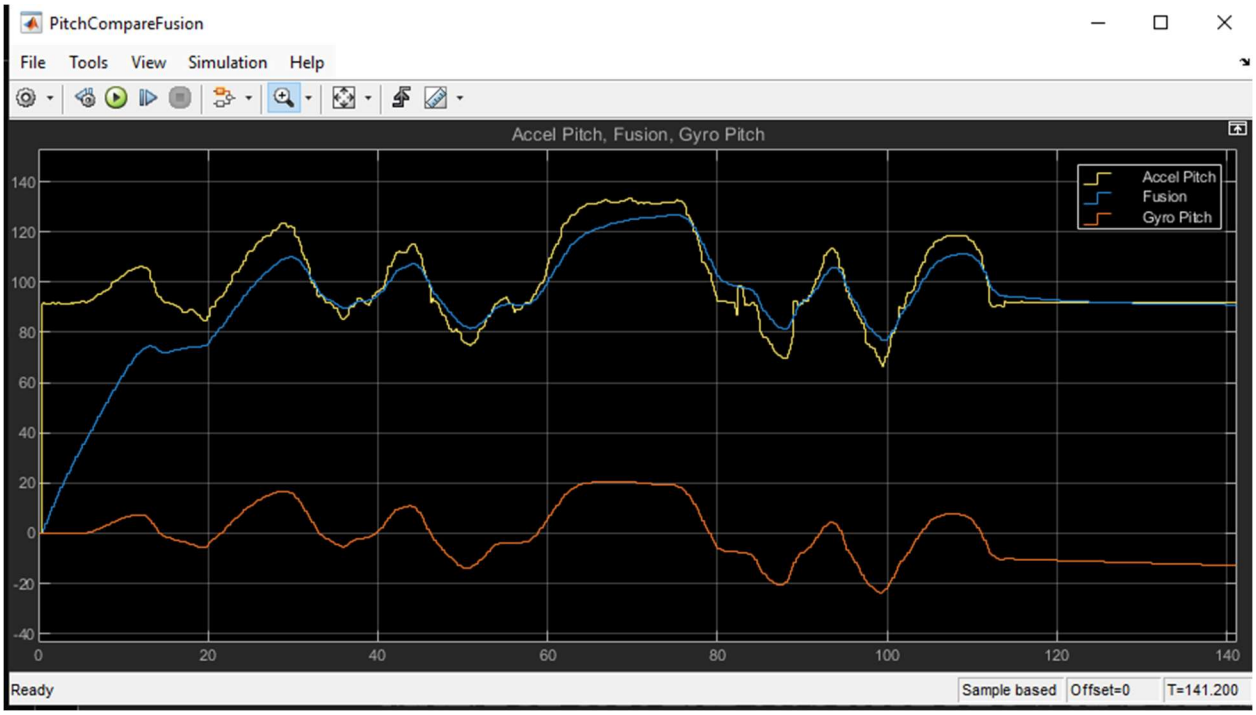
Compare the fusion signal with the accelerometer signal and gyro angle signal (~2 sentences)

-Compare:



-Compare: The Fusion sensor, over time, matches with the accelerometer signal in terms of bias and no drift. However, the fusion sensor incorporates the less-noisy, smooth characteristics of the gyroscope.

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