Sensor Fusion and Kalman Filtering

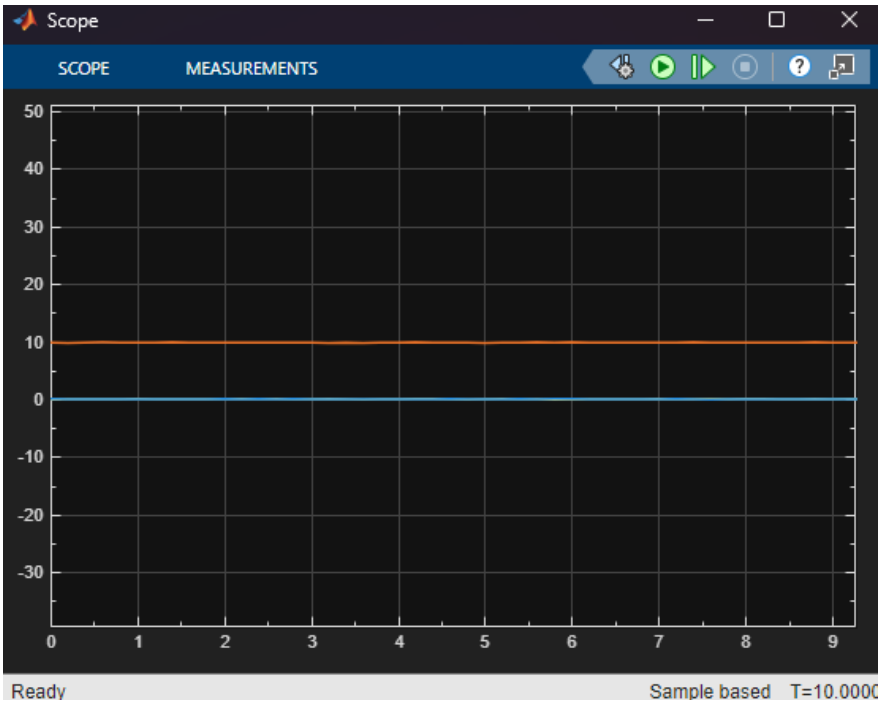
This project has been created with the aim to create sensor fusion with Kalman filtering to accurately estimate rocket state using the following sensors:

1. BMI088 (3- axis accelerometer + 3-axis gyroscope)
2. H3LIS331DL (3- axis accelerometer)
3. LSM6DSL (3- axis accelerometer + 3-axis gyroscope)
4. LIS3MDL (Magnetometer)

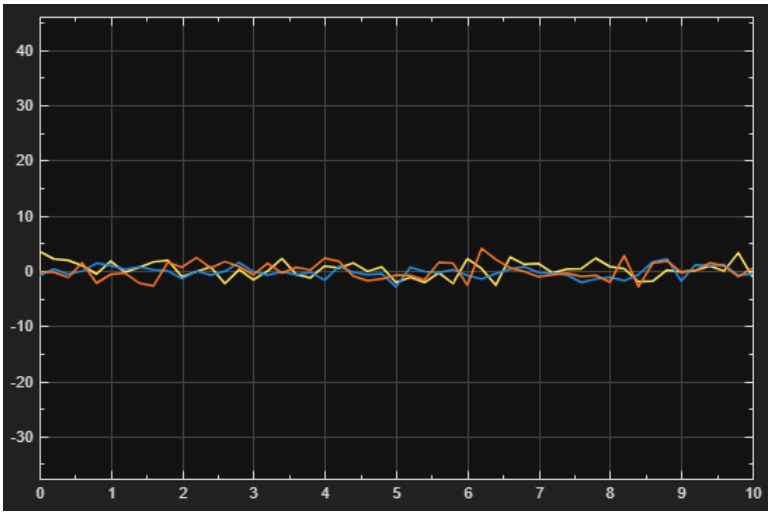
Process:

- First learning to use MATLAB, Simulink
- Figuring how to simulate sensor readings
- Plotting standard IMU readings at rest for respective sensors with parameters from datasheet.
- Importing plots as a timeseries object and then importing them to use as sensor readings in Simulink.
- Checking If all signals are properly obtained for a time of 10 seconds using scope and comparing if output is similar for sensors.
- Using an extended Kalman filter to obtain accurate rocket parameters.

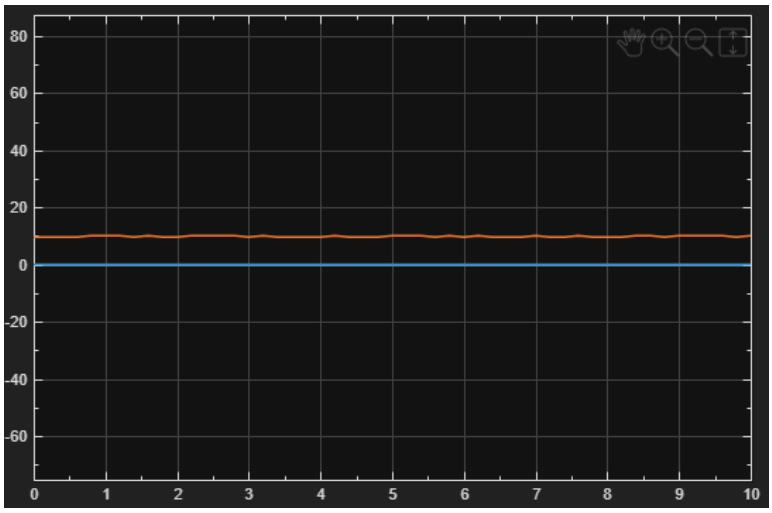
Inference Images:



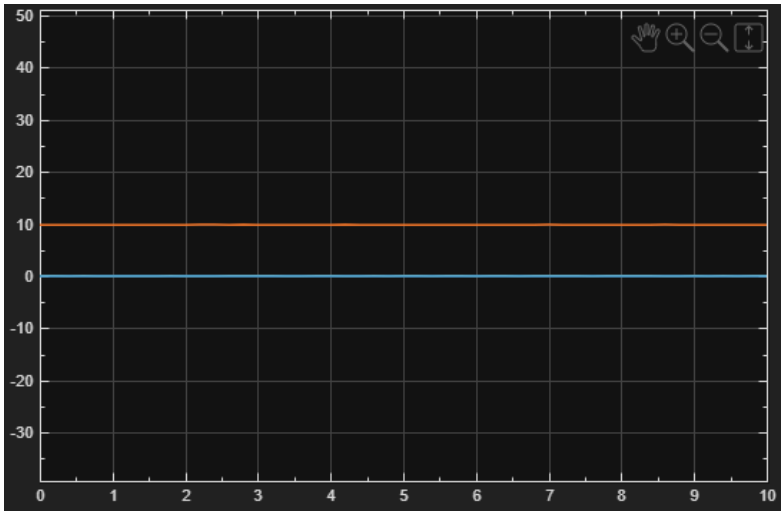
BMI088 Accel Readings



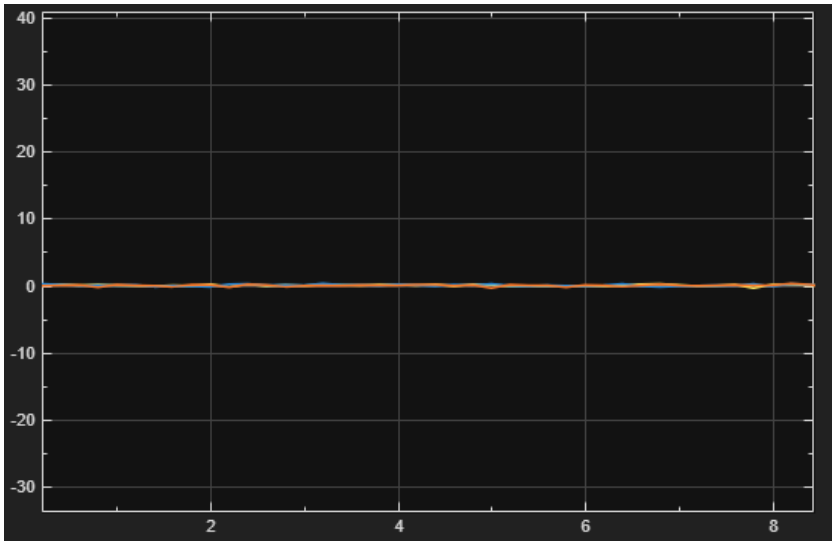
BMI088 Gyro Readings



H3LIS311DL Accel Readings



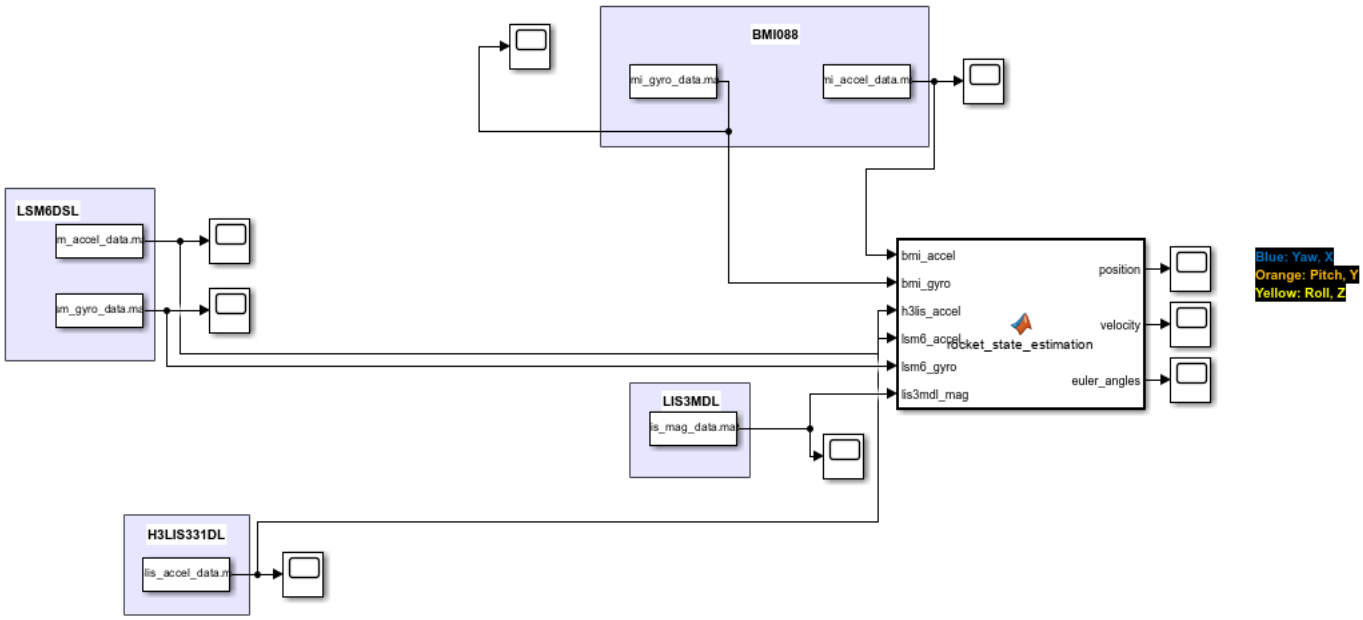
LSM6DSL Accel Readings



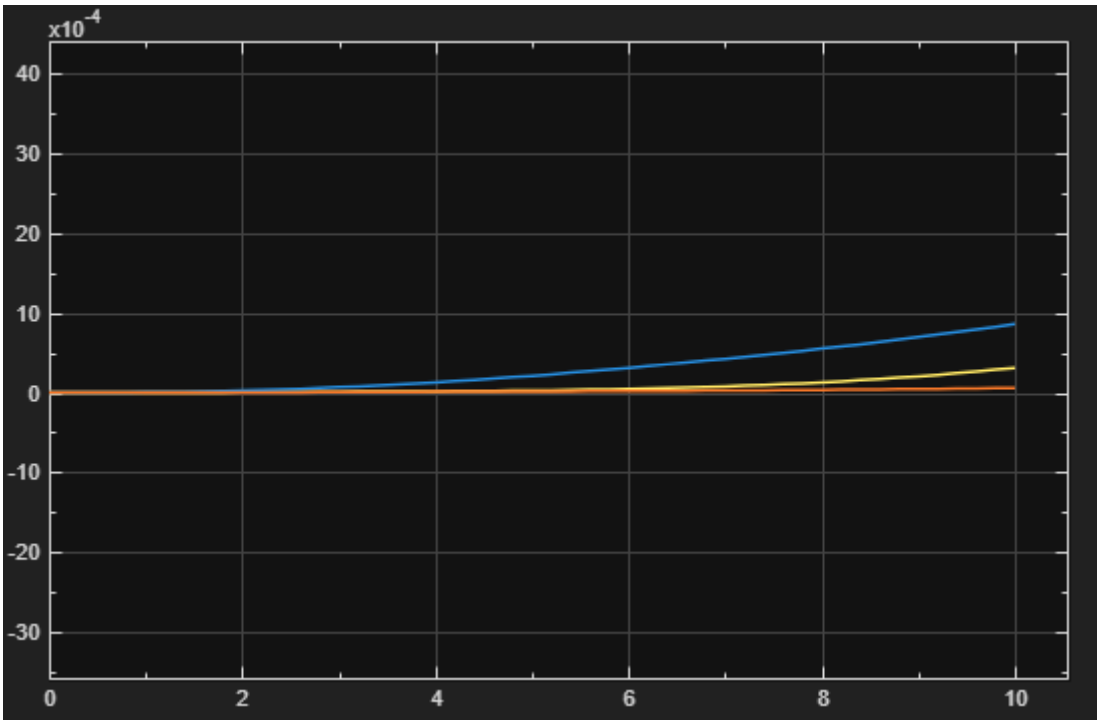
LSM6DSL Gyro Readings

Notes:

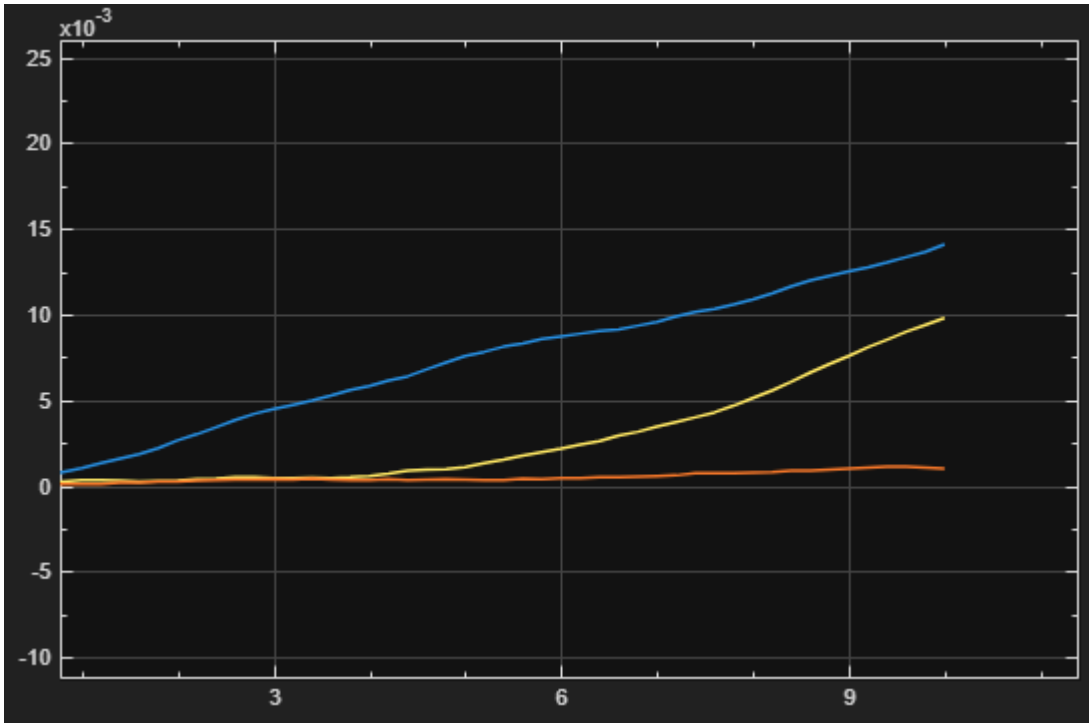
1. For now, simulated with no motion, but can be changed by giving values using repmat() function in MATLAB while assigning values of acceleration and rotation for accelerometer and gyroscope.
   Eg: accelTrue = repmat([0 0 1], N, 1); *accelerate along Z-axis*
   gyroTrue = repmat([0 0 pi/4], N, 1); *rotate at 45 deg/s around Z*



Position



Velocity



Orientation