



Magnetic Compass-Aided Heading and Yaw Gyro Bias Estimation in Spacecraft System

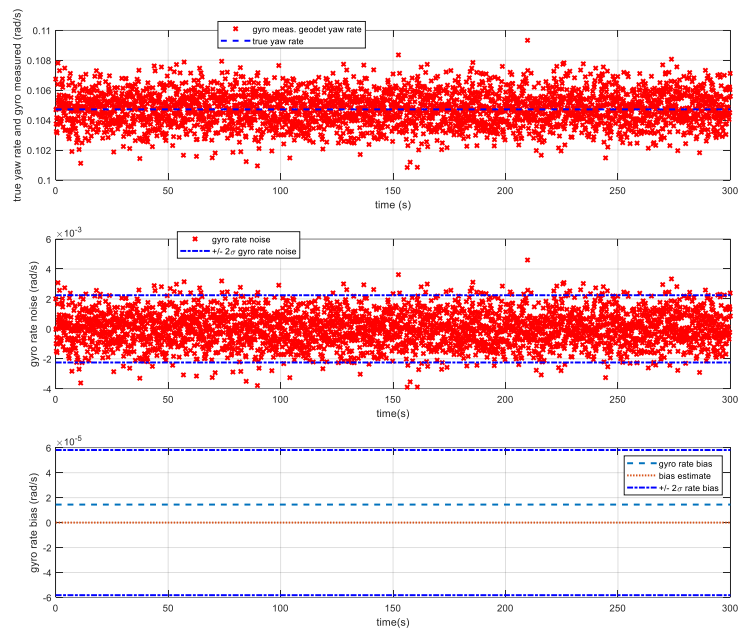
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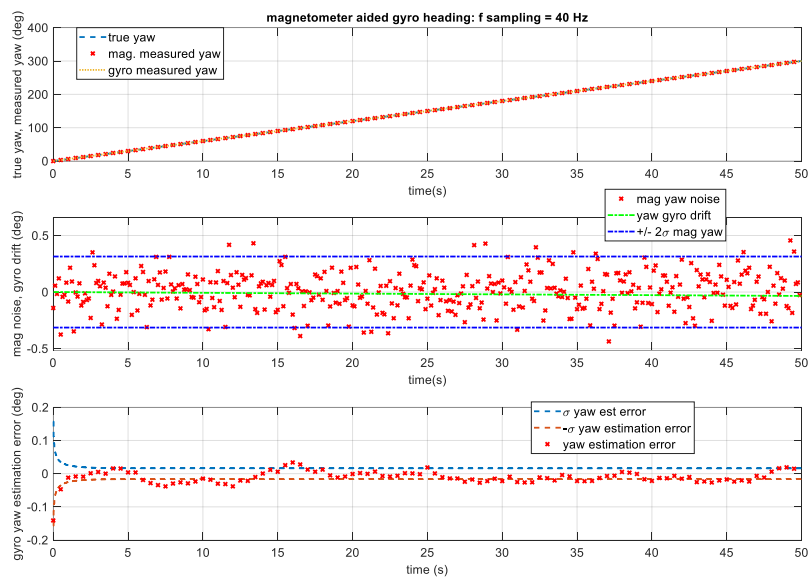
Magnetic heading refers to the direction an object points relative to Earth's magnetic north, determined by magnetometer measurements of the Earth's magnetic field at specific altitudes, latitudes, and longitudes. This magnetic heading, or yaw angle, is derived from the horizontal components (H_0) of the magnetic field. Concurrently, gyroscopes measure the rate of rotation (angular velocity) around an axis but often exhibit bias, a constant error that must be estimated and corrected for precise measurements. Gyro rate bias estimation utilizes a Measurement Model and Bias Estimation through the Kalman Filter. The process involves calculating the magnetic field vector, computing the heading from magnetic field components, and estimating gyro bias using Kalman filtering. By integrating these steps, reliable and accurate heading estimation is achieved while compensating for biases in gyroscope readings, enhancing the performance of navigation and orientation systems. This combined approach is essential for applications such as navigation and orientation tracking in mobile devices, drones, and other systems requiring accurate heading and rotation information. The methodology includes defining matrices for state transition, process noise, measurement noise, and calculating the Kalman gain to minimize estimation error, thereby providing a robust system for magnetic heading and gyro rate bias estimation.

Keywords: Earth Magnetic Field, Magnetic Heading, Gyro Bias, Kalman Filter, navigation, Satellite System.

Some of the Results:

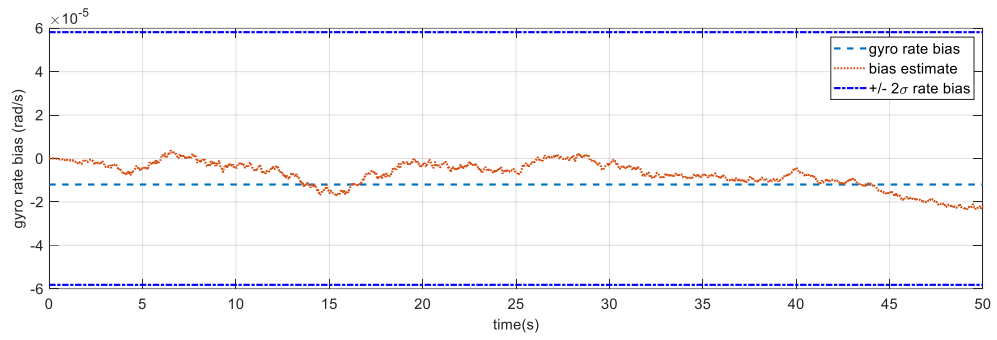
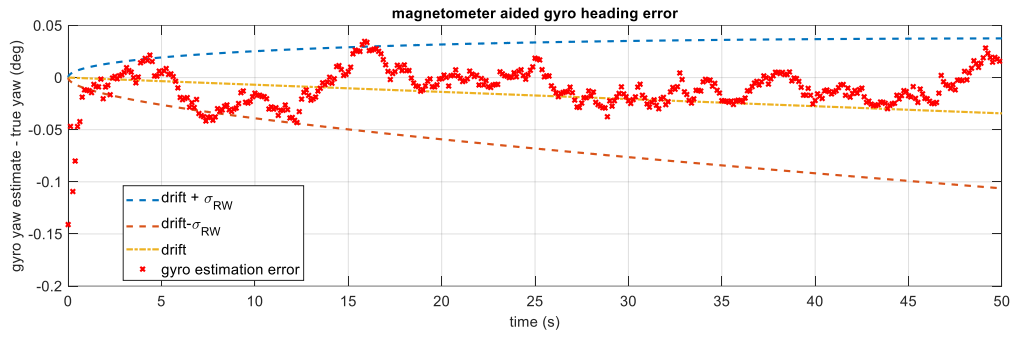


Gyro rate bias is not estimated since the magnetometer is not used.



duration (t = 0 – 50 s) for details

Over a shorter



Magnetometer aided Gyro heading Error