

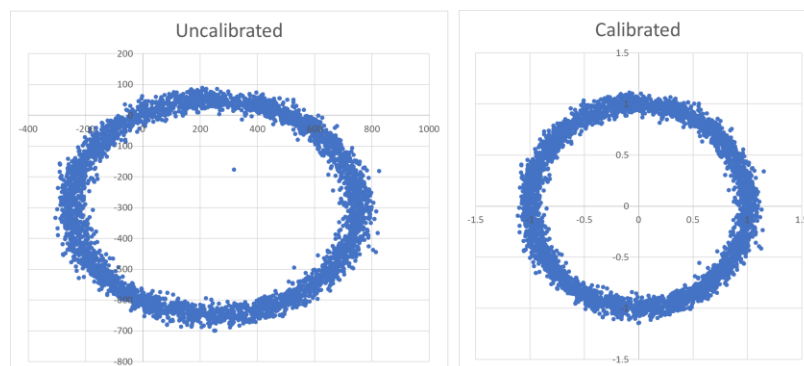
Verification 1 – Experimental

The Experimental verification will evaluate the results of calibrating and characterizing the magnetometer sensor and the servomotor. Note that this verification is only required for the teams with 4 members.

Verification 1 will take place during lab 3 in week 5. Please read the checklist carefully, and be 100% prepared to describe the simulation results and pseudocode.

Calibration of the magnetometer (1 point)

Due to manufacturing variations, your manometer will not respond equally in both axes. In order to use it effectively, you need to correct the offset and standardize the scale of the magnetometer's signal in both the x and y axes. To find the offset and scale correction values for each axis you need to measure raw data from the magnetometer while turning it around the z-axis. Then you can copy the measured data from the serial monitor of Arduino IDE into Matlab to calculate the calibration values (see equation below to calibrate the x-axis). The raw values from the magnetometer will probably look like the left plot (i.e. an ellipse, not centered on (0,0)) and the calibrated values should look like the right figure (a circle, centered on (0,0)). Provide similar plots of the raw data and the calibrated data.



$$\text{Calibrated_Data_X} = (\text{Raw_Data_X} - \text{Offset_X}) / (\text{Range_Raw_Data_X} / 2)$$

Characterization of the noise and drift from magnetometer's signal (2 points)

- a) After calibrating the magnetometer you need to characterize the noise of the signal from the sensor. Provide the average and standard deviation values of the measured signals for at least 3 different orientations of the X and Y axis (e.g. 0, 90 and 180 degrees). The measurements should have a duration of at least 10 seconds and a sampling frequency of at least 100 Hz. Provide a plot showing the results.
- b) To measure the drift of the magnetometer sensor you need to perform a static measurement (that is, the magnetometer is kept exactly in the same orientation) every 10 minutes for at least one hour and provide the angular drift over time (e.g. degrees/hour). Provide a plot showing the results.

Characterization of the position accuracy of the servomotor

To characterize the position accuracy of the servomotor you will need to measure the difference between the reference angle (set using the Arduino) and the actual angle (measured using a protractor). Do this accuracy measurement for at least 5 different angles. Provide a plot showing the results.

Presentation (1 point)

You presented the results of the calibration and characterization of the magnetometer and servomotor on time and within the allotted time given.