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# Where’s the Code (Matlab)

See [this folder](https://drive.google.com/drive/folders/1CTh1HnEMD5w7HQHGiZRvcePvGUhKVm1O?usp=sharing)

# Procedure

1. Download the entire [Springman\_Magnetometer\_Calibration\_Code](https://drive.google.com/drive/folders/1ERtz-S0vEl5RpfHZStGeWuDLywkaEciV?usp=sharing) folder
2. Open MATLAB
3. Run the ‘example\_calibration.m’ script
   1. Adjust ‘filename’ on Line 84 to see results of calibration for all 6 tests available
      1. (e.g. “test0\_esti” through “test5\_esti”)
4. Understanding what’s going on
   1. Read through [Information on Code/Data](#_7wq6r6pzuykk) section of this document
   2. Read through comments of ‘example\_calibration.m’ for details on what’s going on in each step
   3. Read through [John Springman’s paper](#_s4rgkks0au8b) on the actual methodology of this code

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# Calibrating with Your Own Data

Change values/variables in the following locations

* “Optional Parameters” section
  + Line 47
* “Reference Magnetic Field Norm” section
  + Line 68
* “Select Filenames” section
  + Line 80

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# Information on Code/Data

* **extractParameters\_v6a.m**
  + Summary
    - Matlab function written by John Springman
    - Takes in magnetometer data and performs an iterative non-linear least squares to find best calibration parameters
* **correctSensor\_v5.m**
  + Summary
    - Matlab function written by John Springman
    - Input
      * Magnetometer calibration parameters (from ‘extractParameters\_v6a’)
      * Raw data from the same magnetometer
    - Outputs
      * Calibrated magnetometer data
* **evalCostFunc.m**
  + Summary
    - Matlab function written by John Springman
    - Used in doing math for ‘extractParameters\_v6a’
* **example\_calibration.m**
  + Summary
    - Script written by Prince Kuevor
    - Takes raw data and other functions in this directory to demonstrate how to actually calibrate raw magnetometer data
    - See [Procedure](#_unozdzaz5xb) section of this document for more details
* [**20210423\_mag\_cali**](https://drive.google.com/drive/folders/1BKtVMdieoVvlVEhVrDwKCG2EAx5jK79M?usp=sharing)
  + Summary
    - This folder has the raw data from a drone Prince Kuevor uses for his research.
    - There is raw data from 6 tests in this folder
    - ‘EXPLANATION.md’ is a Markdown file that gives more details on the data from each test
  + Files
    - **EXPLANATION.md**
      * Markdown file with more detailed information about each test in this folder
    - **testX\_esti.csv**
      * Raw data from test ‘X’
      * There is *a lot* of information here that you don’t actually care about for magnetometer calibration. The stuff you’re probably most interested in are listed below.
      * Raw MPU9250 Magnetometer Data
        + CSV Column Names

‘mag\_X’, ‘mag\_Y’, and ‘mag\_Z’

* + - * + Units

MicroTesla

* + - * Raw PNI RM3100 Magnetometer Data
        + CSV Column Names

‘rm3100\_x’, ‘rm3100\_y’, and ‘rm3100\_z’

* + - * + Units

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# Text Reference

This procedure and code is based off of work done by John Springmann in his paper [Attitude-Independent Magnetometer Calibration with Time-Varying Bias](https://arc.aiaa.org/doi/10.2514/1.56726).

Note, I (Prince Kuevor), have only done time-invariant magnetometer calibration using this method/code. In effect, I have never compensated for the effect of high-current sources near the magnetometer.