## ENPM 809T – Autonomous Robotics: Spring 2022
Master of Engineering Program in Robotics

**Due Date**          Friday, February 4th, 2022

**Submission Information**
- This assignment focuses on loading sensor data with Python/NumPy and plotting/analyzing data with Matplotlib
- Submit response to Question #1 via Gradescope by 11:59 pm
- All portions of the assignment must be *completed* *<u>individually</u>*

Question #0.1  (0 points)

To ensure you have all components in your parts kit for 809T this semester, please refer to the Bill of Materials posted on ELMS > Modules > Lecture 01.  In the event your parts kit is missing a component(s), please email Abhishek (abhi1793@umd.edu) and cc Dr. Mitchell (mitchels@umd.edu) listing the missing component(s).

Question #1  (20 points)

Consider a small ground robot using an ADXL327 3-axis accelerometer (images at right) as part of its navigational sensor suite:

https://www.analog.com/media/en/technical-documentation/data-sheets/adxl327.pdf

A sample of the data packets streamed from the robot to the control station has been provided under ELMS > Assignments > HW #1 > "imudata.txt".  Each data packet contains the date and time of transmission along with a series of sensor readings that pertain to the robot's navigation. The data packet provided for this assignment was collected with the vehicle at rest, in an effort to calibrate the accelerometer.

Complete the following:

1. **Load** the **data** into Python/NumPy.
2. **Plot** the **raw data** for the 5th column of the file, corresponding to the pitch angle of the accelerometer as configured with the vehicle.  The 5th column begins with values [6, 3, 10, 9, 8, …].  The x-axis of the plot should begin with 0, 1, 2, … ; the y-axis should be in units of degrees.
3. **Label** the axes then add a **title** and **legend** to the plot.
4. Write your own function (i.e. do not use any built-in functionalities) to calculate a **moving average** of the raw accelerometer data.
5. **Plot** the **averaged data** on top of the raw data on the same plot.
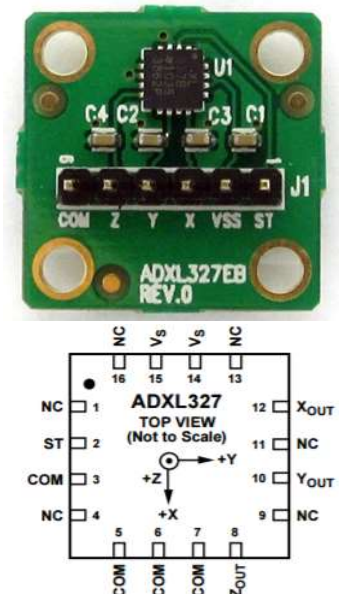
6. **Calculate** the **mean and standard deviation** of the averaged data and include this information **on the plot**.

Items 5 and 6 above should be completed for 2-, 4-, 8-, 16-, and 64-, and 128-pt moving averages. For a review of the moving average, refer to: https://www.youtube.com/watch?v=KBZOgRoiMXI

To complete the assignment, combine your Python code(s) and Matplotlib plots in a single file and upload as a .pdf to Gradescope. Annotate your file with a few sentences to describe each illustration.