# Aerospace Computing

## Assignment 9

Due: 3/29/24

You are to employ a Python fft routine, your choice of packages.

1. You are to demonstrate proper application of the fft routine by using it to represent magnitude and frequency content of $y(x) = 4\sin\left(\frac{3\pi x}{9}\right) - 2\sin\left(\frac{2\pi x}{7}\right)$.
    a. Choose an appropriate number of intervals so that you exactly match both waves.
    b. Choose an inappropriate number of intervals so that your waves spread.
2. You are given three sets of experimental data found on the class webpage as files CupData1.dat, CupData2.dat, and CupData3.dat, which are files of comma separated data. The data consist of 5 seconds of pressure data (in Pa) sampled at 204,800 Hz. There are data for 13 microphones stationed around an arc, so 13*1,024,000 data, with data arranged in columns for the 13 different microphones, and by rows for time. Consider only the data for microphone 5 for your assignment, but feel free to explore the rest of the data or talk with its author, Professor Cupploletti to learn more. Please follow the extra video which gives you further explanation.
    a. Run and plot the fft of this data (microphone 5) for each of the 3 test runs. It it should be presented as Sound Pressure Level (SPL), given by the equation $20log_{10}(\frac{p_{rms}}{2e-5})$, where the $p_{rms}$ is the result of the fft. Plot the results together for the 3 separate runs.
    b. Run this data a second time, by splitting it up into 250 separate data sets. Run the fft as above, then average the $p_{rms}$ before presenting as SPL. Plot the results together for the 3 separate runs.