This data folder contains the raw and processed data described in the TEAMER Post-Access Report titled *Optimal Control of an Oscillating Surge Wave Energy Converter* and is a summary of tests using a laboratory-scale oscillating surge wave energy converter (OSWEC) equipped with fifteen pressure sensors, two 6-axis load cells, an encoder to measure flap position, and four wave gauges. For details on the experiments, refer to the TEAMER Post-Access Report located in the main directory.

In this directory, there are four folders corresponding to the four types of tests conducted during the experimental campaign:

- 1. Buoyancy Tests We measure the torque required to hold the flap at different angles to characterize buoyancy torque as a function of position.
- 2. Locked Flap (Excitation) Tests We measure the torque on a locked flap subject to different wave parameters to extract the excitation torque coefficient.
- 3. Forced Oscillation (Radiation) Tests We force the flap to oscillate at different periods and amplitudes to extract added inertia and radiation damping coefficients.
- 4. Control Tests We subject the flap to different waves and use a linear damping controller to emulate a PTO and extract absorbed power and capture width ratio (CWR) as a function of wave and control parameters.

In each test folder, there are separate folders for tests using a round and square flap that contain a .mat file with the post-processed data and a folder with the raw data files. A summary of all raw data files is given in the spreadsheet in the main directory named Test_Directory.xlsx. The post-processed .mat file contains one of the following data structures:

- roundBuoyancyData and squareBuoyancyData [1 x 1] data structure for the buoyancy tests
- roundLockedFlapData [1 x 1] data structure for the locked flap tests
- roundForcedOscData and squareForcedOscData [1 x 1] data structure for the forced oscillation tests
- roundControlData and squareControlData [1 x q] data structure for the control tests, where q is the number of PTO sweeps for each flap type (13 for round flap, 2 for square flap)

Below is a list of variables in the post-processed .mat files (note: not all tests will contain all variables):

- timestamp [1 x n] cell array of timestamps for each of the n tests
 - Note: For variables with n columns, the values in each column correspond to the test in the same column as timestamp. In other words, for all variables with n columns, the x'th column corresponds to the same test described by the x'th column in timestamp.
- time [t x 1] time vector, in seconds
- T [1 x n] vector of wave/oscillation periods for all tests, in seconds
- H [1 x n] vector of wave heights for all tests, in meters
- amp [1 x n] vector of oscillation amplitudes, in radians

- p [1 x n] vector of percent added buoyancy, in x100%
 - For example, if p = 5, we added five times the original buoyancy torque during the test.
- n [1 x n] vector of boolean values where 1 represents a test where the stiction correction was added, and 0 represents a test where no correction was implemented
- Ia [1 x n] vector of added inertia coefficients, in kg m²
- Br [1 x n] vector of radiation damping coefficients, in Nms
- tauExc [1 x n] vector of excitation torque coefficient magnitudes for all tests, in Nm/m
- nuPTO [1 x n] vector of nominal PTO damping coefficient for all tests, in Nms
- nuPTOeff [1 x n] vector of effective PTO damping coefficient for all tests, in Nms
- flapPosition [t x n] matrix where each column is a time series of flap position for a single test, in radians
- flapVelocity [t x n] matrix where each column is a time series of flap velocity for a single test, in rad/s
- flapAcceleration [t x n] matrix where each column is a time series of flap acceleration for a single test, in rad/s/s
- pitchTorque [t x n] matrix where each column is a time series of pitch torque for a single test, in Nm
 - Note: For control tests, multiplying this by flapVelocity gives PTOPower
- hydrodynamicPitchTorque [t x n] matrix where each column is a time series of hydrodynamic pitch torque for a single test, in Nm
 - Note: This is pitch torque with buoyancy and inertia torques removed
- avgFlapPosition [1 x n] vector with the average flap position for all tests, in radians
- avgPitchTorque [1 x n] vector with the average pitch torque for all tests, in Nm
- surgeForce [t x n] matrix where each column is a time series of surge force for a single test, in N
- heaveForce [t x n] matrix where each column is a time series of heave force for a single test, in N
- PTOAvgPower [1 x n] vector with the average PTO power for all tests, in W
- PTOPower [t x n] matrix where each column is a time series of PTO Power for a single test, in W
- CWR [1 x n] vector with the capture width ratio for all tests, in 1/m

There is also a folder of raw data files for each type of test and each flap type. A summary of all raw data files is given in the spreadsheet in Test_Directory.xlsx. Below is a list of the types variables in the raw data folder:

• instObject - Each test has a corresponding instObject.mat file that contains hardware, tare and calibration information for each sensor and test. Details on which tests belong to which instObject file is summarized in Test_Directory.xlsx. For additional information and code for the instObject files, reach out to Brittany Lydon at BrittLyd@uw.edu.

- Data file This file contains the raw data taken for each test, and contains the following variables:
 - metadata a structure containing details of the test, including:
 - dataCollectTime testing duration, in seconds
 - timeStamp time and date information of the test
 - controlMethod string that describes the type of experiment ran
 - forced-pitch: forced oscillation test
 - locked/free: no control on the flap, just collecting sensor data
 - spring-damper: control test that applies an resistive torque proportional to position, velocity, or both
 - springC (for control tests) PTO spring coefficient, in Nm
 - dampingC (for control tests) PTO damping coefficient, in Nms
 - oswecAmp (for forced oscillation tests) OSWEC oscillation amplitude, in radians
 - oswecT (for forced oscillation tests) OSWEC oscillation period, in seconds
 - rampTime (for forced oscillation tests) length of ramp-up and ramp-down time, in seconds
 - wave a structure containing wave information
 - staticDepth: water depth, in meters
 - Hnom: nominal wave height, in meters
 - Tnom: nominal wave period, in seconds
 - modSampleFreq: sampling frequency, in Hz.
 - wd a data structure containing raw data time series, including:
 - t raw time series
 - motorCommandVolts raw motor command voltage, in V
 - posMotorRaw raw position measured by motor, in V
 - posShaftRaw raw position measured by shaft encoder, in V
 - Note: The shaft encoder malfunctioned during testing and should be ignored
 - zPulse time series used for position tare procedure (not necessary for processing)
 - loadDriveVolts raw drive-side load cell measurements, in V
 - loadFreeVolts raw free-side load cell measurements, in V
 - pressureVolts raw pressure sensor measurements, in V
 - waveVolts raw wave gauge measurements, in V
 - leakSensor time series of leak sensor reading, in V
 - Note: Noise from the motor drive caused false readings in leak sensor measurements

For questions on data collection and analysis, reach out to Brittany Lydon at BrittLyd@uw.edu