

University of Washington Oscillating Surge Wave Energy Converter (OSWEC) Data Structure

Test data and configuration information are embedded in a series of MATLAB structures and objects, as described in this file. Each file describes test conditions for a unique power take-off set point (e.g., damping coefficient) and wave condition.

Variable Sizes

T: number of time stamps

N_g : number of wave gauges

N_p : number of pressure sensors

Field Descriptions

- wd: primary experimental data structure
 - t (Tx1): time [s] since start model counter start
 - t_rel (Tx1): time [s] relative to start of test
 - Kinematic Information
 - posMotor (Tx1): flap position [rad] from motor encoder corrected for gearbox ratio (0 denotes vertical flap, + denotes flap displaced away from wavemaker, - denotes flap displaced towards wave maker)
 - posMotorDeg (Tx1): posMotor in [deg] (included for convenience in plotting)
 - velMotor (Tx1): flap velocity [rad/s] from motor encoder (filtered)
 - accMotor (Tx1): flap acceleration [rad/s²] from motor encoder (filtered)
 - posShaft[...] (Tx1): equivalent fields to posMotor[...], but for the encoder directly on the drive shaft. This sensor was more susceptible to noise than the motor encoder.
 - Dynamic Information
 - loadDriveLocal (Tx6): forces and torques measured on the driven side of the flap, tared to 0 with flap vertical in still water
 - Column 1: x-direction force (instrument coordinate frame) [N]
 - Column 2: y-direction force (instrument coordinate frame) [N]
 - Column 3: z-direction force (instrument coordinate frame) [N]
 - Column 4: Moment about x-axis (instrument coordinate frame) [N-m]
 - Column 5: Moment about y-axis (instrument coordinate frame) [N-m]
 - Column 6: Moment about z-axis (instrument coordinate frame) [N-m]
 - loadDriveGlobal (Tx6): loadDriveLocal, but converted into global coordinate system (filtered)
 - +x: direction of wave propagation
 - +z: up from water surface
 - +y: right hand rule definition based on x and z
 - loadFree[...] (Tx6): as for loadDriveGlobal, but for the non-driven (“free”) see of flap

- loadTotalGlobal (Tx6): total forces and torques measured in global coordinate frame
 - Column 1: surge force [N]
 - Column 2: sway force [N] (*diagnostic*)
 - Column 3: heave force [N]
 - Column 4: roll moment [N-m] (*diagnostic*)
 - Column 5: pitch moment imposed by power take-off [N-m]
 - Column 6: yaw moment [N-m] (*diagnostic*)
 - pressure (TxN_p): gauge pressure [kPa] on sensor (filtered)
 - power (Tx1): mechanical power absorbed by power take-off [W] (+ denotes power absorbed, - denotes power injected to flap)
 - gauge (TxN_g): wave elevation [mm] for each gauge (filtered)
 - Wave Information
 - Diagnostic Information
 - motorCommandVolts (Tx1): voltage command sent to motor drive by DAQ [V]
 - zPulse (Tx1): encoder z-pulse for motor encoder [~]
 - posMotorRaw (Tx1): flap position [count] from motor encoder (continuous increment)
 - leakSensor (Tx1): leak detected (Boolean alarm) (intermittently raised due to noise)
 - loadDriveVolts (Tx6): voltage measured on each load cell channel on driven side of the flap, prior to transformation by calibration matrix and correction for tare values
 - loadFreeVolts (Tx6): as for loadDriveVolts, but for the non-driven side of the flap
 - waveVolts (TxN_g): voltage measured by each wave gauge
 - Processing Information
 - pres_filter: characteristics of filter applied to pressure time series data
 - enc_filter: characteristics of filter applied to motor and shaft encoder time series data
 - lc_filter: characteristics of filter applied to driven and non-driven load cell time series data of forces and torques
 - lcDrive: load cell object containing metadata about load cell on driven side of the flap, including calibration matrix and mean voltage collected during system tares
 - lcDrive: same as lcDrive, but for load cell on non-drive side of the flap
 - encShaft: shaft encoder object containing metadata about shaft-mounted encoder, including absolute position when flap is vertical
 - encMotor: motor encoder object containing metadata about motor-integrated encoder, including absolute position when flap is vertical.
 - pressureArray: pressure sensor array object
 - numSensors: number of pressure sensors (N_p)
 - sensors (N_p x 1): structure containing sensor metadata and voltage collected during system tares – ‘pos’ is the sensor position on the face [cm] relative to global coordinate frame origin ([0,0,0] at waterline in center of flap cross-section)

- tank: tank object
 - slope: tank slope (nominally zero)
 - channelWidth: tank width [m]
- wgArray: wave gauge array object
 - numGauges: number of gauges (N_g)
 - gauge ($N_g \times 1$): structure containing gauge metadata and voltage collected during system tares – pos is distance [m] from wave maker
- motor: motor object containing metadata about motor specification and gear ratio
- flap: flap object containing metadata about properties
- metadata: information about test conditions
 - dataCollectTime: total time data collected [s]
 - instObjectsPath: location of instrument objects during data collection (embedded during post-processing)
 - timestamp: time of start of experiment [datetime]
 - timeStr: time of start of experiment (string)
 - controlMethod: control law applied to power take-off
 - springC: commanded spring constant applied to power take-off (imposed torque product of spring constant and flap pitch angle)
 - dampingC: commanded damping constant applied to power take-off (imposed torque product of damping constant and flap pitch velocity)
 - wave: information about waves during testing
 - static depth: tank water depth [m]
 - Hnom: nominal wave height commanded [m]
 - Tnom: nominal wave period commanded [m]
 - notes: specific information entered in notes field during experiment
 - flapMass: mass of flap [kg] (redundant with information in flap object)
 - modSampleFreq: sample frequency on all DAQ channels during acquisition [Hz]
 - dt: time step between samples [s] (inverse of modSampleFreq)