

Guidelines for Utilizing the Source Code in Simulating FOWT Installations

1) Libraries, Project Design Input Parameters, and Calling Metocean Data - Weather Windows

Before running this cell, users should:

- **Install Required Libraries:**
 - Ensure libraries such as pandas, numpy, and datetime are installed in the Python environment. Install them using pip if not already installed (e.g., **pip install pandas numpy**).
- **Specify Metocean Data File Paths:**
 - Update **PORT_WEATHER_DATA_PATH** and **WEA_WEATHER_DATA_PATH** with the correct Excel file paths for the weather window data for the Staging & Integration Port and Wind Energy Area (WEA).
 - Weather data can be collected and analyzed using 'Source_Code_for_ERA5_Metocean_Data_Collection_Analysis.ipynb' and specifically Cell 8 to generate the required sets to Excel files for your chosen locations.
 - If you prefer not to conduct metocean data analysis initially, utilize the provided pre-processed metocean data Excel files for sample locations like Morro and Humboldt Bay Potential FOWT project areas. These can be directly used by inserting their paths in the simulation tool for experimenting with the tool.
- **Input Parameters Interactively:**
 - Execute the cell and **get_input_parameters()** function to input and confirm project design parameters.
 - Update the variables GCR, ACL, P, and NSS to reflect project design specifications. These include Great Circle Route distance, Array Cable Length distance, number of Floating Offshore Wind Turbines (FOWTs), and number of Substations.
- **Confirm Parameters Post-Execution:**
 - After running the cell, verify that the printed parameters (GCR, ACL, P, NSS) align correctly with the simulation requirements.

2) Task Info Cell (Base Case), # 3) Task Info Cell (Sensitivity Case 1), and # 4) Task Info Cell (Sensitivity Case 2)

Before running these cells, users should:

- **Understand Task Information Structure:**

- The cells define tasks with key parameters like duration and execution pace, operational weather conditions, number task repetitions, and execution location. This information is vital for simulating installation operations.
- **Base Case and Sensitivity Analysis:**
 - Cell 2 sets up the base case scenario. Cells 3 and 4 modify certain tasks for sensitivity analysis, focusing on bottleneck steps.
- **Modifying Task Parameters:**
 - Users can modify parameters like **duration**, **weather_conditions**, **repetitions**, and **location** according to their project's specifics and analysis requirements.
- **Task Dependencies and Start Times:**
 - Some tasks may have dependencies on other tasks or specific start times. Review and adjust these as necessary for the simulation.
- **Location Specificity:**
 - Ensure the task **location** is correctly set (port or WEA) to call correct weather data for consideration and reflect the actual project conditions.
- **Customizing for Sensitivity Cases:**
 - For Cells 3 and 4, focus on the tasks identified for sensitivity analysis. Adjust their parameters to explore different project scenarios and outcomes.
- **Simulation Output:**
 - Single Cell Execution: Run only one of Cells 2, 3, or 4 before execution cell, Cell 5, as needed.
 - Impact on Results: The chosen cell directly influences simulation outcomes.

5) Execution Cell: Simulation Execution and Result Generation

Before running this cell, users should:

- **Update Weather Data Paths:** Ensure **PORT_WEATHER_DATA_PATH** and **WEA_WEATHER_DATA_PATH** are correctly set to point to the weather window data files and called by Cell 1.
- **Review Task Information:** Verify the **tasks_info** dictionary from previous cells accurately reflects the project's tasks and their constraints.
- **Check Simulation Period/Year Range:** Adjust **simulation_chunks** to match the project's time frame and available weather data.
- **Customize Output Path:** Change **excel_path** to the desired location for saving simulation results.
- **Understand Execution Flow:** Be familiarized with the unlocking logic and how tasks are executed based on weather conditions and dependencies.
- **Run and Review:** After execution, review the output in Excel for insights into task performances and project timelines, which will be later used by Cells 6 and 7 for visualization.

6 & 7) Resulting Graphs: Project Completion Time, FOWTs Deployed, Task Performance and Inefficiency Analysis

Before running this cell, users should:

- **Update Simulation Results Directory:** Change the **directory** variable to the location where the simulation results in Excel files are stored. This path is necessary for the cell to locate and process the data.
- **Verify Data File Format:** Ensure that the simulation result Excel files follow the expected format, especially the column names and data types.
- **Customize Plot Settings:** Adjust plot parameters such as figure size, colors, and labels as per the visualization preferences.
- **Review and Execute:** After ensuring the above settings, run the cell to generate the visualizations for project and installation task performance as well as FOWT deployment potentials.