

# Extreme Wave-Structure Interactions

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- This project involves investigating the interactions between extreme wave events and offshore structures.
- Over the course of the project a numerical model will be developed, as well as a methodology for assessing air gap and deck superstructure level, to facilitate the design of offshore renewable energy platforms (fixed & floating).
- It is envisioned that the numerical model will be developed using Smoothed Particle Hydrodynamics (SPH).
- The application of this project is to the design of an offshore power-to-gas wind farm.
- This project is a part of the MaREI research platform 2

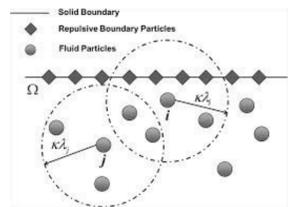
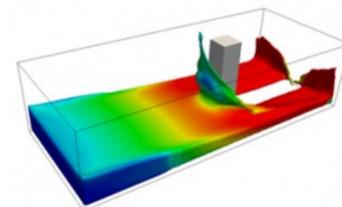
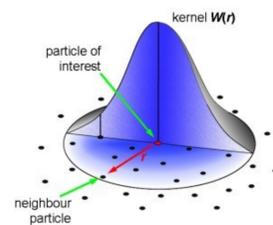


## Smoothed Particle Hydrodynamics

- SPH is a meshless (Lagrangian) computational method whereby the fluid is represented individual particles, as opposed to most conventional CFD methods.
- Each particle is assigned individual fluid properties that travel with them and can change with time.
- Local interpolation with a weighting function (kernel) around each particle to obtain fluid properties.

## Power-to-Gas System

- Power-to-Gas (PtG) is the functional description of the conversion of electrical power into a gaseous energy carrier, such as hydrogen or methane.
- PtG offers a means by which to levelise the amount of energy produced from offshore wind farms and reduce losses.



	Lagrangian Methods	Eulerian Methods
<b>Grid</b>	Attached to moving particles	Fixed in space
<b>Track</b>	Movement of any point on materials	Mass, momentum & energy flux across grid nodes & mesh cell boundaries
<b>Time history</b>	Easy to obtain	Difficult to obtain
<b>Moving boundaries &amp; interfaces</b>	Easy to track	Difficult to track
<b>Irregular geometry</b>	Easy to model	Difficult to model with accuracy

## Methane storage

The novel prospect of storing the methane in a floating, torus shaped container is currently being considered, pending preliminary studies into the required methane capacity. This aspect of the system will be the most important from the views of its structural design. Assigning appropriate factors of safety will be imperative, thus full confidence in the reliability of the design methodology is essential, especially in extreme oceanic climates such as the west coast of Ireland.



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