**Objective**
This project aims to develop a numerical tool to study wave energy converters. In particular, floating OWC (Oscillating Water Column) moored to the seabed will be studied. This software will be used to optimize the design of the devices by analyzing its efficiency under different wave conditions, chamber dimensions and PTO systems (Power Take-Off). Secondly, the survivability of the floating device will also be studied under extreme sea conditions, obtaining the optimum mooring layout to increase the lifetime of OWC, in high energy coasts.

**Numerical Modelling: DualSPHysics**
Smoothed Particle Hydrodynamics (SPH) describes a fluid by replacing its continuum properties with locally smoothed quantities at discrete Lagrangian locations named particles. Each particle is a nodal point where physical quantities are computed as an interpolation of the values of the neighbouring particles solving the Navier-Stokes equations. Hence, the domain can be multiply-connected with no special treatment of the free surface, making it ideal for examining complicated flow situations. The DualSPHysics code is here applied to simulate the interaction between sea waves and OWC.

**FUNCTIONALITIES OF DUALSPHYSICS**
- Fluid-structure interaction
  - DualSPHysics has been already validated and applied to:
    - Study of the run-up on an existing armour block breakwater.
    - Estimation of wave impact on coastal structures.
- Wave propagation, passive & active wave absorption
  - DualSPHysics mimics physical wave facilities:
    - Long-crested wave generation for regular, random and solitary waves.
    - Passive absorption is implemented using a damping zone.
    - Active wave absorption is also implemented, based on time-domain filters.
- Wave interaction with floating bodies
  - Buoyancy has been already validated in DualSPHysics. The study of a floating body subjected to a wave packet has been validated with experimental data.
- Mooring lines
  - MoorDyn (http://www.matt.hall.ca/moordyn/) is an open-source dynamic mooring line model that uses a lumped-mass formulation for modelling axial elasticity, hydrodynamics, and bottom contact. MoorDyn is now coupled with DualSPHysics.

**Simulation of Oscillating Water Column**
- **Fixed OWC (Laboratory scale):**
  - The model was first validated with a laboratory test that consists of a fixed OWC with an open chamber (IHCANTABRIA).
  - Muñiz plant (real scale):
    - The model was then applied to predict water surface oscillations inside the chamber of a real OWC (located in Muñiz, Spain) using the prevailing wave conditions in the area.

**Floating Offshore OWC:**
The new capabilities of DualSPHysics are shown by simulating the effect of mooring systems on a floating offshore OWC in the open ocean. The geometry and size of the floating OWC have been chosen for computational demonstration purposes but using the geometry and size of a realistic device. Regular no-breaking waves (H=1.8 m, T=3.0 s, d=10 m) are simulated in order to obtain preliminary results of i) water surface oscillations inside the chamber, ii) motions of the floating OWC. Maximum values of 75 tons are achieved for the numerical tensions at the four mooring lines.

**Future Work**
The future work will be focused on the implementation of a new version that considers water-air phases. A new version of DualSPHysics will be released as open source including documentation and a new user friendly interface.

**More Information At**
DualSPHysics website: www.dual.sphysics.org
WELCOME website: www.welcome.sphysics.org
Corresponding author: Dr Alejandro Crespo alexsphex@uvigo.es