



lowec

An Inertial Oceanic Wave Energy Converter

Dottorato XXXI ciclo: Sergej Antonello Sirigu
Supervisore: Giuliana Mattiazzo

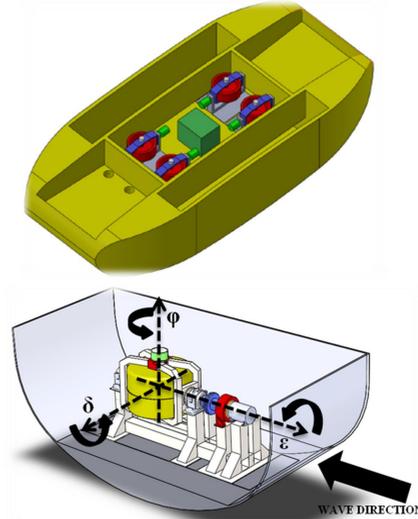
My research activity consists in the development of a gyroscopic based wave energy converter called lowec (Inertial Oceanic Wave Energy Converter). The design of this device starts from the resource assessment and comprehension of the ocean waves phenomena, it continues through the wave-to-wire model of the system, and ends with the experimental validation of the model and the economical assessment of an entire array of devices.

Device characteristics

lowec is a **pitching floating device**, that exploit the energy carried by the ocean waves thanks to the **gyroscopic effect**.

The **main characteristics** are:

- All the mechanical/conversion parts are inside the sealed hull
- Self-orientable with the predominant incoming wave due to the slack mooring system
- The system can be tuned to the incoming wave through the flywheel velocity
- The device can exploit wave energy from a large range of sea state condition, thanks to the PRTT technology(Pitching Resonant Tuning Tanks)
- The system can be deployed in open sea as an array of several devices

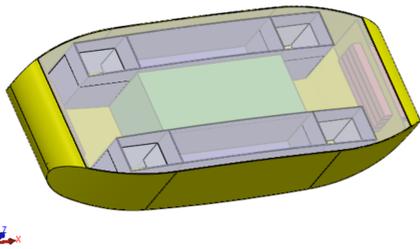
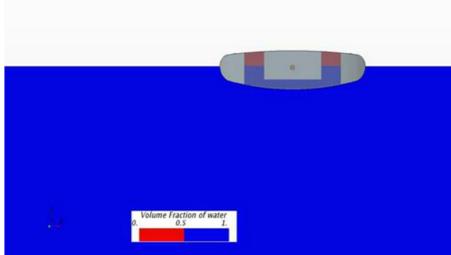
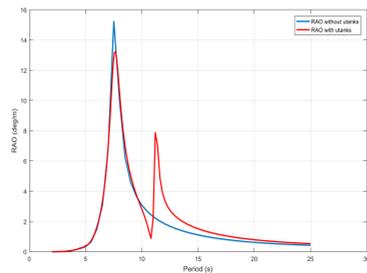


Pitching Resonant Tuning Tanks (PRTT)

Concept and Motivation

PRTTs are basically u-shaped sloshing tanks that change the dynamic behavior of the wave-hull system, creating a second peak in the frequency response for higher periods.

Therefore, the whole system is capable to be tuned for a large variety of sea state conditions

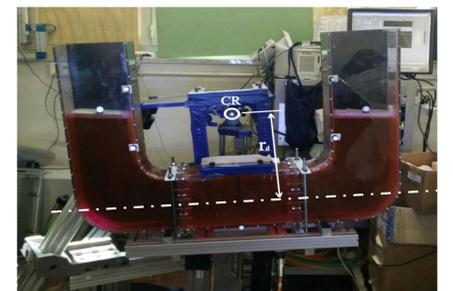
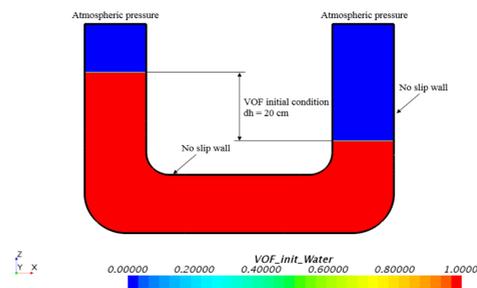
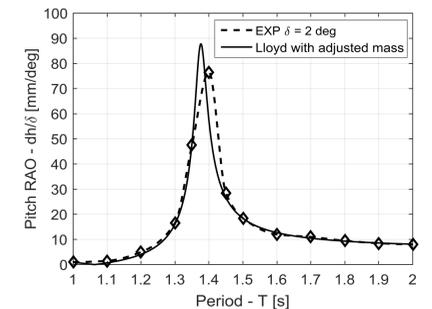


Experimental Tests and model validation

The sloshing motion of the water inside the PRTTs can be model as a 1st order linear system.

A validation campaign of this model has been carried out.

Firstly the viscous damping coefficient has been identified via CFD free decay simulation Secondly an experimental scaled test has carried out in order to validate the analytical model

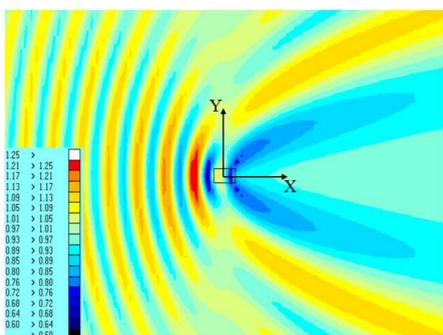
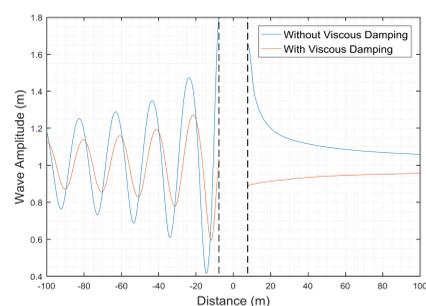


Hydrodynamic study of WEC farms

Hydrodynamic of floating bodies

The advantage of producing energy via array of WECs and not via individual device has long been demonstrated. The hydrodynamic interaction of WECs can affect strongly the productivity performances of the WECs farm.

Therefore, it is fundamental to describe and study accurately the hydrodynamics of interacting bodies. The reference will be the performances of the isolated device



Hydrodynamic performances of WECs farm

