Experimental and numerical investigation of slamming of an Oscillating Wave Surge Converter in two dimensions

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Abstract:
Wave Energy Converters (WECs) are a new class of offshore structures, designed to be excited by the waves to convert this mechanical energy to electricity. One such WEC, called Oyster and developed by Aquamarine Power Ltd., is a large buoyant flap which is hinged close to the seabed and pierces the water surface in water depths of 10 to 15 meters. This flap oscillates back and forth under the action of incoming waves and will be expected to withstand extreme conditions. It has been previously observed that Oyster is not only subject to wave impacts, but it also occasionally slams into water during the oscillation cycle. This slamming phenomenon has been identified as en extreme load case and is studied by means of both experimental and numerical techniques.

During this talk, I will first introduce the dynamics of the flap and the slamming phenomenon of Oyster through recent small-scale experiments performed at Ecole Centrale Marseille. Pressure data acquisition, coupled to image processing, allowed to gain insight in these extreme events and the pressure distribution on the flap will be discussed. The driving mechanisms of slamming in such configuration have been related to classical impact theories, and notably water entry problems, in order to allow an estimation of slam pressures. In addition, the ongoing work on numerical simulations of such phenomena with both a Lagrangian mesh less SPH (Smoothed Particle Hydrodynamics) code and a Eulerian finite volume code, based on a VOF (Volume Of Fluid) method to track the water/air interface and an Immersed Boundary Method to take into account the solid flap, will also be presented.