Proceedings of EWTEC 2021

The 14th European Wave and Tidal Energy Conference was held from 5-9 September 2021 at the University of Plymouth. For the first time, in response to the global pandemic, EWTEC was held in a hybrid format, allowing attendees to present online as well as in person. There were 12 different thematic tracks:

- Wave resource characterization
- Wave hydrodynamic modelling
- Wave device development and testing
- Tidal resource characterization
- Tidal hydrodynamic modelling
- Tidal device development and testing
- Structural mechanics: materials, fatigue, loadings
- Station-keeping, moorings and foundations
- Operations and maintenance
- Grid integration, power take-off and control
- Environmental impact and appraisal
- Economical, social, legal and political aspects of ocean energy

From the 403 abstracts initially submitted, 236 full papers were finally selected by a peer-review process, during which 48 Track Directors requested 963 single blind reviews and 427 reviews were finally carried out. These papers comprise the present proceedings, totalling 1952 pages.

This USB flash drive contains the searchable conference proceedings.

On behalf of the EWTEC Committee, I would like once again to warmly thank all the reviewers and Track Directors for their essential and voluntary work, and all authors for their contribution to the scientific content of the 14th EWTEC.

I would also like to sincerely thank our Sponsors for their valuable support to the conference.

Professor Deborah Greaves

Chair of EWTEC 2021

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Experimental characterization of the chamber-turbine coupling damping of Mutriku breakwater power plant at 1:36 scale model

Iñigo Bidaguren, Gustavo A. Esteban, Iñigo Albaina, Paul Liz, Urko Izquierdo, Alberto Peña, Iñaki Zabala, Jesús M. Blanco.

Abstract— **Amongst the different wave energy converters (WECs), Oscillating Water Column (OWC) has aroused the interest of the scientific community and many companies. The performance of this type of systems depends on several parameters like incident wave conditions, geometry of the chamber structure, control system or the operation characteristic curves of the air turbine. A real case study of a fixed OWC is the breakwater of Mutriku harbour (Bay of Biscay), composed by 16 chambers with a self-rectifying air turbine of Wells type. In the present work, we will focus on the hydrodynamic efficiency of the chamber geometry of this facility. According to available information of the site, a tide level and a wave height have been selected. The pneumatic power as a function of the generated air pressure and flow rate will be studied according to the incident potential and kinetic energy of the incoming waves at several operation points of the Power Take Off (PTO) turbine defined by the corresponding damping state. Experiments using a scale model have been performed in a 2D wave flume. Different damping conditions (orifice plate diameters) have been studied for different regular waves with a broad range of periods, having identified the optimal conditions for energy conversion. The work is a first milestone of a wider job that will contribute to the knowledge of this power plant and its most appropriate operating conditions, to help in the decisions to be undertaken in any future action on this plant, or, in a wider scope, to any new projected onshore OWC power plant.**

Keywords— **Oscillating Water Column, Hydrodynamic efficiency, Turbine-chamber coupling, Turbine damping.**

I. Introduction

SEEKING for new renewable energy resources is an important task in order to prevent a bigger damage of our environment and ensure a sustainable development. Wave Energy Converters (WECs) have been under study for last 50 years as part of the solution to that objective [1]. Several types of WEC systems and devices have been developed and most of them still are on that path. In this work we focus on one of the most relevant WECs: the Oscillating Water Column (OWC) [1–3]. This kind of technology can be separated in two groups: The floating offshore and the fixed onshore devices.

The "Ente Vasco de la Energía" (EVE, the Basque Agency for Energy), promoted a fixed onshore type OWC power plant in the village of Mutriku (Spain) with the final aim of demonstrating the technical feasibility of the technology, including its connection and integration into the electrical grid [4]. It is important to remark the extremal sea-state event on 2009 when Mutriku power plant breakwater front wall collapsed after some episodes of strong waves. As a consequence, the seaward front of the breakwater holding the OWC chambers was reinforced (see Fig. 1) with an improved structural configuration containing a thicker front wall (see Fig. 2). The present work uses this reinforced geometry in order to study the hydrodynamic efficiency of the OWC chambers with a scaled physical model in a wave flume at different incident regular waves and turbine operation states. The set of experimental tests have been carried out using the wave

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