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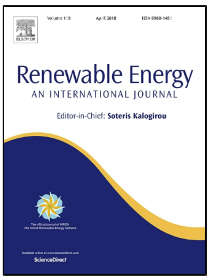

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Application of a Fictitious Domain Method in Numerical Simulation of an Oscillating Wave Surge Converter

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Abstract

In recent years, several numerical methods, including potential flow theory and Computational Fluid Dynamics (CFD) methods, have been employed to predict the hydrodynamic performance of Oscillating Wave Surge Converters (OWSCs). In the CFD methods, in order to consider the motions of the OWSC inside the fluid, a dynamic mesh is commonly used which is computationally expensive and troublesome. In this paper, a fast fictitious domain (FFD) method in conjunction with the Volume-Of-Fluid (VOF) method is proposed, within the frame of a fixed Eulerian grid. The method is used to simulate the fully-nonlinear steep wave interactions with an OWSC at various incident conditions, including the slamming. The accuracy of the proposed model is examined by comparing the numerical results with the available experimental data in the literature for a two-dimensional slamming event. The model is also used to investigate the effects of the Power-Take-Off (PTO) damping coefficient on the OWSC capture factor, slamming characteristics and hinge forces. Results show that a freely moving OWSC, might experience considerably higher hinge forces in comparison with an OWSC having a suitably adjusted PTO damping force. Furthermore, as the wave height increases, the maximum capture factors occur at higher values of the PTO damping coefficient.

Keywords: Oscillating Wave Surge Converter, Slamming, Power Take-Off, Fictitious Domain Method, Wave Energy.