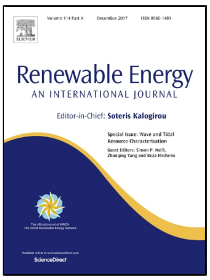
Accepted Manuscript



A geometrical optimization method applied to a heaving point absorber wave energy converter

Milad Shadman, Segen F. Estefen, Claudio A. Rodriguez, Izabel Nogueira

PII:	S0960-1481(17)30813-3
DOI:	10.1016/j.renene.2017.08.055
Reference:	RENE 9153
To appear in:	*Renewable Energy*
Received Date:	04 May 2016
Revised Date:	25 July 2017
Accepted Date:	21 August 2017

Please cite this article as: Milad Shadman, Segen F. Estefen, Claudio A. Rodriguez, Izabel Nogueira, A geometrical optimization method applied to a heaving point absorber wave energy converter, *Renewable Energy* (2017), doi: 10.1016/j.renene.2017.08.055

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Milad Shadman, *Segen F. Estefen, Claudio A. Rodriguez, Izabel Nogueira

Ocean Engineering Department, COPPE – Federal University of Rio de Janeiro
Address: Federal University of Rio de Janeiro, COPPE - Ocean Engineering Department
P.O. Box 68508 – CEP 21945-970 - Rio de Janeiro, RJ - Brazil

*Corresponding author: segen@lts.coppe.ufrj.br

ABSTRACT

A methodology for the geometrical optimization of wave energy converters (WEC) based on statistical analysis methods and the hydrodynamics of the system in the frequency domain is presented. The optimization process has been applied to a one-body point absorber for a nearshore region of the Rio de Janeiro coast. The sea characteristics have been described using a five-year wave hindcast and are based on a third generation wind wave model WAVEWATCH III. The optimization procedure is performed based on the resultant wave spectrum and joint probability distribution. The aim is to determine the WEC that absorbs the maximum energy into the largest range of frequencies with the closest possible natural period to the predominant wave periods of the sea site. The optimized geometry of the WEC is determined by running a few simulations in the frequency domain and using the design of experiment (DOE) method. The software ANSYS-AQWA is used for the hydrodynamic diffraction analysis, and the DOE method is applied through the Minitab software to determine the optimized geometry. The two primary advantages of the proposed optimization method are the reduced computational time and the possibility of performing parametric analyses for the WEC geometry.

Keywords: geometry optimization, wave energy converter, statistical analyses, point absorber, DOE method

1. INTRODUCTION

Wave energy conversion technology is in the pre-commercial stage. The cost of a wave energy converter (WEC) increases with its size. Therefore, the geometry optimization of the system has a significant role in the design process to have an economically feasible system. So far, one of the most promising WEC concepts under technical and economic evaluation is the point absorber (PA). It consists of a floater body, which has small dimensions relative to the incident wavelength and, a support system, which could be mooring cables connected to the seabed or bottom-mounted structures. A heaving PA is a wave energy device in which the heave motion due to the wave-body interaction is absorbed to produce power. The system that receives the