A NUMERICAL SIMULATION OF A VARIABLE-SHAPE BUOY WAVE ENERGY CONVERSION USING HYPER ELASTIC MATERIALS

by

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A thesis report submitted in partial fulfillment of the requirements for the degree of Bachelor of Science in Mechanical Engineering

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Declaration

This is to certify that the thesis work entitled "A Numerical Simulation Of A Variable-Shape Buoy Wave Energy Conversion Using Hyper Elastic Materials" has been carried out by Md Rahatuzzaman Roni, Roll No. 1805049) in the Department of Mechanical Engineering, Khulna University of Engineering & Technology, Khulna, Bangladesh. The above work or any part of this work has not been submitted anywhere for the award of any degree or diploma.

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Approval

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Abstract

Wave energy converters (WECs) that require reactive power often need more complex power take-off (PTO) devices, as compared to those that do not require it. WECs that require reactive power often have more complex power take-off (PTO) devices compared to those that do not require it. Variable Shape Buoy Wave Energy Converters (VSB WECs) were developed to convert energy at a higher rate while reducing the need for reactive power. ANSYS's 2-way fluid-structure interaction (FSI) tool was used in a Computational Fluid Dynamics (CFD) tool to model VSB WECs. A CFD-based Numerical Wave Tank was developed to simulate open sea conditions (CNWT) and evaluate the nonlinear response of the VSB WECs. Results show that the VSB WECs undergo significant deformation before reaching steady-state behavior in response to approaching waves, which is more accurate than previous low-fidelity dynamic models. The study concludes that under suitable conditions, the variance in motion can be utilized to capture energy at a faster rate without requiring power flow.

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CHAPTER I

INTRODUCTION

1.1 Introduction

In recent years, there has been a rise in the number of studies that investigate ways to transform wave energy into forms that can be used. This is an instant response to the rising interest in sustainable power and the many benefits connected with it, such as dependability, minimal carbon, and high density of power.[**?**] This is a reaction to the increasing interest in sustainable energy and the numerous approval with it. This is a direct consequence of people's increasing interest in renewable sources of energy and the advantages that they provide. The process of converting wave energy into forms that may be put to use is currently in the preliminary phases of research and development.[**?**, **?**, **?**] In the past ten years, a significant amount of time and effort has been invested in the academic research of WEC behavior and control. Since we originally began devoting how much time and effort into this endeavor, ten years have gone. From here, we move on to studying nonlinear hydrodynamics (especially nonlinear FK force), conducting CNWT simulations of wave energy converters [**?**] and ultimately exploring nonlinear dynamics in general [**?**]. When it comes to the process of developing appropriate controls, linear models are utilized rather frequently [**?**]. Linear models are frequently utilized in the process of developing optimum control systems. Whilst also attempting to figure the most effective strategy to control a system, linear models are utilized rather frequently in many cases.[**?**] During the past several years, there has been a considerable rise in the amount of research that is being done to investigate how the process of turning wave energy into useable forms might be made more cost-effective.

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[**?**] [**?**] [**?**] [**?**]

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