ARS 2017/M/11

Development of an Adaptive-Controlled Sea Wave Energy Converter System

Mugilgeethan V., Madushan U. R., Ponseka P. P. S. M. K., Wikramasinghe M. and Karunasena H. C. P.*

Department of Mechanical and Manufacturing Engineering, Faculty of Engineering, University of Ruhuna

* *Corresponding Author: chaminda@mme.ruh.ac.lk*

Sea wave is a high density renewable energy source which can be used to extract electrical energy using suitable technology. Performance of wave energy convertors (WECs) depends on the sea or wave conditions and characteristics of the WEC. However, in most of the available WEC systems, the converter characteristics are not tuned dynamically to match with the variations of the incoming wave conditions and as a result, their energy extraction is not optimum. In this background, this research focused to develop an adaptive control system for a single floater based WEC so that the performance of the WECs can be optimised dynamically to match with wave conditions. The technique includes a sonar sensor to per-observe the height and the frequency of incoming waves and to control the dynamic characteristics of the generator so that is natural frequency closely matches with the wave frequency to operate at maximum energy extraction efficiency. From the generator side, armature voltage was varied allowing it to operate at different dynamic characteristics. This controller was implemented using a microcontroller circuit connected to a computer to record the output parameters of the WEC. It was observed that overall 30% of efficiency increment can be achieved with the use of the controller. The proposed controller has a very high potential to be used for new generation of WECs to improve the overall energy conversion efficiency in varying sea wave conditions.

Keywords: wave energy converter (WEC), renewable energy, adaptive controlling, sea wave power, sea wave energy extraction