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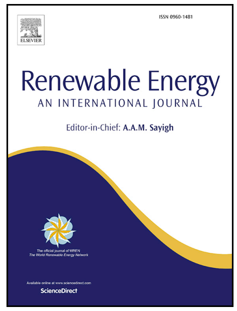


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# Control Of Small Two-Body Heaving Wave Energy Converters for Ocean Measurement Applications

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**Abstract**

Buoys carrying scientific equipment usually need continuous power supply for the operation of these equipments. These buoys can be equipped with actuators and controlled to harvest power from the heaving motion of the buoy. A two-body wave energy converter can be designed such that the buoy heaves to harvest energy while the second (lower) body carries the science equipments. This paper presents a control approach for this type of two-body wave energy converter. This control approach is a multi resonant control that attempts to maximize the harvested energy from the buoy (upper body). In this model, the actuator is attached to both bodies. The lower body however is required to have minimal heave motion. The proposed multi resonant control utilizes measurements of the buoy position. The frequencies of the measured buoy position are estimated, along with the motion amplitudes of these frequencies, and used for feedback control. Estimation is carried out using two approaches; the first uses a linear Kalman filter while the second uses an extended Kalman filter. A new method for handling the motion and actuation limitations, suitable for the multi resonant control, is proposed. Various numerical simulation results are presented in the paper. Simulation results show that the linear Kalman filter estimation approach is more robust and computationally efficient compared to the extended Kalman filter.

*Keywords:* Wave Energy Conversion, Two-Body Heaving Wave Energy Converter, Multi Resonant Control, Kalman Filter

## 1. Introduction

Research on ocean wave energy converters (WECs) have been going since 1970s [1] covering several aspects including the hydrodynamics of interaction between a buoy and the wave [2, 3, 4], and including different concepts for ocean

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