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# Predictive control and modeling of a point absorber wave energy harvesting connected to the grid using a LPMSG-based power converter

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**Abstract.** In this paper, the authors explore the modeling and control of a point absorber wave energy converter, which is connected to the electric grid via a power converter that is based on a linear permanent magnet synchronous generator (LPMSG). The device utilizes a buoyant mechanism to convert the energy of ocean waves into electrical power, and the LPMSG-based power converter is utilized to change the variable frequency and voltage output from the wave energy converter to a fixed frequency and voltage suitable for the electric grid. The article concentrates on the creation of a predictive control system that regulates the speed, voltage, and current of the LPMSG, and the modeling of the system to simulate its behavior and optimize its design. The predictive model control is created to guarantee maximum energy output and stable grid connection, using Matlab Simulink to validate the proposed strategy, including control side generator and predictive current grid-side converter loops.

**Keywords:** back to back converter; LPMSG; multi-level inverter; point absorber; predictive control; wave energy harvesting

## 1. Introduction

The use of renewable energy sources has gained significant attention in recent years due to the need to reduce greenhouse gas emissions and mitigate the effects of climate change (Richter 2011). One promising source of renewable energy is ocean waves, which contain a significant amount of energy that can be harnessed and converted into electricity using wave energy converters. Point absorber wave energy converters are a type of wave energy converter that uses a buoyant device to capture the energy of ocean waves (Xu *et al*. 2020). To connect the point absorber wave energy converter to the electric grid, a power converter based on a linear permanent magnet synchronous generator (LPMSG) can be used. However, to ensure optimal energy output and a stable grid

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