

Novel Model of an Adaptive Wave Energy Converter With Spectral Analysis-Based Sea State Classification

EGSD012

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**Energy: Sustainable
Materials and Design**

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The objective of this project is to measure the effects of adaptive control on the performance of a wave energy converter (WEC). Ocean wave energy is one of the most promising sources of renewable energy with a measured annual 2.64 trillion kWh. This energy is harvested via WECs, which utilize a power-take-off (PTO) system to convert the kinetic energy of wave movement into usable electrical energy. The most common type of WEC is the point absorber, and one limitation of WECs is the unstable electrical power generation across changing climates. To solve this problem, an adaptive model of a point absorber with a hydraulic PTO was designed. The adaptive model consisted of a spectral analysis-based sea state classification algorithm and an alterable swashplate angle ratio. The adaptive model is compared to a non-adaptive model on a phased simulation to determine the megawattage. The results showed that the adaptive WEC generated 19.928% more electrical power than the control WEC, and the results were found to be significant via a t-test. It was found that an adaptive WEC could significantly increase the electrical power generation and maximize performance across sea state changes.

1. In this research project, the student directly handled, manipulated, or interacted with (check ALL that apply):

<input type="checkbox"/> human participants	<input type="checkbox"/> potentially hazardous biological agents
<input type="checkbox"/> vertebrate animals	<input type="checkbox"/> microorganisms
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3. This project is a continuation of previous research (Form 7): YES NO

4. My display board includes non-published photographs/visual depictions of humans (other than myself): YES NO

5. This abstract describes only procedures performed by me/us, reflects my/our own independent research, and represents one year's work only: YES NO

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The stamp or embossed seal attests that this project is in compliance with all federal and state laws and regulations and that all appropriate reviews and approvals have been obtained including the final clearance by the Scientific Review Committee.

