

Sandia Wave Energy Power Take-off (SWEPT) Lab

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Abstract

The newly operational Sandia Wave Energy Power Take-off (SWEPT) Lab is designed to test wave energy converter (WEC) power take-off (PTO) systems. Unlike most energy generation technologies, which harness relatively steady input mechanical energy that fluctuates about some mean (e.g., wind, nuclear, hydroelectric), WECs capture purely oscillatory mechanical energy from ocean waves to generate electricity. This unique characteristic requires both specialized methods for the design of WEC PTOs and specialized facilities for testing those designs.

The SWEPT Lab is designed just for these purposes and is realized as a mobile system, to allow for tests to be performed where ever is most convenient (Figure 1). The SWEPT Lab utilizes hydraulic machinery to simulate the input from the ocean waves (including wave forcing and WEC hydrodynamics), allowing for hardware in-the-loop (HIL) testing of PTO systems, for system identification (SID), real-time control, reliability analysis, and grid interface analyses. A basic system diagram of a SWEPT Lab experiment is shown in Figure 1. Rotational and linear WEC PTOs can be tested independently or in parallel in order to simulate an array of devices. Large-scale hydraulic actuators and modular systems allow for testing of PTOs with $5 < P < 500$ kW and $0 < f < 2$ Hz. A series of different size linear actuators, of which the largest have a net stroke 4 m, are available. The SWEPT Lab also includes high-performance real-time computing hardware for performing HIL analyses, including array analyses and grid modeling.

This poster will provide a detailed overview of the SWEPT Lab. Specific hardware capabilities will be shown. A series of potential experiment types, such as PTO control, reliability, array performance, and grid interaction, will be detailed and illustrated.

Acknowledgements

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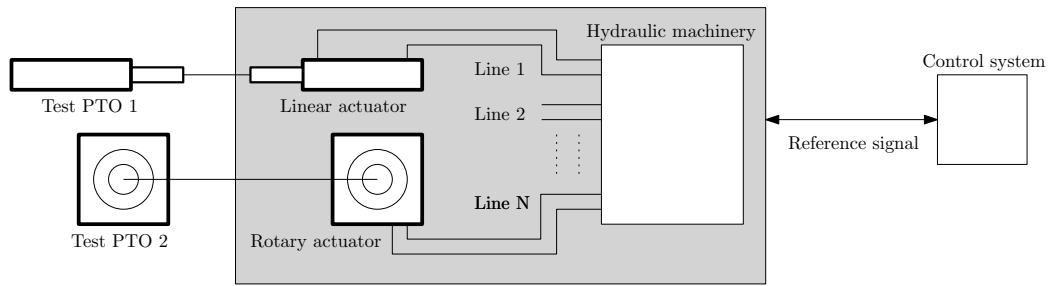


Figure 1: Basic SWEPT Lab experiment system diagram.

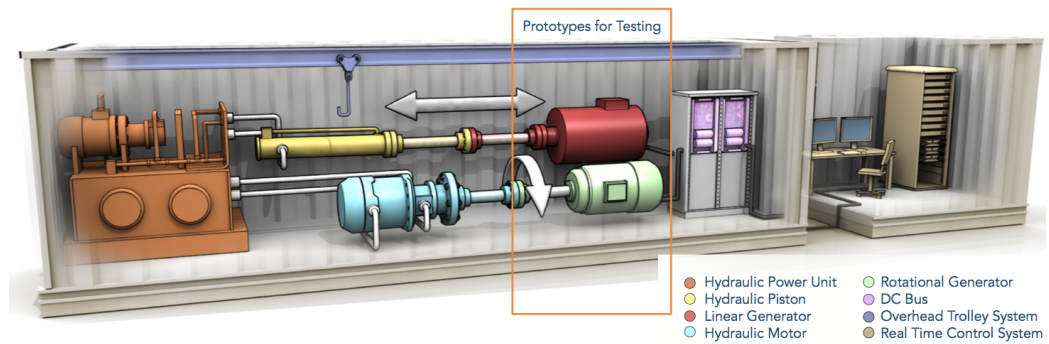


Figure 2: Artistic rendering of the SWEPT Lab.

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