Design and Experimental Testing of a Submerged Point Absorber

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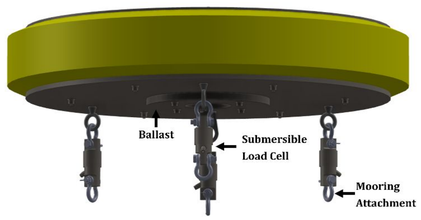
Test Campaign Motivation

Experimental and numerical testing of a subsurface WEC with a coupled mooring-PTO system was conducted to investigate:

- How does the number of tethers in a coupled power take off mooring system affect power production in a subsurface WEC
- How does the energy generation decay with increasing submergence depths for WEC's with different mooring system configurations
- How does the non-linear hydrodynamic coupling between surge and pitch affect the power performance of a submerged WEC

Device Description & Experimental Set-Up



Parameter	Value	Units
Float diameter	1	m
Float height	0.2	m
Float Mass	136-172	kg
Float Buoyancy	326	N
Water Depth	3.69	m
Depth of submergence	0.5-2.5	m
Tether inclination angle	32-58	deg

Float

- 1 & 3 tether configurations possible
- Float Mass adjustable up to 35 kg
- Submergence depth of float can be controlled using PTO motors
- Submersible load cell captures the in-line tether tensions and forces on the system
- Qualisys motion capture used to capture float positions

Power Take-Off

- Power Take-Off units are mounted on the flume wall
- PTO turns the linear motion of the mooring lines to rotary motion through a webbing/pulley interface
- Two air filled tanks pressurize a tie rod cylinder and supply a restoring force to and allows for the float to sit at an equilibrium position

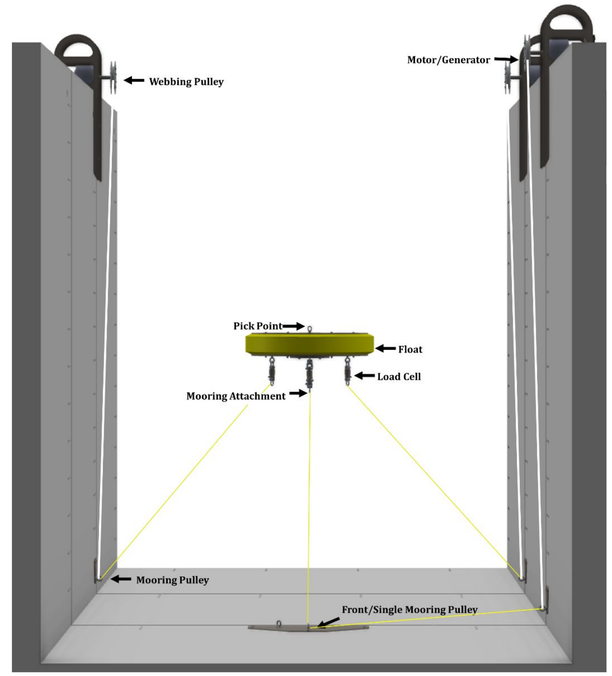


Figure 2: SubWEC three tether configuration design showing the major components of the mooring and PTO system

Numerical vs Experimental Single Tether RAO

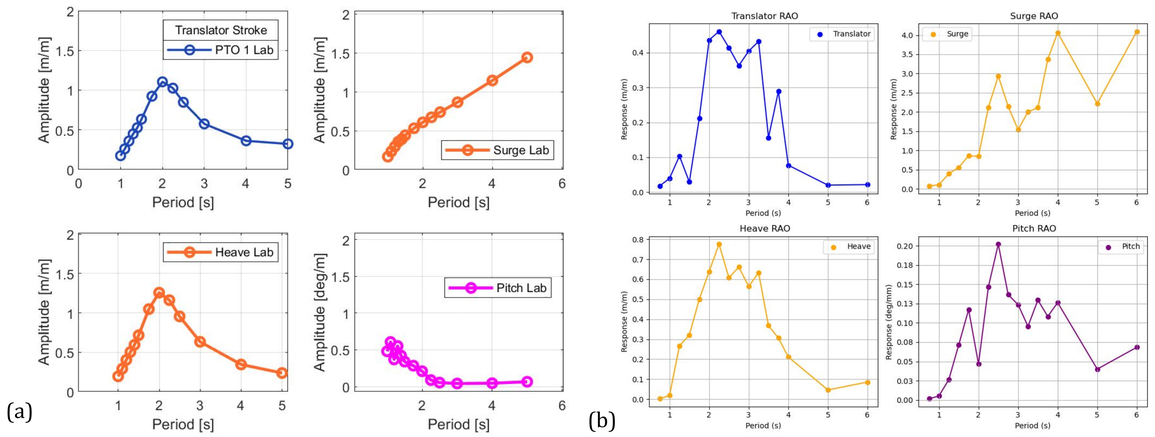


Figure 1: a) Numerical RAOs device DoFs and translator stroke b) Experimental RAOs for device DoFs and translator stroke

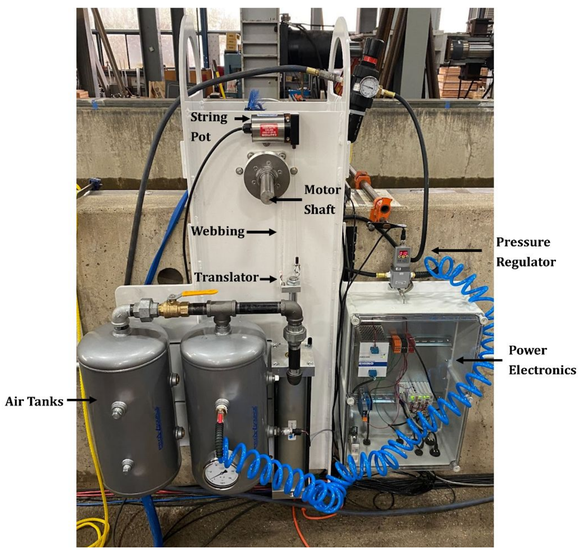


Figure 3: Experimental Power Take-Off System

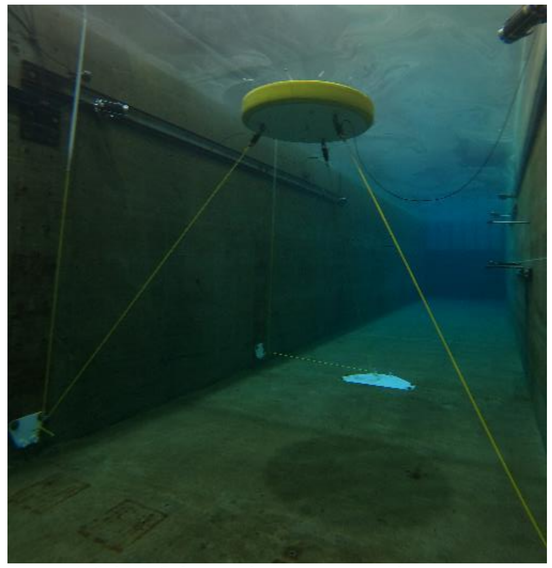


Figure 4: SubWEC three tether experimental set-up.

PMEC Member Universities

University of Alaska Fairbanks · Oregon State University · University of Washington

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NAVFAC Naval Facilities Engineering Systems Command