WAVE TANK EXPERIMENTATION ON A TWO-BODY POINT ABSORBER

DILLON MARTIN, XIAOFAN LI, CHEIN-AN CHEN, XIUXING YIN, ROBERT PARKER, KHAI, NGO, KRISH THIAGARAJAN AND LEI ZUO

[1]*Dillon Martin, Department of Mechanical Engineering, Virginia Tech, Blacksburg, VA, dilmart@vt.edu*
[2]*Xiaofan Li, Department of Mechanical Engineering, Virginia Tech, Blacksburg, VA, lixf@vt.edu*
[3]*Chien-An Chen, Department of Mechanical Engineering, Virginia Tech, Blacksburg, VA,* cacee14@vt.edu
[4]*Xiuxing Yin, Department of Mechanical Engineering, Virginia Tech, Blacksburg, VA,* xiuxy@vt.edu
[5]*Robert Parker, Department of Mechanical Engineering, Virginia Tech, Blacksburg, VA,* r.parker@vt.edu
[6]*Khai Ngo, Department of Electrical Engineering, Virginia Tech, Blacksburg, VA,* kdtn@vt.edu
[7]*Krish Thiagarajan, Department of Mechanical Engineering, University of Maine, Orono, ME,*
krish.thiagarajan@maine.edu
[8]*Lei Zuo, Department of Mechanical Engineering, Virginia Tech, Blacksburg, VA, leizuo@vt.edu*

A wave tank test was performed to understand the hydrodynamic and power performance of the wave energy converter (WEC) and power takeoff (PTO) system designed by Virginia Tech. The objective of these tests was to provide experimental data to validate and improve our numerical simulations of the two-body point absorber. Three configurations of a 1/30th scale model using a direct mechanical drive PTO were tested, including a single-body heave only test, a two-body heave only test, and a six (6) degree of freedom test. Experimental results show for regular waves the two-body WEC can produce twice the amount of power as a single-body WEC and can be further increased by PTO design and power electronics optimization. The capture width ratios also met or exceeded similar two-body WEC designs. The two-body WEC also produced a quarter more power than the single-body WEC in irregular waves using the same optimal PTO damping value found for regular waves.

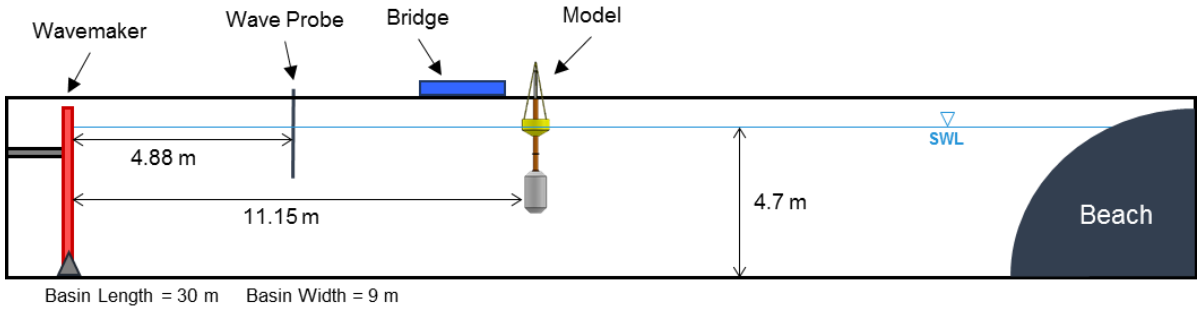

FIGURE 1. WAVE TANK LAYOUT AND DIMENSIONS.

Preprint submitted to 2018 6th Annual Marine Energy Technology Symposium.
Received February 14, 2018.

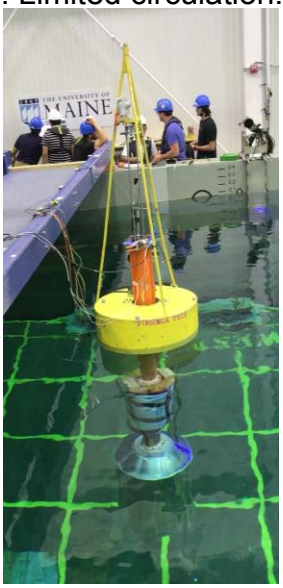

FIGURE 2. SIX DEGREE OF FREEDOM TESTING OF 1:30 SCALE TWO-BODY WEC.

ACKNOWLEDGEMENTS

The authors would like to acknowledge the financial support from the US Department of Energy, National Science Federation and Center for Innovative Technology/Commonwealth Research Commercialization Fund, as well as facility and staff support from the University of Maine.

REFERENCES

[1] Liang, Changwei and Zuo, Lei. "On the Dynamics and Design of a Two-Body Wave Energy Converter." Renewable Energy, Vol. 101 (2017), pp. 265–274. DOI 10.1016/J.RENENE.2016.08.059 http://www.sciencedirect.com/science/article/pii/S0960148116307698.

[2] Liang, Changwei, Li, Xiaofan, Martin, Dillon, Wise, Adam, and Zuo, Lei. "Dynamics and Power Absorption of a Self-Reacting Wave Energy Converter with Mechanical Motion Rectifier." Proceedings of the ASME 2017 IDETC/CIE. DETC2017-67464: pp. V006T10A052. Cleveland, OH, August 6 – 9, 2017 DOI 10.1115/DETC2017-67464. http://proceedings.asmedigitalcollection.asme.org/proceeding.aspx?articleid=2662379.