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When it comes to validatingerify simulation results for Wwave eEnergy Cconverters, physical scale models experiments play an important role as a cost effective preliminary stage before full--scale test to verify simulations. But especially modelling the power take--off for scale models can be is a complex process. State--of--the--art models uses static friction [1] or controlled motors [2-4] to simulate the behavior of the actual power take--off generator. In simulations, while simulatingof an idealized generator, a constant velocity-proportional damping is often used. Controlled motors can act operate this way but are relatively complex and expensive and may suffer from friction or are limited by the motor dynamics [4]. Especially whileIn particular when comparing physical models is to beare compared to simulations, a good parametrized model is invaluable. The model proposed here, uses eddy currents to provide a constant velocity dependent damping: Permanent magnets generate a magnetic field in which an aluminum disc, accelerated by the force acting on the buoy, rotates. As counter force, weights, attached to the disc by a rope, generate a moment to turn the disc in the opposite direction.

The system is able to provide a constant damping, while being nearly frictionless. The motion of the PTO is measured using an accelerometer, acting as a high precisione position measurement system.

The results of 1:10 wave tank tests are compared to a numerical model based on linear potential wave theory, with excellent . Simulation and scale test results agreed very wellagreement.

REFERENCES

[1] Göteman, M., et al., Wave Loads on a Point-Absorbing Wave Energy Device in Extreme Waves, Journal of Ocean and Wind Energy, Vol. 2, No. 3, 2015

[2] Mercadé Ruiz, P., Ferri, F., Kofoed, J., Experimental Validation of a Wave Energy Converter Array Hydrodynamics Tool, Sustainability, Vol. 9, 2017

[3] Ding, B. et al., Study of fully submerged point absorber wave energy converter modelling, simulation and scaled experiment, The 32nd International Workshop on Water Waves and Floating Bodies, Dalian, China, 2017

[4] Thomas, S., Giassi, M., Göteman, M., Eriksson, M.m Iserbg, J., Engström, J., Optimal Constant Damping Control of a Point Absorber with Linear Generator In Different Sea States: Comparision of Simulation and Scale Test, 12th European Wave and Tidal Energy Conference, Cork, Ireland, 2017