

Innovative and cross-disciplinary wave energy research, aiming to develop a revolutionary Smart Control Algorithm (SCA)

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Despite decades of research and development, large-scale wave energy deployment is hardly seen due to many remaining challenges. From the economic point of view, the Levelized Cost of Electricity (LCoE) of wave energy is still higher than other sustainable energy recourses, e.g. offshore wind. Technically, the reliability and survivability of wave energy converters (WECs) in extreme waves conditions are not yet fully resolved. This project conducts innovative and cross-disciplinary research about wave energy, aiming to develop a revolutionary Smart Control Algorithm (SCA) to tackle the two challenges mentioned: increase power capture and reduce potential damage to the device.

Based on Artificial Intelligence (AI) techniques, the SCA forecasts future wave loads and implements tailored control actions to the WEC. Figure 1 shows the developed SCA block diagram, where the Neural Network was trained by numerical simulations.

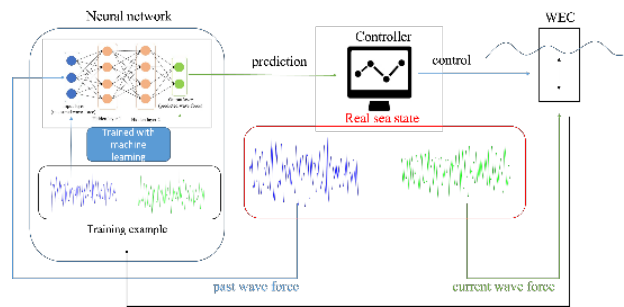


Figure 1 Smart control algorithm block diagram.

Tank test of a truncated cylinder has been carried out to measure the wave force acting in the heave direction, see Figure 2. The measured force was used to validate the force prediction capability of the SCA algorithm. Figure 3 shows the comparison between the predicted and measured wave force. As suggested, the SCA is able to predict the wave force accurately. It is anticipated that the developed SCA can be extended to different types of WEC in the future.

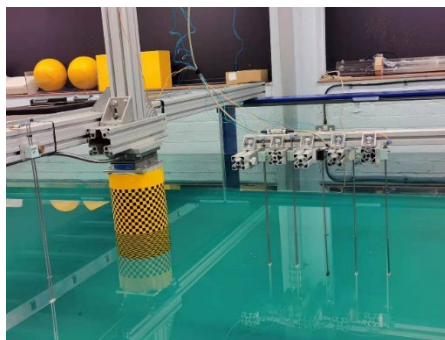


Figure 3 Tank setup for wave loading prediction.

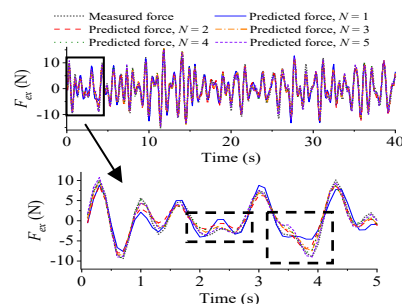


Figure 2 Comparison between predicted results and measurement.