FEEDBACK RESONATING CONTROLLER FOR A HEAVING POINT ABSORBER WEC

GIORGIO BACELLI, VICTOR NEVAREZ, RYAN COE AND DAVID WILSON

Sandia National Laboratories, {gbacell, vnevare, rcoe, dwilso}@sandia.gov

The optimal feedback control law for a wave energy converter (WEC), namely complex conjugate (CC) control, is known to be acausal, meaning that it cannot be physically implemented without future knowledge of the incoming wave forces. However, one of the assumptions in the derivation of the CC controller is that it allows the device to resonate and absorb the maximum amount of power at all frequencies, that is on the entire interval $f \in [0, \infty)$, where f is the wave frequency. In practice, however, for every location in the sea, the large majority of the power transported by waves is concentrated in a limited frequency band, and the tuning of the optimal controller for all frequencies is unnecessary.

This work presents the design and implementation of a simple, stable, and causal Feedback Resonating Controller (FBR) that approximates the response of the CC controller in a limited frequency band. By making the limited bandwidth assumption, simulation results show (see Figure 1) that the FBR controller is able to absorb more than 95% of the power absorbed by the CC controller in the desired interval $f \epsilon [0.25, 0.95] Hz$, without requiring information about incoming waves; the only required measurement is the velocity of the buoy. Figure 1 shows the simulation results for a full-scale device, assuming a 1:16th scale of the model; the FBR controller performs very closely to the CC controller in the range of wave period between T=4s and T=16s.

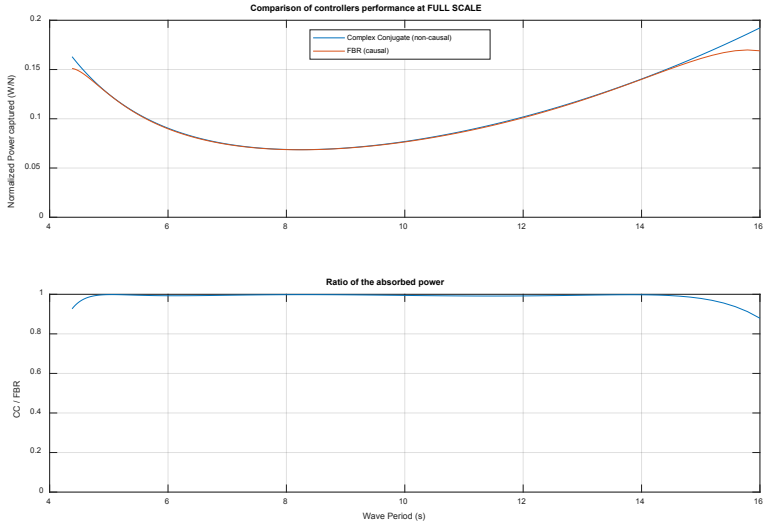

FIGURE 1. COMPARISON OF THE POWER ABSORBED BY THE CC CONTROL AND THE FBR CONTROL

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