

Initial conceptual demonstration of control co-design for WEC optimization

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October 30, 2023

Abstract

While some engineering fields have benefited from systematic design optimization studies, wave energy converters have yet to successfully incorporate such analyses into practical engineering workflows. The current iterative approach to wave energy converter design leads to suboptimal solutions. This short paper presents an open-source MATLAB toolbox for performing design optimization studies on wave energy converters where power take-off behavior and realistic constraints can be easily included. This tool incorporates an adaptable control co-design approach, in that a constrained optimal controller is used to simulate device dynamics and populate an arbitrary objective function of the user's choosing. A brief explanation of the tool's structure and underlying theory is presented. In order to demonstrate the capabilities of the tool, verify its functionality, and begin to explore some basic wave energy converter design relationships, three conceptual case studies are presented. In particular, the importance of considering (and constraining) the magnitudes of device motion and forces is shown.