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Self-tuning, load mitigating control of a WEC

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Seedling Water Power Innovation: An R&D Showcase

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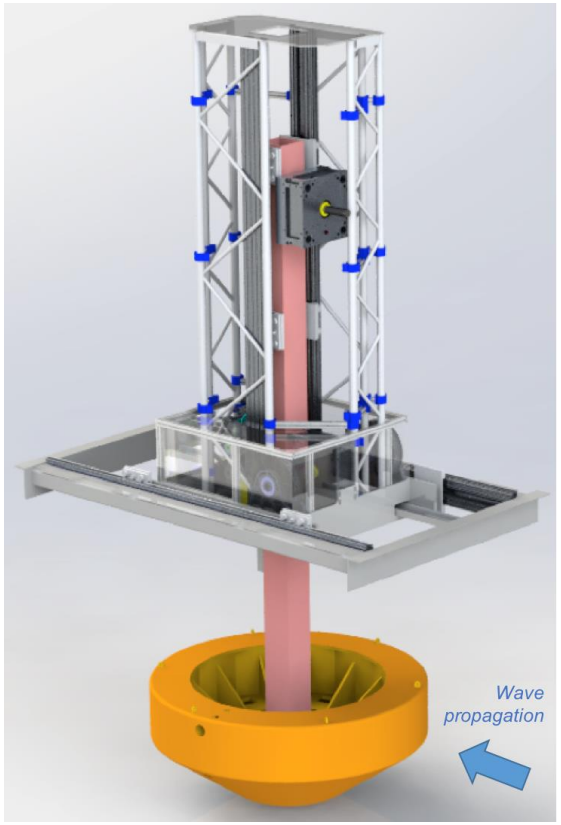
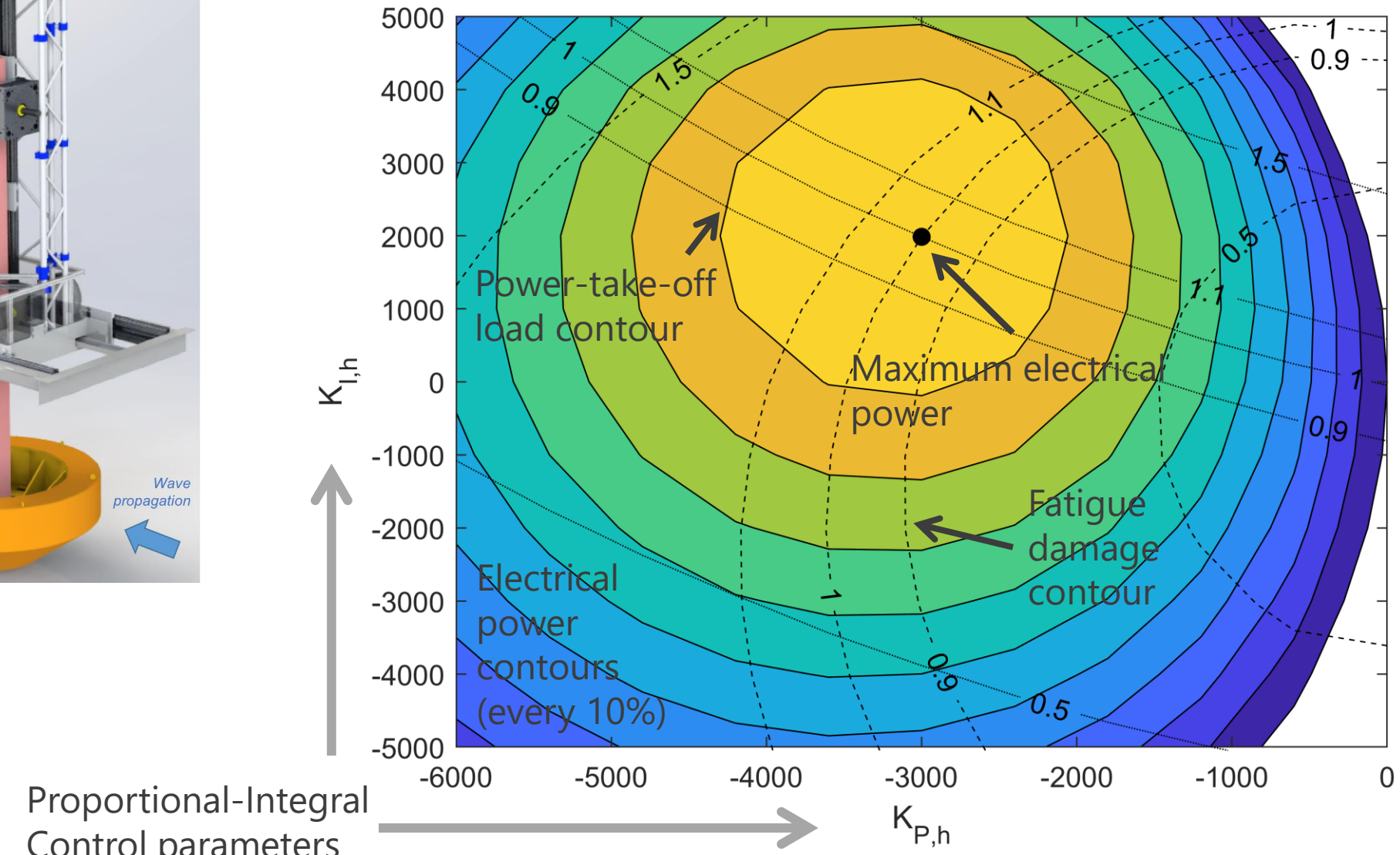
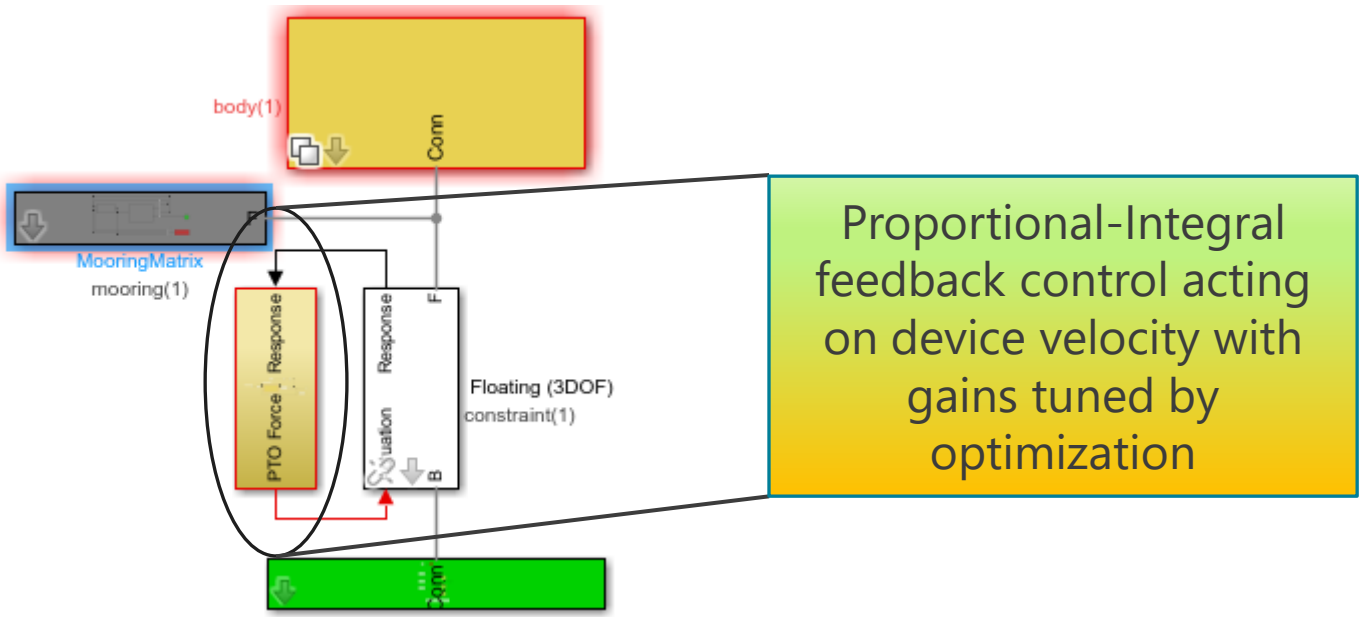
An observation from wave-tank testing of the WaveBot WEC





Modeling approach



Proportional-Integral feedback control acting on device velocity with gains tuned by optimization

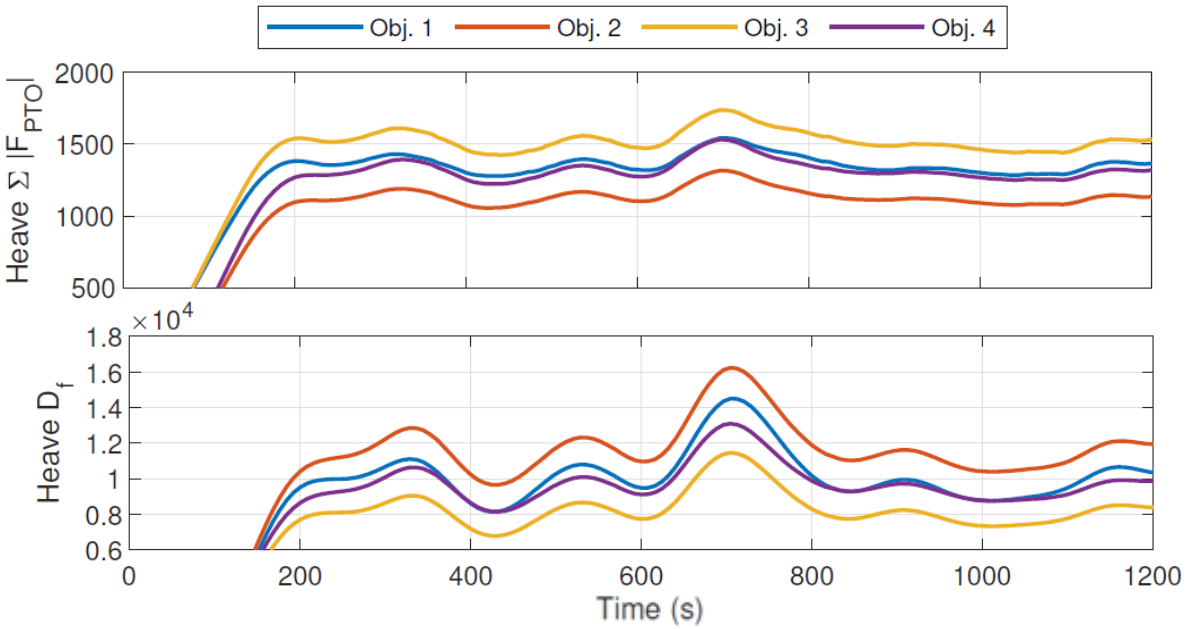
1. Move to frequency domain
2. Estimate wave excitation spectra
3. Select “optimal” controller gains
4. Apply control, observe response

“Optimal” changes with objective:

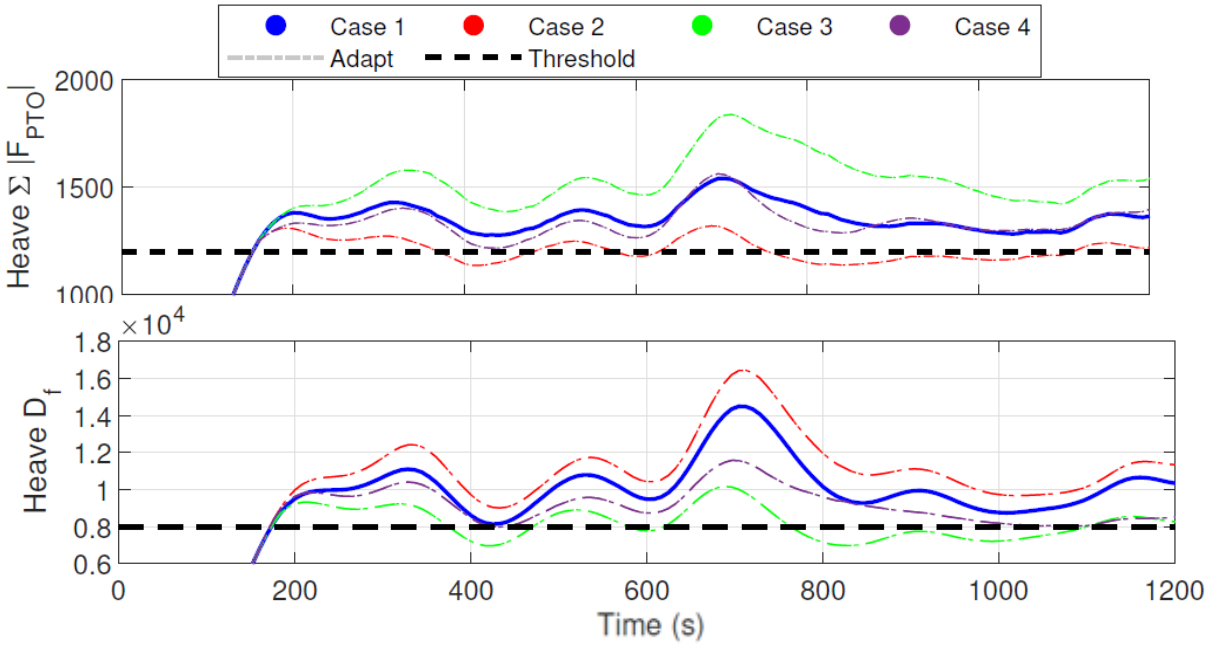
Objective 1: Maximize Power	Objective 2: Maximize Power Minimize PTO load	Objective 3: Maximize Power Minimize fatigue damage	Objective 4: Maximize Power Minimize PTO load Minimize fatigue damage

Successes

Static

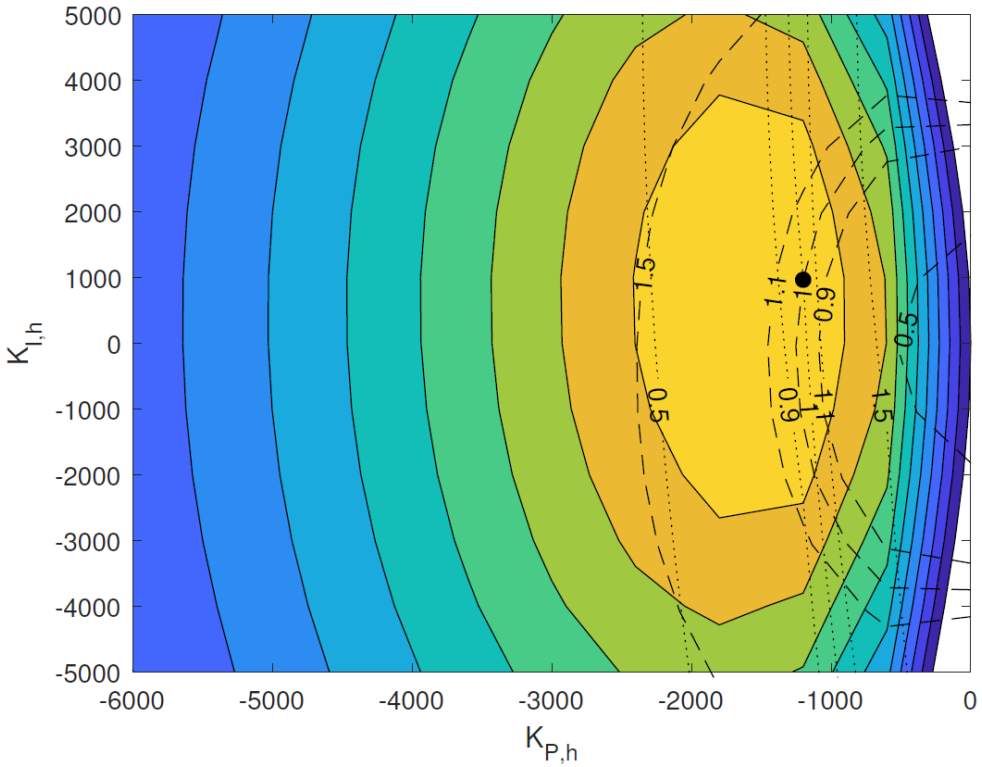


Adaptive

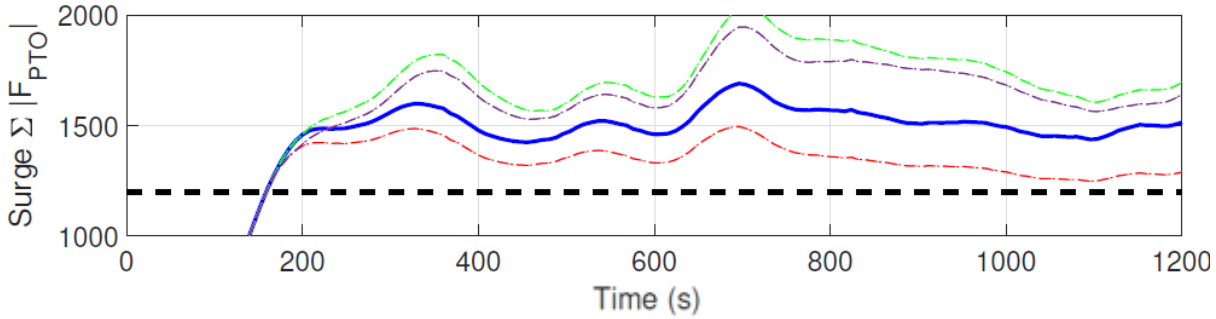


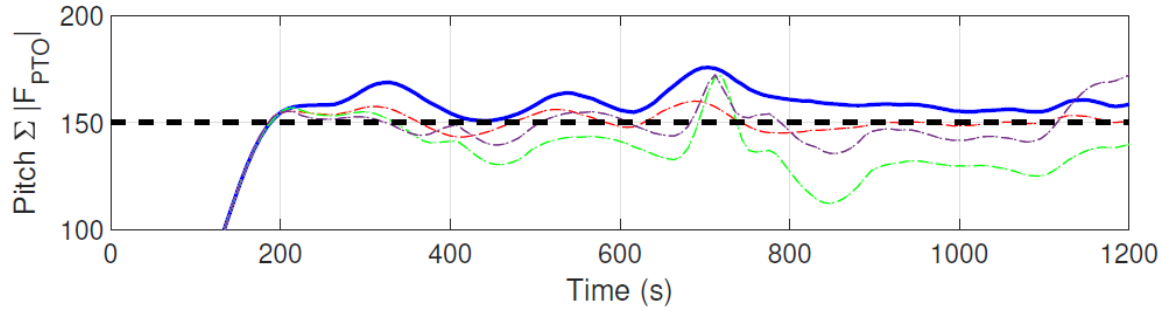
Limitations

Orthogonality of load contours varies by sea-state, can create objective conflicts



Coupling between DOF can create objective conflicts





THANK YOU

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