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Ph.D. DISSERTATION DEFENSE

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Date/Time: **Tuesday, November 28 at 9:00 a.m. (EST)**
Location: **Samuel C. Williams Library, B16.**

Title: Multi-Fidelity Framework for Modeling and Optimization of a Dual-Flap Oscillating Surge Wave Energy Converter

Chairperson:	Muhammad Hajj**,**	CEOE, School of Engineering & Science
Committee Members:	Raju Datla,	CEOE, School of Engineering & Science
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ABSTRACT

Because of its high density, wave energy should have a dominant role in the development of future renewable energy resources. Designing and testing wave energy converters in open waters is expensive and complex, giving numerical simulations an important tool in assessing their performance analysis and optimization. Different fidelities in numerical simulations offer different accuracy levels and needs in terms of computational power. Solving potential flow based on linear wave theory has been used because it consumes the least computational time. However, to maintain a reasonable accuracy, it limits the analysis to small wave and motion amplitudes. We present a multi-fidelity framework to compare and assess the accuracy of multi-fidelity numerical simulations in the performance analysis of a dual-flap oscillating surge wave energy converter hinged to a platform for potential installation in deep waters. All simulations are validated with data from wave tank tests. Medium-fidelity simulations based on solving Euler equations are shown to have acceptable accuracy levels with a 90% reduction in computational time required to perform higher-fidelity simulations. Euler-based simulations were used to estimate the expected annual energy production, wave power capture and PTO loads. They were also used to investigate the coupling effects of the two flaps and impact of separation distance on their performance. To implement PTO control, a more reduced order model in terms of degrees of freedom that does not require solving the flow dynamics at every time step is needed. One issue is the convolution term, which represents the radiation damping and makes the model inconvenient for time-domain simulation or integration. We represent this term with a state-space model and perform system identification that exploits different dynamics to determine contributions by different wave forces to the flap motions.