WAVE LOADS AND STRUCTURAL DESIGN OF OSCILLATING WAVE SURGE CONVERTERS
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The oscillating wave surge converter (OWSC) is a promising type of wave energy device consisting of a wide buoyant flap which typically hinges to the seabed and rotates under shallow-water wave loading. In this regime, the wave energy is concentrated and relatively close to the shore, providing benefits such as shorter cables and easier maintenance access than deep-water devices. For the technology to progress, it must push the limits of power capture while surviving the dynamic and sometimes extreme loads of the ocean environment.

Previous work has shown that OWSC power is proportional to the torque on the flap and that peak torque increases faster than flap width, resulting in an increased capture factor for wider flaps [1]. Numerical methods such as computational fluid dynamics (CFD) lead to more precise load predictions than analytical studies, which are limited to linear wave theory and small flap rotations. Based on the prevalence and success of using the leading open-source CFD software, OpenFOAM [2], to model the dynamics of OWSC and other devices, this research will use similar techniques to study time-varying pressure distributions on one or multiple OWSC configurations. The purpose will be to increase understanding of when and where the structure is more heavily loaded. This will lead to greater structural efficiency, better informed fatigue design, and increased design life of the device.

Although maximizing the loads will maximize the power, there could still be situations where reducing loads on the structure is desired, such as during an extreme wave event. This work will also investigate load control and reduction strategies, with deflections incorporated in the fluid-structural model. Results of loading and power capture will be compared to that of a rigid-body and show how load-shedding can be achieved to reduce the overall structural demands on the OWSC.

REFERENCES

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