The novel excitation system has several similarities with the well-known mechanical amplification produced by parametric excitation [1] and the mechanics of pumping a swing [2]. Our research features the development and analysis of a novel ocean wave energy converter (WEC). One class of ocean wave energy converter is a buoy, which is resonantly excited by the ocean waves. A novel excitation method is used with this class of converter in order to amplify its energy harvesting capabilities.

### Aims of Research

Our research features the development and analysis of a novel ocean wave energy converter. The following issues associated with the excitation scheme will be addressed:

- Optimization of the design of the water intake system and prototype testing.
- Examination of stochastic excitation of models for the WEC.
- More realistic fluid-structure interaction models.
- Post-processing of results and field testing.
- Experiments are intended to examine the feasibility of the novel excitation method.

### A Simple Model

The energy $e$ of the oscillator is not a continuous function of time, and experiences a discontinuity when mass is added. For several steady state responses, this phenomenon is shown in the figures below. For further details, see [4].

### The Dynamics of a Novel Ocean Wave Energy Converter

Preliminary work on the wave energy converter features a single degree-of-freedom hybrid system model with state-dependent switching [3].

Depending on damping $\delta$, mass modulation $\mu$, and dimensionless forcing frequency $\omega = \omega_F/\omega_0$, the system can exhibit limit cycles, bounded oscillations, and unbounded motions. A sample of these behaviors is shown in the figures below. For further details, see [4].

### Prototype Design and Testing

We have performed preliminary experiments on the WEC. These experiments are intended to examine the feasibility of the novel excitation method.

### Future Work

The following issues associated with the excitation scheme will be addressed:

- More realistic fluid-structure interaction models.
- Examination of stochastic excitation of models for the WEC.
- Optimization of the design of the water intake system and prototype testing.

Some preliminary work on stochastic excitation has been completed [5].

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