Numerical modelling of the Seaflex mooring component: Effects of hysteresis on snap load events of wave energy converters

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ABSTRACT

Compliance is a key feature for mooring systems of point-absorbing wave energy converters. Geometric compliance is typically achieved by the natural spring of a catenary system or a knowledgeable combination of submerged floats and weights connected with taught mooring lines. In the case of wave energy converters in relatively shallow water, the challenge to avoid cable slack in all possible wave load scenarios can prove too difficult. Therefore it is important to study how the mooring material behaves during a snap load event. The severity of the snap load magnitude is governed by the stiffness of the mooring material and the relative velocity at the moment the mooring cable goes into tension after a period of slack [2]. But the propagation of the snap load is also affected by the damping properties of the material, which play an important role in mitigating the snap load damage. One material built for the mitigation of snap loads is the Seaflex mooring component [1]. Allowing up to 80% elongation and showing a progressive stiffness curve with significant hysteresis, it provides an interesting and challenging case study for numerical hysteresis modelling.

We will present an implementation of the Seaflex mooring component in Moody [3], a high-order discontinuous Galerkin method for mooring dynamics. The discussion will cover numerical stability, and the difference between modelling the Seaflex as a component or as a constitutive material model. Results will focus on explaining the influence of material damping properties in different snap load scenarios of wave energy converters.

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