Numerical Modeling of Hydrodynamic Behavior of Kelp Lines in Macroalgae Farming Systems

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ABSTRACT

A finite element modeling technique is proposed to analyze the hydrodynamic response of densely grown kelp lines to environmental loading in a marine environment. The technique represents agglomerates of kelp as equivalent finite elements similar to the approach previously utilized for mussel lines, see [1]. It is based on the Morison-type equation with the hydrodynamic coefficients determined from the experimental data [2].

The aggregate finite element model was built using measurements of kelp blade length and width, number of blades, and material mass density. It was calibrated using the tow tests conducted on a full-scale physical model as described in [2]. The model was then applied to analyze the experimental kelp cultivation system deployed in Saco Bay (Maine, USA) from 2020 to 2022, see Fig. 1. The numerical results were validated by comparison with the field measurements for several load cases with various wave and current parameters

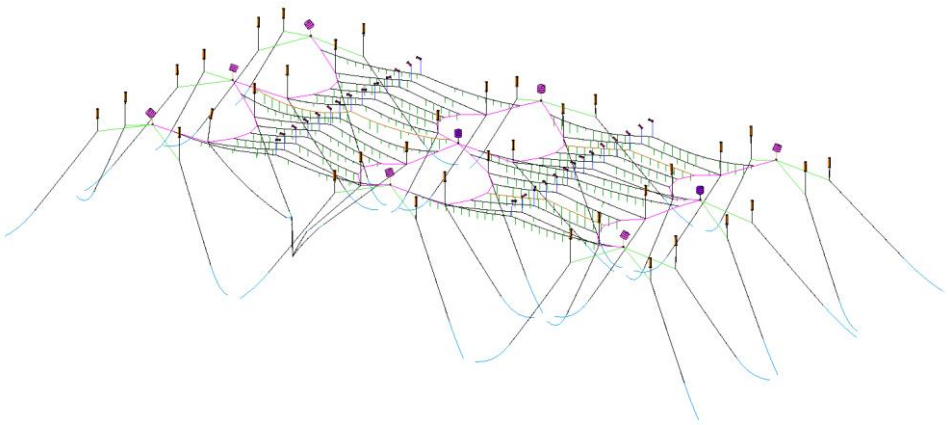

Figure 1. Finite element model of the experimental kelp cultivation system deployed in Northern Atlantic near Ram Island, ME USA in 2022.

REFERENCES

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