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Mooring Lines Multi-component Analysis using OpenFOAM

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ABSTRACT

The marine renewable energy (MRE) sector, particularly floating offshore wind, faces challenges such as cost reduction, shallow water deployment, and environmental considerations. Advances in mooring systems, such as the integration of clump weights and submerged buoys, provide solutions by enhancing restoring forces and optimizing design. Computational Fluid Dynamics (CFD) offers a high-fidelity alternative to traditional methods for analyzing these complex systems. Palm [1] conducted the first CFD-based investigation of mooring components for a wave energy converter (WEC), demonstrating that submerged buoys modeled with CFD exhibited reduced motion amplitudes compared to the Morison approach, while maintaining similar peak mooring loads. Building on this, Eskilsson [2] integrated the mooring dynamics software MoodyCore [3] into CFD simulations, providing a more detailed analysis of mooring components. The current study builds upon these efforts by incorporating clump weights and submerged buoys into isolated catenary mooring lines. Simulations were performed using OpenFOAM, MoodyCore [3], and MoorDyn version 2 [4], with added mass effects evaluated using the FloatStepper solver [5]. Validation was conducted using experimental tension data from the CEHIPAR campaign, López-Olocco [6]. These findings bridge the gap between traditional mooring design approaches and high-fidelity simulation techniques, advancing configurations for floating renewable energy platforms.

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