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## ABSTRACT:

### Meso-Scale Finite-Element Mechanical Modeling of An Innovative Woven-HMPE Fiber Chain for Mooring Offshore Wind Turbines

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An innovative chain is proposed by project Velella (BW Ideol, funded by the French government as part of France 2030, ADEME) for the moorings of floating wind turbines (FOWT). Indeed, the classical chain failures account for approximately half of all permanent mooring failures [1]. This innovative proposed solution is a textile chain made of HMPE fibres. It offers several improvements but its damage mechanisms have to be investigated as was done in other projects for the case of stranded nylon ropes [2,3]. A mechanical finite element (FE) model of the textile chain is proposed at its meso-scopic scale. One of the objectives of the FE model is to better understand the contact phenomena between links, where the damage is located. The parameters of this model will be optimized to further improve mechanical performance. The presentation will highlight the numerical process for obtaining a relevant definition of the geometry of a link of the chain. Instead of capturing this geometry by 3D scan (X ray Tomography), we chose to simulate numerically the process of manufacturing the chain link, starting from a simple and well known configuration of its anisotropic component; a woven HMPE-yarn strap. This simulation allows numerical optimization of the chain geometry and also to define precisely the anisotropy directions in a complex 3D structure. Indeed, the chain link is a Moebius ribbon with several layers.

[1] C. Del Vecchio, et al., in OTC Conference, p. D011S013R001 (2024).

[2] Y. Chevillotte et al. Ocean Engineering 199 (2020): 107011.

[3] L. Civier et al. International Journal of Fatigue 188 (2024): 108532.