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Testing and modelling of elastomeric material for nonlinear mooring systems

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ABSTRACT

Mooring systems in offshore renewable energy projects constitute a key part for the station-keeping of these structures. Mooring systems of floating offshore renewables must withstand the forces and stresses expected over the system lifetime, whilst being as cost-effective as possible. Commonly used mooring materials are steel for chains and connectors and/or synthetic materials for synthetic mooring lines. This paper will present an elastomeric material, within the application of a nonlinear mooring tether. The paper will present the physical tests and results carried out to characterise the material. Additionally, mooring specification and international standards (ISO) are studied prior the design stage of the mooring configuration along with other parameters.

Experimental loads that have been implemented on elastomer specimens in terms of stress and strain taken into consideration for modelling purposes. A small-scale test has been carried out to examine the stress-strain behaviour in order to inform a finite element method afterwards. The nonlinear behaviour of the rubber is modelled through i) a hyper-elastic material approach and ii) a surface consideration following the Newton-Raphson method for nonlinear structural analysis. The quality and fit of the two models is assessed and compared with the experimental data.

The stiffness of the elastomer provide important information for the operation and life-cycle of the mooring lines, while the understanding of the rubber material operation mechanism in moorings can help to predict its behaviour profile through modelling.

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