A novel mooring tether for highly-dynamic offshore applications: Overview

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Work stream: Reliability

Introduction

The University of Exeter is developing a novel mooring tether to mitigate against extreme and fatigue loads in marine energy device mooring systems. The tether aims to reduce these loads by increasing compliance and introducing two distinct phases of stiffness. In addition, the tether decouples the minimum breaking load (MBL) and stiffness properties of the mooring, allowing these to be specified independently for a specific device and location. This poster will discuss a selection of findings published in a recent paper [1].

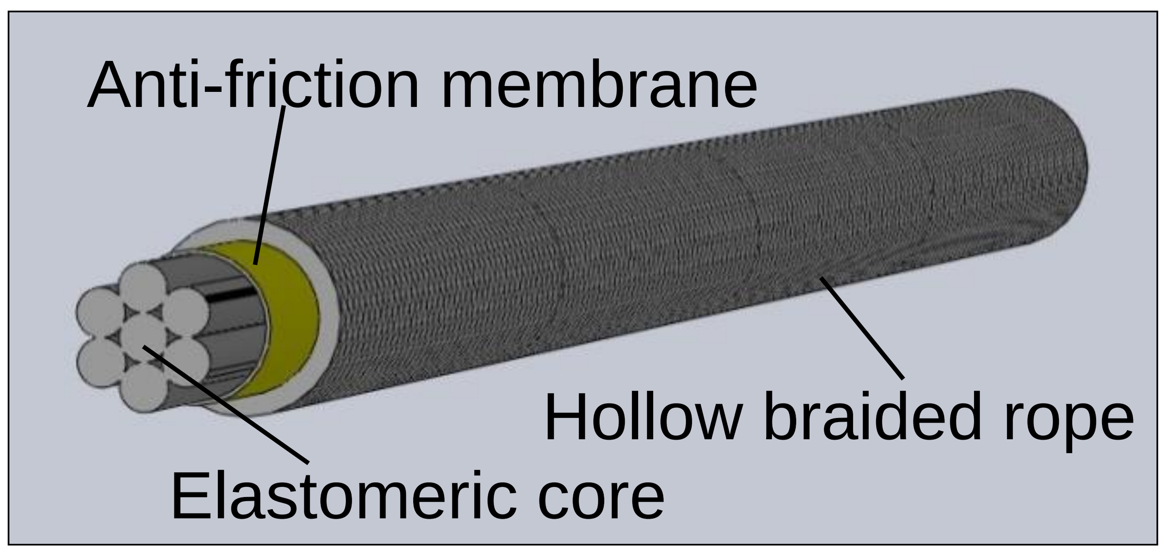

Figure 1: Schematic of Exeter Tether with key components listed

Method

A range of 12 tether variants have been developed for the P1-Protoype proof of concept testing. One of the variants is the Shore Hardness value of the elastomeric core, with five different values used ranging from 54-81 Shore A. The core affects the radial compression of the Tether, so it is anticipated that altering the hardness of the core will provide different stiffness responses.

A series of displacement driven and force driven tests were conducted on DMaC to investigate the performance of the P1 range.

Figure 2: A tether under test at the Dynamic Marine Component Test Facility (DMaC).

References

[1] T Gordelier, D Parish, PR Thies, L Johanning. (2015) *A Novel Mooring Tether for Highly-Dynamic Offshore Applications; Mitigating Peak and Fatigue Loads via Selectable Axial Stiffness*, JMSE, 3(4): 1287-1310

Results

Increased compliance & two phase stiffness

Can the Tether offer increased compliance in comparison to existing mooring options? Results for Tether P1-6 in Figure 3 show strains approaching 35% are observed at loads of 30% MBL. 10% strain is achievable at 30% MBL for a comparative polyester rope. In addition, two distinct phases of stiffness are evident.

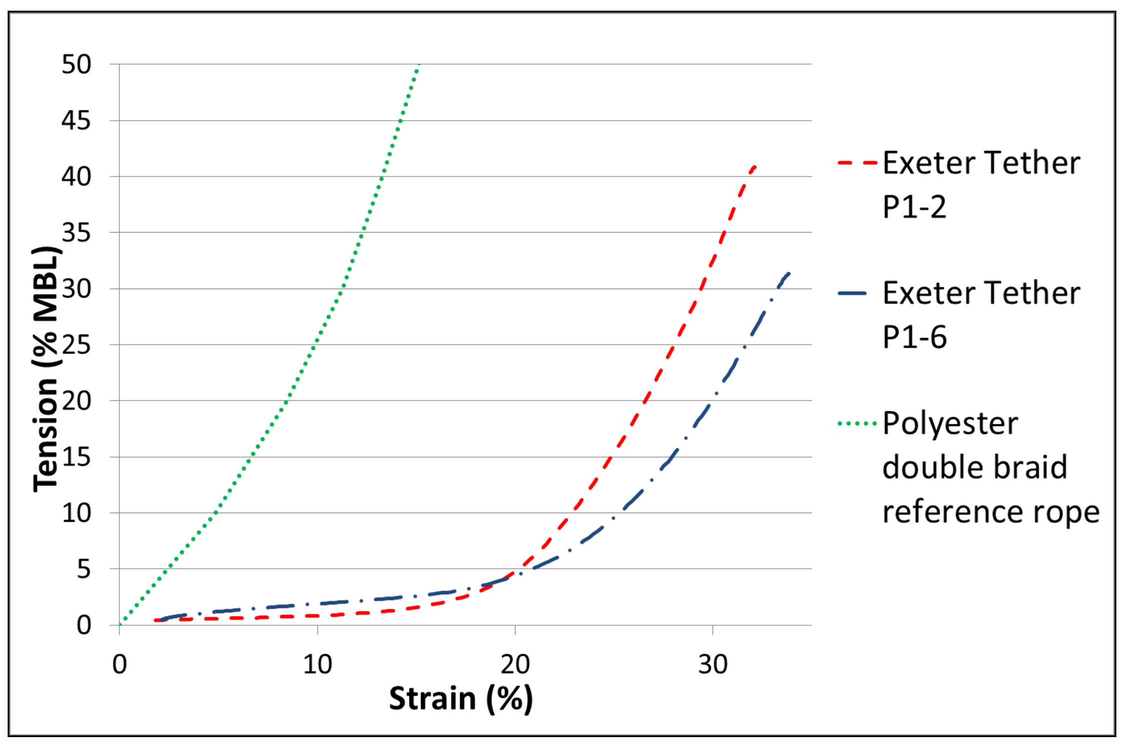

Figure 3: Results from ETT_19 (displacement driven from 0-0.99m) P1-2 and P1-6 in comparison to a polyester reference rope.

Selectable axial stiffness

Can axial stiffness be selected? Figure 3 details the range of stiffness profiles observed during test ETT_08. The observed range is dependant upon the shore hardness of the elastomeric core, as detailed in Table 1.

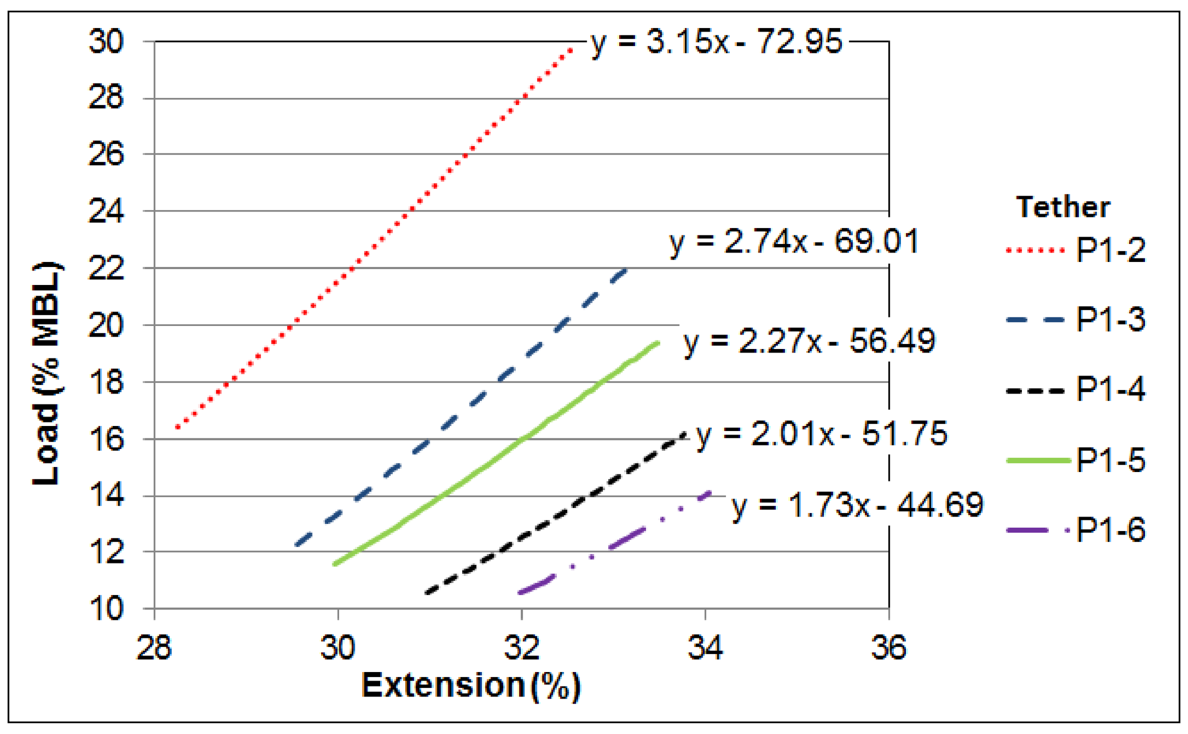

Figure 3: Results from displacement driven test ETT_08, 0.5 -0.9m

Hardness (Shore A)	Tether	Stiffness ranking
54	P1-2	1
59	P1-3	2
70	P1-5	3
71	P1-4	4
81	P1-6	5

Table 1: Linking axial stiffness to shore hardness

Conclusions

The results shown here demonstrate that the novel Tether can offer increased compliance as well as two distinct phases of stiffness. In addition, the axial stiffness of the tether can be selected (within limits) based upon the Shore Hardness of the elastomeric core.