A flexible chain proposal for winch-based point absorbers [

Analítica

Ocean wave power is a promising renewable energy source. It has, however, been difficult to find a cost-effective solution to convert wave energy into electricity. The harsh marine environment and the fact that wave power is delivered with large forces at low speed make design of durable mechanical structures and efficient energy conversion challenging. The dimensioning forces strongly depend on the wave power concept, the wave energy converter (WEC) implementation, and the actual power take-off (PTO) system. A WEC with a winch as a power take-off system, i.e., a winch-based point absorber (WBPA), could potentially enable a low levelized cost of energy (LCOE) if a low-cost, durable and efficient winch that can deal with peak loads can be developed. A key challenge for realizing such a winch is to find a force transmitting solution that can deal with these peak loads and that can handle up to 80 million cycles during its life. In this article, we propose a design solution for a force transmitting chain with elastomer bearings connecting the links of the chain. With this solution no sliding is present, and the angular motion is realized as elastic shear deformations in the elastomer bearings when the chain is wound onto the winch drum. The elastomer bearings were designed for low shear stiffness and high compression stiffness, and the links were designed primarily to minimize the number of joints in the chain. Thereby, the maximum allowed relative angle between the links when rolled up over the drum should be as large as possible within practical limits. Finite element-based topological optimization was performed with the aim to increase the link strength to weight ratio. A test rig for a first proof of concept testing has been developed, and preliminary test results indicate that this chain concept with elastomer bearings can be a potential solution for a durable chain and should be analyzed and tested further for fatigue and sea operations

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