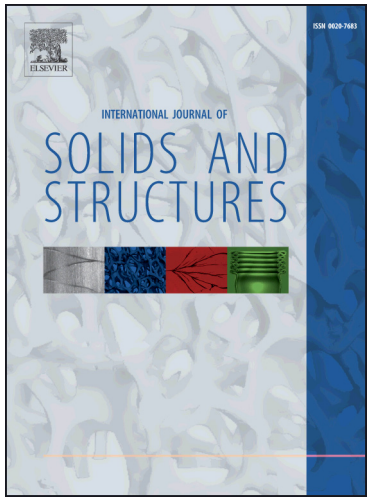

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Finite element simulation of the mechanical behaviour of synthetic braided ropes and validation on a tensile test

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Abstract

A finite element approach to the mechanical behaviour of braided ropes at the scale of their internal components is proposed in this paper. The ropes considered are composed of a few tens of textile yarns, twisted into strands, which are then braided together. The approach aims at determining the mechanical equilibrium of such structures, viewed as assemblies of yarns undergoing large displacements and developing contact-friction interactions. To solve this equilibrium within a quasi-static framework, and using an implicit solution scheme, each yarn of the rope is represented by a finite strain beam model, and special emphasis is put on the detection and modelling of contact-friction interactions between yarns. The approach is used first to determine the unknown initial configuration of the rope, starting from an arbitrary configuration and using contact interactions together with information from the selected braid pattern, to determine the braided structure as the solution of a mechanical equilibrium. Comparisons are made with experimental data on

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