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A LOCAL FRAME APPROACH FOR LINE-TO-LINE CONTACT BETWEEN THIN BEAMS WITH CIRCULAR CROSS-SECTIONS

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Flexible slender structures like cables have a variety of applications in high-performance engineering systems. The complex mechanical behaviour of such components, resulting from interactions between individual fibers, cannot be captured by means of global constitutive laws [1]. In mesoscopic models a cable is seen as a collection of fibers, modeled as 1D Cosserat beams, experiencing frictional contact.

In the mathematical framework of Lie groups, beams are described through a space curve augmented by a frame attached to each cross section. The mechanical behaviour of a beam is the result of frame transformations belonging to the Lie group of rigid body motions $SE(3)$. Discretization methods consistent with the framework implicitly conserve the intrinsic geometric characteristics of Cosserat curves and hence lead to interesting numerical properties [2].

In this contribution the modeling of cables made of elastic fibers with circular cross sections undergoing frictionless contact interactions is addressed. A continuous formulation as Cosserat beams with line to line contact conditions [3] modeled as unilateral constraints is established in $SE(3)$. A local frame formulation of contact kinematics emerges from the formalism. The spatial discretization is performed using helicoidal shape functions resulting from the geodesic interpolation of elements in $SE(3)$. At the minisymposium an outline of the problem with its scientific challenges, first numerical results, as well as an outlook on future work will be presented.

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