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An isogeometric frictionless contact formulation for hyperelastic Cosserat rods with deformable cross-sections

Myung-Jin Choi[1*], Roger A. Sauer[2,3,4] and Sven Klinkel[1]

[1] Chair of Structural Analysis and Dynamics, RWTH Aachen University, 52064 Aachen, Germany, (*) choi@lbb.rwth-aachen.de, klinkel@lbb.rwth-aachen.de

[2] Aachen Institute for Advanced Study in Computational Engineering Science (AICES), RWTH Aachen University, 52062 Aachen, Germany, sauer@aices.rwth-aachen.de

[3] Faculty of Civil and Environmental Engineering, Gdańsk University of Technology, ul. Gdańsk, Poland

[4] Department of Mechanical Engineering, Indian Institute of Technology Guwahati, Assam 781039, India

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We present an isogeometric finite element formulation of frictionless beam-to-beam contact based on a surface-to-surface contact algorithm for hyperelastic Cosserat rods with deformable cross-sections. The beam formulation is based on extensible director kinematics of an arbitrary order, which enables an additive configuration update process, a straightforward utilization of three-dimensional constitutive laws without zero-stress conditions, and deformable cross-sections, see [1] and the references therein. Further, a spatial discretization using NURBS basis functions enables a description of lateral boundary surface with higher-order continuity. We verify the accuracy and efficiency of the proposed contact formulation by comparison with brick element solutions in numerical examples.

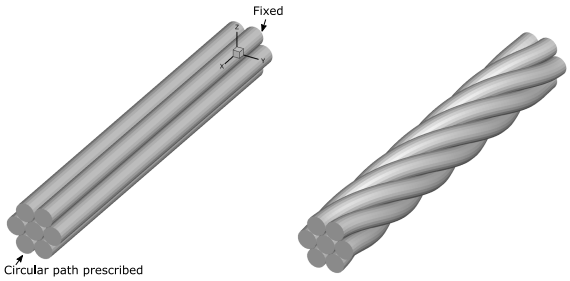

Figure 1: Twisting of wire strands. A circular path is prescribed at the ends of the outer beams. Initial (left), and deformed (right) configurations.

REFERENCES

[1] Myung-Jin Choi, Roger A. Sauer, and Sven Klinkel, An isogeometric finite element formulation for geometrically exact Timoshenko beams with extensible directors. *Comput Methods Appl Mech Eng* **385**, pp. 113993, 2021 [arXiv: 2010.14454]