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Axially moving beams in contact with sheaves

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This work investigates highly flexible axially moving beams with co-moving discrete masses in contact with sheaves. For the numerical modeling a two dimensional Arbitrary Lagrange Eulerian (ALE) formulation is used [1]. The implemented beam elements are based on the Absolute Nodal Coordinate Formulation extended by an additional independent coordinate that represents the axial motion. In order to consider the full dynamics of discrete masses they are integrated through a Multibody Dynamics approach using ALE sliding joints [2].

The current presentation focuses on the problem of modeling the contact between the beam elements and sheaves which is addressed by finding the intersection points of the circular sheaves and the cubic splines used to interpolate the beam nodes. The detection of contact points is based on the numerical solution of the exact geometrical problem. The sixth order polynomial which results from the exact solution of the geometrical problem is solved finding the eigenvalues of the companion matrix of the polynomial. In order to reduce the computational cost a box search is implemented with exact computation of bounding boxes of beam elements. The newly developed algorithm offers a considerably improved efficacy against more traditional linear segments methods. The proposed contact formulation is implemented into a multibody dynamics framework and applied to a small test model and a real-world ropeway system.

REFERENCES

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