Contact Behaviour of Isogeometric Analysis for Rotating Structures and its Industrial Application by Coupling to the Classical Finite Element Method

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ABSTRACT

Especially for rotating structures like bearings non-smooth contact surfaces, as they appear in classical finite element modeling, lead to various problems during the analysis involving mesh interlocking and spurious oscillations in contact forces. In order to eliminate these issues, very fine meshes and additional smoothing strategies are employed in case of the finite element method (FEM). But also Non-Uniform Rational B-splines (NURBS) based isogeometric analysis (IGA) can be very useful for the contact analysis due to the inherent higher order continuity of NURBS basis functions. In this contribution, the contact behavior using classical FEA and IGA approaches is studied by means of an example of a pendulum under gravitational load. In addition, a more practical example of a coupled IGA–FEM problem with a cylindrical roller bearing is also reported in this paper. This research study of contact analysis has been carried out for the above mentioned examples using LS-DYNA and illustrates that contact surfaces of coarsely meshed geometry lock the rotation of the parts in case of classical FEM. On the contrary, when the contact surface is represented by NURBS elements it allows the rotation of the parts and effectively alleviates the contact force oscillation.