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ISOGEOMETRIC CONTACT ANALYSIS USING A THIRD MEDIUM

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Abstract

Recently, Wriggers *et al.* [1] proposed a new approach for contact analysis, based on the concept of the so-called third medium. With this approach, the two contacting bodies are assumed to be embedded in a third continuous medium, described as a fictitious material featuring an isotropic/anisotropic behavior with changing directions and characteristics. Isogeometric analysis (IGA) was recently proposed by Hughes *et al.* [2] with the original purpose to fill the gap between computer-aided design (CAD) and finite element analysis. In place of the standard Lagrange polynomial basis functions used in the finite element method (FEM), IGA typically adopts non-uniform rational B-spline (NURBS) basis functions, resulting in exact geometry representation (i.e. exact reproduction of the CAD geometry) and arbitrary order approximation, with maximum inter-element continuity C^{p-1} for order-p parameterization. Recent attempts to solve contact problems within the IGA framework (see [3] among others) demonstrated significant advantages of IGA over conventional FEM, especially for contact problems involving large deformations and large sliding. The combination of the third medium approach with IGA appears promising for a few reasons. First, IGA is capable of importing the geometry parameterization directly from CAD. Thus the geometry of the two contacting bodies and of the third medium can be defined directly in the CAD environment. Second, IGA has been shown to deliver an increased degree of robustness over FEM under severe mesh distortions [4]. This is expected to be useful for contact problems with large deformations and large sliding, whereby extreme distortions typically take place in the third medium. Finally, IGA offers the possibility to flexibly increase the order of the discretization without any geometry and parameterization change.

In the present work, we explore the use of a third medium approach for the contact description within the IGA framework. Several significant examples are presented.

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