

A mixed formulation for large deformation contact problem using IsoGeometric Analysis

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ABSTRACT

In this work, we propose an isogeometric method for solving rigid-deformable contact problems in small and large deformations. The contact constraints are treated with a mortar like approach combined with a interpolation of gap (to see [1] on a second order elliptic equations and [3] using a augmented Lagrangian method). These constraints are satisfied with a Lagrangian formulation to impose the Signorini contact conditions and an Active Set Strategy [4] ensures the complementary conditions. A inf – sup stability is proved to ensure a good property of the method using NURBS of degree p for the displacement and B-Splines of degree $p - 2$ for the Lagrange multiplier. An optimal a priori error estimate without assumption on the unknown contact set is presented.

Some numerical results will be presented showing the good convergence properties of our algorithms on numerical tests in two and three dimensions in small and large deformation.

References

- [1] E. Brivadis, A. Buffa, B. Wohlmuth, and L. Wunderlich, Isogeometric mortar methods. *Comput. Methods in Appl. Mech. Eng.* 284:292-319, 2015.
- [2] T. J. R. Hughes, J. A. Cottrell and Y. Bazilevs, Isogeometric analysis: CAD, finite elements, NURBS, exact geometry and mesh refinement. *Comput. Methods in Appl. Mech. Eng.* 194:4135-4195, 2005.
- [3] L. De Lorenzis, P. Wriggers, and G. Zavarise, A mortar formulation for 3d large deformation contact using nurbs-based isogeometric analysis and the augmented Lagrangian method. *Springer-Verlag* 49:1-20, 2012.
- [4] A. E. Maliki, M. Fortin, J. Deteix, and A. Fortin, Preconditioned iteration for saddle-point systems with bound constraints arising in contact problems. *Comput. Methods in Appl. Mech. Eng.* 254:114-125, 2013.