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AN EXTENDED ISOGEOMETRIC MORTAR METHOD FOR FRICTIONAL CONTACT

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Mortar methods [1] in combination with isogeometric analysis introduce a great improvement in computational contact mechanics. The smoothness of contact interfaces due to isogeometric disretization and the weak enforcement of contact constraints in mortar methods provide increased robustness and accuracy. In this contribution, we presents a new isogeometric mortar formulation, denoted *extended mortar* formulation, for frictional contact. It is based on an extended finite element interpolation to capture physical pressure discontinuities at the contact boundary.

In previous work [2], we developed the extended mortar formulation for frictionless contact problems. Since the physical pressure discontinuities at the contact boundary are recovered, the so-called *refined boundary quadrature* [3], which is based on adaptive partitioning of contact elements along the contact boundary, is employed for the numerical integration. The extended mortar formulation was shown to pass the contact patch test and apply to large deformation mechanics. In particular, the unbiased version of the extended mortar can be obtained by employing the so-called two-half-pass algorithm [4]. Since the mortar coupling term is no longer present in the contact forces, this formulation can pass the patch test without segmentation at overlapping master-slave element boundaries as usually required in classical mortar methods.

Here, we extend the previous approach [2] to account for frictional contacts. The penalty regularization is considered. The robustness and accuracy of the proposed formulation are demonstrated by several challenging numerical examples.

REFERENCES

[1] Puso, M. A. and Laursen, T. A. *A mortar segment-to-segment contact method for large deformation solid mechanics*. Comput. Methods Appl. Mech. Engrg. (2004) **193**, pp. 601-629.

[2] Duong, X. T, De Lorenzis, L. and Sauer, R. A. *A segmentation-free isogeometric extended mortar contact method*. Submitted (2017), https://arxiv.org/abs/1712.01179.

[3] Duong, T. X. and Sauer, R.A. *An accurate quadrature technique for the contact boundary in 3D finite element computations*. Comput. Mech. (2015) **55**(1), pp. 145-166.

[4] Sauer, R. A. and De Lorenzis, L. *A computational contact formulation based on surface potentials*. Comput. Methods Appl. Mech. Engrg. (2013) **253**, pp. 369-395.