The 8th European Congress on Computational Methods in Applied Sciences and Engineering
ECCOMAS Congress 2022
5-9 June 2022, Oslo, Norway

A Virtual Element Method for 3D Contact

Mertcan Cihan[1*], Blaž Hudobivnik[2] and Peter Wriggers[3]

Leibniz Universität Hannover, 30823 Garbsen, Germany,
E-mail: [1]cihan@ikm.uni-hannover.de, [2]hudobivnik@ikm.uni-hannover.de &
[3]wriggers@ikm.uni-hannover.de, Web page: https://www.ikm.uni-hannover.de/

Keywords: *Virtual Element Method, Contact Mechanics, Node-to-Node, Remeshing*

The virtual element method (VEM) has been shown to perform well in various engineering problems, such as fracture mechanics and contact problems, as outlined in [1, 2, 3]. In this work, we present a virtual element method for 3D contact problems with non-conforming meshes. The contact conditions can be employed on different enforcing strategies. For non-conforming meshes, a node-to-surface enforcement will lead to wrong force distributions and thus to non homogenous stress distributions within the contact bodies. Here, we introduce a new framework, including a remeshing strategy, which leads to conforming meshes. In fact, we use the advantageous feature of the virtual element method, which allows the introduction of new topological nodes during the simulation, without changing the ansatz of the element. This idea was presented first in [2] in 2D for small strains and normal contact and was extended to finite strains and tangential contact in [3]. In [4], contact problems with curvilinear virtual elements have been investigated. So far, these works are done for 2D. Thus, this work extends this idea to 3D problems. To verify the new methodology, numerical examples in 3D are shown, including the contact patch test and Hertzian contact.

REFERENCES

[1] Hussein, A., Hudobivnik, B. and Wriggers, P. A combined adaptive phase field and discrete cutting method for the prediction of crack paths. *Computer Methods in Applied Mechanics and Engineering.* (2020) **372**: 113329.

[2] Wriggers, P., Rust, W. and Reddy, B. A virtual element method for contact. *Computational Mechanics* (2016) **58**: 1039–1050.

[3] Wriggers, P. and Rust, W. A virtual element method for frictional contact including large deformations. *Engineering Computations* (2019) **36**: 2133–2161.

[4] Aldakheel, F., Hudobivnik, B., Artioli, E., Beirão da Veiga, L. and Wriggers, P. Curvilinear virtual elements for contact mechanics. *Computer Methods in Applied Mechanics and Engineering.* (2020) **372**: 113394.