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Abstract of Contribution 121

ID: 121
Abstract Submission
Keywords: Level Set, LS-DEM, Shape, YADE

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For the purpose of capturing realistic particle shapes in DEM, a Level Set (LS) approach (Kawamoto et al., 2016) can be chosen whereby particle's surface is implicitly defined as the zero-level set of a discrete distance-to-surface field. The latter can be obtained for virtually any shape thanks to e.g., Fast Marching Method algorithms, conferring an interesting versatility to the approach. As a second key ingredient, a surface discretization in terms of vertices is also defined from the distance field and ray tracing methods in order to execute contact detection through a master-slave algorithm whereby surface vertices of one Discrete Element are tested against the distance field of another. After implementation in the YADE open-source code (Duriez & Galusinski, 2021), the LS method is herein discussed considering different kinds of shape.

The spherical case is first revisited as it enables one to validate the implementation by comparing to a classical DEM reference and measure its computational costs (Duriez & Bonelli, 2021). The LS approach is then illustrated to require around 100 times more memory (for storing the distance field, mostly) and time (for looping over surface vertices during the contact algorithm) than classical DEM. OpenMP parallelization is nevertheless shown to be beneficial for effectively reducing time costs and memory costs could also be optimized (Duriez & Galusinski, 2020).

Then, a direct application of the LS approach is proposed to convex superquadrics (superellipsoids). Describing non-convex rock aggregates from 3D scans is also discussed.

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