DEM GPU Simulations With Convex and Non-convex Particles for Railway Ballasts

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Abstract

The stability of the ballast depends on the characteristics include particle shape and angularity which are critical to provide sufficient load distribution and strength to the railroad structures. The Discrete Element Method (DEM) is classically used to model the ballast layer as spherical particles using complex contact models or clustered particles that lack resolution on participle angularity. Although both approaches are able to reproduce the behavior when characterized for that ballast, the geometrical simplifications limit the application of these models away from the point where it was characterized. In addition, any investigation that relies on geometrical changes are limited using spherical particle models. In contrast, a polyhedral particle representation would be ideal to represent the faceted nature of ballasts but unfortunately this used to significantly limit the number of particles that can be modeled. The recent advances of using the graphical processing unit (GPU) to model polyhedral discrete element particle systems as demonstrated by BlazeDEM-3DGPU, is allowing for the first time convex and non-convex polyhedral ballast representations to be studied for up to a 100 000 particles. This study investigates the modeling the ballast as convex or non-convex particle systems. The shaped geometries used were directly extracted from the real ballasts using 3D-laser scanning for different resolutions allowing for representative ballast shapes.

References

1. D.N Wilke and N. Govender and P. Pizette P. and N-E Abriak. Computing with non-convex Polyhedra on the GPU. Springer Proceedings Phys. (2017) 188:1371–1377.