

VGCM3D – Flexible: A 3D generalized particle contact model for rock fracture taking into account particle deformability

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ABSTRACT

2D and 3D rigid particle models taking directly into consideration the physical mechanisms and the influence of the material grain structure have been developed for fracture studies of quasi-brittle material such as rock. It is known that traditional rigid spherical particle models proposed in the literature do not properly reproduce the rock friction angle and the rock tensile strength to compressive strength ratio. A 3D rigid particle generalized contact model (GCM3D) has been proposed which properly reproduces the rock friction angle and the rock tensile strength to compressive strength ratio, while keeping the simplicity and the reduced computational costs characteristic of circular particle models [1]. More recently, the 3D contact model has been further extended in order to include in an approximate way the polyhedral particle shape [2].

In this work the 3D contact model is extended in order to include in an approximate way the particle deformability by considering in each polyhedral particle an inner finite element mesh tetrahedra discretization, VGCM3D. In order to keep the model as simple as possible, the contact between the polyhedral shaped particles is handled as if the particle geometry is in fact spherical and the contact surface is located at the corresponding Laguerre Voronoi surface. The VGCM3D flexible contact model is tested against known experimental data on a hard rock, namely triaxial tests and Brazilian tests. The results are also compared with the results obtained with the rigid model (GCM3D). The study carried out highlights the importance of considering the particle deformability in order to obtain results closer to the experimental data.

REFERENCES

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