APPLICATION OF AN ELLIPSOIDAL APPROXIMATION TO DISCRETE ELEMENT MODELING

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Discrete element modeling has become a popular method to analyze a variety of granular discontinua and has especially gained favor in the geotechnical field for describing the behavior of small grain interaction, such as sand pile formation and particle influence in fluidized beds.

Many discrete element modeling approaches in three dimensions use heterogeneous spheres as models for geological particles. Though spheres are geometrically compact and possess favorable contact detection properties, the constant radius can lead to pathological dynamic behavior. Excessive rolling and an inability to interlock are two such problems. Some approaches use an empirically derived friction factor to dampen the rolling of sphere systems. In others, clusters of spheres are rigidly bonded to form non-spherical shapes. This approach introduces non-spherical geometry but the union of spheres does not meet C^1 parametric continuity requirements without additional constraints.

This paper introduces a method for generating a combination of spheres that satisfy C^1 continuity. It demonstrates the construction of particles with ellipsoidal geometry from the volume enclosed by the rotation of 3 arcs about a central axis. The computational performance of a system of these ellipsoids is compared against a similar system composed of traditional sphere clusters. Results of particle flow simulations are also discussed.