On Characterizing Particle Shape (Abstract #392646)

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It is well known that particle shape affects flow characteristics of granular materials, as well as a variety of other solids processing issues such as compaction, rheology, filtration and other two-phase flow problems. The impact of shape crosses many diverse and commercially important applications, including pharmaceuticals, civil engineering, metallurgy, health, and food processing. Two applications studied here include the dry solids flow of lunar simulants (e.g. JSC-1, NU-LHT-2M, OB-1), and the flow properties of wet concrete, including final compressive strength.

A multi-dimensional generalized, engineering method to quantitatively characterize particle shapes has been developed, applicable to both single particle orientation and multi-particle assemblies. The two-dimension, three dimension inversion problem is also treated, and the application of these methods to DEM model particles will be discussed.

In the case of lunar simulants, flow properties of six lunar simulants have been measured, and the impact of particle shape on flowability – as characterized by the shape method developed here -- is discussed, especially in the context of three simulants of similar size range.

In the context of concrete processing, concrete construction is a major contributor to greenhouse gas production, of which the major contributor is cement binding loading. Any optimization in concrete rheology and packing that can reduce cement loading and improve strength loading can also reduce currently required construction safety factors. The characterization approach here is also demonstrated for the impact of rock aggregate shape on concrete slump rheology and dry compressive strength.