

# Generic Modelica Framework for MultiBody Contacts and Discrete Element Method

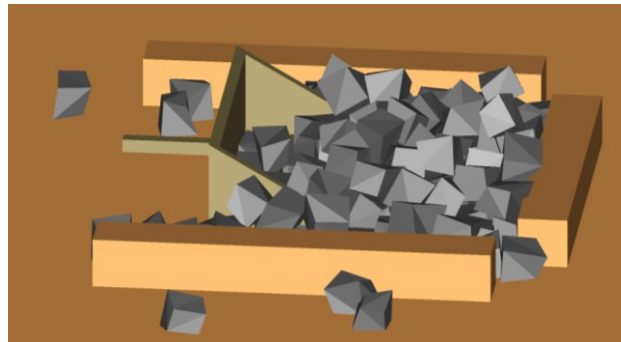
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A generic framework for mechanical modeling of objects that collide and have contact is presented. It can be used in combination with the Modelica MultiBody library and to model granular objects using DEM (Discrete Element Method). The shapes of the objects are given by general triangular meshes. The special case of spheres is also supported in order to handle tens thousands of objects for DEM.

The contact handling is organized using ExternalObjects, i.e. C and C++ code. Each body in the scene registers its current position which is given as the solution of the Modelica motion equations. After that a centralized routine of the scene calculates and adds all forces between pairs of bodies in contact. The force calculation is done using the intersection volume found by the CSG (Constructive Solid Geometry) intersect operator. We have used a generalization of the Hertz contact model, where the force is proportional to  $\sqrt{Vd}$ , with  $V$ =penetration volume and  $d$ =penetration depth. The force is acting at the centroid of the penetration volume.



**Figure 1.** Bucket digging in a pile of Belgian Block stones



**Figure 2:** Snapshot of Tippe Top inversion, from left to right