Using Arbitrary Triangulated Shapes in DEM Simulations. Contact models and applications

S. Vanmaercke*, B. Smeets, T. Odenthal, J. Keresztes, H. Ramon

*Mechatronics, Biostatistics and Sensors division, MeBioS,
KU Leuven,
Kasteelpark Arenberg 30,
3001 Heverlee, Belgium
e-mail: Simon.Vanmaercke@kuleuven, web page: http://www.mebios.bes

ABSTRACT

Many applications of the Discrete Element Method (DEM) require a grain description which accounts for irregular, arbitrarily shaped particles in order to obtain accurate simulation results. Contrary to the Finite Element Method, where triangulations are commonly used, it is not straightforward to use a triangulated representation of grains in DEM.

Two contact models are presented that allow accurate contact force prediction between two triangulated shapes. The first model [1] assumes that the grain has a rounded shape, and calculates forces based on the Hertz contact pressure by fitting a sphere through every triangle. This allows for realistic simulations using only physical parameters such as Young's moduli of the materials.

The requirement of a rounded shape is often not acceptable, since many common objects are sharp angled (e.g. tetrahedra). The second presented contact model [2] does not impose this restriction and integrates a contact pressure over the contact area of both triangles.

By triangulating the fruit, local contact pressures per triangle can be calculated and using an appropriate damage model, the expected damage from a given contact predicted. Using this methodology, damage on fruit can be integrated during a transport chain and potential measures to lower this damage can be evaluated.

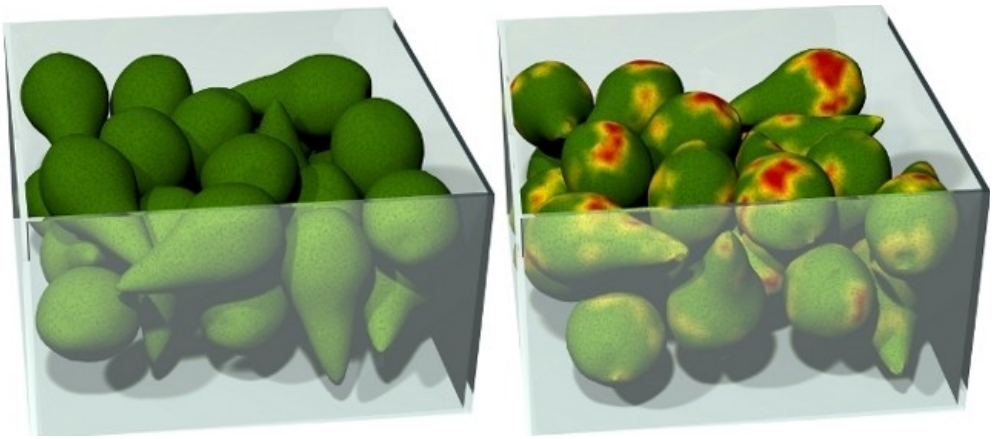

Figure 1: Damage prediction on triangulated representations of pears during transport using DEM.

REFERENCES

[1] B. Smeets Bart, T. Odenthal, J. Keresztes, S. Vanmaercke, P. Van Liedekerke, E. Tijskens, W. Saeys, H. Van Oosterwyck, H. Ramon, “Modeling contact interactions between triangulated rounded bodies for the discrete element method”, Computer Methods in Applied Mechanics and Engineering, Volume: **277**, Pages: 219-238 (2014)

[2] B. Smeets , T. Odenthal, S. Vanmaercke, H. Ramon, “Polygon-based contact description for modeling arbitrary shapes in the Discrete Element Method”, Computer Methods in Applied Mechanics and Engineering (submitted) (2015)