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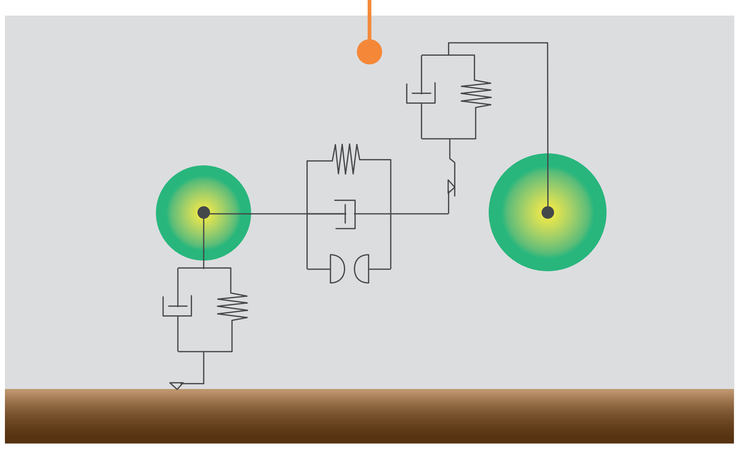
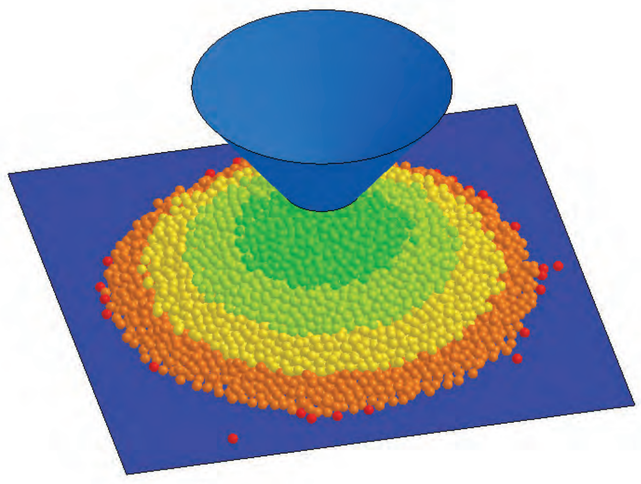
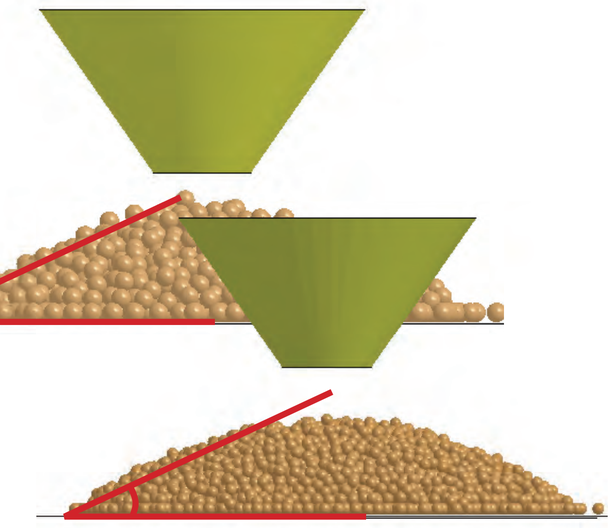
INTRODUCTION

This poster presents an application of the Discrete Element Method (DEM) for the modeling of a granular soil and its interaction with a generic tool.
DEM is mainly used to model granular material including: powders, sand, plastic granules, gravel; compared to classical finite element (FE) techniques, DEM has the advantage of handling extreme deformations.



Compression modulus, Shear modulus
Normal damping, Tangential damping
Coulomb friction, Rolling friction
Capillary force





DEM SOIL MODEL

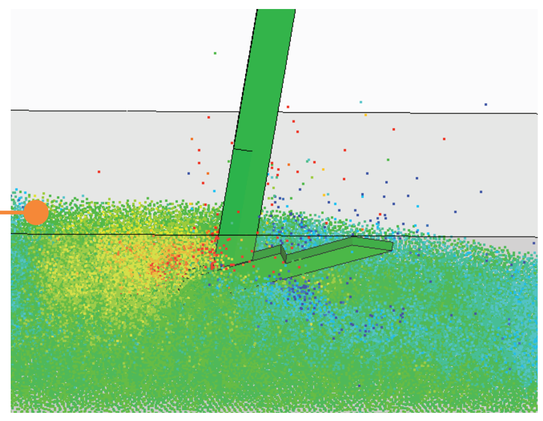
The Discrete Element Method represents a special class of simulation techniques that uses unconnected, generally spherical, elements to model the behavior of granular material.
Latest improvement to DEM includes the presence of adhesion forces, that model the presence of moisture, thus extending the application to semi solid and plastic soil.
The interaction between Discrete Elements (DE) is modeled with a simple set of stiffness, damping, friction and adhesion parameters.

In order to achieve accurate results a calibration phase is needed before practical usage.

Calibration of material parameters:
- density (particle vs bulk)
- repose angle (modeling real soil particle size would be impractical, for this reason a coarse graining techique is used to collapse many small size DE into a larger one)
- durometer / penetrometer
- shear test

Grid independence study:
different grids give almost the same integral force but different particle behavior.

Comparing the model with in field observations shows a good qualitative correlation during soil strip tillage practice.



Tool geometry kindly provided by Mattia Trevini, www.agroingegno.it

CONCLUSION AND PERSPECTIVES

A soil mathematical model has been developed with the ability of handling extreme deformation. The model has been calibrated and successively used to analyze soil deformation during strip tillage implement.
The DEM soil model developed so far is flexible and can be used jointly with deformable tools or tires to study their complex interaction.