Department of Materials Simulation (WW8)

Multi-scale Simulations II

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1 Viscoelastic contact model

For two interacting disk-shaped particles, write a function that takes the radii of the spheres, their positions and velocities and calculates the normal force between them, using the viscoelastic model based on the following materials parameters:
$Y = 0.1MPa$, $\nu = 0.5$ and $A = 0.01$

$$F_{viscoel} = \rho\xi^{3/2} + \frac{3}{2}\xi A\dot{\xi}\sqrt{\xi},$$

$$\rho = \frac{2Y\sqrt{R_{eff}}}{3(1-\nu^2)}. \tag{1.1}$$

2 Contact Search

Conducting "contact search" is an essential step in any DEM simulations. The contact force calculations would be accurate, only if the contact search algorithm covers all the interactions between the particles. In the datafile "position.dat" you will find the positions of 1000 spherical particles at a certain time. Let's assume that the spheres are all from the same size and have the radius of 1. Now set up a function that reads in the spheres' x,y and z coordinates and calculates the number of the existing contacts between them.

3 DEM GUI

In the zip file "demgui.zip" you will find a function for simulation of granular materials. To make a setup containing a pack of particles falling into a funnel, run the program "demgui.m" and set the following materials parameters:

- Material: Rubber
- Friction Coefficient: 0.0
- Gravity: 9.81
- Time Step: 4.1e-5
- File: funnel.dem

How long does it take for the last particle to cross the funnel exit? How is the friction coefficient related to this time? What can you notice in the particles pileup when having different friction coefficients?