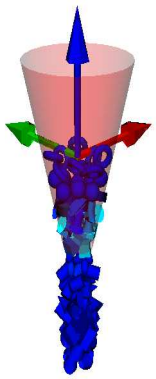
Diffpack® DPM Plug-In



Granular Matter of Different Shapes in a Hopper

DPM (Discrete Particle Method) – developed to describe processes of particles and to adapt to your requirements

DPM derived from the Discrete Element Method is an advanced numerical simulation tool for particulate applications including motion as a granular material and chemical conversion such as pyrolysis, gasification or combustion in the near future.

Modelling Capabilities

For these purposes DPM provides you with an interface that gives you the freedom to define

- Material properties
- Characterization of particle-particle interaction varying between simple impact forces and most complex interaction forces

DPM provides but not limited currently the following particle shapes

- Barrel
- Block
- Cone
- Cylinder
- Double-Cone
- Ellipsoid
- Hexahedra
- Hyperboloid
- Parallelepiped
- Sphere
- Torus

Which are accompanied by moving boundary shapes for which translational and angular velocities may be prescribed versus time

- Bend
- Conical pipe
- Wall

Further shapes are provided upon request.

Solution

DPM employs a fast algorithm to detect contact between particles and runs in both a Linux and XP environment. Algorithms to integrate the dynamics of particle motion are

- Explicit Euler Scheme
- Explicit Taylor Scheme
- Verlet Position Scheme
- Verlet Velocity Scheme
- Gear Scheme of 4^{th} order

An external interface gives the user access to define laws of impact and the resulting forces via a C++ class hierarchy. Similarly, customer needs concerning material properties are taken into account.

The following contact models are provided

- Simple collision
- Hooke
- Hertz

which may be easily extended by user defined models tailored to particular requirements.

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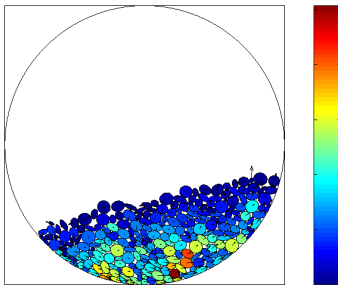

Granular Matter in a Rotary Kiln

Analysis

DPM relies on the powerful VTK tool (www.vtk.org) that allows generation of images and animation even during runtime. In order to provide the highest degree of flexibility, ASCI output of DPM is easily used for post-processing with additional tools such as simple xy-plotting routines or Matlab. Analysis includes the following time-resolved properties:

- Position and velocity of particles
- Forces acting on particles
- Orientation of particles
- Angular velocity

Applications

- Motion on a forward and backward acting grate
- Rotary kilns
- Transport in pipes and hoppers
- Impact on structures
- Probability and classification of particle related properties such as position or residence time

DPM as a whole product is embedded into the software concept of Diffpack and thus, offers unrivaled flexibility and handling combined with an excellent service and support. Additionally, this concept allows for a coupling between CFD and granular material in particular inter-action forces such as aerodynamic and fluid forces.

References

Peters; Thermal Conversion of Solid Fuels, WIT Press, 2003

Langtangen; Computational Partial Differential Equations: Numerical Methods and Diffpack Programming, Springer Berlin, 2002

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