Technalysis ®

Coupling of PASSAGE®: DEM and FLOW Software

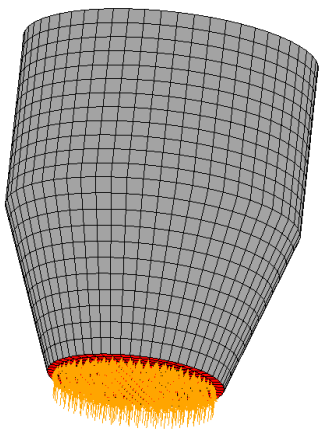
By coupling **PASSAGE®: DEM** and **FLOW** software a variety of problems can be solved which can not be treated by using either one model individually. This capability allows modeling of liquids, gases, solid particles and their mixtures for many industrial problems in both micro and macro scales. It can be applied to process modeling of mixing, wetting, coating, filtration, fermentation and filling operations for applications in food, pharmaceutical, chemical, metals, plastics, glass, ceramics, powders processing and emission control.

- **DEM** and **FLOW** modules can be coupled in a variety of ways depending on the application:
  - Many mixtures or two-phase flows require modeling of microscopic behavior of the material (e.g. air flow around solid particles. In this case **DEM** and **FLOW** modules are executed in parallel.
  - Industrial applications of particle flows usually involve billions of particles which cannot be efficiently modeled by **DEM** models. On the other hand, flow codes can not predict the material properties of mixtures or particle flows in sufficient detail due to the lack of accurate material models. In this case, **DEM** model is used to determine material properties for the **FLOW** model.

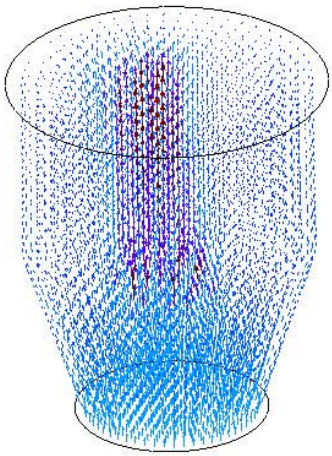
Example: Fluidized Bed Granulation of Tablets

This case involves calculation of the motion of particles coupled with the surrounding airflow. **DEM** model is used to model the motion of the particles and **FLOW** model for air flow.

Flow Model- Air

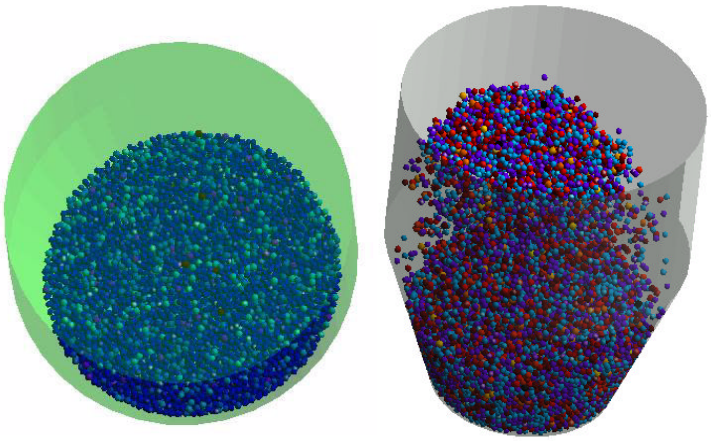


FEM Mesh



Air Velocity

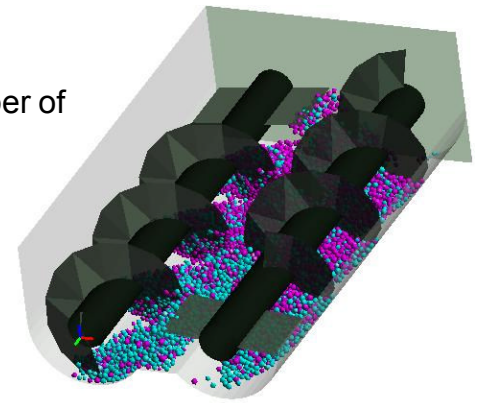
DEM Model- Particles



Example: Mixing of Powders

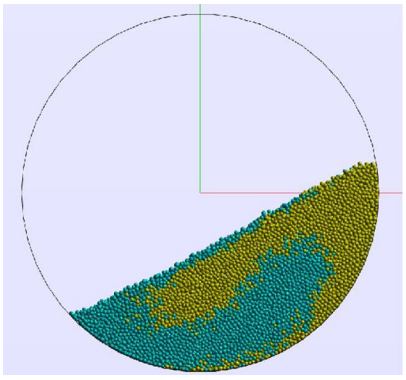
A. Mixing of powders for industrial applications, again involves calculation of the motion of large number of particles. **DEM** models can be used to simulate applications with smaller number of particles in the laboratory.
B. Simple experiments can be designed which are modeled by both **DEM** and **FLOW**. Microscopic material properties are used for the DEM model. Macroscopic material properties are then determined by comparing the DEM and **FLOW** solutions for simple cases.
C. After determining the material properties for particle flow, **FLOW** model is used for solving industrial problems.

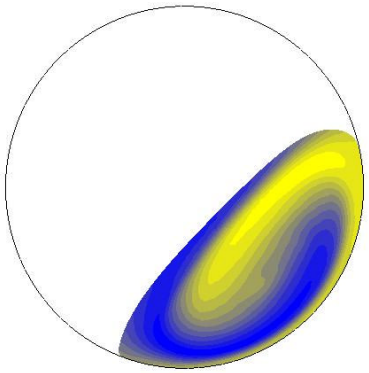
Limited number of particles



A. DEM Model

Input: Microscopic properties of material
Output: Motion of each particle



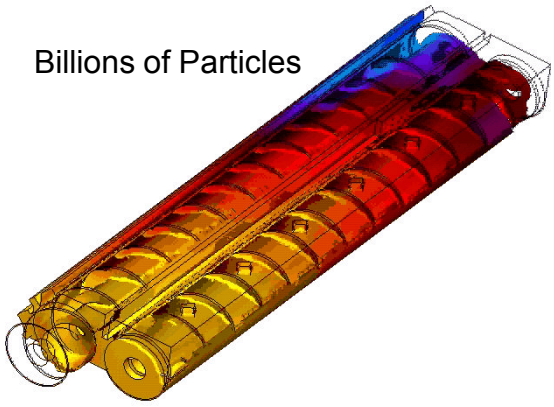


DEM Model Flow Model

B. Simple Models

Input: Microscopic material properties for DEM model
Output: Macroscopic material properties for FLOW model

Billions of Particles



C. FLOW Model

•Input: Material Properties for FLOW model
•Output: Material Flow: for the application with large number of particles

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