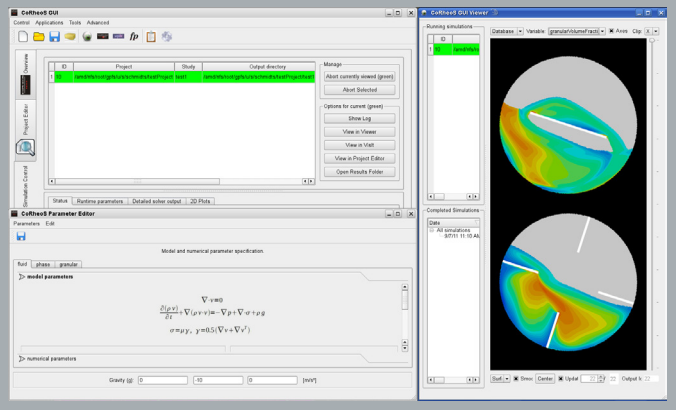

SERVICES AND CONTACT

Fraunhofer ITWM

FRAUNHOFER INSTITUTE FOR INDUSTRIAL MATHEMATICS ITWM

GRAIN – software infrastructure for granular and bulk flow simulation

GRAIN – simulation infrastructure

The simulation of granular flow is a highly involved complex CFD process which, contrary to pure CFD, needs to take into account both the material and process conditions. For this challenging task, Fraunhofer ITWM provides a simulation infrastructure GRAIN, based on the software platform CoRheoS – Complex Rheology Solvers. Physically consistent and simulation-adapted characterization of the granular material and the process to be simulated is part of this simulation infrastructure.

Macroscopic properties of granular material, measured through standard lab experiments, are used to adapt the physical model to a specific material and process.

Software platform CoRheoS

- Validated, documented, graphical software
- Preprocessing from CAD data, 3D postprocessing
- Makes use of multicore computing
- Runs on Windows and Linux

CoRheoS

General services

- Simulation of granular bulk flow processes
- Simulation of two and three-phase fluid-driven granular flow processes including separation and segregation
- Simulation of mechanically driven mixing and milling processes
- Project-based collaborations and scientific consulting for
  - Material characterization targeted towards simulation in collaboration with Fraunhofer ITKS
  - Modeling extensions to customer-specific process conditions
  - On-site licensing, installation and running of the software

Contact

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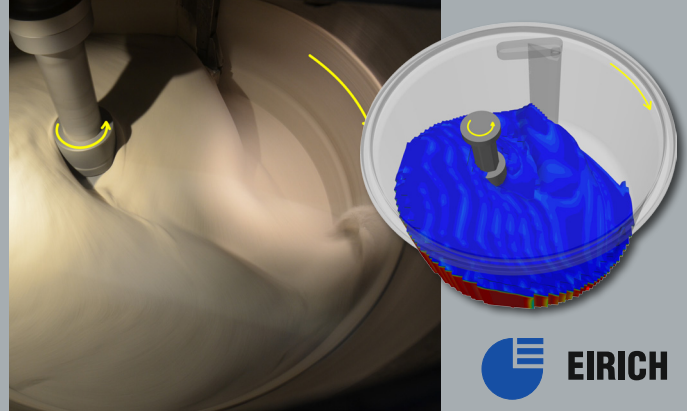
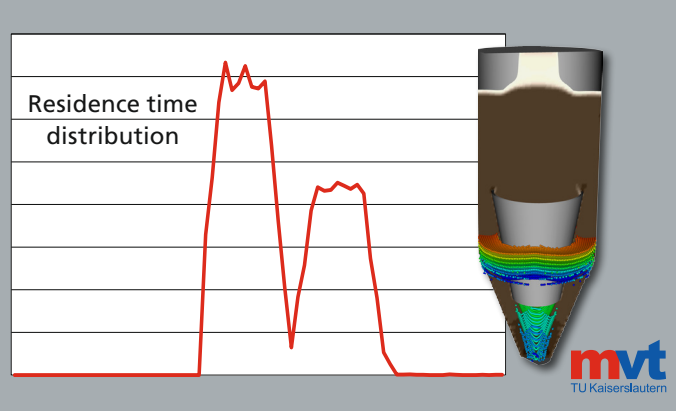
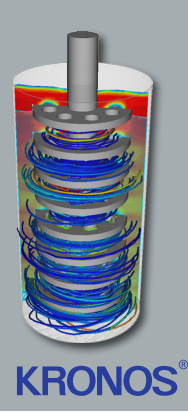
GRAIN – GRANULAR AND BULK FLOW SIMULATION







Simulation of mixing processes and devices

The simulation of mixers poses the unique challenge of combining the granular flow model with rapidly moving mixing devices which induce enormous shear forces into the bulk material.

We are able to successfully simulate such processes using realistic rotation speeds and material properties.

Project example with EIRICH

Full 3D flow simulation of EIRICH Mixer

Services

- Spatially resolved information on local
  - Densities
  - Velocities
  - Shear rates
  - Pressure
  - Stresses
- Virtual testing of
  - Mixing device design
  - Mixer upscaling
  - Process conditions

GRAIN

Simulation of silo processes and devices

Built on top of our unique single-phase continuum model for the flow of granular and bulk material and within our software GRAIN we offer the simulation of the influence of materials, installations, inserts and the silo design itself on the flow pattern in silos.

In contrast to DEM simulations, we are able to consider industry-size silos with realistic particle sizes in computation times comparable to complex CFD simulations.

Project example with University of Kaiserslautern

Residence time simulation of a cycling process in a silo with a bin insert

Services

- Spatially resolved dynamic 3D simulation of flow in silos and silomixers with local information on
  - Densities
  - Velocities
  - Pressure
  - Stresses
- Virtual testing and evaluation of
  - Residence time distributions
  - Flow patterns
  - Flow paths for arbitrarily placeable tracers and markers

GRAIN

Multiphase granular flow simulation of bead mills

The simulation of flow in bead mills inherits the challenge of a spatially resolved dynamic three-phase coupling between the bulk material suspension (two phases) and the beads in a highly dynamic setting of moving geometries.

GRAIN, coupled to the FLUID module of CoRheoS handles this challenge within our simulation infrastructure.

Project example with KRONOS

Simulation of TiO_2-suspension flow through granular beads in vertical rotating disk mill

Services

- Dynamic calculation of local quantities
  - Density distribution of suspension and beads
  - Velocity fields
  - Pressure distribution
  - Shear forces and energy dissipation for all phases
- Virtual testing of mill performance regarding
  - Local stresses and local energy dissipation to characterize grinding efficiency
  - Local shear forces at discs and cylinder walls to indicate abrasive wear

FLUID GRAIN