Validation of contact models for DEM (I)

Process Engineering

BASF The Chemical Company

Validation of contact models for dynamic behavior of bulk solids

Parameters:

- **Bulk density**
- **Wall friction**
- **Particle friction**
- **Rotational friction**
- **Stiffness / damping parameters of spring-damper system**

Pictures from:
S. Kriebitzsch, Diplomarbeit, Universität Dortmund

Validation of contact models for DEM (II)

Process Engineering

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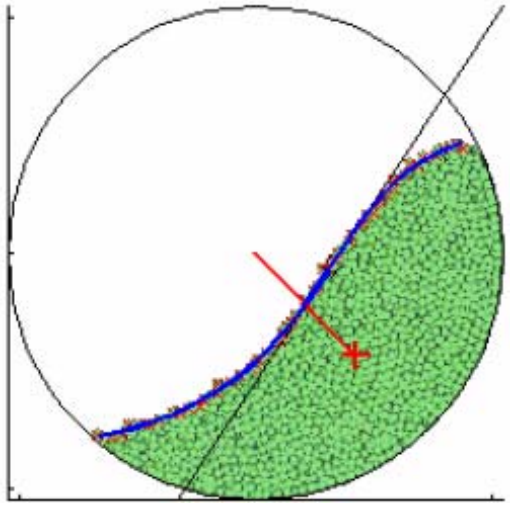
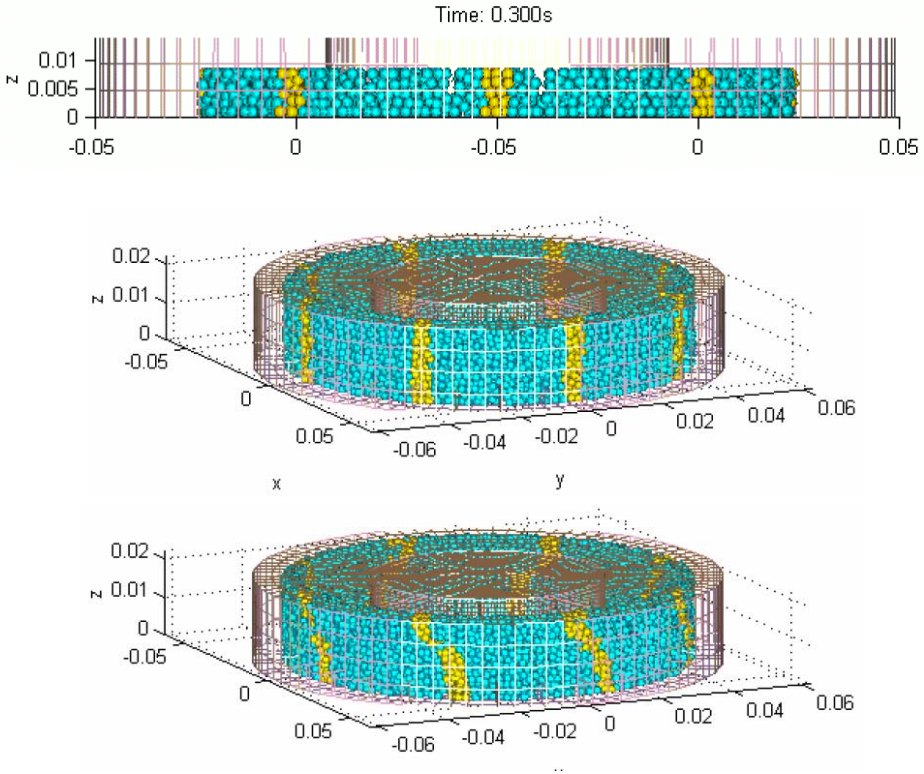
Assumption: Reasonable validation has to consider bulk effects

Set of experiments needed to independently determine different model parameters



Rotating drum



Ring shear tester

Pictures from:
S. Kriebitzsch, Diplomarbeit, Universität Dortmund

CFD/DEM for multiphase flows (I)

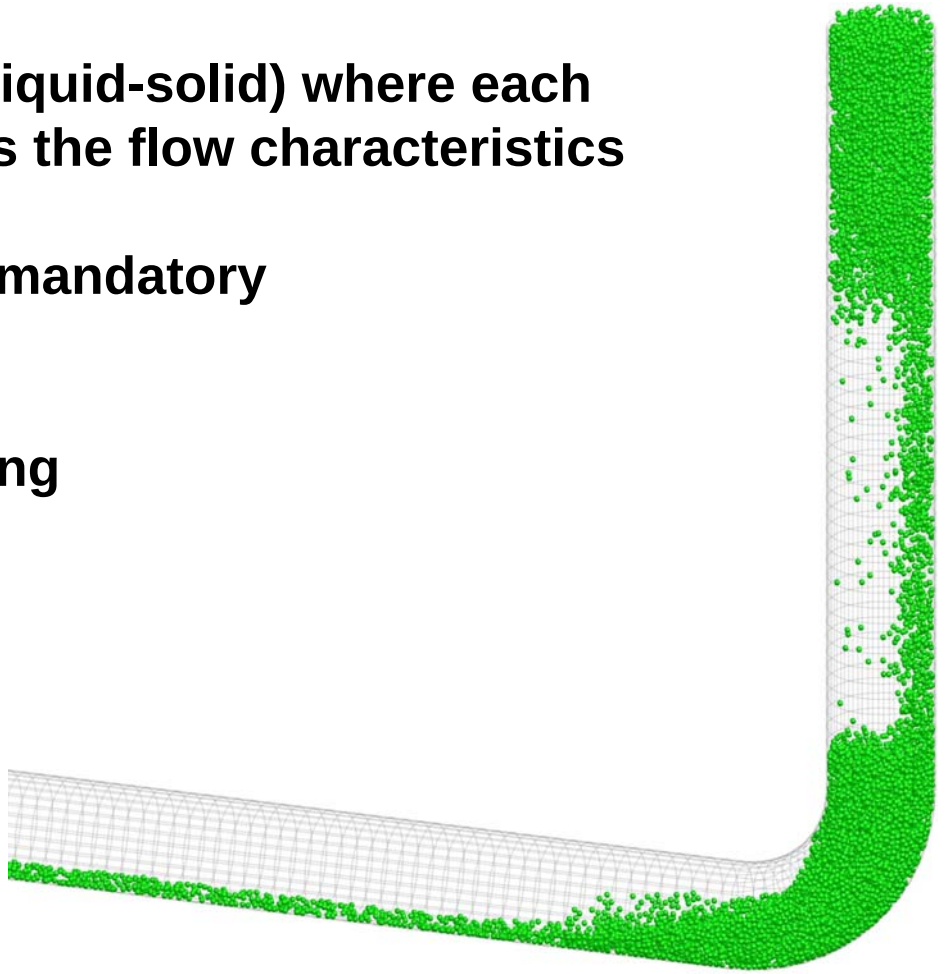
Process Engineering

BASF
The Chemical Company

Scope:
Multiphase flows (gas-solid, liquid-solid) where each phase significantly influences the flow characteristics of all other phases
Two-way (4-way) coupling is mandatory

Example: Pneumatic conveying
Subjects of interest:

- **Product flux**
- **Pressure drop**
- **Prediction of flowability**
- **Prediction of flow regime**



Calculation: S. Götz, Universität Dortmund

CFD/DEM for multiphase flows (II)

Process Engineering

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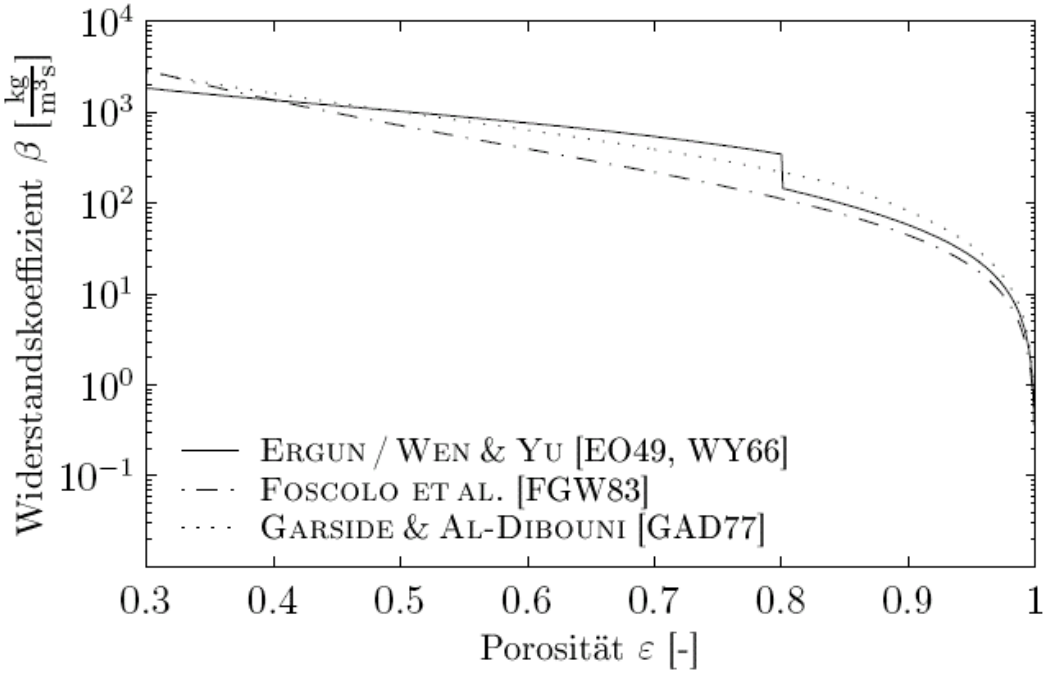
Validation procedure for drag models needed

Critical aspects:

- **Nonspherical particles**
- **Size distribution**
- **Swarm effects**
- **Cohesion**



Diss: S. Götz, Universität Dortmund

FEM for Bulk Research (I)

Process Engineering

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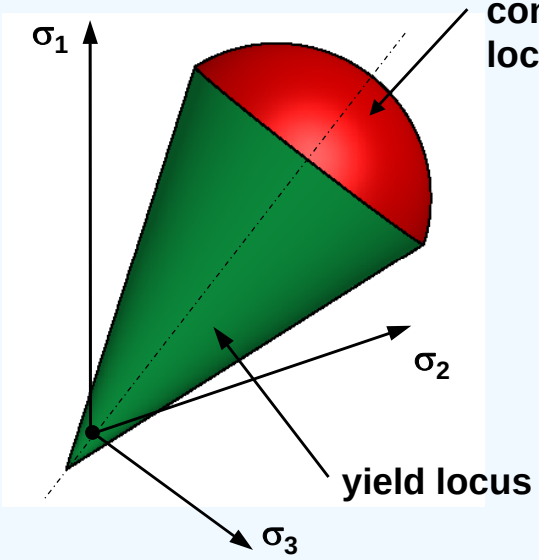
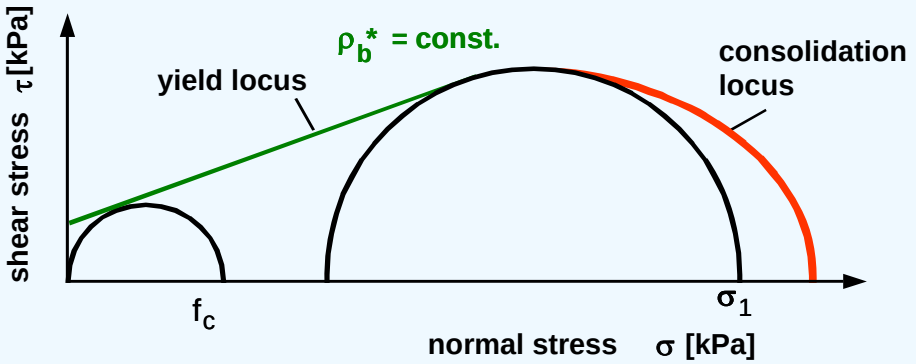
The Drucker - Prager - Model as basis for the FEM-simulation



Drucker - Prager - Model with contractive flow on yield cap

- dilatant flow on yield cone
- contractive flow on yield cap
- tensile strength



FEM for Bulk Storage Research (II)

Process Engineering

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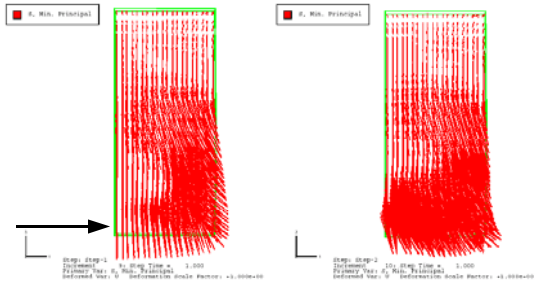
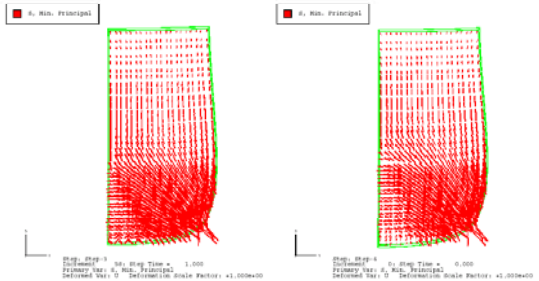
Gravitation

Big Bag outlet



Vertical bearing loosened on the floor

Big bag with realistic stiffness



Discharge of the FIBC

- Lab tests with Fine Dolomite
- First simulations
- Lab tests with additional cohesive products
- Verification in large scale tests
- Constitutive models suitable for bulk solids, preferably in a multi-phase setup
- Models using parameters that can be measured at reasonable expenditure of time and money