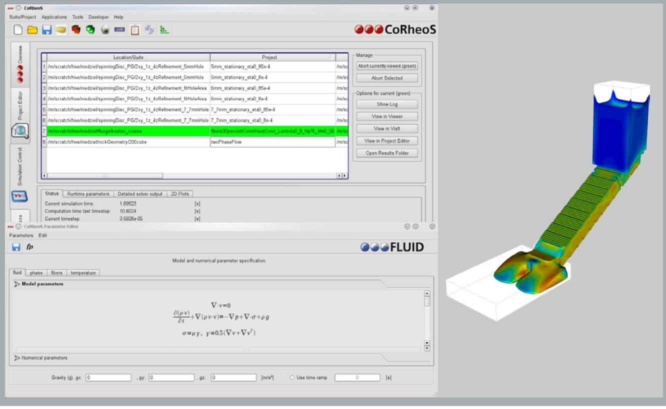

SERVICES AND CONTACT

Fraunhofer
ITWM

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FLUID – software infrastructure for complex non-Newtonian fluid flow simulations

FLUID – simulation infrastructure

Many innovative products are based on materials which show a complex rheological behavior during production. Well known examples for such materials are polymer based liquids, particle and fiber suspensions, foams, concrete and many more. For being able to offer simulation solutions for such a diverse range of materials used in industrial applications Fraunhofer ITWM provides a simulation infrastructure FLUID, based on the software platform CoRheoS – Complex Rheology Solvers. CoRheoS facilitates the fast implementation of new rheological models and their robust and efficient solution for actual industrial application problems.

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

- Numerical simulation of complex rheological flows and multiphase flows
- Injection molding and extrusion of fiber reinforced materials
- Powder injection molding with the particle migration
- Flow simulation of concrete
- Simulation of expanding polyurethane foams
- Coupling with granular flow simulation GRAIN
- Fast implementation of user-defined rheology models
- Simulation-based scientific consulting for industrial flow problems with complex material behavior

Contact

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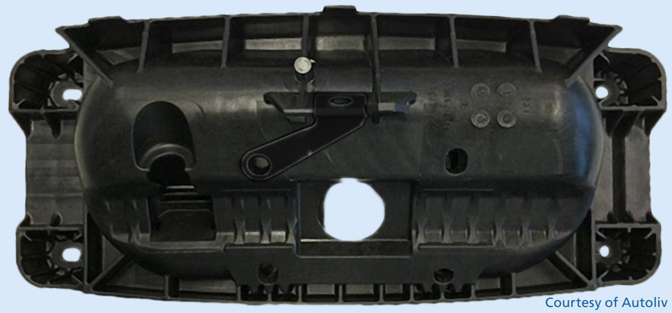
FLUID – COMPLEX RHEOLOGY FLOW SIMULATION



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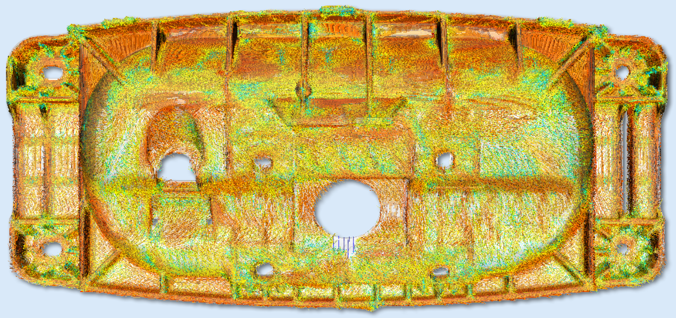
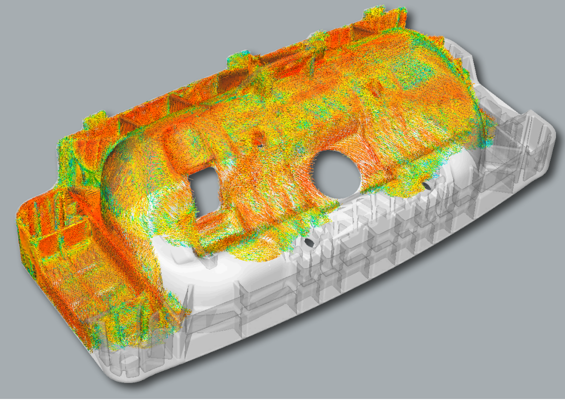
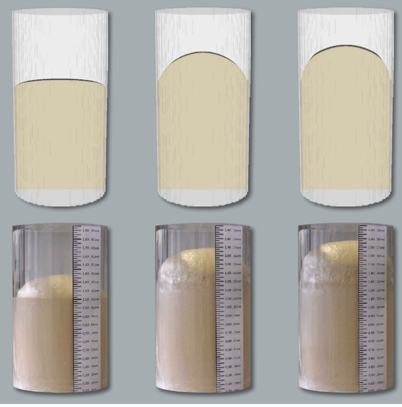
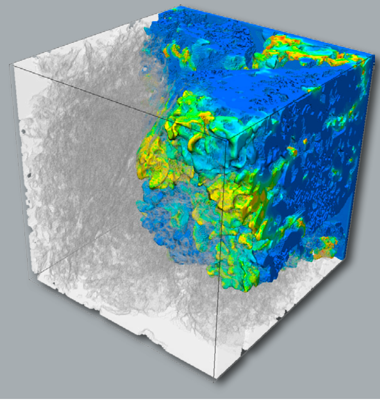


FLUID







Injection molding simulation of fiber reinforced material

Fiber reinforcement of polymeric materials is a very important technique in the production of lightweight materials. The potential of these materials can be explored only if the fiber orientation during the production process can be predicted with high accuracy. Within the software FLUID a sophisticated physics based modeling approach is implemented, which accounts not only for the influence of the flow on the fiber concentration and orientation but also for the effect of the fiber concentration and orientation on the rheological behavior of the suspension.

Simulation example

Injection molding simulation of airbag housing

Services

- Spatially resolved information on local
  - Pressure
  - Velocities
  - Fiber orientation
  - Fiber concentration
  - Front flow propagation
  - Fluid temperature

Simulation of self-expanding polyurethane foams

Polyurethane (PU) foams have certain physical attributes which makes them quite attractive for various industrial and consumer applications. For instance, PU foam exhibits good thermal resistance property, high energy absorption capacity and thermosetting nature, thereby making them very useful in shock application, acoustics and thermal insulations; with extensive application in automotive, aircraft, refrigerators, building and packaging industries. FLUID is able to successfully simulate expansion of PU foams in arbitrary geometries.

Simulation example

Expansion process of polyurethane foam

Services

- Spatially resolved information on local
  - Pressure
  - Velocity
  - Temperature
  - Polymerization
  - Gas volume fraction
  - Foam front propagation

Simulation of multi-phase non-Newtonian fluids

FLUID allows simulations of non-Newtonian fluids i. e. in micro scale geometries that are complex three-dimensional geometric structures of porous materials, e. g.. The structures that we simulate can be used from computed tomography scans directly, or generated with the software GeoDict®. Such simulations can help to understand and establish relations between fluid velocity, pressure and permeability of the medium. The effective permeability law can be used in macro-scale simulations, where porous structure is only a part of full geometry configuration.

Simulation example

Non-Newtonian fluid infiltration process in a micro scale resolved rock

Services

- Spatially resolved information on micro scale
  - Pressure
  - Velocity
  - Temperature
  - Fluid front propagation
- Information for macro scale simulations
  - Effective permeability tensor