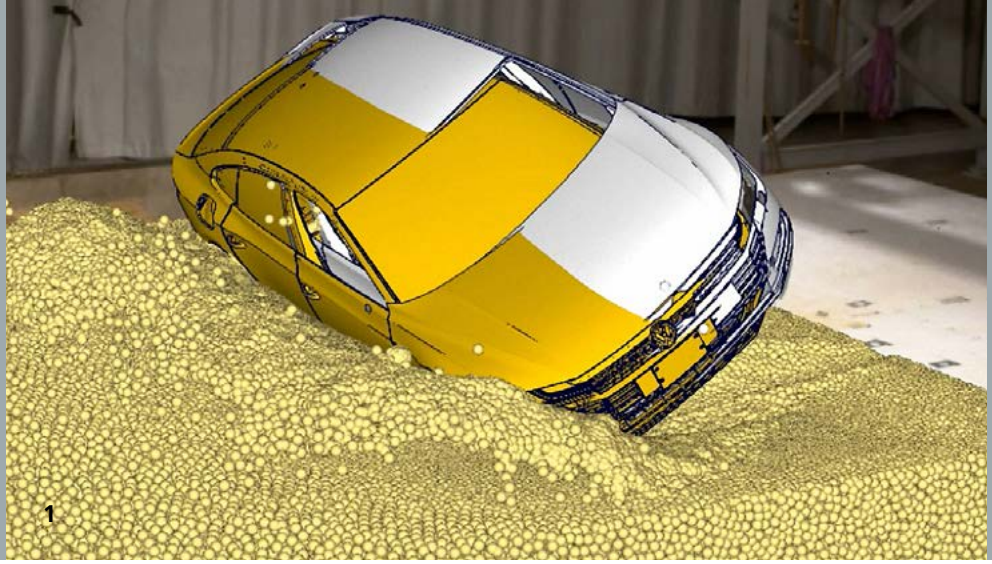

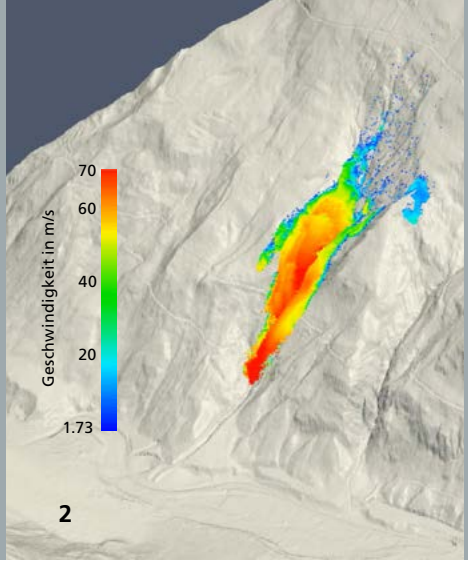


# MODELING NON-NEWTONIAN FLUIDS WITH MESHFREE

**In cooperation with Fraunhofer SCAI since 2018, we supply a software product for the mesh-free simulation of physical processes. The innovative software combines the expertise of both institutes in the area of meshfree scientific computing and satisfies a wide range of applications.**

1 *Lateral rollover of a vehicle in sand: comparison of experiment and simulation*

2 *Simulation of the Wolfsgruben avalanche (March 13. 1988), geo data: with kind support of BFW Austria.*

**Our development of the Finite-Point-Method**

Meshfree simulation expands the horizon of computational models, in particular, in the context of industrial applications. The Finite-Point-Method (FPM) was originally developed at ITWM and has been in use since the year 2000 in many projects with European partners. The method was first developed and used to model airbag deployment. Later, FPM evolved into an implicit, meshfree flow tool.

The absence of calculation grids saves preparation time for the simulations. How do you model the flow of rain water, the passage of water, the filling or sloshing from a passing auto? How do you emplace floating pontoon bridges? How do you optimize Pelton turbines in hydropower plants? The applications are plentiful and FPM has a clear advantage over mesh-based methods in the area of free surface flows and fluid structure interaction (FSI). This implies the need to solve large linear equation systems. Combining FPM with the algebraic multi-grid process (SAMG, Fraunhofer SCAI) enables efficient solving of linear systems. The resulting software is called MESHFREE.

**Meshfree simulation of granular media**

We are significantly expanding the focus of meshfree simulation. Not only do we rely on completely new applications, for example, for process engineering or processes in the food industry. We are also exploring a much wider range of materials. In addition to traditional computational fluid dynamics (CFD), we also focus on non-Newtonian fluids – for example, foams, batters, or polymer melts. MESHFREE is also used to model the dynamics of granular media like sand, gravel, snow, grain, flour, etc. For example, this is part of a German Research Foundation (DFG) project at University of Innsbruck (Working Group for Geotechnical and Tunnel Engineering). In addition to the simple Drucker-Prager material model, we anchor hypoplastic and barodesy descriptions (complex, non-linear, constitutive frameworks to express very exact surface behavior) in MESHFREE. Together with automobile manufacturer VW we rely on VPS (Virtual Performance Solution), a software package from the ESI Group, for example, to simulate an overturning vehicle (rollover processes) on sandy surfaces.

MESHFREE