

PROMETECH.

[Developer, Main Domestic / Global Dealer]

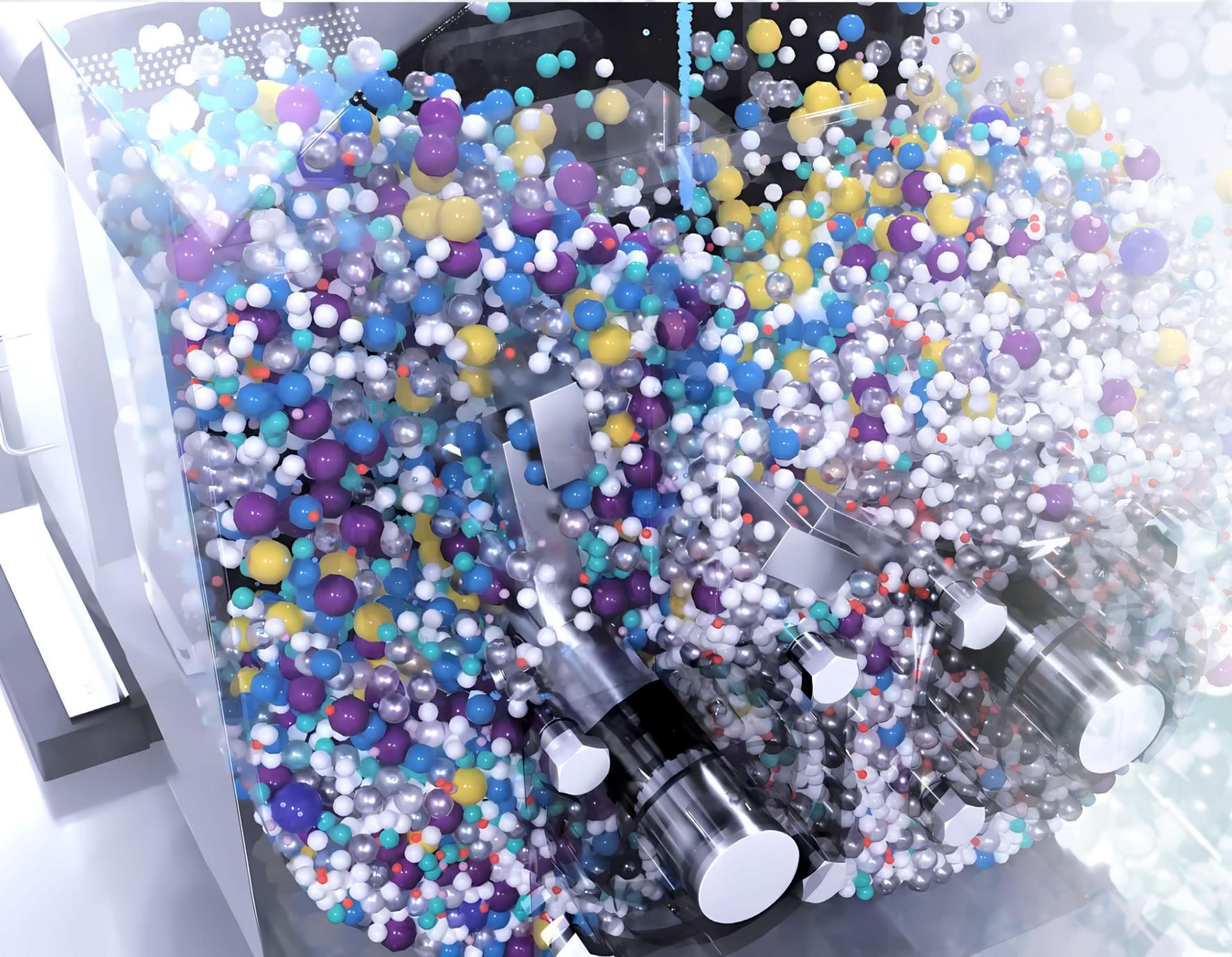
Prometech Software, Inc.



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Computational Reality



High-accurate simulation for various behaviors of granular materials

DEM-based granular solver

Granuleworks, developed by Prometech Software, is simulation software for granular materials based on Discrete Element Method (DEM). It is being introduced in multiple industries, such as food, medicines, chemicals, and electronic materials, contributing to various powder-related processes, including manufacturing, processing, design, improvement, and more.

Computational efficiency brought by SDEM

Granuleworks implements a coarse-grained technology called SDEM (Scalable DEM). That makes it possible to reduce the number of particles and improves calculation speed by replacing the original particles with larger ones.

Expanding application by cooperating with other software

By cooperating with other simulation software, its application would be broader and closer to reality. Moreover, high-speed calculations can be realized in GPU computing environments.

Wide-range solutions applied for various industries

Granuleworks has been adopted in various industries; Electricity, machinery, automotive, materials, chemicals, foods, and lifestyle-related products.

Users / Industries and applications

Social infrastructure and energy



- Filling simulation for battery materials
- Contamination prediction

Construction & Civil Engineering



- Landslides
- Fresh concrete flow
- Filtration system

Materials & Chemicals



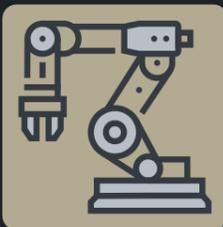
- Mixing
- Compaction
- Heat treatment
- Dust collector

Steel & Metals



- Additive manufacturing
- Segregation prediction
- Powder metallurgy and mold filling
- Shot blast

Electricity



- Dustproof simulation
- Toner development, transcription, cleaning

Foods & Consumer goods



- Conveyor
- Dryer
- Filling process

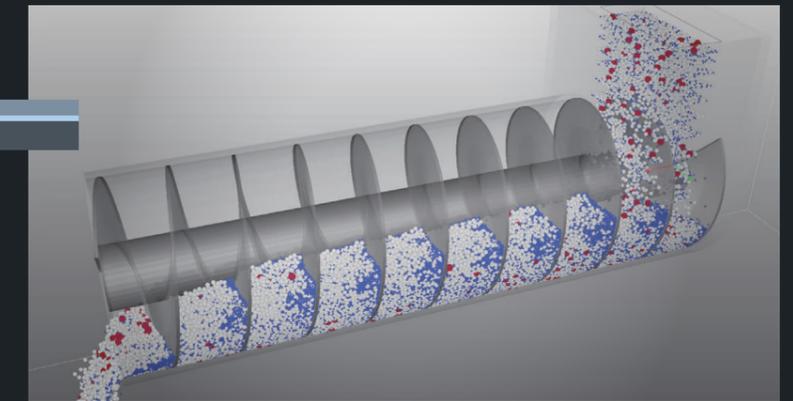
Medical & Pharmaceuticals



- Granulation and compression
- Tablet coating
- Tableting

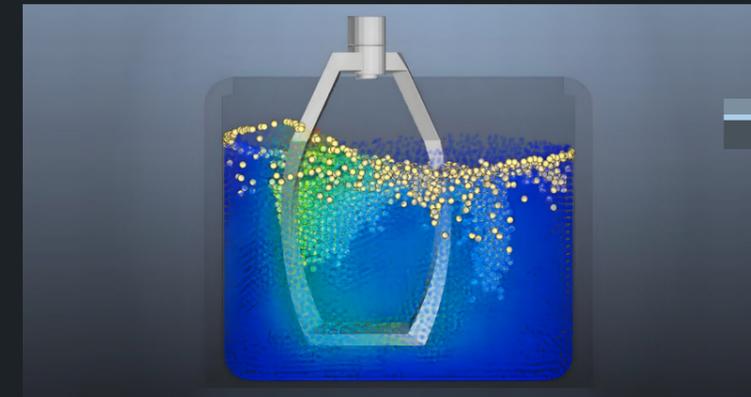
Practical solutions

We develop our software to solve on-site issues by incorporating customers' feedback.



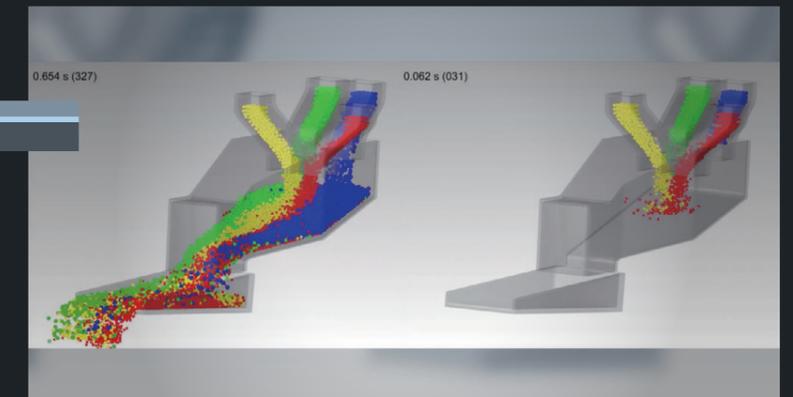
Multiphysics simulation

The cooperation with other software enables a broader range of simulations.



HPC Customization for your demand

We provide the best hardware environment for each customer.



Visualization

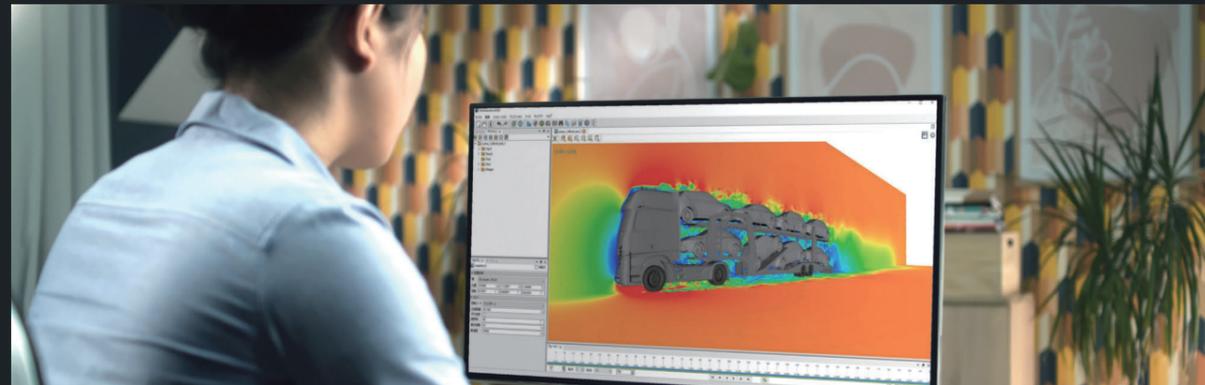
Let us know if you want photoreal images and videos based on CAE results.



Intuitive GUI

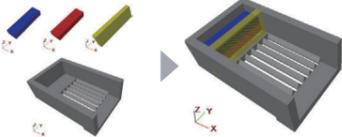
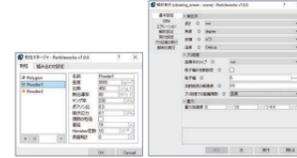
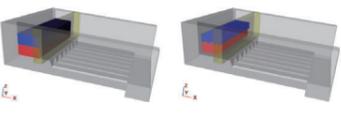
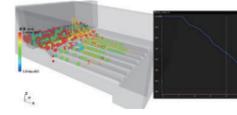
GUI

Equipped with a viewer compatible with Windows and Linux, the GUI allows intuitive operation of pre-processing, calculation, and post-processing. The efficient and simple design and architecture reduce the time spent on initial user training and facilitate complex project management, calculation setup, post-processing, and evaluation of calculation results.



4 Steps to complete the simulation process

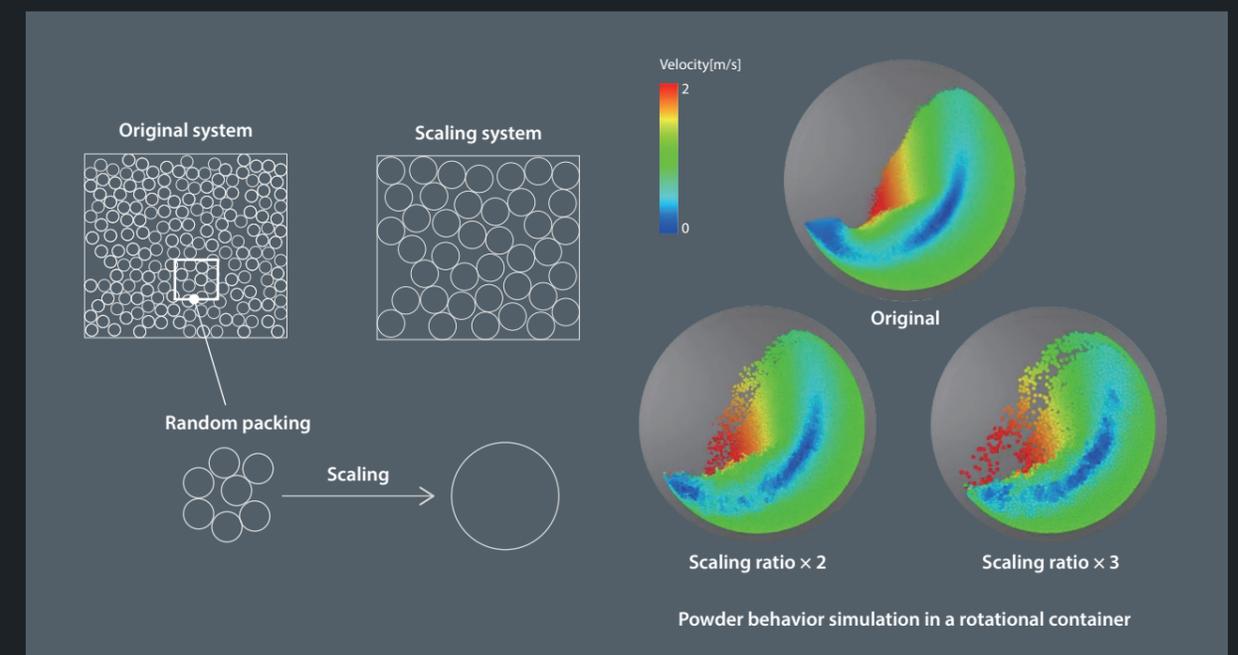
There is no need to make troublesome model modifications. The whole simulation process, from settings to visualization of results, can be done with seamless operation along the wizard. The GUI makes it easy to set up even more complex conditions.

<p>STEP 01 Modeling</p> <p>The modeling phase would be done by simply importing CAD data (STL, OBJ, and Nastran are supported) directly into Granuleworks.</p> 	<p>STEP 02 Setting conditions</p> <p>Set material properties, physics model, and calculation conditions for the imported model.</p> 
<p>STEP 03 Calculation</p> <p>Particles are generated with the initial placement conditions and size you set, and the calculation is ready to run.</p> 	<p>STEP 04 Post-processing</p> <p>Various post-processing can be applied, such as generating animations, coloring physical quantities, displaying streamlines, converting to ASCII, and exporting videos.</p> 

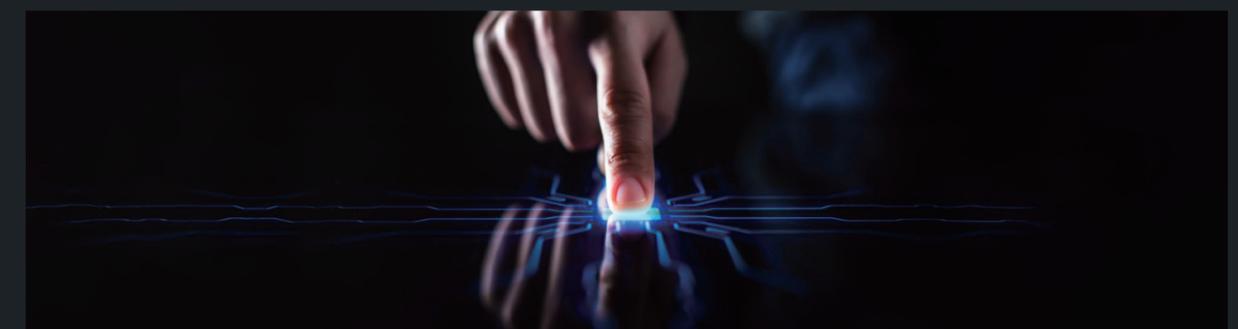
Advanced simulation functions and physical models

SDEM (Scalable DEM)

A technique that reduces the number of particles and improves computational speed by replacing multiple original particles in a granular system with large particles is called coarse-graining technology. SDEM (Scalable DEM), one of the coarse-graining technologies, is implemented in Granuleworks. Since SDEM can account for bulk density for scale particles, setting parameters at one scale will yield similar behavior at other scales. It supports the rotational resistance model, van der Waals force, as well as particle size distribution, making it a powerful tool for DEM simulation of actual machines.



Make granular simulations far more simple & speedy



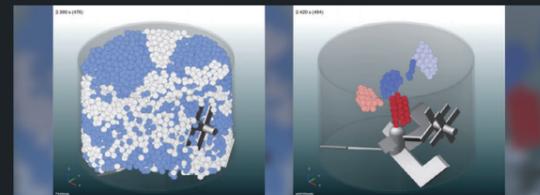
Applicable for various granular behaviors

In addition to robust and stable computations using the high-performance DEM solver as the core, a heat transfer solver is included. Cooperation with Particleworks, a particle-based fluid simulation software, enables multiphysics simulations that more closely approximate real-world phenomena.

GPU computing

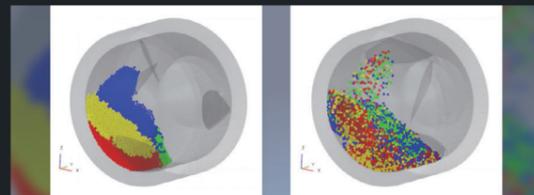
With the GPU option, high-speed simulations can be performed with GPU computing. This significantly reduces computational time compared to CPU computing, making it possible to perform computations as fast as HPC servers on desktop PCs.

Mixing simulation



High-speed mixer

The mixing process for the homogeneous mixing of cohesive fine powders is simulated. The tendency of the aggregates to be unraveled by two blades can be confirmed. The agitator (horizontal blade) promotes convective/diffusive mixing, and the chopper (vertical blade) promotes shear mixing.



Rotary-type mixer

This is a mixing simulation that mixes mildly without applying strong force to powder. The simulation result captures the tendency that the internal flight promotes mixing.



V blender

The behavior of mixing without applying strong force to powder is simulated.



Rotary-type mixer

In this simulation, two types of particles with different particle sizes are mixed. When compared with experiments for validation, the particle behavior and the degree of mixing were confirmed to agree with experimental data with high accuracy.

Filling simulation

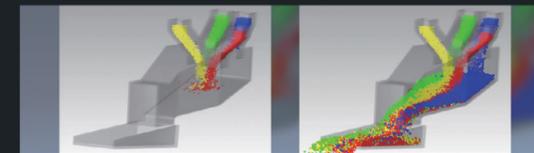
Powder filling simulation into a mold

This is a simulation of a series of processes in which high stress is applied to powder to form it. Segregation, which is believed to affect the quality of the finished product, is observed in the simulation.



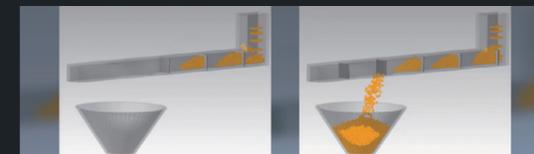
DEM solver for practical use

Conveying simulation



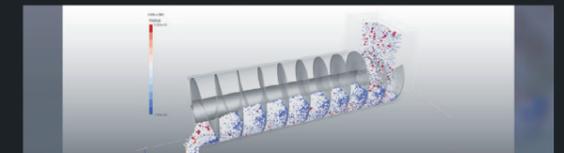
Pipe junction flow

The flow conveying powders in ducts with complex passages is simulated.



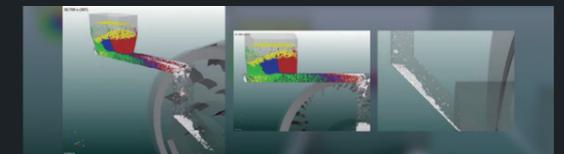
Flight conveyor

A flight-type conveyor, widely used for powder conveying, is simulated to reproduce the continuous transport of powders.



Single-axis screw conveyor

This is a simulation of a single-type screw conveyor widely used for powder conveying.



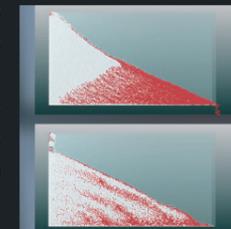
Screw conveyor

This is a simulation of conveying sticky powder created by dewatering the slurry. The simulation shows that although the twin screw cuts out the powder, it will accumulate in the duct below and eventually block the channel.

Segregation phenomenon simulation

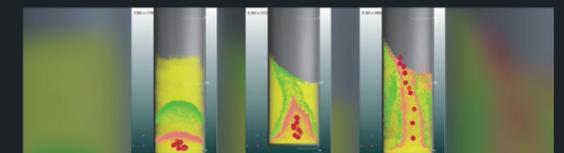
Container design to prevent segregation due to vibration during transportation

The segregation of granules deposited by gravity is simulated. Red particles have a larger particle size than white particles. The image above shows the segregation mode which is generally expected while the image below shows the curious mode under certain conditions.



Granular convection in a vibrating device

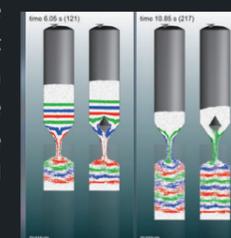
This is a simulation of granular convection known as the "Brazil nut effect," where the large particles move up through the layers.



Storage simulation

Granular flow through a hopper

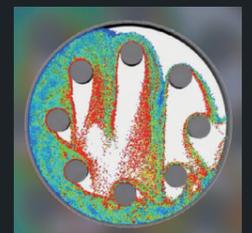
This simulation evaluates the mass flow in the powder hopper. In the beginning, the powder is colored as stripes for visualization. The simulation result shows that the right hopper has a uniform flow due to the rectifying cone inside, while the left hopper has a typical funnel flow.



Heat transfer simulation

Dryer with heating tubes

The heating of the powder is simulated. The temperature rises due to heat transfer of the powder in contact with the heat source (i.e., the heating tubes placed inside the cylindrical container) can be captured.

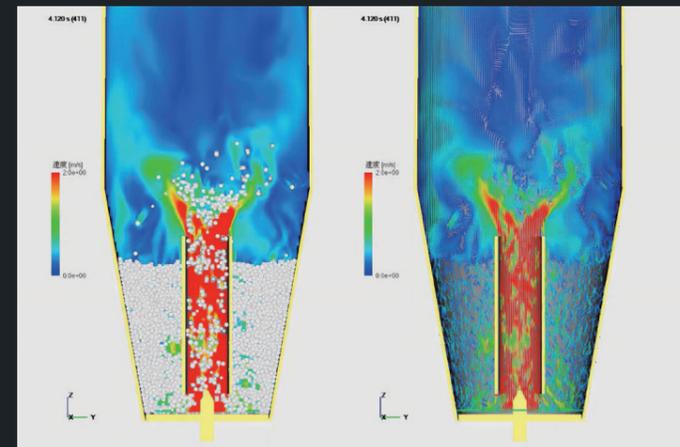
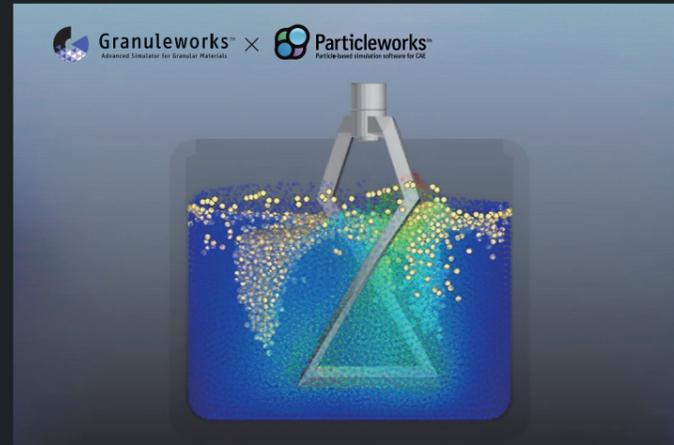


Multiphysics simulation

For a more realistic evaluation of designs, various coupled calculations can be performed with Particleworks, Prometech's CFD solver, and third-party CAE software that handles other calculations such as; structure, impact, mechanism, fluid, and electricity.

Granular - fluid simulation

By coupling the DEM with the particle-based fluid analysis by the MPS method, complicated simulations such as mixing, stirring, and conveying granular materials and fluids can be performed. With the aeration function coupled with Particleworks, you can model air bubbles as DEM particles in oil behavior simulations, mixing tank simulations in chemical processing, etc.

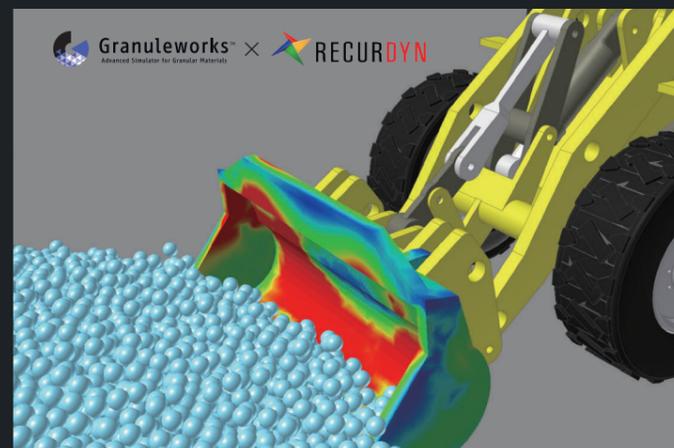


Granular – airflow simulation

DEM - Airflow coupling simulation is possible by coupling with the Finite Volume Method (FVM) solver in Particleworks. Behaviors of airflow - driven granules, observed in conveying process and fluidized bed, can be simulated.

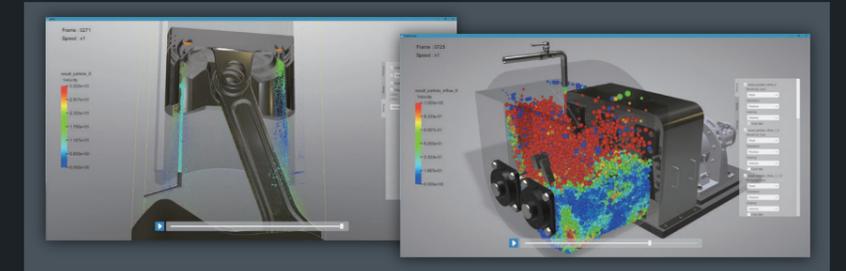
Coupling with other software

Coupled with RecurDyn, FunctionBay's mechanical simulation software, mechanical and deformation behavior caused by powder forces can be simulated. RecurDyn can compute deformations, stresses, and strains of elastic bodies with powder forces calculated by Granuleworks.



SIMUNIMA - The efficient visualization program for CAE results -

SIMUNIMA enables CG software to edit and render CAE results by converting them into a universal CG format. It supports Particleworks/Granuleworks natively, enabling efficient visualization, movie creation, and development of XR content.

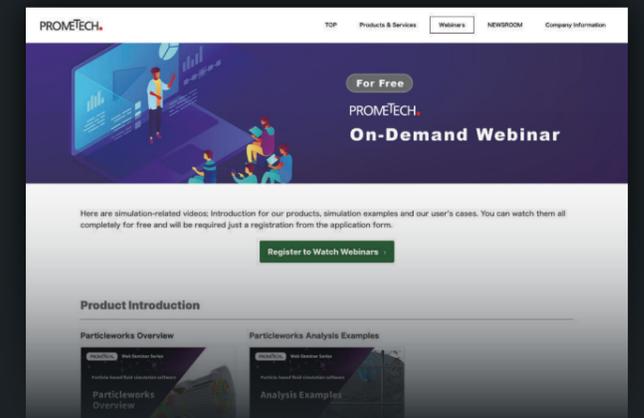


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Prometech on-demand webinar

https://www.prometech.co.jp/web_seminar_outline_en.html



Website

Our website offers a variety of useful content, including not only product introductions, but also a wealth of analysis case study videos and technical columns.

Granuleworks Product Site

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