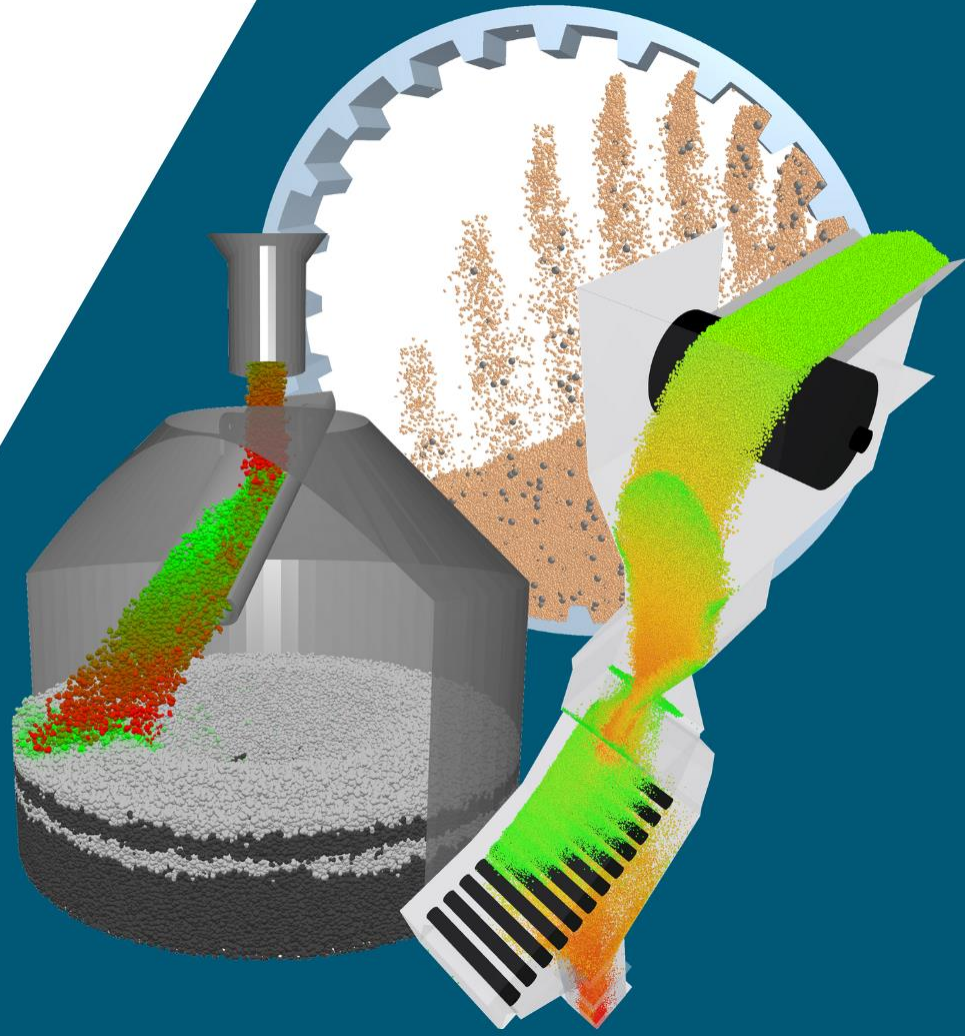


EBOOK

Applications of EDEM for Steelmaking



Challenges of Bulk Material Handling

One of the main challenges faced by the steelmaking industry is to improve energy efficiency while maintaining steel quality.

Bulk materials such as iron ore, coal, pellets and sinter are at the core of the steelmaking process. From transporting raw materials from the mines to the plant by wagons, moving materials on conveyor belts to the blast furnace and the actual charging of the furnace, efficient handling and processing of those materials is critical to achieve efficiency.

Typical challenges linked to bulk materials handling include spillage, blockage and wear as well as material segregation. Understanding the solid burden flow and the formation of the cohesive zone in the blast furnace is also critical to ensure performance and stability.

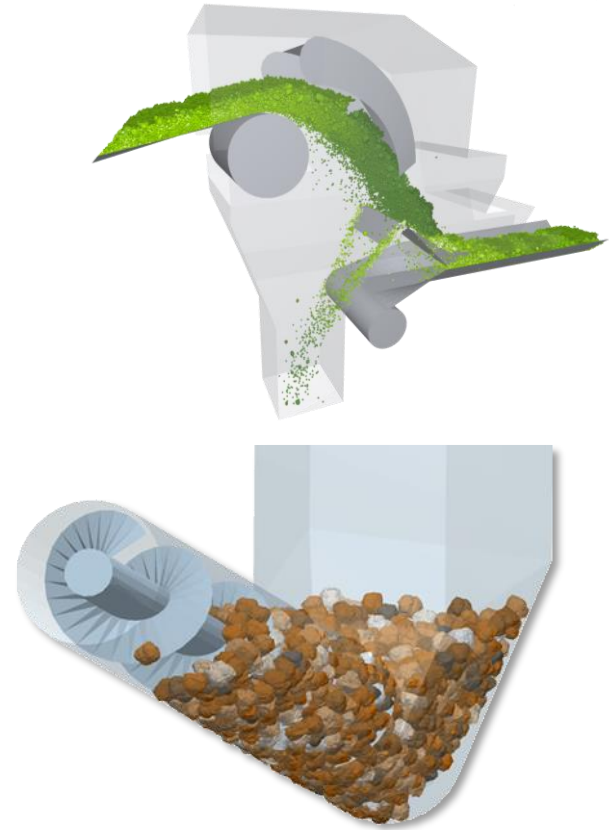


Introducing EDEM simulation technology

Powered by Discrete Element Modeling (DEM) technology, EDEM simulates and analyses the behavior of bulk materials such as coal, coke, iron ore, limestone, sinter as well as a range of other ores and pellets.

By including EDEM as part of their design analysis, engineers can understand the flow of these materials through each segment of their equipment or operation.

EDEM simulation technology can be used to optimize a range of operations and processes as part of the steelmaking process.

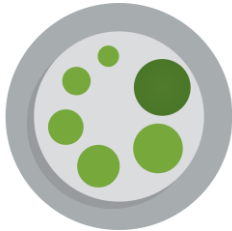


Overview of EDEM components



EDEM CREATOR

Create materials, particles, geometry and physics models



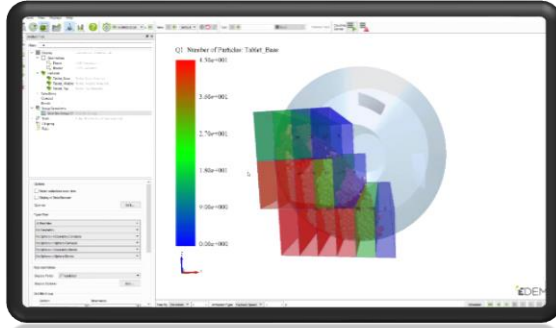
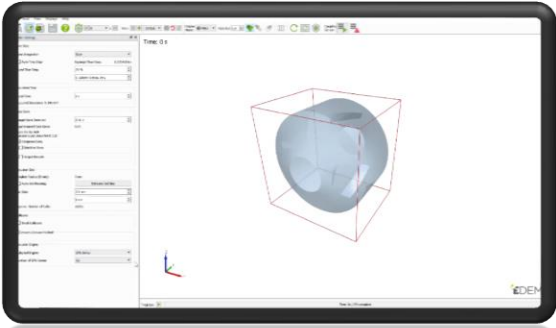
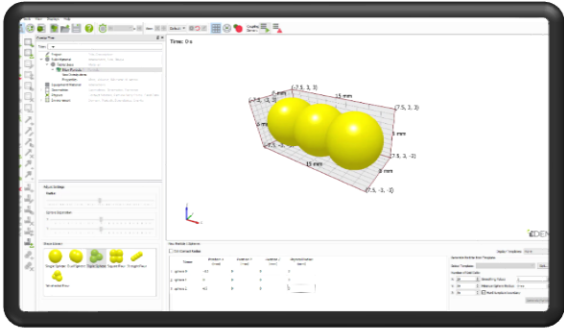
EDEM SIMULATOR

Define run-time and simulation settings and process the simulation on CPU or GPU



EDEM ANALYST

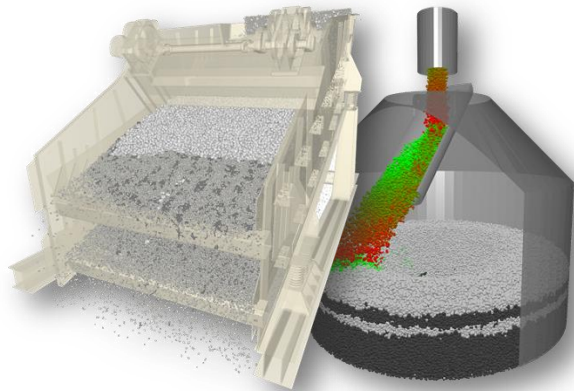
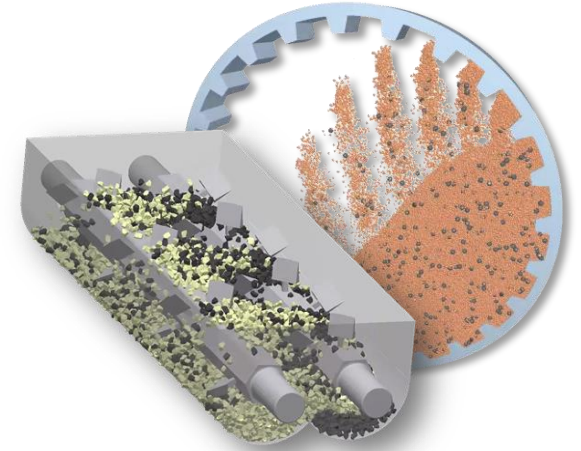
Visualize your results, create videos, graphs and export data



Benefits of EDEM simulation

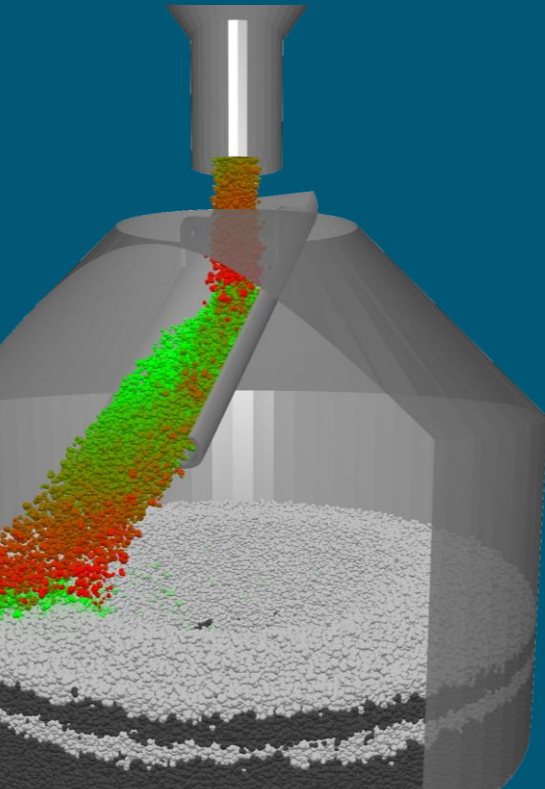
By including EDEM in their design workflow, researchers and engineers are able to:

- **Analyze** material flow and behavior
- **Optimize** existing equipment
- **Optimize** complex blast furnace processes
- **Validate** and check analytical models
- **Reduce** full scale testing costs



Leading steel producing companies use EDEM to improve:

- steel quality
- energy efficiency
- equipment performance
- blast furnace performance



APPLICATION EXAMPLES

Transportation and raw material handling

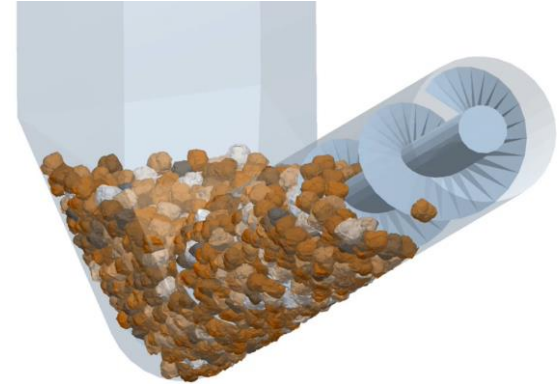
Coal wagon, screw augers, bucket elevators

- **Ensure** efficient loading & unloading
- **Predict** charging & uncharging times
- **Forecast** maintenance
- **Prevent** spillage

Coal wagon



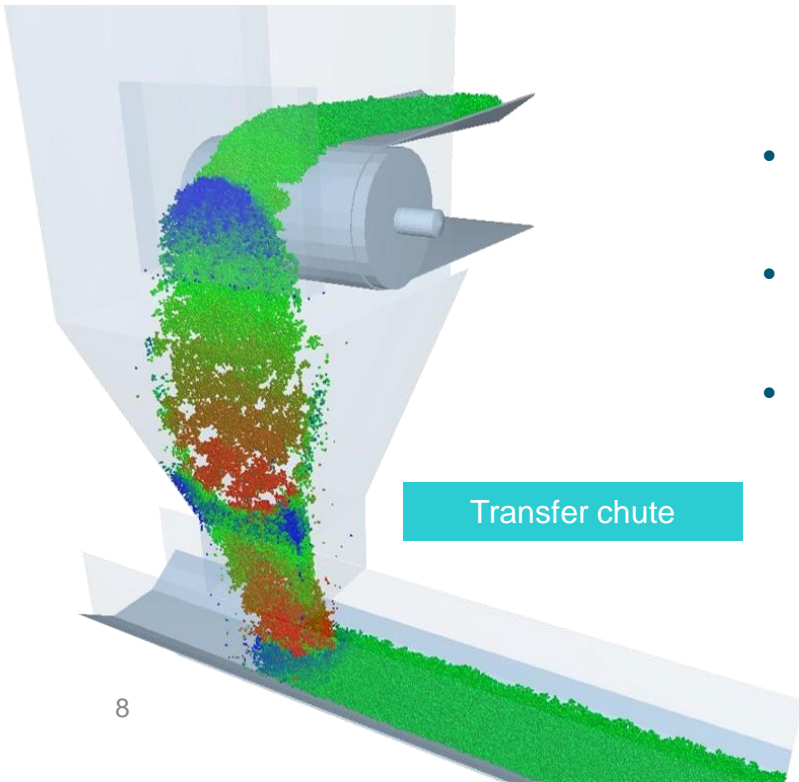
Screw auger



- **Identify** maximum flow rate
- **Measure** segregation
- **Prevent** clogging
- **Identify** areas of wear

Transportation and raw material handling

Transfer chutes and belts

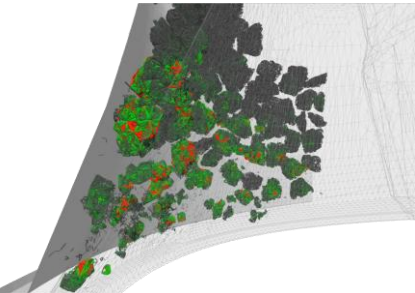


- **Prevent blockage, spillage and wear** of chutes, hoppers and belts when transporting material towards the blast furnace
- **Find ideal setup** to get the best material flow rate, without failure
- **Cope with variation** in the feedstock (sintered iron ore, iron ore pellets, coking coal, additives)
- **Design the retro-fit** of several existing conveyors & transfer chutes to handle new material (iron ore pellets)

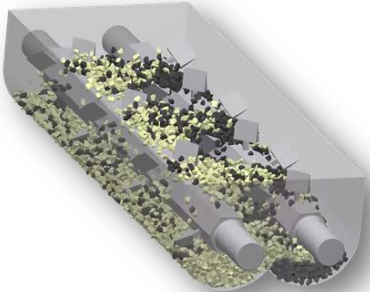
Processes

Breakage, Vibration, Drying, Mixing, Agglomeration

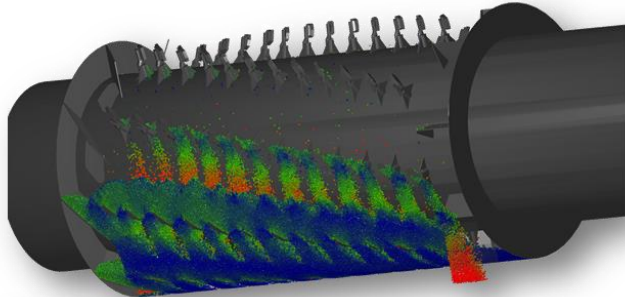
EDEM is used to simulate and understand material flow behavior for a range of operations and machines and can provide key insights into complex processes.



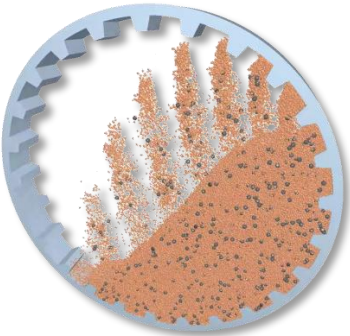
Cone crusher



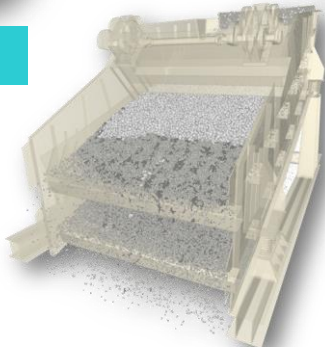
Mixer



Dryer/drum mixer



Ball mill

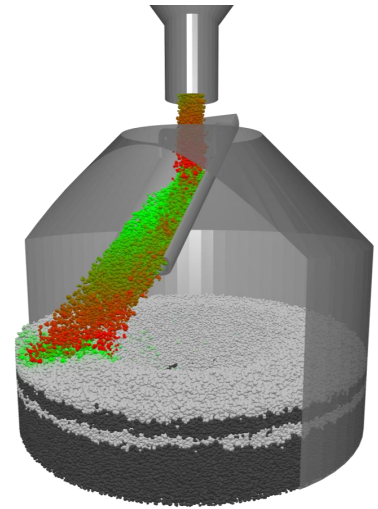


Vibrating screen

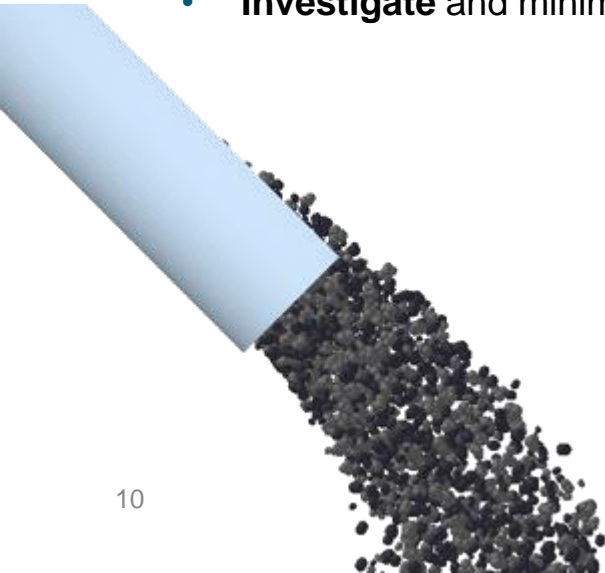
Blast Furnace

Blast furnace loading

- **Virtually** examine the operation of charging devices
- **Optimize** materials distribution and dispersal
- **Develop** virtual models of burden layering
- **Predict** areas of excessive equipment wear
- **Investigate** and minimize segregation in the loading process



Blast furnace loading



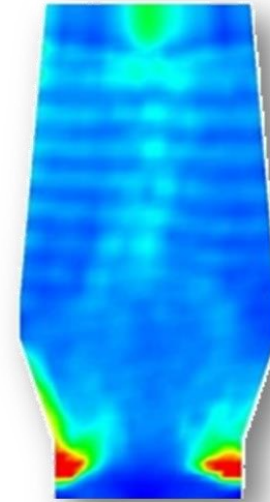
- **Visualize** burden flow
- **Identify** material segregation and causes
- **Improve** sieving process to eliminate small particles
- **Analyze** the influence of factors like burden apex position and hopper slope

Blast Furnace

Blast furnace cohesive zone

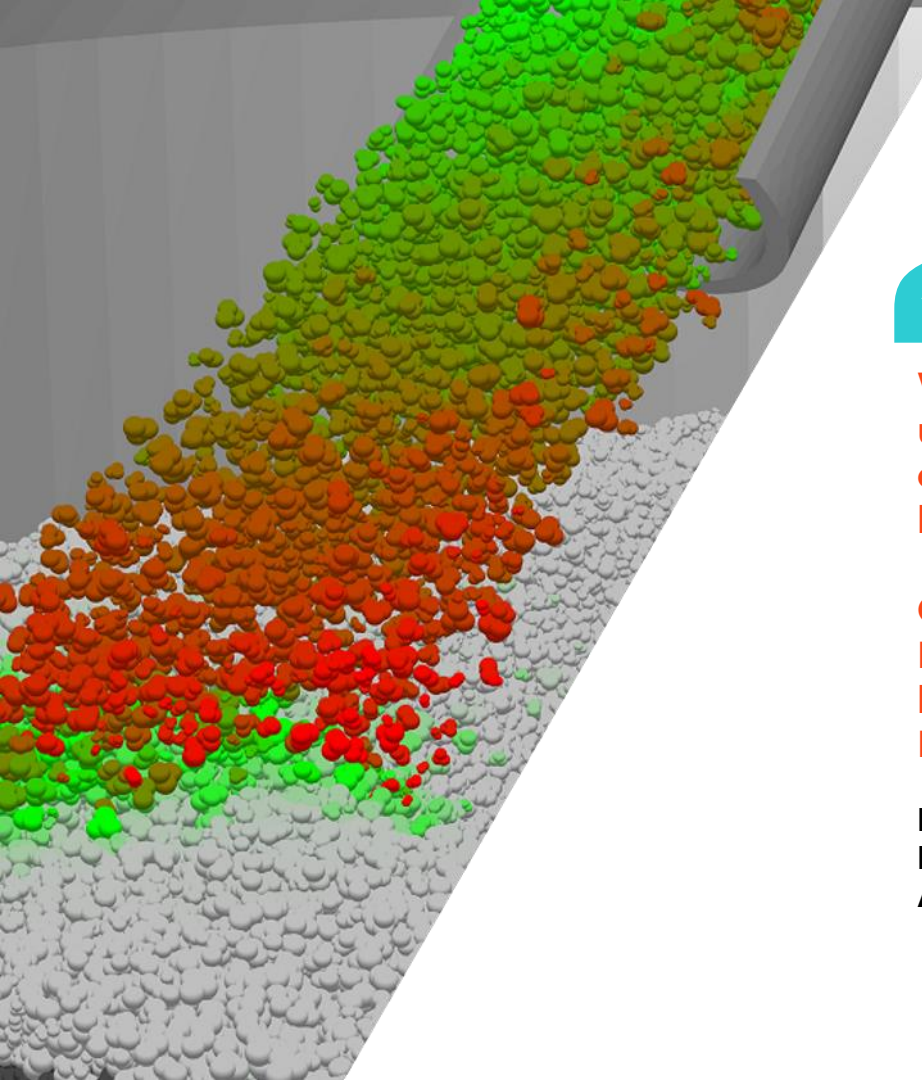
Using EDEM coupled with Computational Fluid Dynamics (CFD) allows to simulate solid-gas flows and to develop complex and realistic models of the cohesive zone and processes such as iron smelting.

- **Predict** the cohesive zone properties
- **Model** realistic solid burden flow
- **Determine** the formation of the cohesive zone, its shape, location, structure and permeability
- **Include** thermodynamics and reaction kinetics



Gas velocity





We were looking for a tool to help us understand material behavior and optimize complex blast furnace processes such as loading and unloading as well as wear.

One of the key reasons that made us choose EDEM over other DEM software was the high level of expertise and support provided by the EDEM technical team.

**Dr Edouard Izard
Research Engineer, Process Engineering
ArcelorMittal**

FOR MORE INFORMATION VISIT

www.altair.com/edem