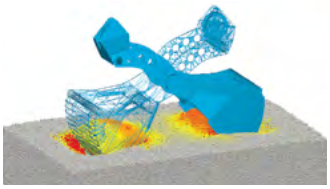
DESIGNING FASTER, LIGHTER EQUIPMENT

NEMAG AND TU DELFT DESIGN INNOVATIVE GRAB FOR FASTER UNLOADING

About the Customer

Nemag BV is a manufacturer of grabs designed for handling a range of bulk materials from coal and iron ore to grain, animal feed, scrap metal, minerals, and biomass. Nemag worked with the group of Dr. Dingena Schott at Delft University of Technology (TU Delft) to develop a new generation of grabs for iron ore that are faster and lighter — using Altair EDEM™ bulk material simulation software to test and optimize the new design.

> “As an early adopter we believed in EDEM to help make a difference in simulation-supported design and realize breakthroughs through advanced simulations. We also use EDEM in education; its ease of access comes with good support and quick response times.
>
> Dr. Dingena Schott, Associate Professor Material Equipment Interaction for Logistics, TU Delft



Teams from Nemag and TU Delft collaborated to develop a new generation of grabs for iron ore that are faster and lighter

Their Challenge

Grabs are a type of equipment used for unloading dry bulk cargo vessels, grabbing dry bulk material such as iron ore or coal from the vessel and transferring the grabbed material to a hopper on the quay. **Development of grabs is a complicated process** as predicting the performance of a new design is hard and involves building physical prototypes — which is expensive, time consuming and limiting; it is hard to understand what happens inside the grab. The interaction between the bulk material and the grab influences the performance of the grab heavily but it is difficult to predict using traditional methods. A **virtual prototyping approach** was therefore developed at TU Delft to model iron ore pellets in interaction with grabs.

Our Solution

TU Delft used simulation software to perform virtual testing of a grab design and predict grab performance. TU Delft developed a coupling to use EDEM Discrete Element Method with multibody dymanics simulation software, with which they modeled iron ore pellets and a crane in a virtual environment. **Extensive model calibration procedures** were developed accounting for material structure interaction. With this they were able to effectively capture both material behavior and grab behavior. The co-simulation was validated with measurements on industrial scale at Tata Steel IJmuiden in the Netherlands. The coupled simulation could then be used in the innovative design process, providing **key insight into the dynamics of the grab together with the iron ore**.

Results

Simulation results were used to develop new-generation grab designs. The patented nemaX® grab combines lower deadweight and higher payloads with shorter closing times, leading to **great improvement in efficiency with a vessel that unloads in 10% less time**. The new grab has been extensively tested and its performance matches the simulation predictions.

The innovative nemaX® grab won two awards: the International Bulk Journal's Innovative Technology Award in 2017 and the Red Dot Award for product design in 2018.