

## GRADUATION PROJECT

### Optimization of Grab Design using a Discrete Element Model

Date 12 June 2013

#### Introduction

Nemag B.V. develops and produces very large grabs (with a volume up to 60 m<sup>3</sup> and a deadweight of 38 tons) for the handling of dry bulk, such as iron ore or coal. Since the foundation of the company in 1924, Nemag has developed a full range of grabs and accessories, focusing on efficient unloading and the lowest cost per ton handled. The grabs are custom built at the production site in Zierikzee, The Netherlands and exported world wide.

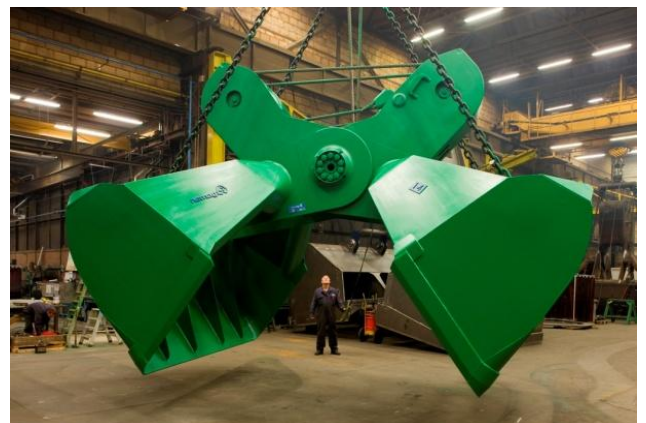
Nemag is continuously investigating new materials, experiment with new types of grabs to shorten cycletimes, increase payloads and lifetime of grabs, resulting in lower costs per transshipped cargo.



#### Development process of grabs

Development of grabs and other types of bulk handling equipment is still a complicated process: predicting the performance of a new design is hard, as continuous models are not very suitable due to the particulate nature of the dry bulk material. The current design process of bulk handling equipment such as grabs is based on years of experience and consists of designing a prototype, building it in the factory and evaluating it at a test site. This is an expensive process involving high risks and long R&D times. Virtual prototyping could be a promising solution in predicting the performance of bulk handling equipment such as grabs and an affordable lowrisk way to improve grab designs.

A validated model using the Discrete Element Method (DEM) and Multibody Dynamics (MBD) has been developed and can be used to predict the performance of a virtual prototype grab. This combined model computes the behavior of the individual particles as well as and the behavior of the grab. With this tool, the performance of virtual prototypes can be compared, indicating whether a design change is an improvement or not. As many variables can influence the performance of a grab, finding an optimal performance is a challenging task.

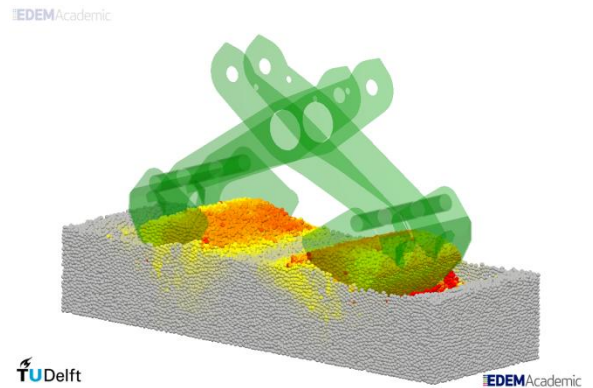




## Graduation project

The goal of this graduation project is to develop the optimal grab. This can be done through the application of optimization techniques and design principles in combination with the validated model. The research in this graduation project should cover the following:

- Select a maximum of three grab design parameters
- Study different concepts using different combinations of the three design parameters
- Look for an optimal grab design using optimization techniques



The research will be carried out at both Nemag B.V and TU Delft. During this project you will be coached by ir. Stef Lommen and prof.dr.ir. Gabriel Lodewijks of the section Transport Engineering and Logistics as well as the Engineering team at Nemag B.V.

## Interested in this project?

Students can apply for this position by sending an email to [michel.corbeau@nemag.com](mailto:michel.corbeau@nemag.com) or [s.w.lommen@tudelft.nl](mailto:s.w.lommen@tudelft.nl) .

[www.nemag.com](http://www.nemag.com)