TUHH
Hamburg University of Technology

Numerical Structural Analysis with Application in Ship Technology
Institute for Ship Structural Design and Analysis

Application of DEM-BPM to simulate the mechanical behaviour of coated particles

HiWi, Bachelor-, Project-, Master thesis

As part of the project "Optimisation of kinetic energy of coated particles for improved kinetic energy absorption" in the research training group "Processes in natural and technical particle-fluid systems" (PintPFS), HiWis, Bachelor, Project and Master theses are offered.

Presence of granular material in the cavity of a ship's double hull leads to improved crashworthiness. Expanded glass granules (Poraver) have been found to be particularly suitable due to their chemical and physical properties. However, the abrasive behaviour of Poraver particles under dynamic load is a disadvantage for the application investigated. One way to overcome these problems is to use coated particles, as depicted in Figure 1. Furthermore, the idea is to provide increased kinetic energy absorption.

Figure 1: Wax coated Poraver particle

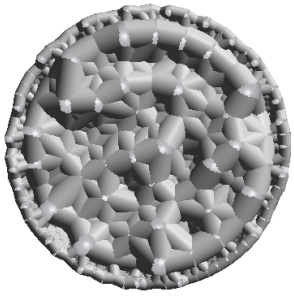

Figure 2: Cross section of DEM model

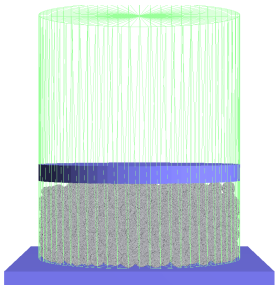

Figure 3: Multi particle test

Current work involves the numerical modelling of coated particles using the Discrete Element Method (DEM) shown in Figure 2. The difficulty lies in the correct determination of large number of structural and material parameters for the numerical model. Since there is more than one coating material, a robust methodology needs to be developed for parameter identification that can be validated against experimental results from single and/or multi particle tests, see Figure 3. The validated numerical model will be used to simulate a collision scenario with a particle filled double hull to determine the extent of kinetic energy absorbing capabilities of coated particles. In this context, different topics can be developed, such as:

- Identification of material parameters for simulating the mechanical behaviour of coated particles (comparison of different optimisation algorithms, statistical analysis, neural networks, algorithm for generating different agglomerate shapes)
- Support in performing new experiments and simulations (new coating material)

Knowledge of MATLAB is required for the evaluation of results. For further information, contact us at:
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