

Application of FEM to simulate the mechanical behaviour of particles

HiWi, Bachelor-, Project-, Master thesis

As part of 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 (see Figure 1). However, in case of big simulations like an actual collision of a double hull with a bulbous bow, a coupled DEM-FEM approach is needed, as depicted in Figure 2.



Figure 1: Poraver particles

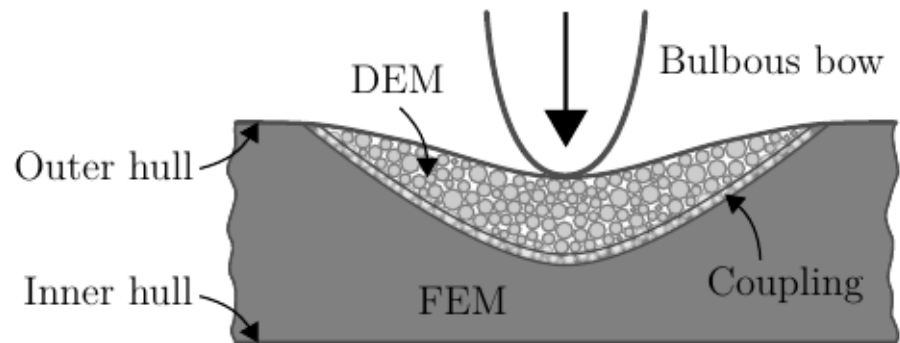


Figure 2: Modelling approach of a double hull filled with particles

For the FEM modelling of particles, a continuum approach needs to be adopted. Previous work has been done using Mohr-Coloumb and hypoplastic material model to simulate the breakage of Poraver particles. Experiments were carried out to validate the simulations. However, the results were not reliable in areas with large deformation where the particles are crushed by contact with the bulbous bow. Therefore, the work needs to be repeated and extended by using other material models. In this context, different topics can be developed, such as:

- FEM simulation of particle breakage (identification of material parameters, comparison of different material parameters)
- FEM-DEM coupling

Knowledge of FEM is required for the evaluation of results. For simulation, ANSYS may be used. However, there is a possibility to test a new open-source code "OpenRadioss" that works with LS-DYNA input files. For further information, contact us at:

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