

# Experimental investigation of granular material as crash-absorber for double hull ships

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## ABSTRACT

Today, the collision safety in ship building is of major concern. Due to increased environmental requirements, the collision and grounding behaviour of ships is of increasing interest in experimental and numerical investigations. In particular, the crashworthiness of double hull ships, such as oil tanker, is of interest. To improve the safety, the filling of the void area between the inner hull and outer hull of a double hull ship was suggested in [1]. We take up this idea and investigate the change of the structural behaviour due to the filling with granular material, focusing on the increase of the energy dissipation during a ship collision.

To do so, a simplified side hull structure has been investigated. This structure is built using two steel plates as outer and inner side hull. A rectangular box is welded between these plates as bounding box for the granular material. As filling material expanded glass granules are used due to environmental aspects and its relatively high compression strength compared to its bulk density. The material behaviour of the granules is described in [2] and used within the simulation with the Discrete Element Method [3].

In total four experiments are conducted. On the one hand, two reference experiments without a filling material are carried out. These two experiments differ with respect to the chosen boundary conditions. On the other hand, two filled side hull structures are examined, too. The resulting force-displacement curve during the indentation with a simplified bulbous bow is used to determine the dissipated energy until the rupture of the inner hull.

To model these experiments, material parameters for the steel and the granules are required. Therefore tension tests – for the steel plates – and triaxial and friction tests are performed for the granular material. The setup of the model will be described and finally the simulation results will be discussed with respect to the increase of the crashworthiness.

## REFERENCES

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