Granular flow model for large scale wear prediction

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ABSTRACT

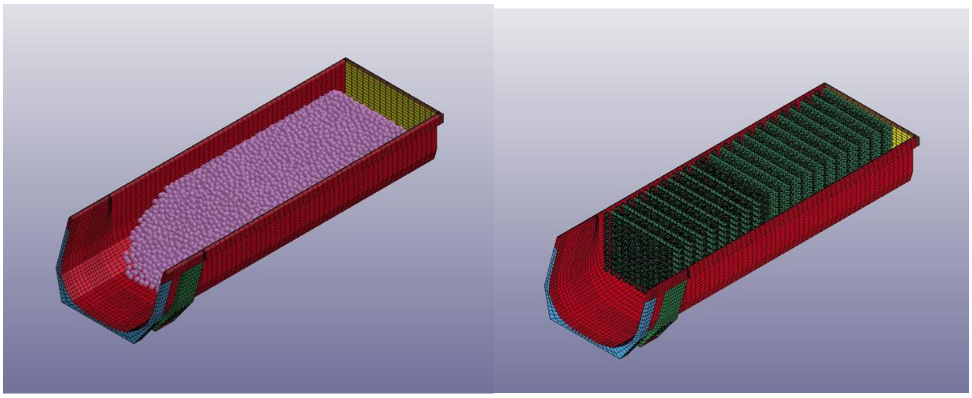
To predict abrasive wear in industrial bulk material, couplings between granular material flow and wear calculation have to be developed. It would also be desirable to include both sliding and impact wear in such model.

The emptying of a tipper loaded with a rock mass of approximately 20 tonnes was modelled. The rock was modelled using two different numerical techniques: the discrete element method (DEM) and the finite element method (FEM). The purpose of the simulations was to study the coupling between the two numerical techniques and to compare their usefulness in wear calculation.

The tipper emptying model had previously been used in calculating abrasive wear during unloading. A tipper body [1], protected with SSAB Hardox 450 steel, was modelled with FEM using and a piecewise linear plasticity model for the material behaviour. For the numerical model labelled DEM-FEM, the rocks were modelled with spherical discrete elements with rolling friction and damping parameters applied to simulate non-spherical rocks. Another numerical model labelled FEM-FEM, to mimic arbitrary shape rocks used two slightly different simplified shapes, round and prism like kinds.

To compare the numerical approaches the pressure on the tipper body was studied at two times during the unloading. The first measurement occasion was defined when the rock mass had been dropped into the tipper and had come to rest and the second when the tipping had started and approximately half of the load had been unloaded.

When the two approaches were compared it could be seen that the calculated pressure field agreed fairly well both initially with the rock mass at rest and during emptying with the rock mass in motion.



REFERENCES

[1] D. Forsström, *Numerical prediction of wear in industrial raw material flow*, Licentiate thesis, Luleå University of Technology, Sweden, (2014).