

Discontinuous Deformation Analysis applied to the optimization of bucket elevators

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ABSTRACT

Bucket elevators transport particulate materials to be processed in industrial and civil applications. These materials are composed by huge number of particles where the global behavior is defined by contact interactions.

The first work to analyze the transportation of granular materials [1] used very simple continuum methods that do not take into account these interactions, producing simulations that do not fit the experimental data.

Due to the internal discontinuous nature of granular media, it is reasonable to use numerical methods to model their behavior, such as discontinuous deformation analysis (DDA) [2]—a member of the discrete element method family that started to be used in the 90s to analyze similar problems. The version of DDA used in the current work treats grains as rigid 2D circular frictional particles to simulate and analyze in detail the discharge of granular materials with bucket elevators.

The DDA has been validated against simplified analytical formulae and experimental results taken from the literature [3]. The DDA is then used to obtain optimum two-dimensional bucket geometries under specific working conditions.

The optimization aims to maximize transport distance and to minimize remaining material, taking into account bucket velocity and the properties of the grains. The resulting geometries are discussed and compared against standard designs.

REFERENCES

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