Numerical simulations of particle grinding inside 2D ball mills by Contact Dynamics

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Abstract

In many industrial applications grinding and breakage of particulate materials are key processes that are often performed using ball mills. Balls are included in such systems in order to increase the collision energy and therefore optimize the grinding process. However, the choice of the ball size and quantity is still based on empirical relations. DEM simulations allow one to model the mechanical interactions between grains inside a mill and therefore, the interactions between powder, balls and drum walls can be studied at the particle and contact scale. A study of the grinding evolution of ball mills with different balls size and quantity has been performed using 2D DEM simulations. The bonded cell method (BCM) is used for model breakable polygonal particles that represent the powder. As a result, we found that the grinding evolution behaves non-monotonically with the balls quantity. Cases with low ball contents are similar to the milling of powder without balls and at high balls quantities, the collisional forces are mainly transmitted between balls rather than to the powder. On the other hand, when the volume of balls is kept constant, the ball size is not relevant to the grinding evolution except for the cases of small and large ball sizes.

Keywords: Granular Materials, breakage, ball mills, Bonded cell method

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