Peridynamics simulation of particle fracture embodying defects

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Abstract

During grinding, granular materials are submitted to different mechanical loads leading to the failure of particles depending on the mechanical properties of the materials, the interactions between the particles in the bulk, and the presence of heterogeneity inside the grains. In particular, the presence of defects influences directly the strength of the particles and are often the weak points where the fractures are initiated.
In this study, we investigate the failure of 2D round particles using peridynamics simulations [1].

Defects are introduced as 1D inclusions of lower toughness. Particles of different sizes are loaded quasi-statically between two plates and the probability of failure are investigated in terms of Weibull distribution [2]. The variation of yield stress with particle size is also investigated. The same procedure is applied to study the effect of dynamic loading by varying either the mass or the speed of an impactor. In both cases, thanks to a Floodfill algorithm the crack patterns and fragment size distributions are studied and compared.

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