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AN EFFECTIVE LEVEL SET DISCRETE ELEMENT MODEL (LS-DEM) FOR SINTERING

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Sintering is a high temperature process for the consolidation of powders (metallic, ceramic, polymer, organic and composites). Given the granular nature of the initial powder, the discrete element method (DEM) is a good choice to model the sintering process [1]. The classical DEM considers particles as spheres, which is not realistic to represent actual powders. The level set discrete element method (LS-DEM) [2] jointly uses the dynamic framework of the classical DEM and the level set method to capture arbitrary shapes. Here, we propose a LS-DEM model for sintering, including appropriate expressions for the normal and the tangential forces. The normal force includes attractive and viscous terms that introduce surface energy and diffusion parameters. Contact detection is a critical step for the accuracy and the computational cost of the model. LS-DEM models typically use boundary nodes on the particle surface to detect contact and calculate indentations between particles [2], but at the cost of high CPU and RAM consumption. Here we implement a contact detection algorithm based on an optimization scheme [3]. Its accuracy is validated against classical DEM with spherical particles using elastic and sintering interactions. Sintering simulations for non-spherical shapes are carried out at different process conditions and for different powders. The model is shown to be suitable for running thousands of particles with arbitrary shape during sintering. The model is able to study elastic, plastic or sintering interactions.

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