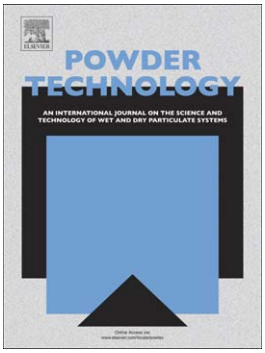

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Gang Ma, Wei Zhou, Richard A. Regueiro, Qiao Wang, Xiaolin Chang

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Modeling the fragmentation of rock grains using computed tomography and combined FDEM

Gang Ma[a], Wei Zhou[a], Richard A. Regueiro[b], Qiao Wang[a], Xiaolin Chang[a]

[a] State Key Laboratory of Water Resources and Hydropower Engineering Science, Wuhan University, Wuhan 430072, China

[b] Department of Civil, Environmental, and Architectural Engineering, University of Colorado Boulder, Boulder, CO 80309-0428, USA

Corresponding author at: State Key Laboratory of Water Resources and Hydropower Engineering Science, Wuhan University, Wuhan 430072, China.
E-mail address: zw_mxx@whu.edu.cn

1. Introduction

Granular soils yield and exhibit irrecoverable deformation when compressed to high stresses. This macroscopic "yielding" has been shown to originate from grain breakage [1]-[3]. This grain scale behavior causes significant changes to the macroscopic response. Extensive laboratory investigations have been conducted to correlate the breakage behavior with the initial density, stress level, gradation characteristics, loading conditions, and grain characteristics. [4]-[8]. Recently, some advanced in-situ measurement techniques, such as X-ray computed tomography (CT) scanning and synchrotron micro-computed tomography (SMT), have been adopted in experimental studies to visualize the development of grain breakage under axial compression [9]-[11].

As an effective complement to experimental studies, the discrete element method (DEM) has been widely used to study the mechanical behavior of crushable granular materials. Two groups of methods have been developed to simulate grain breakage in discrete element modeling, namely, the agglomerate method [12]-[16] and replacement method [17]-[19]. Both methods have their advantages and disadvantages [20]. One of the disadvantages of the agglomerate approach is the loss