Discrete Models and Their Application in Damagemechanics

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Different discrete element models (DEM) for the simulation of problems in the context of damage mechanics will be presented. The target materials to be simulated are cohesive and non-cohesive geomaterials like concrete- or sand-type materials.Starting from a basic polygonal two-dimensional DEM model for non-cohesive granular materials, more complex models for cohesive materials are obtained by inclusion of beam or interface elements between corresponding particles. The last step in the series of increasing complexity is the realization of a microstructure-based simulation environment which utilizes the enhanced DEM models. With growing model complexity a wide variety of failure features of geomaterials can be represented. Furthermore, adequate homogenization approaches are derived which supplement the definition of the discrete models. These homogenization approaches allow us to relate microscopic quantities, like contact forces or displacements, to corresponding macroscopic quantities, like stresses or strains. Representative numerical examples are used to validate the proposed DEM models along with the homogenization.

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