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Multiscale modeling and characterization of coupled damage-healing-plasticity for granular materials in concurrent computational homogenization approach

Xikui Li, Zenghui Wang, Songge Zhang, Qinglin Duan

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Highlights on "Multiscale modeling and characterization of coupled damage-healing-plasticity for granular materials in concurrent computational homogenization approach"

1. Propose a novel methodology to characterize coupled damage-healing-plasticity for granular materials based on concurrent computational homogenization modeling.

2. Derive an incremental non-linear constitutive relation for a discrete meso-structural RVE of granular material.

3. Formulate a meso-mechanically informed macroscopic incremental non-linear constitutive relation for a gradient Cosserat continuum model of granular material.

4. Define meso-mechanically informed macroscopic anisotropic tensorial damage, healing and net damage factors and plastic strain in the thermodynamic framework

5. Propose scalar internal state variables, i.e. densities of thermodynamic net damage energy, plastic energy and total dissipative energy to characterize tensorial damage-healing factors and vectorial plastic strain.

6. The effects of damage, healing and plasticity on material failure and structural collapse are comparable.