

COMBINED FIELD DISLOCATION MECHANICS AND PHENOMENOLOGICAL PLASTICITY

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We present a continuum theory of plasticity for the analysis of inelastic response at small scales. The theory incorporates a model of field dislocation mechanics for the analysis of stress fields of net dislocation distributions observable at the desired scale of resolution. Dislocation distributions not observable at this scale of resolution are accounted for phenomenologically through a work hardening model that incorporates macroscopic gradient effects. These two models are combined heuristically to produce a unified model of plasticity.

We present results of exercising the theory in the context of predicting size-dependent response in the presence of imposed heterogeneity and in developing heterogeneous deformation from nominally homogeneous initial and boundary conditions.