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COMPUTATIONAL HOMOGENIZATION MODELLING OF MICROSCALE LOCALIZATION TOWARDS MACROSCOPIC FAILURE

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The goal of this research is to propose a multiscale computational homogenization model for the post localization behavior of a macroscale domain crossed by a cohesive discontinuity emanating from microstructural damage. The stress-strain and the cohesive macroscopic responses are obtained through the incorporation of the underlying microstructure, in which the damage evolution results in the formation of a strain localization band. The macro structural kinematics entails a discontinuous displacement field and a non-uniform deformation field across the discontinuity. Novel scale transitions are formulated to provide a consistent coupling to the continuous microscale kinematics [1]. To allow for the strain localization band development within the microstructural volume element with minimal interference of the boundary conditions, new percolation path aligned boundary conditions have been used, based on the projection of the boundary contraints in the direction of the developing localization band [2]. From the solution of the micromechanical boundary value problem, the macroscale stress responses at both sides of the discontinuity are recovered, providing automatically the cohesive tractions at the interface. The effective displacement jump and deformation field discontinuity are derived from the same microscale analysis. The macroscopic boundary value problem may be solved both with embedded discontinuities [3], or within an extended finite element (X-FEM) approach [4].

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