

# **Numerical Analyses of Micro- to Macroscopic Non-Uniform Deformation during Plane Strain Compression Using Second-Order Homogenization Method**

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## **ABSTRACT**

In the framework of multiscale simulation of polycrystalline materials, an FE-based homogenization technique has been widely used to analyze the effect of microscopic heterogeneity in material properties on the macroscopic deformation. However, the effect of the length of microstructure such as grain size cannot be considered by the conventional homogenization method because relationship of the size between macroscopic and microscopic region is not taken into account. Thus, a second-order homogenization method, in which strain gradient in macroscopic region is considered, has been proposed to evaluate the size effect on the macroscopic deformation. In this study, plane strain compression is numerically investigated using an FE-based second-order homogenization method of a polycrystalline material, and effects of grain size and friction on micro- to macroscopic non-uniform deformation is discussed.