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Sheet Necking Analysis under Biaxial Strain Considering Crystalline Scale Inhomogeneity

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In this study, the necking analysis of sheet specimen under biaxial strain state is conducted. A homogenization-based finite element method with the crystal plasticity model is combined with the Marciniak-Kuczynski type formulation. The onset of necking that can be considered as the trigger of ductile failure is predicted. In the present framework, the inhomogeneity such as textures in crystalline scale microstructure can be introduced. The several strain paths are subjected to a sheet specimen, and the effect of crystalline scale inhomogeneity on the onset of necking is investigated. An important advantage of the present scheme is the very low computational cost. Only two material points are required to detect the onset of localization when the general necking analysis with the finite element method requires a huge number of material points.

Keywords: Plastic Instability, Sheet Necking, Crystal Plasticity, Homogenization