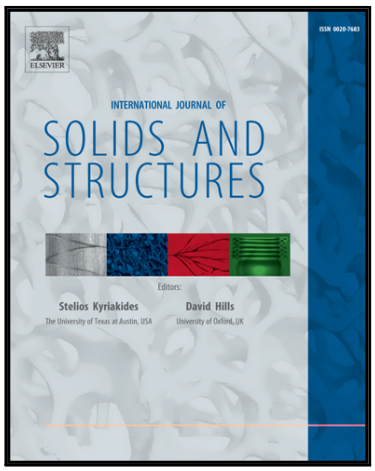

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Numerical Investigation of the Post-Necking Behavior of Aluminum Sheets in the Presence of Geometrical and Material Inhomogeneities

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Abstract

The proper numerical treatment of strain is an indispensable prerequisite of an accurate localization prediction. The plastic deformation in the post-necking regime is, however, challenging to simulate as factors with marginal influence in the stable range can sensitively affect results in the localized regime. The present study aims to clarify the role of intrinsic inhomogeneities in aluminum alloy AA6016-T4 sheet sample in its post-necking deformation behavior. This is carried out through the FE simulation of a tensile test with randomized thickness and yield stress properties. The inhomogeneous thickness distribution of the sheets has been characterized by a 3D optical digitization system, whereas the crystallographic texture has been measured using X-ray diffraction analysis. The results show that the presence of inhomogeneities allow for a more realistic description of the localized necking phenomenon, especially concerning the initiation and development of shear bands. Also, the variable shear angle observed on failed specimens is better captured numerically in presence of inhomogeneities.

Keywords: Post-critical regime, Material inhomogeneity, Thickness inhomogeneity, Shear instability band

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