Development of a distortional hardening model in the axial-torsional-hoop stress space

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ABSTRACT

The experimental evidence shows the yield surface of AL6061 alloy expanses, translates and distorts in the stress space under pre-loading. To simulate the complicated behavior of the yield surface evolution more closely, the elastoplastic models should contain the distortional hardening rule besides the isotropic and the kinematic hardening rules. In this paper, a new elastoplastic model is proposed to simulate the behavior of AL6061 under combined axial-torsional-internal pressure loading. The yield surface of the proposed model is described by a convex-closed-cubic function of stress which is able to model the isotropic, kinematic, and distortional hardening. Comparisons of the simulation of the proposed model and experimental results are made with the enhancement of yield surface evolution under proportional and non-proportional. The yield surfaces of the proposed model for different pre-loading states are constructed in the axial-torsional-hoop stress space and the evolution of yield surface is observed. The performance of the proposed model under cyclic loading is also exhibited and examined.

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