

Comparative evaluation of plasticity theories against tension-torsion test at finite strain

Al-Gadhib, Ali H., Havner, Kerry S.

Journal of Engineering Mechanics

Vol. 118, Issue.10, 1992

Abstract: Classical isotropic hardening, nonlinear kinematic hardening, and a combined linear-isotropic/nonlinear-kinematic hardening theory are compared and contrasted with experimental results from nonproportional loading of thin-walled tubes of annealed copper (published by Bell and Khan in 1980) and mild steel (published by Bell in 1983) in tension and torsion. Comparisons are made for principal direction paths of Eulerian strain rate and for individual axial and shear strain components. In addition, experimentally determined ratios of principal strain-rates and principal stresses are compared. Because of the near coaxiality and proportionality of the strain-rate and deviatoric stress tensors in the moderate finite-deformation range of the experiments (for a variety of nonproportional loading paths), isotropic hardening theory provides the most satisfactory predictions over-all. A simple means of further improving those predictions is suggested.