Validation of notch stress estimation schemes for different constraints, strain gradients and loading conditions on low C-Mn steel

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Abstract

The present study is aimed at validation of notch stress/ strain estimation schemes such as classical Neuber, Hoffmann-Seeger and recently developed Ince-Glinka method for Nuclear piping material (low C-Mn steel). The study has considered different constraints, loading conditions, various hole sizes to accommodate strain gradient variations and equivalent peak strains. The notch stress field evaluated using these schemes is compared with corresponding stress using elastic-plastic Finite Element (FE) analyses. The comparisons have brought out that the Hoffmann-Seeger scheme results in reasonably accurate assessment of stress localization nearly for all constraint geometries, loadings and strain gradients. However, the classical Neuber scheme is more suitable for low constraint geometries and intermediate constraint geometries whereas it results in under-estimation of maximum principal stress for high constraint geometries, thereby leading to over-prediction of fatigue life. Further, the suitability of energy equivalence equations of Ince-Glinka model for individual stress components, has been reviewed.

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