

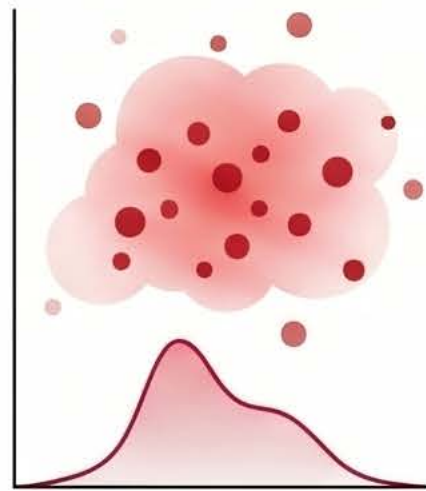
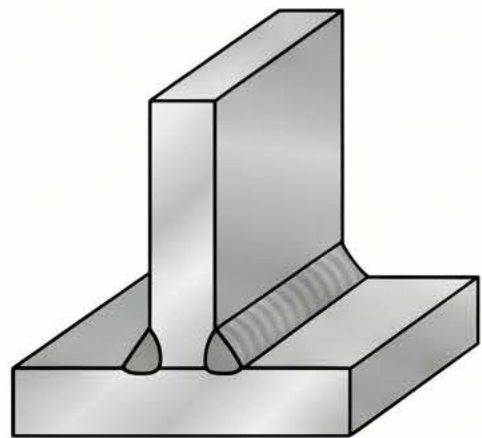
Local Approaches for Fatigue Assessment in Austenitic Steel Welds

CONTEXT

Traditional fatigue design uses 'nominal stress,' which often fails to account for local stress concentrations at weld roots and toes, leading to high data scatter.

This study validates three advanced numerical models—N-SIF, SED, and ENS—specifically for austenitic stainless steels, which exhibit higher ductility and different notch sensitivity.

TRADITIONAL: NOMINAL STRESS APPROACH

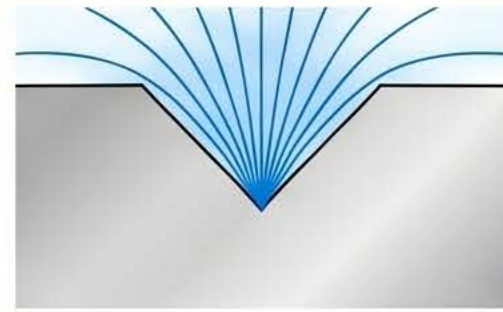


High Data Scatter
(Scatter Index $T_\sigma \approx 105$)

Baseline for Comparison.
Fails to account for localized stress at weld toe/root.

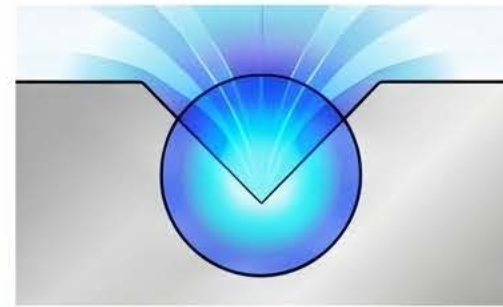
NUMERICAL CONTENDERS: ADVANCED LOCAL METHODS

N-SIF (Notch-Stress Intensity Factor)



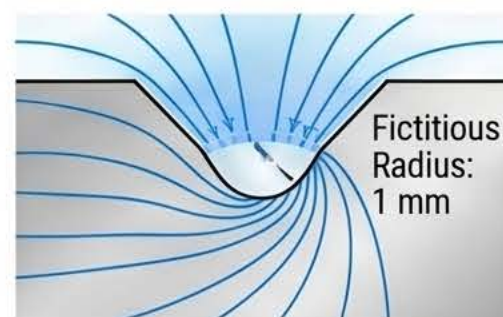
Models weld roots as sharp V-notches to determine local asymptotic stress fields.

SED (Strain Energy Density)



Averages elastic strain energy within a material-specific control volume ($R_c = 0.195$ mm).

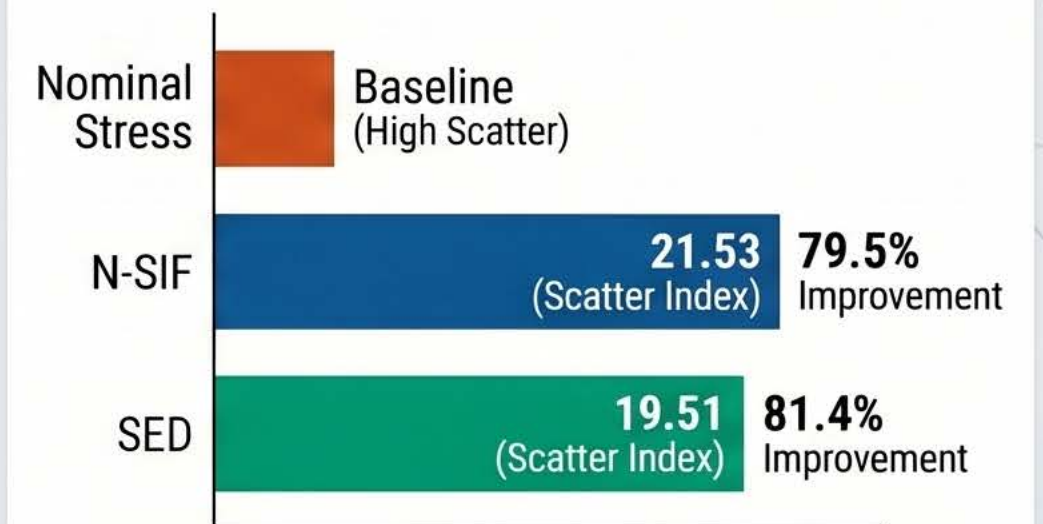
ENS (Effective Notch Stress)



Applies a fictitious 1 mm radius to weld roots per international design recommendations.

PERFORMANCE AND SCATTER VALIDATION

SIGNIFICANT SCATTER REDUCTION (Performance vs. Baseline)



SED and N-SIF reduced data scatter by over 80% compared to nominal stress.

SED OFFERS SUPERIOR UNIFICATION

The energy-based SED approach enables direct comparison between different joint geometries and load ratios.

ENS LIMITATIONS IN THIN JOINTS

The 1 mm fictitious radius caused high dispersion in joints with small cross-sections.