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Fatigue Life Prediction Considering Residual Stress Relaxation

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Residual stress relaxation during fatigue tests and the metallurgical difference between weld metals and parent materials play an important role in fatigue behavior. We studied the effect of welding residual stress relaxation on the fatigue behavior of a material, JIS SM 490 A, with yielding strength of about 350 MPa and tensile strength of about 520 MPa. Fatigue tests of X-grooved butt weld plates under tensile loading and unloading at loading ratio, R=0.1, were carried out to failure. The dimension of the specimens is 200 25 10 mm. We developed a fatigue life prediction model based on a nominal stress approach considering residual stress relaxation. The stress relaxation is assumed to be a function of applied load and loading cycles. Finite element analysis of residual stress relaxation was carried out on an X-grooved butt weld specimen. The estimated fatigue lifetime was compared to experimental results.

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