An energy-based method for lifetime assessment on high strength steel welded joints under different pre-strain levels

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Abstract

The pre-loading on the engineering materials or structures may produce pre-strain, especially plastic strain, which would change the fatigue failure mechanism during their service time. In this paper, an energy-based method for fatigue life prediction on high strength steel welded joints under different pre-strain levels was presented. Three kinds of tensile pre-straining were conducted on the specimens, and the cyclic stress and strain responses with pre-loading were compared with the ones without pre-loading at the same strain level. The experimental work showed that the plastic strain energy density of pre-strained welded joints was enlarged, while the elastic strain energy density of pre-strained welded joints was reduced. Then, based on the strain energy density method, a fatigue life estimation model of the high strength steel welded joints in consideration of the pre-straining was proposed. The predicted results agreed well with the test data.

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