

## Method for estimating the residual operating life of the trunk pipeline in the presence of a surface crack under conditions of operational loads

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*The study proposes a method for determining the surface crack propagation rate in the wall of a trunk pipeline under the influence of variable biaxial cyclic loading. The analysis of the three-dimensional elastoplastic stress state at the tip of surface cracks is carried out by means of 40X steel for various types of biaxial loading. The study shows the results of fatigue tests of cross-edged specimens with the surface crack during biaxial loading. The change in the normal stresses in front of the crack front is studied when the samples are loaded to the maximum value and then off-loaded to zero. The dependence of the type of loading the samples with crack opening is identified. Moreover, we introduce a characteristic of the stress state at the crack tip, the characteristic correlating with the crack propagation rate for various types of loading. As a result, a formula is obtained that describes the propagation of fatigue cracks. Having studied the process of loading a sample in the presence of an overload cycle, we found that the obtained dependence can be used to predict the development of cracks and to estimate the residual operating life under variable operating loads.*

**Keywords:** surface crack, biaxial loading, finite element method, crack propagation rate, cyclic stresses, coefficient of variation of average stresses per loading cycle, residual operating life

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