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## Fatigue Strength under Service Load

(Quantification of cumulative damage on fatigue)

Yoshihiko HAGIWARA\*

To clarify the behavior of fatigue under service load from the view point of crack propagation, several experiments concerning crack propagation under successively varying load were performed, but papers on which have seldom been presented.

First, applying the superposition law to crack propagation of the carbon steel specimens of both annealed and induction-hardened, which are loaded under sinusoidally varying amplitude, a method for calculating the predicted curve was presented in this paper.

Comparison the results in the above experiments with those already obtained under stepwise varying load showed that the difference between both results is not recognized so remarkably in case of the annealed specimens, and the principle of superposition is not applicable to them, while the difference may appear in case of induction-hardened specimen so that the results for stepwise loading is located in the dangerous side and the superposition is available only for specimen loaded continuously.

Next, investigating the behavior of crack propagation of medium carbon steel specimen under gradually increasing and decreasing amplitude of applied stress, leads to the conclusion that the superposition is not available for its crack propagation. However, as far the crack propagation which precedes under constant stress amplitude after gradually increasing and decreasing applied stress, the crack propagation is related to their rates. And in this case, such complicated behavior appears that the superposition holds for low rate but the crack propagation depends upon its depth in case of high rates.

As stated above, the unified interpretation about the behavior of the crack propagation can not be concluded because of their complexities under varying load.

However, several informations related to the crack behavior under varying load came out from this investigation.

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