CHAPTER - I

INTRODUCTION

As early as 1850 it was observed that a material would fail at a lower stress when subjected to cyclic loading. Various investigations have shown that cyclic loading causes a significant change in different physical and mechanical properties of the material subjected to it. For instance resistance (both thermal and electrical) increases, magnetic permeability and critical stress required for inducing martensitic transformation decrease, residual stress is induced.

In the present work an attempt has been made to correlate the changes in properties and crack growth with the experimental variables, namely stress and number of cycles in order to estimate the life spent and thereby the residual life. The crack growth is not a state function but a path function of number of cycles and the applied stress level and the same applies to various properties of the material. Hence none of the properties alone can be used to estimate crack length or residual life of the material concerned. Crack growth has been estimated by computer simulation based on Paris equation ; it has been shown that the accelerating stage or the third stage of fatigue crack growth (i.e. the final stage of $\ln \frac{da}{dN}$ vs. $\ln\Delta K$ curve) can be accounted for by incorporating geometrical factor.

The material used in the present study is low carbon steel containing 0.23%C. The specimens were subjected to reverse bending in a cantilever machine. The properties studied were electrical resistance, eddy current loss and residual stress.

The electrical resistance has been found to depend strongly on the number of cycles while the other two are mainly influenced by the applied stress level. It has also been found that the residual life prediction can be made possible (at least to a considerable extent) by studying a number of properties (as already mentioned prediction of residual life can not be performed by studying the effect of fluctuating loading on a single property). Estimation of residual life, however, becomes difficult at very high stress levels (90% Y.S. or above).