Fatigue defect tolerant assessment of hydraulic cylinders

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ABSTRACT

Hydraulics cylinders are mechanical components subjected to fatigue. Indeed, to assess their fatigue strength is essential to consider the presence of inhomogeneities, for example inclusions or surface defects, since inhomogeneities reduce the fatigue strength.

In order to address this problem, in the present paper the defects in a stress relieved steel are analysed by polishing sections and the largest defect is estimated by means of the statistics of extreme values, both for surface and internal defects. Besides, the so-called Kitagawa diagram is obtained through fatigue tests performed onto smooth and micro-notched specimens. This diagram gives the information about the detrimental effect of the defects. Then, both of these two information, Kitagawa diagram and maximum inclusions present in the material, are used in order to obtain the fatigue limit. Moreover, low cycles fatigue properties and cyclic properties of the material are analysed and a simplified model is proposed for estimation the S-N diagram for a notched-cylinder. In both cases, fatigue limit and fatigue life predictions show a good agreement with full scale evidences.

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