INFLUENCE OF THREE DIMENSIONAL FINITE ELEMENT MESH SIZE ON PLASTICITY INDUCED CRACK CLOSURE PHENOMENON

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ABSTRACT

Fatigue crack closure has been studied by means of finite element method since long time ago. Most work has been performed considering bi-dimensional models. Lately, the use of three-dimensional models has been extended. Nevertheless, the methodology employed has been taken from that developed for bi-dimensional cases.

There are a great number of previous bi-dimensional studies which analyse different numerical parameters and optimise them. The current computational capabilities allow a comprehensive study of the influence of the different modelling parameters in a similar way to those studies carried out with bi-dimensional models, with the advantage, that the evolution along the thickness of the analysed parameters can be taken into consideration.

In particular, one of the key issues is related to the element size, which has a huge influence on the crack opening and closure values. In the three-dimensional case, it is not only related to the minimum element size at the crack tip but also, the mesh size along the thickness is critical.

In the present work, a CT aluminium specimen has been modelled three-dimensionally and several calculations have been made in order to evaluate the influence of the mesh size around the crack front. The numerical accuracy is analysed in terms of crack closure and opening values as in terms of the stress and strain fields near the crack front. Classical bi-dimensional recommendations are updated.