

#122 A numerical analysis of the plastic wake influence on plasticity induced crack closure

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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 plastic wake length which is developed during the previous loading cycles. This residual stresses have a great influence on the crack opening and closure values. As the numerical analysis are complex and computationally expensive, the length of the simulated wake is a critical parameter.

In this work, a comprehensive study of the effect of the plastic wake in fatigue crack closure is made. On this purpose, a CT aluminium specimen has been modelled three-dimensionally and several calculations have been made in order to evaluate the influence of the simulated plastic wake length. The numerical analysis is made in terms of crack closure and opening values as in terms of the stress and strain fields near the crack front.