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D. Camas, J. Garcia-Manrique, B. Moreno, A. Gonzalez-Herrera

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D. Camas[1], J. Garcia-Manrique, B. Moreno, A. Gonzalez-Herrera

Department of Civil and Materials Engineering, University of Malaga,
C/ Doctor Ortiz Ramos, s/n, 29071, Malaga, Spain
Phone +34 951952303; Fax +34 951952601
[1]dcp@uma.es

Abstract

Fatigue crack closure has been studied by means of the finite element method for a long time. Most work has been performed considering bi-dimensional models where the numerical methodology has been developed. A great number of bi-dimensional studies analyses different numerical parameters and optimise them.

Three-dimensional models have extended lately. Nevertheless, the methodology employed was taken from the one developed for bi-dimensional cases. The current computational capabilities allow a comprehensive three-dimensional study of the influence of the different modelling parameters in a similar way to those studies carried out with bi-dimensional models.

In particular, one of the key issues is related to the element size, which has a huge influence on crack opening and closure values. 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. Classical bi-dimensional recommendations are updated. A similar linear relationship has been identified and a minimum mesh recommendation of 60 divisions of the Dugdale's plastic zone size is made.

Keywords: finite element analysis, fatigue crack closure, element size, crack growth.