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Modelling Fatigue Damage in Fibre Metal Laminate Adhesive Joints

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Abstract

This study concentrates on the development of a constitutive damage model for use at the interfaces of metals and fibre composites under high-cycle fatigue loading. The model is implemented through a user-defined VUMAT subroutine in the Abaqus/Explicit software. This subroutine is based on a novel cohesive zone model using a trapezoidal traction-separation law which enables the definition of cohesive interfacial properties representative of those observed for Glare® fibre-metal laminates (FMLs). By considering elastic-plastic damage behaviour, this model provides more accurate results for the simulation of toughened epoxy matrices than the commonly used bilinear cohesive zone model. The FE model is verified against experimental data taken from Glare® specimens under high-cycle fatigue loading. It is shown that the fatigue model – which is based on a modified Paris law – is in good agreement with experimental results in terms of the fatigue crack growth observed in FMLs in the presence of such internal features.

Keywords: Fibre Metal Laminates, Fatigue, Delamination, Cohesive Zone Model

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