

Modelling of crack path in layered architectures composed of dissimilar materials

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Abstract

In order to make full use of the potential fatigue crack growth resistance provided by layered architectures, a validated crack path simulation algorithm for crack propagation through different elements of the layered architectures was established. The crack path approaching a material interface was predicted by using the maximum tangential strain (MTSN) criterion and the crack behaviour at the interface was simulated by a developed two-step method (a modified stress-and-energy-based cohesive zone method considering the change in direction of an interface penetrating crack). The crack path simulation by using this algorithm in layered example architectures indicates: 1) there are two criteria zones for the transition between crack deflection and penetration in terms of the relationship between interfacial strength and toughness; 2) the likelihood of a crack deflecting out of the interface will increase with the propagation of an interfacial crack and 3) the architecture difference which affects shielding or anti-shielding behaviour has a significant effect on crack deflection or penetration events.

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