Abstract

Material fracture by opening (mode I) is not the only failure criteria responsible for fracture propagation. Many industrial examples show the presence of mode II and mixed mode I + II. In the present work, numerical analyses of the three-dimensional and non-linear finite element method are used to estimate the performance of the bonded composite repair of metallic aircraft structures with a pre-existent damage by analyzing the plastic zone size ahead of repaired cracks under mixed mode loading, to assess the effect of the composite repair system on the plastic zone. The Von Mises stress is used to predict yielding of materials under this loading condition. The extension of the plastic zone, which takes place at the tip of a crack, strictly depends on many variables, such as the yield stress of the material, the loading conditions, the crack size and the thickness of the cracked component.

The obtained results have demonstrated that the plastic zone ahead of the crack is significantly reduced by the presence of composite patch materials. Furthermore, parametric

analysis has been carried out to evaluate the effect of lay-up and material system variation on the J integral.