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Analysis of the Plastic Zone Under Mixed Mode Fracture in Bonded Composite Repair of Aircraft

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Abstract : Material fracture by opening (mode I) is not alone responsible for fracture propagation. Many industrial examples show the presence of mode II and mixed mode I + II. In the present work the three-dimensional and non-linear finite element method is used to estimate the performance of the bonded composite repair of metallic aircraft structures by analyzing the plastic zone size ahead of repaired cracks under mixed mode loading. The computations are made according to Von Mises and Tresca criteria. 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 show that the presence of the composite patch reduces considerably the size of the plastic zone ahead of the crack. The effects of the composite orientation layup (adhesive properties) and the patch thickness on the plastic zone size ahead of repaired cracks were analyzed.

Keywords : crack, elastic-plastic, J integral, patch, plastic zone
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