6th European Conference on Computational Mechanics (ECCM 6)
7th European Conference on Computational Fluid Dynamics (ECFD 7)
11 – 15 June 2018, Glasgow, UK

INCREASE OF FRACTURE RESISTANCE BY THE INTERACTION OF TWO CRACKS – COHESIVE LAW SCALE EFFECTS

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Key Words: *Mutiple Cracks, Fracture Resistance, Delamination, Cohesive Law.*

Through-thickness stresses can cause initiation and propagation of interlaminar cracks which may lead to a decrease of the structural integrity of a composite component [1]. An example is cracks initiated at ply-drops in wind turbine blades. A number of techniques have been developed to increase the fracture resistance of composites by making the damage prone areas stronger or tougher. This is achieved by either using tougher matrices [2] or by modifying the fibre architecture e.g. z-pinning [3].

Based on the experimental work of Rask and Sørensen [4], an alternative approach was proposed by Gouitianos and Sørensen [5]; the fracture resistance is increased by introducing weak planes and thus allowing the initiation and propagation of multiple cracks. The analytical model was verified by a cohesive based finite element model including cracks. In this initial investigation, the increase of the fracture resistance was examined for a fixed cohesive law and varying the distance between the two cohesive cracks.

In the present work, the effects of the cohesive law parameters on the fracture resistance are examined in detail. Effects of peak cohesive traction value and work of the cohesive traction will be investigated. It will be shown that maximum increase of the fracture resistance can be attained for certain ratios of the peak tractions to Young's modulus or ratios of critical opening to height of the composite structure even if the distance between the two cracks is relatively large e.g. in thin laminates.

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