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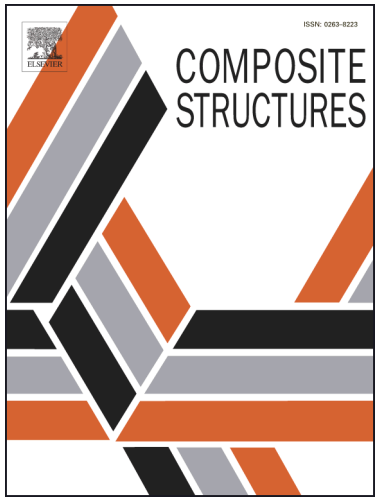

Development of a Novel Compact Tension Specimen to Mitigate Premature Compression and Buckling Failure Modes within Fibre Hybrid Epoxy Composites

T.J. Katafiasz, L. Iannucci, E.S. Greenhalgh

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ACCEPTED MANUSCRIPT

Development of a Novel Compact Tension Specimen to Mitigate Premature Compression and Buckling Failure Modes within Fibre Hybrid Epoxy Composites

T. J. Katafiasz[1], L. Iannucci[1], E. S. Greenhalgh[1]

[1]Department of Aeronautics, Imperial College London, Exhibition Road, London SW7 2AZ, UK

Corresponding Author Email: tomas.katafiasz11@imperial.ac.uk

Abstract

A Notched Curved Compact Tension (NCCT) and Extended Notched Curved Compact Tension (ENCCT) specimen geometry are presented for the measurement of translaminar critical strain energy release rates in composite laminates with low compressive to tensile strengths. Premature compressive and buckling failure occurred when a conventional Compact Tension (CT) specimen geometry (similar to ASTM E399 [1]) was utilised for monolithic Non-Crimp Fabric (NCF) S2-Glass / MTM57 epoxy and an interlayer fibre hybrid T700 carbon spread tow / NCF S2-glass epoxy composite. The NCCT and ENCCT specimen design methodology and manufacturing routes are presented where premature compressive failure was mitigated through a curvature at the rear of the profile and the introduction of a through-thickness groove that had been pre-cured along the crack growth region. The latter ensured that buckling was eliminated, whilst stable crack growth was achieved. The development involved FE model material validation and optimisation for the novel specimen design. Experimental tests presented both interlayer and intralayer fibre hybrid composites with good repeatability and low scatter within the results.

Keywords: buckling, translaminar, Mode I, finite element, design, fracture

1. Introduction

The need to characterise materials' translaminar through-thickness fracture toughness relates directly to FE modelling and component design of industrial components, where loading scenarios such as open hole tension and impact are often involved. Energy-based numerical modelling techniques [2–5]

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