Experimental and numerical studies on the impact response of damage-tolerant hybrid unidirectional/woven carbon-fibre reinforced composite laminates

Haibao Liu, Brian G. Falzon, Wei Tan

PII: S1359-8368(17)32205-9
DOI: 10.1016/j.compositesb.2017.10.016
Reference: JCOMB 5336

To appear in: Composites Part B

Received Date: 29 June 2017
Revised Date: 28 August 2017
Accepted Date: 10 October 2017


This is a PDF file of an unedited manuscript that has been accepted for publication. As a service to our customers we are providing this early version of the manuscript. The manuscript will undergo copyediting, typesetting, and review of the resulting proof before it is published in its final form. Please note that during the production process errors may be discovered which could affect the content, and all legal disclaimers that apply to the journal pertain.
Experimental and numerical studies on the impact response of damage-tolerant hybrid unidirectional/woven carbon-fibre reinforced composite laminates

Haibao Liu, Brian G. Falzon*, Wei Tan

* School of Mechanical and Aerospace Engineering, Queen’s University Belfast, Ashby Building, Belfast BT9 5AH, UK
b Engineering Department, University of Cambridge, Trumpington Street, Cambridge CB2 1PZ, UK

ABSTRACT

A woven five-harness satin (5HS) weave with AS4 carbon fibres, and unidirectional high strength IMS60 carbon fibres were used to manufacture hybrid laminates, using resin infusion, to assess their performance in low velocity impact tests. Load/energy-time curves and load-displacement curves were extracted from the experimental data, and non-destructive C-scanning was performed on all pre- and post- impacted specimens to quantify the extent of damage incurred. A finite element-based computational damage model was developed to predict the material response of these hybrid unidirectional/woven laminates. The intralaminar damage model formulation, by necessity, consists of two sub-models, a unidirectional constitutive model and a woven constitutive model. The built-in surface-based cohesive behaviour in Abaqus/Explicit was used to define the interlaminar damage model for capturing delamination. The reliability of this model was validated using in-house experimental data obtained from standard drop-weight impact tests. The simulated reaction-force and absorbed energy showed excellent agreement with experiment results. The post-impact delamination and permanent indentation deformation were also accurately captured. The accuracy of the damage model facilitated a quantitative comparison between the performance of a hybrid unidirectional/woven (U/W) laminates and a pure unidirectional (PU) carbon-fibre reinforced composite laminates of equivalent lay-up. The hybrid laminates were shown to yield better impact resistance.

Key words: A: Laminates; B. Impact behaviour; C. Finite element analysis; D. Non-destructive testing;

1. Introduction

Carbon fibre reinforced polymers (CFRPs) have been widely adopted in modern high performance lightweight structures. The main advantages of composite materials include high specific strength, stiffness and good fatigue resistance [1–3].
دریافت فوری متن کامل مقاله

| امکان دانلود نسخه تمام متن مقالات انگلیسی | ✓ |
| امکان دانلود نسخه ترجمه شده مقالات | ✓ |
| پذیرش سفارش ترجمه تخصصی | ✓ |
| امکان جستجو در آرشیو جامعی از صدها موضوع و هزاران مقاله | ✓ |
| امکان دانلود رایگان ۲ صفحه اول هر مقاله | ✓ |
| امکان پرداخت اینترنتی با کلیه کارت های عضو شتاب | ✓ |
| دانلود فوری مقاله پس از پرداخت آنلاین | ✓ |
| پشتیبانی کامل خرید با بهره مندی از سیستم هوشمند رهگیری سفارشات | ✓ |