Accepted Manuscript

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PII: S1359-8368(17)30135-X

DOI: 10.1016/j.compositesb.2017.07.014

Reference: JCOMB 5149

To appear in: *Composites Part B*

Received Date: 13 January 2017

Revised Date: 4 July 2017

Accepted Date: 13 July 2017

Please cite this article as: Mahmoud B, Colungo Torrecilla M, Navarro P, Marguet S, Tawk I, Ferrero J-F, Semi-continuous strategy for the modelling of damage mechanisms in unidirectional composites under low velocity impacts, *Composites Part B* (2017), doi: 10.1016/j.compositesb.2017.07.014.

Semi-Continuous strategy for the modelling of damage mechanisms in unidirectional composites under low velocity impacts

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Abstract

This article deals with the development of a finite element model for the prediction of low velocity impact damage within unidirectional composite laminates. This model is based on analysis of the impact damage observed experimentally. The modelling scale is that of the bundle of fibers of the unidirectional ply. These bundles are represented with 1D rod elements. The matrix is modeled with 2D damageable shell elements. The laminate is the built using cohesive elements. The strategy is validated by a comparison with low velocity drop weight impact tests. Several experimental parameters are varied : the materials (T700/M21 and HTA7/913), the thickness ($1.44mm$ and $2.4mm$), the stacking sequence and the impact velocity ($2m.s^{-1}$ and $3m.s^{-1}$). The calculated load-displacement curves and the damage extent correlate well with experimental results.

Keywords:

A. Carbon fibre, B. Impact behaviour, C. Finite element analysis (FEA), C. Damage mechanics