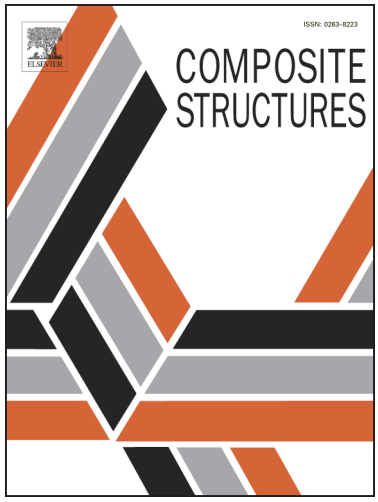

Finite element analysis of dynamic progressive failure of carbon fiber composite laminates under low velocity impact

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PII: S0263-8223(16)30251-3
DOI: http://dx.doi.org/10.1016/j.compstruct.2016.04.012
Reference: COST 7376

To appear in: *Composite Structures*

Received Date: 25 January 2016
Revised Date: 31 March 2016
Accepted Date: 6 April 2016

Please cite this article as: Liu, P.F., Liao, B.B., Jia, L.Y., Peng, X.Q., Finite element analysis of dynamic progressive failure of carbon fiber composite laminates under low velocity impact, *Composite Structures* (2016), doi: http://dx.doi.org/10.1016/j.compstruct.2016.04.012

Finite element analysis of dynamic progressive failure of carbon fiber composite laminates under low velocity impact

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Abstract The purpose of this paper is to explore the effects of different failure criteria including Puck, Hashin and Chang-Chang criteria on the dynamic progressive failure properties of carbon fiber composite laminates. First, a unified theoretical framework on the intralaminar damage and interlaminar delamination of composites based on the variational form of the initial value problem with an interface discontinuity is presented. Second, a parametric modeling plug-in for impact analysis of laminates is established using ABAQUS-PYTHON scripting language. Third, the intralaminar damage models using three failure criteria are implemented by the explicit finite element subroutine ABAQUS-VUMAT and the delamination is simulated by the bilinear cohesive model in ABAQUS. Finally, numerical analysis is performed on carbon fiber composite specimens with different materials, layups and impact energies to study the impact force-time/displacement curves and the dissipated energy as well as the damage evolution behaviors of the matrix and delamination interface. Results show that the impact responses and energy dissipation using three criteria are basically consistent except some difference in damage features for matrix cracking and delamination. This research provides a fundamental support for appropriate selection and use of