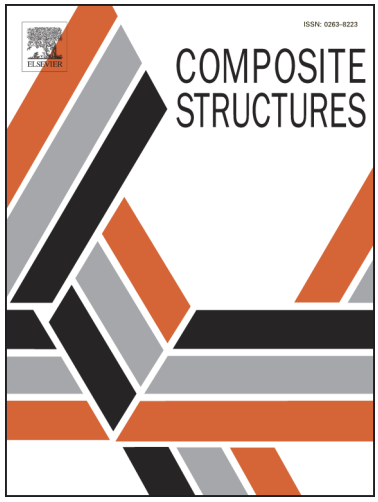

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Impact damage prediction in thin woven composite laminates – Part I: Modeling strategy and validation

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Abstract

An explicit finite element modeling of the 5-harness satin woven composite material is proposed in this paper. It is based on the semi-continuous approach. The bundles are modeled with rod elements and a specific damageable shell element is used to stabilize this truss structure. As the woven pattern geometry plays a key role in damage initiation and propagation, the rods located at the crimp regions where warp and weft yarns cross each other have been offset to represent the bundles undulations. The main objective of the presented modelling strategy is to represent local bending stiffness variations and damage initiation at the crimp regions without using artificial parameters, but only geometric and material parameters.

The method has been implemented into the explicit finite element code RADIOSS. The modeling strategy is validated by representing a three-point bending test and a drop weight test. It provides good prediction for the local bending stiffness, the impact force history and the damage size and shape. The strain concentration at the crimp regions is well represented.

Keywords: Woven fabric composite, 5-harness satin, Damage, Impact, Explicit F.E modeling