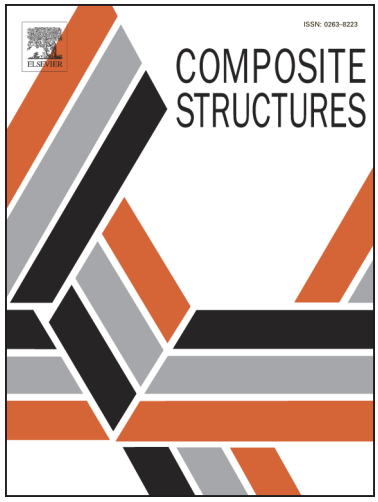

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Three-dimensional progressive failure modeling of glass fiber reinforced thermoplastic composites for impact simulation

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Abstract

In this study, a three-dimensional (3D) progressive failure material model was developed for glass fiber reinforced thermoplastic (GFRP) composites to predict the nonlinear mechanical response under impact loads. For the formulation of progressive failure, the material property degradation model (MDM) was constructed using a continuum damage mechanics (CDM) model based on the 3D Hashin failure criteria. The proposed progressive failure formulations were implemented in the user-defined material model (UMAT) in the commercial nonlinear finite element analysis (FEA) software LS-Dyna. Then, the progressive failure model was verified experimentally with flexural and impact tests. Finally, it was found that the proposed 3D progressive failure model can be used to predict not only damage progression and impact behavior, but also interlaminar delamination.

Keywords: Polymer-matrix composites (PMCs); Thermoplastic resin; Damage mechanics; Finite element analysis (FEA).