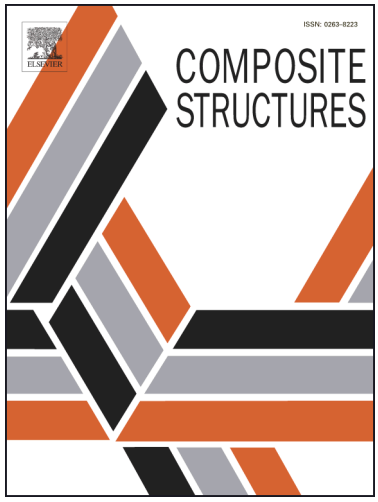

An insight into the low-velocity impact behavior of patch-repaired CFRP laminates using numerical and experimental approaches

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An insight into the low-velocity impact behavior of patch-repaired CFRP laminates using numerical and experimental approaches

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Abstract

In this paper, the low-velocity impact response of patch-repaired CFRP laminates is investigated experimentally and numerically. This study considers various patches of different shapes and sizes placed on the single side of the parent laminate plates. In the low-velocity impact simulation, damage development and the failure process of the repaired laminate plates are analyzed based on continuum damage mechanics (CDM) theory which is derived from 3D Hashin failure criteria, and a cohesive zone model (CZM). In order to validate the proposed numerical approach, impact response such as impact force and energy are predicted from simulation. Moreover, the corresponding drop weight impact tests have been performed, and the numerical prediction is in a good agreement with the experimental measurements. Finally, the influence of patch parameters on repair performance has been analyzed according to the delamination surface area and absorbed energy of the repaired laminates from the low-velocity impact simulation. And, an optimal impact-resistance design of the patch repair is obtained based on the finding results.

Keywords: Composite structures, Impact behavior, Low-velocity impact, CFRP laminates, Patch-repair technique

1. Introduction

Due to the inherently excellent mechanical properties as well as low weight, composite materials such as carbon fiber reinforced polymer (CFRP) laminates, have become attractive alternatives for modern engineering applications, particularly in the transport industry (aeronautic, automotive and marine) [1]. Commonly, partial damage on CFRP laminates, which is caused by low-velocity impacts, leads to the reduction in local mechanical properties of the composite structures. And, it gives rise to the demand of repair rather than replacement as the first-time solution to reduce the

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