Accepted Manuscript

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PII: S0263-8223(17)33081-7
DOI: https://doi.org/10.1016/j.compstruct.2017.09.089
Reference: COST 8952

To appear in: *Composite Structures*

Received Date: 21 September 2017
Accepted Date: 26 September 2017

Please cite this article as: Debski, H., Rozylo, P., Gliszczynski, A., Effect of low-velocity impact damage location on the stability and post-critical state of composite columns under compression, *Composite Structures* (2017), doi: https://doi.org/10.1016/j.compstruct.2017.09.089

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Keywords: composite structures, finite element analysis, damage, failure mechanism, impact behavior, CAI

Abstract. *This study investigates the effect of low-velocity impact damage location on the stability and post-critical states of thin-walled channel section columns under compression. The profiles were made of GFRP with a symmetric ply orientation relative to the mid-plane of the laminate. The damaged area (its shape and size) was defined based on the results of experiments performed on composite plates and reported in the literature. The composite damage was modelled using a simplified damage model (SDM), in which the thickness of individual plies of the laminate was reduced depending on the impact energy. The numerical analysis by the finite element method led to development of a series of numerical models of the thin-walled channel section column with the SDM by placing the damaged area in different places of the walls and web of the C column. The composite damage in the post-critical state was determined by the progressive damage criterion according to which composite damage initiation is described by the Hashin criterion whereas damage evolution is described by the energy criterion.*

1. INTRODUCTION

Due to their high strength properties and relatively low mass, thin-wall composite structures are widely used in aerospace, aircraft and automotive designs. In addition, composite materials produced by the autoclave technique have very low porosity (usually less than 1%) and high surface quality, which further increases the strength of structural members produced from these materials. Given their high mechanical and physical properties, composite materials are used to produce load-carrying structural members that can operate in complex stress states. These include thin-walled profiles with complex (open and closed) cross-sectional shapes that are widely used in aerospace or automotive designs for stiffening purposes [1,2,3]. An important characteristic of thin-walled stiffening profiles is that they may become unstable when subjected to axial compressive loads. Nonetheless, if this occurs, such structural members can continue to operate provided that the buckling is elastic. Such behaviour is typical of profiles made of GFRPs and CFRPs because these materials retain elastic characteristics in the full load range.

Load-carrying composite structures are exposed during operation to dynamic loads caused by low-velocity impact of foreign bodies. This is undesired as it may lead to local damage of the laminate and thus significantly reduce strength properties of the entire structure [4,5,6,7,8]. Richardson et al. [5] described the effect of low-velocity impact on the extent of damage in fibrous composites depending on the impact velocity and energy. These authors conclude that composite impact damage can be divided into internal impact damage and external impact damage, e.g. perforation. Composite