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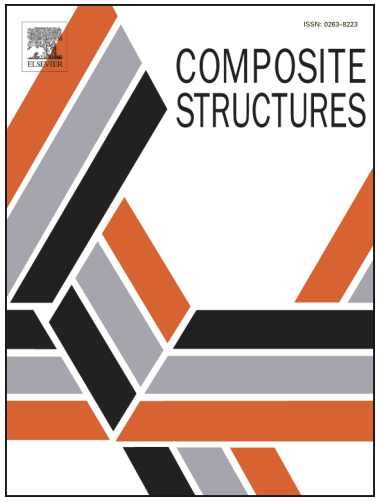

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Analysis of local and global localizations on the failure phenomenon of 3D interlock woven fabrics under ballistic impact

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ABSTRACT

In this work, the effects of global and local localizations impact on the ballistic behavior of 3D interlock woven fabric are investigated. The influence of global localization has on the failure process of textile materials can be validated by experimental data, while the effect of local localization needs a lot more sophisticated experimental testing to verify. The ballistic impact of 3D interlock woven fabric is tested with different impact locations. The fabric ballistic behaviors are compared in terms of projectile velocity evolution and the development of deformation pyramid. The effects of both localization modes are significant on the ballistic limit of fabric. During impact, the global localization affects the deformation of the whole fabric through the primary weft yarn pulled-out mainly on the side near the free edge of the fabric, while the impact location decides the failure mechanism of primary weft and warp yarns around impact location.

Keywords: *3D woven fabric; Ballistic impact; Numerical modeling; Dynamic behavior; Impact localization.*

1. Introduction

Nowadays, there is an increasing demand for materials with very high strength-to-weight ratio in ballistic protection to maximize the optimization of energy and to minimize the impact on the environment. A new challenging material in this application field is the 3D interlock woven fabrics. Indeed, 3D interlock woven fabrics have several advantages in comparison with plan-woven-fabrics, such as higher through-thickness and interlaminar properties, and offering the possibility to insert in each layer of stuffing yarns to give additional strength [1]. Although these structures are typically more expensive than plan-woven-fabrics and mats, they reduce labor, have higher performance, and improve efficiency, which results in overall cost savings in a variety of applications. When we compare the cost per square meter of finished composite structure, 3D woven fabric reinforcements consistently outperform traditional 2D materials [2].

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