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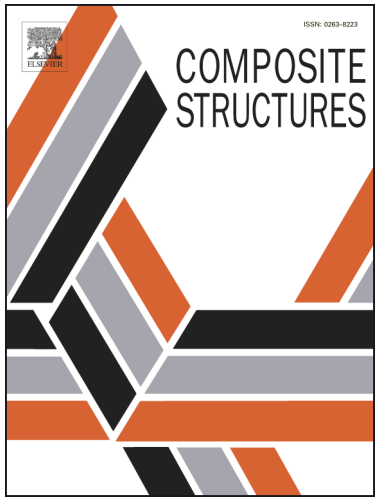

Energy absorption study considering crush test on carbon fiber/epoxy and carbon fiber/polyurethane structural composite beams

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ENERGY ABSORPTION STUDY CONSIDERING CRUSH TEST ON CARBON FIBER/EPOXY AND CARBON FIBER/POLYURETHANE STRUCTURAL COMPOSITE BEAMS

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ABSTRACT

Crashworthiness of a high-performance composite structure is associated to its energy absorption capacity through controlled failure mechanisms during an impact or crushing event. Furthermore, crush and compression testing usually characterize the failure mechanisms, which considers the specimen geometry, material type, fiber architecture and loading rate. This study focuses on energy absorption capability of carbon fiber/epoxy (CF/Epoxy) and carbon fiber/polyurethane (CF/PU) composite hat beams (HB) by a nonstandard quasi-static crush test for crashworthiness applications, including a discussion of how the material properties affect the structural behavior. In addition, the materials evaluation by low velocity impact (LVI), compression after impact (CAI) test, and in-plane shear response by tensile test was performed to determine and compare mechanical behavior and damage modes caused by the impact event. Despite the differences observed on the CF/Epoxy and CF/PU composites in terms of energy absorption capacity on impact, post-impact compression strength and shear strength, the HB specimens presented similar average crush force when subjected to the crush loading, but different types of failure modes. A multiple linear regression model has been developed which is able to predict the HB absorbed energy on crush considering the matrix behavior and energy absorption capability corresponding the failure mechanisms observed.

Keywords: Hat beam composites, energy absorption, crush test, failure modes

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