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Impact-Induced Mission Effects and Risk Assessments (3)

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AN OVERVIEW ON SMART BALLISTIC OPTIMIZATION FOR REPAIRING OF AEROSPACE EXOSTRUCTURES USING 3D PRINTED KEVLAR

Abstract

Impact resistance, weight and design process are key features of materials used in aerospace. Continuous Aramid Fibers (like Kevlar®) are widely used reinforcement for military and civil systems due to their excellent impact resistance and high strength-to-weight ratio properties. In recent years advancements in the aerospace sector revealed the need for improved repair strategies in case of damages, following a high-energy impact, such as a bullet or a space debris impact. Amongst the alternative approaches proposed, additive manufacturing represents a promising field of research allowing great flexibility in the design of multilayer protection shields and aerospace structures. The paper presents the roadmap to develop ballistic optimized 3D printed continuous fibers-based shields for aerospace high-energy impact applications. One of the core novelties is the multi-objective optimization procedure applied in the design of the experimental samples, which are evaluated through simulations and laboratory tests. The great advantage of this process will be its faster implementation in comparison with traditional methods and the high level of customization possible for specific cases. The described project will represent a paradigm shift for repairing procedures applied to inflatable manned modules in Space and for new and more efficient small satellites shields.