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EXPERIMENTAL AND NUMERICAL INVESTIGATION OF SPREAD TOW FABRIC COMPOSITES FOR BOOM APPLICATION

Abstract

Based-spread tow fabric composites have the potential of reducing structural mass while increasing performance of a composite structures. The aim of this work is to assess the additional benefits of using them for boom structures. In particular, the material bending properties influence both the boom packing efficiency during transport and its load bearing capability during operational life, thus playing a key role in the storage volumes required and the structural support provided. Therefore, the structural behaviour of the based-spread tow fabric composite booms under flexure loading scenario is investigated. In order to compare the behaviour of these booms with those made of the based-traditional ultrathin fabric, composite samples were fabricated and tested. The samples under investigation are made of two layers with an anti-symmetrical stacking sequence (+/-45), so that the boom exhibited the unique behavior of bistability. The same aerospace grade matrix was used for both composite types, thus narrowing the analysis to the implications of the choice of fabric only. The study was conducted experimentally carrying out three-point bending tests, platen folding tests and dynamic mechanical analysis (DMA). The results show that the based-spread tow fabric composites can achieve larger curvature before failure and have higher bending modulus with respect to the traditional one. Consequently, based-spread tow fabric composite boom exhibits smaller storage volumes and increased load bearing capacity respect to those realized with traditional ultrathin fabric technology.