



ADVANCED GRID STIFFENED COMPOSITE STRUCTURES

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ABSTRACT

Lattices of rigidly connected ribs, known as grid structures, have many advantages over the traditional construction methods, which use panels sandwich cores and/or expensive frame works [1]. Grids derive their global stiffness and strength from their ribs. Recently, Advanced Fiber Reinforced Polymer (FRP) Grid Stiffened (AGS) structures have been developed, which have the advantage of light weight, high strength, and inherent impact resistance. Because of the above advantages the AGS composite structures are finding many applications in Aerospace, Ship building and Construction industries [2]. Even though the AGS composite structures appear flawless they also have some inherent disadvantages like buckling particularly localized buckling and crippling [3, 4]. Obviously, the lack of lateral support is the underlying mechanism governing the local buckling failure. It is thus envisioned that if lateral supports are provided to the ribs, the local buckling resistance can be enhanced, while keeping the advantages of AGS composite structures. The purpose of this study is to conduct a local buckling analysis using a finite element modeling when the ribs are subjected to lateral supports. In this study, the lateral supports are simplified as a Winkler foundation. A cylindrical AGS tube, which is subjected to a coaxial compressive load, is investigated. Various types of lateral supports are considered. COSMOS/M software package is used to conduct the buckling analysis. The effect of the lateral supports on the local buckling resistance is evaluated based on the finite element modeling results. Currently, AGS cylinders are being prepared. The lateral supports will be provided by engaging various materials in the open panels between and among the ribs. Experimental study will be conducted to validate the modeling results.

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