COMPRESSIVE FAILURE BEHAVIORS OF COMPOSITE AND COMPOSITE SANDWICH STRUCTURE

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Abstract

The compressive strength of unidirectional fiber composites is normally lower than the tensile strength. In this talk, the compressive failure behaviors of unidirectional composites are characterized based on the microbuckling model with the consideration of initial fiber misalignment. In addition, the compressive failure tests of fiber composites are performed in terms of different testing techniques. From the experimental data, it is indicated that the stress concentration occurring in the clamping area can significantly lower the compressive strength of fiber composites. A design of testing method is proposed to reduce the stress concentration resulting in the higher experimental data.

Composite sandwich structures are composed of highly stiff composite face sheets and a low density foam core. The foam core is sandwiched between two face sheets, and the entire laminate is bonded together by using an adhesive to form a sandwich structure. During the manufacturing process or engineering application, a debond defect between the face sheet and foam core might be generated, substantially deteriorating the performance of the sandwich structure. The second part of the talk will focus on the failure behaviors of debond sandwich structures subjected to compressive loading. Experiments and numerical simulations are conducted to understand the effects of the face sheet thickness and debond length on the compressive strength and failure mechanisms of the composite sandwich structures. It is revealed that, when the dominant failure mode is global buckling, failure occurs at the intermediate portion of the foam core and strength could be characterized using the maximum principal strain criterion. However, when the failure mode is local buckling, failure is initiated at the debond tip, and strength could be predicted using the damage zone method.