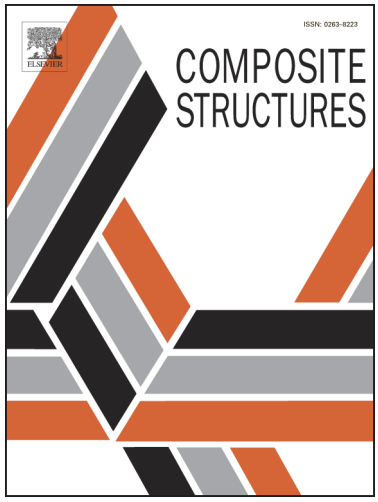

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Bending/tensile tests and simulations of the 2.5D woven T-shaped hooking composite structure

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ABSTRACT: The bending strength and the tensile strength are the important mechanical properties of T-shaped hooking composite structures, which are one of the connection structures in aero-engine. In this paper, a kind of 2.5D woven T-shaped hooking composite structure, which consists of a groove structure and a T-shaped structure, was designed and used for bending test and tensile test, respectively. Experimental results showed that the initial damages both occur at the root-edge of web, and then the damages extend to the root-middle in bending test or extend perpendicular to the root-edge to the edge of the flange in tensile test. Then, a strength prediction method of progressive damage for 2.5D woven T-shaped hooking composite structure based on three-unit-cell model was proposed and used to describe the mechanical behaviors and damage processes of the connecting structure under bending/tensile loads, respectively. The comparisons between the simulation results and tests showed that the maximum error of the bending/tensile strengths is less than 15% and the damage modes between tests and simulations are similar. Therefore, the predicted strengths are accurate and the strength prediction method of progressive damage proposed in this paper is effective.

Keywords: Bending test; Tensile Test; 2.5D woven T-shaped hooking composite structure; strength prediction method, failure mode.

1. Introduction

Due to the high specific strength/stiffness properties and improved fatigue life of fiber-reinforced resin matrix composites, they have made new breakthroughs in the development of key components of advanced aero-engines, such as the fan blade, fan case, compressor guide vane [1]. It is important to design the connection structure between vane and fan case during the application in aero-engines of composites. According to the traditional design experiences, T-shaped hooking composite structures may be one of the valuable connection structures for their dismounting convenience and simple mechanism. Considering the vanes will subjected to the out-of-plane loads during service, 2.5D woven composites will be feasible for vane due to their favorable delamination resistance properties.

Recently, 2.5D woven composites have attracted many attentions due to their excellent mechanical properties. Dalmaz [2-4] studied the mechanical properties of 2.5D C/SiC composite