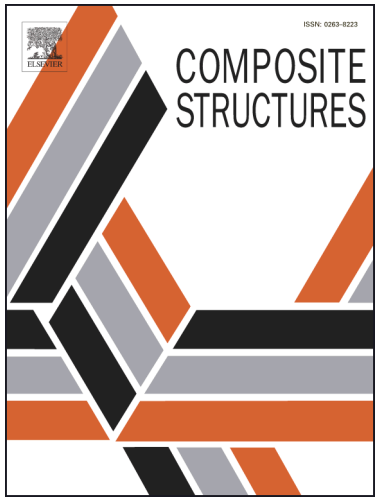

Failure prediction of composite sandwich L-joint under bending

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Failure prediction of composite sandwich L-joint under bending

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Abstract:

This article studies failure prediction of composite sandwich L-joint under bending. Five specimens have been tested to failure and numerical model has been established to predict load bearing capacity of such joint. Progressive damage model (PDM) technique is used in numerical simulation. Failure load and damage locations via numerical modelling have been experimentally verified. Relationship between failure load and geometric parameters of stiffener has been established based on dimensional analysis. Based on the comparison with FEM prediction and test result, it has been validated that the proposed expression is capable of predicting failure load with certain accuracy. Influence of each geometric parameter is clearly shown in the expression and the proposed model provides a reference for joint design.

Keywords: sandwich composites; L-joint; failure prediction; dimensional analysis

1 Introduction

Composite sandwich structures have been widely used in automation, shipbuilding and aerospace. For the configuration of sandwich composites, composite skins with higher modulus and thinner thickness, are designed to bear tensile and compression loads. And the role of the soft and thick core is to separate skins and transfer shear loads. Some studies have been carried out on the mechanical properties of sandwich composite beams and plates. Steeves and Fleck [1,2] have performed experimental investigation and numerical simulation for simply supported sandwich composite beams subjected to three-point bending(TPB). Failure maps have been constructed to reveal the collapse mechanism by connecting the failure mode with geometry of the beam. Similar study on the behavior of sandwich panels under four-point bending (FPB) has been done by Mostafa et al. [3]. Some researchers have studied the buckling and post-buckling behavior of sandwich constructions [4-6]. These investigations mainly focus on the analysis of simple sandwich structures, specifically beams and plates.

For actual engineering structures, connections between different parts are inevitable and basic strength requirements should be satisfied to ensure the safety during service. For composite ship structures, the hull frame consists of transversal and longitudinal girders [7]. Transversal and longitudinal girders are connected to the hull plates, as shown in Fig.1 [8]. It can be seen that load transfer between side plate and deck is achieved by means of L-joint configuration, as marked by dashed circle in Fig.1. This kind of L-joints is mainly subjected to bending load during service.