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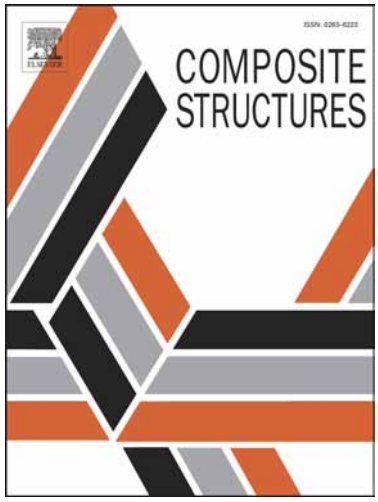

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Elastic Constants for adhesively bonded corrugated core sandwich panels

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Abstract: In this paper, the adhesively bonded corrugated core sandwich panel is introduced and its elastic properties are discussed. Due to the relative displacement and rotation between face and core plates in adhesive joints caused by adhesive layer distortion, traditional elastic constants with considering both face and core plates to be fastened to each other are no longer fit for adhesively bonded sandwich panels. Therefore, its elastic constants with effect of adhesive layer distortion have been derived and presented in this paper. By submitting these elastic constants into closed-form solution, the response of simply supported sandwich panel under uniform load with small deflection is calculated which agrees well with 3D FEM analysis. Lastly, with the elastic constants, the effects of adhesive layer thickness and its elastic modules on both transverse shear stiffnesses with different shapes and dimensions are further studied and discussed.

Key Words: sandwich panels; adhesively bonded; corrugated core; elastic constants

1 Introduction

Sandwich panels are three-layer composite structures consisting of two thin outside face plates and a thick but low density core plate between them. Sandwich panels have been widely used in shipbuilding, making of high-speed trains and the construction industry given their higher stiffness and strength to weight ratios as compared to the thick homogeneous panels [1,2]. Among the key joining processes is the adhesively bonding process that can connect two different materials while distributing the stress uniformly over bonded regions but with better fatigue performance as compared to laser welding process [3,4].

Although elastic constants of sandwich structures are important in both engineering design and scientific research, they are more complicated and difficult to evaluate than homogeneous plates. Since the types of core plates are varied from each other, the expressions of their elastic constants are quite different [5–8]. Normally, the equivalent homogeneous orthotropic model theory which considers the sandwich panel as a continuous and homogeneous but orthotropic thick plate is an efficient method to obtain the elastic constants and deformation of sandwich panel [9–14]. For

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