EFFECT OF SHEAR DEFORMATION ON THE FUNDAMENTALFREQUENCIES OF COMPOSITE LAMINATES IN DIFFERENT THICKNESS

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Keywords: Composite, Laminate, Fundamental Frequency, Mode Shape

ABSTRACT

Using of composite materials in the structures has increased dramatically in the past two decades, due to the unique advantages of these materials such as high strength to weight ratio and selection of required material properties in desired directions. The composite materials commonly arecomposed frommultiplelaminates. Preciseknowledgeabout natural frequencies of the laminates is of particular importance for investigating their behavior. Classic theory is often used for analysing composite laminates whih does not onsider shear deformation. In this paper, several plates are modelled in ANSYS program and then frequency and mode shapes are calculated and compared with the exact solution in literature. After model validation, the laminates with different boundary conditions and different thickness are analyzed in ANSYS software and the result of Mindlin theory and classical theory are compared. The results show that for thickness to width ratioless than0.005, the fundamental frequency in Mindlin theory and classical theory are approximately the same.

INTRODUCTION

The using of composite materials in the structures is growing rapidly, primarily because of the very high strength to weight ratio, and secondly strength of composite materials can beincreased in the arbitrary direction and also other parameters such as thermal expansion coefficient, electrical resistivity, etc. can be changed according to need. Composite materials are composed from two main parts, reinforced phase and the matrix phase. Matrix phase is usually ceramics, metals or polymers, that protect reinforce phase. Reinforced phases are constructed usually from fibers, flaks, or particles as shown in Figure 1. When reinforced phase of composite materials are particle or flakes, they are analyzed as an isotropic material such as concrete, because their directivityis random. Wheredirections of fibers are deterministic, the composite materials that are reinforced with fibers have orthotropic properties.