Optimization of laminate stacking sequence for maximum buckling load of Mindlin plates

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ABSTRACT

The main objective of the study is to use genetic algorithm for the buckling optimization rotationally restrained laminated plates. Mindlin plate theory considering the first-order shear deformation effect, is used to extract characteristic equations of the plate under in-plane load. The buckling problem of laminated plate is analyzed by Rayleigh–Ritz method. Using Genetic Algorithm method, the aim of the optimization is to maximize the buckling load capacity and the design variable is the ply orientation. For validation of the formulas, the numerical results that obtained by MATLAB programing have been compared with the Abaqus software results. The results showed a good correlation between the outputs.

Keywords: Stacking sequence optimization, Mindlin plate theory, uniaxial and biaxial buckling load, Genetic Algorithm

1. INTRODUCTION

Polymer matrix laminated composites have been used due to their low weight, high strength, high stiffness, and corrosion properties in structural, aerospace, marine and automotive industries. Composites structures generally are modeled as shell, plate or beam, thus the behaviors of them are important to understand the response of the structures under various loadings [1-3]. The variation of plies thickness, plies orientation as well as stacking sequence make easy and possible to tailoring for achieving the desired mechanical properties, such as in-plane, flexural and buckling behavior of composite laminates. It is the reason of the optimization of composite laminates has attracted and increased attention [4-7].

There are several methods for obtaining the critical buckling load in isotropic and orthotropic plates. One of the best methods is Mindlin plate theory. Mindlin plate theory introduced by Mindlin et al. [8] who modified the classical