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Stability Characteristics of Angle Ply Bi-Stable Laminates by Considering the Effect of Resin Layers

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Abstract : In this study, the stability characteristics of a bi-stable composite plate with different asymmetric composition are considered. The interest in bi-stable structures comes from their ability that these structures can have two different stable equilibrium configurations to define a discrete set of stable shapes. The structures can easily change the first stable shape to the second one by a simple snap action. The main purpose of the current research is to consider the effect of including resin layers on the stability characteristics of bi-stable laminates. To this end and In order to determine the magnitude of the loads that are responsible for snap through and snap back phenomena between two stable shapes of the laminate, a non-linear finite element method (FEM) is utilized. An experimental investigation was also carried out to study the critical loads that caused snapping between two different stable shapes. Several specimens were manufactured from T300/5208 graphite-epoxy with [0/90]T, [-30/60]T, [-20/70]T asymmetric stacking sequence. In order to create an accurate finite element model, different thickness of resin layers created during the manufacturing process of the laminate was measured and taken into account. The geometry of each lamina and the resin layers was characterized by optical microscopy from different locations of the laminates thickness. The exact thickness of each lamina and the resin layer in all specimens with [0/90]T,[-30/60]T, [-20/70]T stacking sequence were determined by using image processing technique.

Keywords : bi-stable laminates, finite element method, graphite-epoxy plate, snap behavior
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