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Design and optimization of defense hole system for shear loaded laminates
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Abstract
Reducing stress and weight of structures are most important to structural designers. Most engineering structures are an assembly of different parts. On most of these structures, parts are assembled by bolts, rivets, et cetera; this riveted and bolted structure is highly used in aerospace industry. Defense hole theory deals with introducing auxiliary holes beside the main hole to reduce the stress concentration by smoothing the stress trajectories in the vicinity of the main hole. These holes are introduced in the areas of low stresses that appear near the main circular hole. Defense hole system under shear loading is investigated. The optimum defense hole system parameters for a circular hole in an infinite laminated composite plate are unveiled. This study is conducted using finite element method by utilizing commercial software package. The finite element model is verified experimentally using RGB-Photoelasticity. Digital Image Processing is utilized to analyze the photoelastic images. Stress concentrations associated with circular holes in pure biaxial shear-loaded laminates can be reduced by up to 20.56%. This significant reduction is made possible by introducing elliptical auxiliary holes along the principal stress direction. The effect of the stacking sequence, the fiber orientation, and the stiffness of both the fiber and the matrix are investigated. © 2012, IGI Global.

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