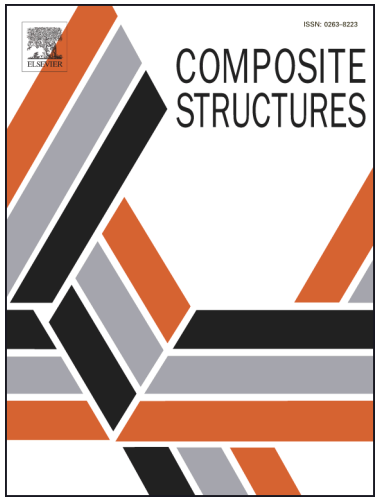

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Buckling Optimization of Variable-Stiffness Composite Panels based on Flow Field Function

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Due to the non-uniform in-plane stress distribution, variable-stiffness panel with curvilinear fiber paths is a promising structural concept for cutout reinforcement of composite structures under axial compression, due to the more diverse tailorability opportunities than simply choosing the best straight stacking sequence. However, traditional representation methods of curvilinear fiber path are usually not flexible for cutout reinforcement. In this study, the flow field function containing a uniform field and several vortex fields is utilized to represent the fiber path due to its inherent non-intersect and orthotropic features, and a bi-level optimization framework of variable-stiffness panels considering manufacturing constraints is then proposed. A typical rectangular composite panel with multiple cutouts is established to demonstrate the advantage of proposed framework by comparison with other fiber path functions. Results indicate that the flow fiber path only needs few variables to finely represent the fiber path, which can provide satisfying and manufacturable fiber paths by combination use of curvature constraint.

Keywords: variable-stiffness panels; cutout; buckling; fiber path; optimization; flow field function

I..... Introduction

Buckling is the main failure mode for composite thin-walled panels under axial load or combined load [1]-[9]. Cutouts are widely existed in various branches of thin-walled structures to accommodate the need of easy access,