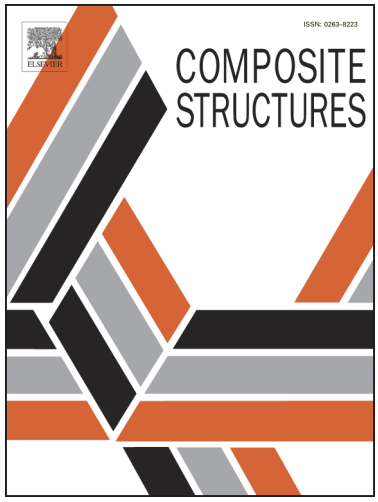

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Design, Manufacturing and Testing of A Fibre Steered Panel with A Large Cut-out

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Abstract

Variable stiffness composites, where fibre angles are spatially varied by steering the tows in curvilinear paths to optimise the structural response, have been a subject of intensive study. In this paper, experimental validation of the variable stiffness composite technology is carried out for a panel representing a wing lower-skin with a large access hole designed against material failure. An idealised flat panel with a large cut-out under tension or combined tension and shear is modeled using finite elements. In addition to a quasi-isotropic laminate, constant stiffness and variable stiffness laminates are designed to maximise the failure load using a multi-step optimisation framework. Three panels, one for each type of laminate, are built from thermoset prepreg material using automated fibre placement. All three panels are tested in pure tension. The failure loads, failure modes and weights of the tested panels are compared. The results indicate that the variable stiffness laminate is capable of sustaining significantly larger loads, before failure, than the constant stiffness and quasi-isotropic laminates of equal weight.

Keywords: Variable Stiffness Laminate, Fibre steering, Strength, Failure criterion, Stress concentrations

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