

TOPOLOGY AND LAY-UP OPTIMIZATION OF MULTI-LAYERED COMPOSITE MATERIALS

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Keywords: Level set method, Topology Optimization, Stacking sequence optimization, Composite materials, Integer programming, Point-wise constraints.

Abstract. *This work is devoted to multi-layered composite design in aerospace structures. We determine the optimal fiber orientation, stacking sequence and topology of a composite multi-layered structure where each layer is modeled as biphasic orthotropic linearly elastic membrane. The objective function to be minimized is the weight of the composite structure under a global rigidity constraint and a point-wise buckling constraint. Due to the double discrete and continuous nature of the problem, we propose a numerical algorithm for fiber orientation and stacking sequence optimization based on non-linear integer programming coupled to a level set method controlled by a shape and topological sensitivity analysis for the topology optimization. A 2-d airplane fuselage section test case is discussed.*