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Optimization of the mass of laminated composite structures stressed in membrane and bending

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ABSTRACT

Nowadays, industrialists are more and more interested in integrating composite parts into their creations, especially in aerospace, naval, and railway. Where these materials present many advantages, in particular, that allow a reduction of the mass of the parts when they are correctly exploited. Laminated composites offer the greatest flexibility, as they allow a variation in the thickness of the stacks throughout the structure made of composite materials often have the characteristic of being modular structures, i.e. constituted by the assembly of several elementary units. Optimization is the process of designing structures that best meet a given set of criteria. The weight optimization of laminated composite structures is of primary interest especially when one is interested in aeronautical applications, and in order to achieve an efficient optimization, it is then necessary to take into account the optimization variables (materials, orientations, thicknesses of the layers as well as the total number of layers n). This introduces complications both in the formulation and in the solution of the associated optimization problems. In this study, we propose to develop an efficient numerical optimization method to solve the optimal design problem of a laminated structure (with glass/epoxy UD plies) solicited in membrane, bending, or membrane-bending coupling using the classical theory of laminates (CTL) and the two software *Scilab* and *Castem* for the validation of the obtained results (constraints and homogenization)

Keywords: *Composite material; Classical theory of laminates; Homogénéisation;Optimisation.*