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Structural Optimization of Composite Shell Structures Using a Discrete Constitutive Parameterization

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The objective of this paper is to present a novel method for structural optimization of composite laminated shell structures where the design objective is chosen to be a global quantity such as maximum stiffness or maximum lowest eigenfrequency with a mass constraint. The problem is then to choose between a number of composite materials, oriented at given discrete angles, and foam materials, thereby allowing the formation of areas with sandwich structures. In order to solve this discrete design problem the mixed materials strategy suggested by Sigmund & Torquato (1997) where the total material stiffness is computed as a weighted sum of possible materials is used. Several new parameterization schemes have been developed, and examples involving challenging real life design problems such as wind turbine blades will illustrate the potential of the method to solve the combinatorial problem of proper choice of material, stacking sequence and fiber orientation simultaneously.

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