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Abstract

The paper presents a global numerical approach for lightweight design optimization of laminated composite plates subjected to frequency constraints. In these optimization problems, the objective function is to minimize the weight of the whole laminated composite plate. The design variables are fiber volume fractions and thicknesses of layers, in which the fiber volume fractions are continuous variables and the thicknesses of layers are discrete variables. The constraints include the frequency constraint, fiber volume fractions and thicknesses of the layers. For analyzing the behavior of laminated composite plates, a recently proposed smoothed finite element method named the cell-based smoothed discrete shear gap method (CS-DSG3) is employed. For solving the current optimization problems which contain both integer and continuous variables, a recently proposed adaptive elitist differential evolution (aeDE) algorithm is applied. The reliability and effectiveness of the proposed approach are demonstrated through two numerical examples. Additionally, the influence of various boundary conditions on the optimal solution is also investigated and the comparison between the obtained results with those gained by previous authors is also discussed.

Keywords: *laminated composite plates*, *lightweight design*, *differential evolution*, *smoothed finite element method*, *mixed variable optimization, frequency constraints*.

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