Extended Layerwise Optimization for Vibration and Buckling Design of Laminated Composite Plates

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It is widely known that advance composite materials are cost-effective in weight-sensitive structures, such as aircraft and spacecraft, not only due to stiffness-to-weight ratio but to the tailoring capability. Many computational researches have therefore resulted to develop numerical approaches for analysis and optimization. A layerwise optimization (LO) approach was previously proposed by the author for the lay-up optimization problem of laminated composite plates, and has been extended in many applications. Various structural analysis methods, including semi-analytical Ritz method, self-made FEM and commercial FEM, are accommodated in the LO optimization scheme. In such lay-up design problems, the problems usually cause rapid increase in computation time due to the search for optimum solutions of the multi-dimensional space, when design variables are taken to be the fiber orientation angles directly in all layers. The LO makes it possible, however, that this multi-dimensional optimization problem can be reduced into only K times repetition of one-dimensional search. In the present study, further extension of the LO method is proposed to obtain more accurate optimum solutions. In numerical results, some improvements are demonstrated in global solution search of the lay-up design for vibration and buckling of laminated composite plates.