Paper Title: A Study on the Effect of Several Modelling and Analysis Parameters on the Optimization of Composite Laminates for Vibro-acoustic Requirements

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Text of the Abstract

Optimization of laminated composite structures for mechanical and vibro-acoustic requirements often involves alteration of stiffness distribution and structure thickness. This process requires accurate models and methods. The results can change significantly depending on the values of the modelling parameters and the analysis methods used for the optimization. Hence having prior knowledge on their effect is essential for being well aware of the design methodology options and choosing the most appropriate one; also for validation and justification of the results. Therefore, the investigation and quantification of the modelling and analysis parameter effects in the optimization of composite structures is important.

The optimum design for the laminated composited can be found by analytical means for relatively simpler problems and by using finite element simulations for more complex ones. In order to work on a convex domain the modelling the technique called lamination parameters is used which provides means to represent the overall stiffness behavior. This removes the dependency of the optimum to the assumptions on the number of plies, ply thicknesses and initial configuration. Individual and combined effect of the parameters can be studied using design of experiment methods (DoE) methods.

In this paper, the several problem variables that affect the stiffness optimization results of composite panels are investigated. Design sensitivity analyses are conducted with respect to physical model parameters such as thickness and panel aspect ratio. In addition, the influence of the numerical solution parameters such as mesh density and initial design points is analyzed. The effects of each parameter on the several vibro-acoustic responses are quantified. In the optimization processes, DoE-based and gradient-based methods are used. Studies combining different responses and optimization methods have been carried out and their combined implications are presented.