11th World Congress on Structural and Multidisciplinary Optimisation
07th -12th, June 2015, Sydney Australia

On objective functions of minimizing the vibration response of continuum structures subjected to external excitation

Bin Niu[1], Xiaomeng He[1] and Rui Yang[1]

[1] Dalian University of Technology, China

Abstract

This work deals with the topological design of vibrating continuum structures. The vibration of continuum structure is excited by time-harmonic external mechanical loading with prescribed frequency and amplitude. In comparison with well-known compliance minimization in static topology optimization, various objective functions are proposed in literature to minimize the response of vibrating structures, such as power flow, sound radiation, vibration transmission, and dynamic compliances, etc. Even for the dynamic compliance, different definitions are found in literature, which have quite different formulations and great influences on the optimization results. The aim of this paper is to provide a comparison of these different objective functions for design optimization of vibrating problems. Plane and plate structures are optimized using different optimization formulations in numerical examples for given excitation frequencies. The results are obtained by the finite element method and gradient based optimization using analytical sensitivity analysis. The optimized topologies, the iteration histories, and vibration response of the optimized structures are presented. The influence of excitation frequencies, the eigenfrequencies of the structure, damping are discussed in the numerical examples.