Accepted Manuscript

Active vibration attenuation in viscoelastic laminated composite panels using multiobjective optimization

Ndilokelwa F. Luis, J.F.A. Madeira, A.L. Araújo, A.J.M. Ferreira

PII: S1359-8368(17)30395-5

DOI: 10.1016/j.compositesb.2017.07.002

Reference: JCOMB 5137

To appear in: *Composites Part B*

Received Date: 2 February 2017

Revised Date: 29 June 2017

Accepted Date: 1 July 2017

Please cite this article as: Luis NF, Madeira JFA, Araújo AL, Ferreira AJM, Active vibration attenuation in viscoelastic laminated composite panels using multiobjective optimization, *Composites Part B* (2017), doi: 10.1016/j.compositesb.2017.07.002.

Active vibration attenuation in viscoelastic laminated composite panels using multiobjective optimization

Ndilokelwa F. Luis[a], J.F.A. Madeira[a,b], A.L. Araújo[a,*], A.J.M. Ferreira[c]

[a] *IDMEC, Instituto Superior Técnico, Universidade de Lisboa, Portugal*
[b] *ISEL – Instituto Superior de Engenharia de Lisboa, Portugal*
[c] *Department of Mechanical Engineering, Faculty of Engineering, Universidade do Porto, Portugal*

Abstract

The optimal design of viscoelastic laminated composite panels with active piezoelectric patches is addressed in this paper. Constrained optimization is conducted to determine optimal distributions of piezoelectric patches on the top and bottom surfaces of laminated plates with viscoelastic layers. The design variables are the number and position of these patches, and the objectives are the minimization of the number of patches, the maximization of the fundamental modal loss factor and the maximization of the fundamental natural frequency. The problem is solved using the Direct MultiSearch (DMS) solver for derivative-free MultiObjective Optimization (MOO). The objective functions are evaluated by a finite element model that was developed for laminated sandwich plates incorporating piezoelectric or viscoelastic layers. Trade-off Pareto optimal fronts and the respective optimal active patch configurations are obtained and the results are analyzed and discussed.

Keywords: Laminated composite; Direct MultiSearch; Piezoelectric patches; Active control; Vibration; Damping; Viscoelastic.

1. Introduction

In the last decades, laminated composite structures have been widely used in aeronautic and aerospace applications. Normally, applications with composite structures in the aerospace field consist of large and lightweight panels, which are prone to vibration problems. The use of both passive and active treatments for structural energy dissipation is an efficient way of reducing vibration levels in lightweight structures. Passive treatments are achieved by incorporating viscoelastic

*Corresponding author. Tel: +351 218 417 453; Fax: +351 218 417 915.
Email address: aurelio.araujo@tecnico.ulisboa.pt (A.L. Araújo)