Title: Dimensionless analysis of constrained damping treatments

Author(s): Sher, B. R. [1]; Moreira, R. A. S. [2]

Source: Composite Structures **Volume:** 99 **Pages:** 241-254
DOI: 10.1016/j.compstruct.2012.11.037 **Published:** May 2013

Document Type: Article

Language: English

Abstract: One of the most effective ways of controlling vibrations in plate or beam structures is by means of constrained viscoelastic damping treatments. Contrary to the unconstrained configuration, the design of constrained and integrated layer damping treatments is multifaceted because the thickness of the viscoelastic layer acts distinctly on the two main counterparts of the strain energy the volume of viscoelastic material and the shear strain field. In this work, a parametric study is performed exploring the effect that the design parameters, namely the thickness/length ratio, constraining layer thickness, material modulus, natural mode and boundary conditions have on these two counterparts and subsequently, on the treatment efficiency. This paper presents five parametric studies, namely, the thickness/length ratio, the constraining layer thickness, material properties, natural mode and boundary conditions. The results obtained evidence an interesting effect when dealing with very thin viscoelastic layers that contradicts the standard treatment efficiency vs. layer thickness relation; hence, the potential optimisation of constrained and integrated viscoelastic treatments through the use of properly designed thin multilayer configurations is justified. This work presents a dimensionless analysis and provides useful general guidelines for the efficient design of constrained and integrated damping treatments based on single or multi-layer configurations.

Author Keywords: Viscoelastic damping; Modal strain energy; Thin layers; Thickness optimisation; Dimensionless loss factor

Keywords Plus: Layerwise Finite-Element; Viscoelastic Layers; Sandwich Beam; Vibration Plates; Model; Core

Reprint Address: Sher, BR (reprint author) - Inst Super Engn Lisboa, Rua Conselheiro Emídio Navarro 1, P-1959007 Lisbon, Portugal.

Addresses:
[1] Inst Super Engn Lisboa, P-1959007 Lisbon, Portugal
[2] Univ Aveiro, Dept Engeh Mecan, P-3810193 Aveiro, Portugal

E-mail Addresses: bsher@dem.isel.pt; rmoreira@ua.pt

Publisher: Elsevier SCI LTD
Publisher Address: The Boulevard, Langford Lane, Klidlington, Oxford OX5 1GB, Oxon, England
ISSN: 0263-8223

Citation: SHER, B. R.; MOREIRA, R. A. S. - Dimensionless analysis of constrained damping treatments. Composite Structures. ISSN 0263-8223. Vol. 99 (2013), p. 241-254.