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TRANSIENT AND HARMONIC RESPONSE OF A SANDWICH WITH PARTIAL CONSTRAINED LAYER DAMPING: A PARAMETRIC STUDY

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Abstract

The aim of this paper is to present a parametric study of PCLD (partial constraining layer damping) characteristics on the response of a rectangular plate. Both harmonic and transient regimes are considered. In harmonic response, natural frequencies and loss factors are studied, while in transient response, where the external force is an impact, displacement and acoustic pressure are analyzed. The governing equation is obtained from Lagrange's equations. The viscoelastic behaviour of the core, which depends on frequency, is represented by Prony series. Once obtained, the governing equation is solved in frequency domain using Fast Fourier Transform (FFT). The solution is then converted back into time domain with the Inverse Fast Fourier Transform (IFFT).The model was validated in our previous paper, Ref. [B. Khalfi and A. Ross, "Transient Response of A Plate With Partial Constrained Viscoelastic Layer Damping," International Journal of Mechanical Sciences, http://dx.doi.org/10.1016/j.ijmecsci.2013.01.032, 2013] with experimental results, in this paper other validation with literature using a plate with PCLD is also made. The simulation results show that patch geometry has a significant effect on the vibration behaviour of the sandwich. Several conclusions were obtained: (a) Identification of the proportions of different layer thickness for optimal damping, (b) Definition of areas in the plate promoting maximum shear in the viscoelastic layer, (c) Existence of a relationship between loss factor and deformation mode. The originality of this work comes from the capacity of the model to study the influence of any input parameter on the behaviour of the sandwich in harmonic response as well as in transient response.

Keywords: A. Plates; B. Vibration; B. Internal friction/damping; B. Impact behaviour;

C. Analytical modelling.

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