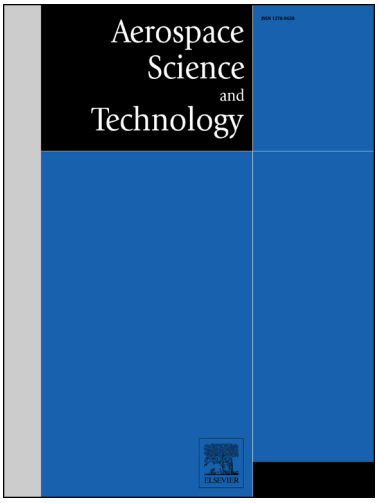
Accepted Manuscript



Smart control and vibration of viscoelastic actuator-multiphase nanocomposite conical shells-sensor considering hygrothermal load based on layerwise theory

Mohammad Hadi Hajmohammad, Ahmad Farrokhian, Reza Kolahchi

PII: S1270-9638(18)30017-8
DOI: https://doi.org/10.1016/j.ast.2018.04.030
Reference: AESCTE 4535

To appear in: *Aerospace Science and Technology*

Received date: 4 January 2018
Revised date: 15 April 2018
Accepted date: 16 April 2018

Please cite this article in press as: M.H. Hajmohammad et al., Smart control and vibration of viscoelastic actuator-multiphase nanocomposite conical shells-sensor considering hygrothermal load based on layerwise theory, *Aerosp. Sci. Technol.* (2018), https://doi.org/10.1016/j.ast.2018.04.030

Smart control and vibration of viscoelastic actuator-multiphase nanocomposite conical shells-sensor considering hygrothermal load based on layerwise theory

Mohammad Hadi Hajmohammad[1], Ahmad Farrokhian[1], Reza Kolahchi[2*]

[1]Department of Mechanical Engineering, Imam Hossein University, Tehran, Iran

[2]Department of Civil Engineering, Meymeh Branch, Islamic Azad University, Meymeh, Iran

Abstract

Smart control and vibration analysis of laminated sandwich truncated conical shells with piezoelectric layers as sensor and actuator are presented in this paper. The core of the sandwich structure is reinforced by carbon fibers and carbon nanotubes (CNTs) where the effective material properties are obtained by Halpin-Tsai model. The actuator layer is subjected to external voltage and a Proportional-Derivative (PD) controller is used for sensor output control. Based on Kelvin-Voigt model, the structural damping effects are assumed. The formulation of the problem is based on the layerwise first order shear deformation theory (FSDT). Considering the continuity of the displacements and the internal stress fields at the interfaces of the layers, the motion equations are derived utilizing Hamilton's principle. The solution of the problem is carried out by differential quadrature method (DQM) for calculating the frequency of the smart sandwich structure. The effects of different parameters such as structural damping, weight percent of CNTs, boundary conditions, geometrical parameters of the structure, semi vertex angle of the cone, external voltage, temperature and moisture changes are examined on the vibration response of the smart sandwich structure. Numerical results indicate that using a PD controller can increase the frequency of the structure. In addition, the hygrothermal load decreases the vibration frequency of the system.

Keywords: Vibration, Sandwich truncated conical shells, Sensor and actuator, Structural damping, Hygrothermal load.

* Corresponding author email: r.kolahchi@gmail.com