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Control of Large Amplitude Vibrations of Doubly Curved Sandwich Shells Composed of Fuzzy Fiber Reinforced Composite Facings

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Abstract

This paper is concerned with the analysis of active constrained layer damping (ACLD) of geometrically nonlinear vibrations of doubly curved sandwich shells with facings composed of fuzzy fiber reinforced composite (FFRC). FFRC is a novel composite where the short carbon nanotubes (CNTs) which are either straight or wavy are radially grown on the periphery of the long continuous carbon fiber reinforcements. The plane of waviness of the CNTs is coplanar with the plane of carbon fiber. The constraining layer of the ACLD treatment is composed of the vertically/obliquely reinforced 1-3 piezoelectric composites (PZCs) while the constrained viscoelastic layer has been sandwiched between the substrate and the PZC layer. The Golla–Hughes–McTavish (GHM) method has been implemented to model the constrained viscoelastic layer of the ACLD treatment in time domain. A three dimensional finite element (FE) model of smart doubly curved FFRC sandwich shells integrated with ACLD patches has been developed to investigate the performance of these patches for controlling the geometrically nonlinear vibrations of these shells. This study reveals that the performance of the ACLD patches for controlling the geometrically nonlinear vibrations of the doubly curved sandwich shells is better in the case of the facings composed of laminated FFRC than that in the case of the facings made of conventional orthotropic laminated composite. The research carried out in this paper brings to light that even the wavy CNTs can be properly utilized for attaining structural benefits from the exceptional elastic properties of CNTs.

Keywords: Fuzzy fiber, 1-3 Piezoelectric composite (**PZC**), Smart doubly curved Sandwich shells, active constrained layer damping (**ACLD**), nonlinear vibrations.

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