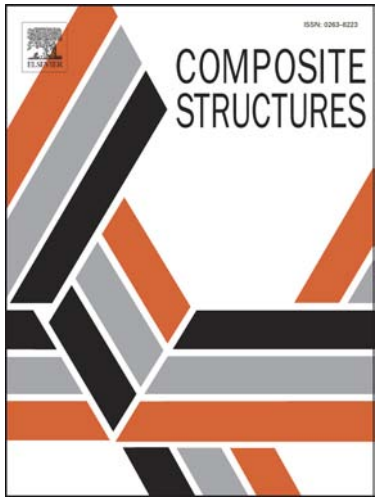

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Damping Mechanism of Elastic-Viscoelastic-Elastic Sandwich Structures

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Abstract: There exist two kinds of damping mechanisms in elastic-viscoelastic-elastic (EVE) sandwich structures, namely the shear and compressional damping mechanisms. The former makes the fundamental assumption that the longitudinal shear deformation in the viscoelastic core yields the damping and the transverse compressive deformation is negligible. On the contrary, the latter assumes that the vibration energy is dissipated only through the transverse compressive deformation of the viscoelastic core. However, their scope of application has not been thoroughly studied. In this paper, two integral finite element (FE) models, based on the two damping mechanisms, respectively, are presented to model the EVE sandwich beam structures. In the FE models, the frequency-dependant viscoelastic material properties are depicted using the Golla–Hughes–McTavish (GHM) model. A series of experiments are carried out for the EVE sandwich beams with different layer thicknesses. The experimental and numerical results obtained through the two FE models are compared to investigate the scope of application of the two damping mechanisms.

Keywords: sandwich beam; damping mechanism; dynamic analysis; finite element method

1. Instruction

Vibration and noise control are essential for mechanical structures to achieve desirable performance. As an effective and successful passive damping treatment technique, the elastic-viscoelastic-elastic (EVE) sandwich structures have been extensively used in many structural systems to reduce vibration and vibration-induced noise [1]. **Figure 1** shows a typical EVE sandwich beam structure. The high-damping viscoelastic material layer is