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Bending analysis of FG viscoelastic sandwich beams with elastic cores resting on Pasternak's elastic foundations

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Abstract The investigation of bending response of a simply supported functionally graded (FG) viscoelastic sandwich beam with elastic core resting on Pasternak's elastic foundations is presented. The faces of the sandwich beam are made of FG viscoelastic material while the core is still elastic. Material properties are graded from the elastic interfaces through the viscoelastic faces of the beam. The elastic parameters of the faces are considered to be varying according to a power-law distribution in terms of the volume fraction of the constituent. The interaction between the beam and the foundations is included in the formulation. Numerical results for deflections and stresses obtained using the refined sinusoidal shear deformation beam theory are compared with those obtained using the simple sinusoidal shear deformation beam theory, higher- and first-order shear deformation beam theories. The effects due to material distribution, span-to-thickness ratio, foundation stiffness and time parameter on the deflection and stresses are investigated.

1 Introduction

Sandwich structures are often found in aerospace applications such as in the skin of wings, vertical fin torque box, aileron, spoilers, etc. The advantages of these structures are that they provide high specific stiffness and strength-to-weight ratios, good fatigue properties, good thermal and acoustical insulation and ease of mass production [1]. Recently, sandwich construction becomes even more attractive due to the introduction of advanced composite materials for the faces and the core. Considerable effort has been devoted to study viscoelastic sandwich beam problems, with relatively little work directed toward developing numerical models that might be applicable to more general beams and support conditions.

The damping behavior of a 0° laminated sandwich composite beam inserted with a viscoelastic layer is investigated by Yim et al. [2]. Barbosa and Farage [3] studied a sandwich viscoelastic beam based on a finite element model. In this work, an assessment of a time-domain formulation for numerical modelling of viscoelastic materials was made. This formulation is based on a second-order time-domain realization of Laplace-domain

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