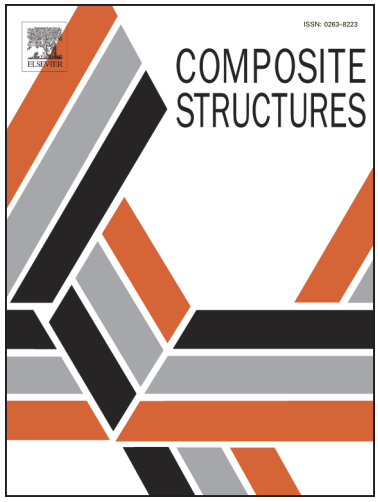

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Vibration and bending analysis of a sandwich microbeam with two integrated piezo-magnetic face-sheets

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Abstract. In this paper free vibration and bending analyses of a sandwich microbeam with two integrated piezo-magnetic layers as sensor and actuator are studied. Strain gradient theory of micro-structures is used to derive the governing equations of motion. First-order shear deformation theory as well as strain gradient theory is used for this purpose. The micro-piezo-magnetic layers are subjected to applied electric and magnetic potentials. The sandwich microbeam rests on visco-Winkler-Pasternak foundation. Electric and magnetic potentials are assumed as combination of linear function along the thickness direction that reflects applied electric and magnetic potentials and a cosine function that satisfies boundary conditions. Numerical results of this problem investigates the effect of some important parameters of sandwich microplate such as three micro length scale parameters, applied electric and magnetic potentials and parameters of foundation on the magneto-electro-mechanical responses of the problem.

Keywords: Magneto-electro-mechanical analysis, First-order shear deformation theory, Applied electric and magnetic potential, Visco-Pasternak foundation, Micro length scale parameters, Sandwich microbeam.

1. Introduction

Researchers have found this fact that the behavior of structures and materials in very small scales such as micro and nano basically differs from macro scale predicted by classical theories. To overcome this difference and exactly prediction of behavior of micro structures, some new higher-order theories have been proposed to account small scale effects. Eringen [1] proposed the new theory to account the effect of very small sizes on the different behaviors of structures. After this novel issue, researchers have focused on different analysis of structures in nano- and micro-scales. As a new and attractive analysis of micro structures, the authors consider sandwich micro structure subjected to multi-field loadings. These sandwich structures can be employed as sensor and actuator in micro-scale engineering problems. A comprehensive literature review can justify necessity of current issue.

Wang et al. [2] employed nonlocal elastic continuous models to investigate transverse wave propagation in double-walled carbon nanotubes (DWNTs) based on the Euler-Bernoulli and Timoshenko beam models. Small scale effect was investigated on the wave dispersion of DWNTs. Vibration analysis of initially stressed micro- and nano-beams based on the Eringen's

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