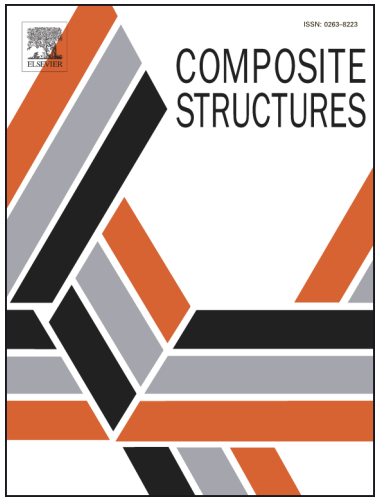

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Active Vibration Control of Functionally Graded Piezoelectric Material Plate

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Abstract: The present paper is concerned with active vibration control of functionally graded piezoelectric material (FGPM) plate using the piezoelectric material component as actuator. Using the classical laminated plate theory, the equation of motion for the functionally graded piezoelectric material plate is deduced based on Hamilton's principle and Rayleigh-Ritz method. A velocity feedback control method is used to obtain an effective active damping in the vibration control. The influences of distribution type, volume fraction index and total volume fraction of piezoelectric material on the vibration control of functionally graded piezoelectric material plate are investigated. The calculation results show that the vibration control result is strongly affected by the distribution of piezoelectric materials in functionally graded piezoelectric material plate. It is also found that the total volume fraction, especially the volume fraction index play an important role in the vibration control. Furthermore, under the non-uniform electric field the effect of external voltage position on active vibration control is studied. The results show that one can obtain an excellent control effect by optimizing the structure of FGPM plate and the position of external control voltage.

Keywords: functionally graded piezoelectric material; active vibration control; electromechanical coupling; velocity feedback

1. Introduction

Functionally graded materials (FGMs) are inhomogeneous composites formed by two or more materials and the compositional profile and material properties of FGMs vary smoothly and continuously in one or more directions [1-2]. This is achieved by varying the volume fraction of the constituents, i.e., ceramic and metal in a gradient manner. In addition to reducing the residual stress and thermal stress, the mechanical response under different loads is also an important research direction. Such as Yang and Shen [3] solved the resonance parameters of the FGM rectangular plate under the

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