Bending analyses of magnetoelectroelastic plates considering size effect based on the meshless method of polynomial particular solutions

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Abstract

With the developments in nanotechnology and the significant requirements of miniature magnetoelectric systems, more and more attention has been paid to the researches about micro- and/or nano- magnetoelectroelastic (MEE) plates. Meanwhile, the size effect shows up in micro- and/or nano- structures, which cannot be described by the classical continuum theories. Therefore, the bending problems of single layer and bi-layered MEE plates resting on the Pasternak foundation have been studied where the governing equations and concrete forms of three different mechanical boundary conditions under nonlocal theory and modified strain gradient theory are derived by the variational principle in this paper. By virtue of the general applicability and superior flexibility, the meshless method of polynomial particular solutions is utilized to solve above governing equations under various boundary conditions. By some typical numerical examples, the influences of size effect, applied coupling loads, boundary conditions, structure dimensions and foundation parameters on bending properties of MEE plates are systematically discussed. Some important conclusions have been drawn, which should be helpful for the designs and applications of magnetoelectric systems in micro- and/or nano- scales.

Keywords: Magnetoelectroelastic plate bending, size effect, method of polynomial particular solutions