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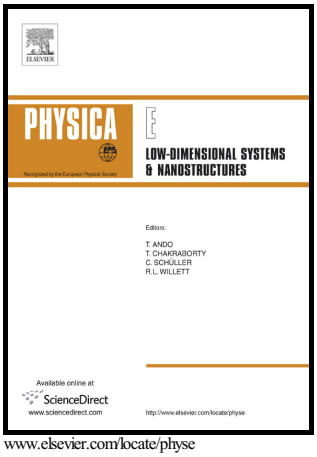

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Nonlinear analysis of 0-3 polarized PLZT microplate based on the new modified couple stress theory

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Abstract

In this study, based on the new modified couple stress theory, the size- dependent model for nonlinear bending analysis of a pure 0-3 polarized PLZT plate is developed for the first time. The equilibrium equations are derived from a variational formulation based on the potential energy principle and the new modified couple stress theory. The Galerkin method is adopted to derive the nonlinear algebraic equations from governing differential equations. And then the nonlinear algebraic equations are solved by using Newton–Raphson method. After simplification, the new model includes only a material length scale parameter. In addition, numerical examples are carried out to study the effect of material length scale parameter on the nonlinear bending of a simply supported pure 0-3 polarized PLZT plate subjected to light illumination and uniform distributed load. The results indicate the new model is able to capture the size effect and geometric nonlinearity.

Keywords: nonlinear bending, 0-3 polarized PLZT, size effects, new modified couple stress theory, material length scale parameter, Galerkin method

1. Introduction

Lanthanum zirconate titanate (PLZT) ceramic was first prepared in 1970 by