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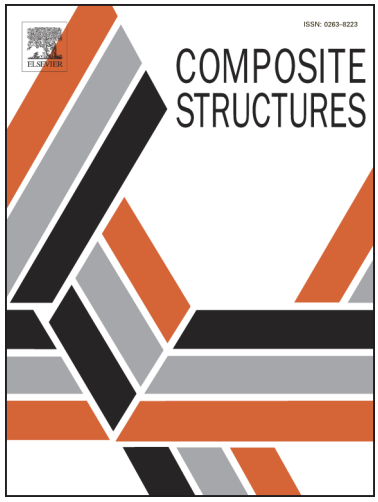

Nonlocal nonlinear plate model for large amplitude vibration of magneto-electro-elastic nanoplates

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Nonlocal nonlinear plate model for large amplitude vibration of magneto-electro-elastic nanoplates

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Abstract

In the present work, a nonlocal continuum model is developed for the nonlinear free vibration of size-dependent magneto-electro-elastic nanoplates subjected to external electric and magnetic potentials. Using the nonlocal elasticity theory and Hamilton's principle, the nonlinear differential equations of motion and corresponding boundary conditions are derived. The effect of geometric nonlinearity is taken into account based on the von Kármán's assumptions. Various non-classical plate theories are introduced by considering two additional scale parameters. The coupled nonlinear differential equations are solved analytically using a perturbation technique. Closed-form solutions are obtained for the nonlinear natural frequencies, critical external electric voltages and critical magnetic potentials of magneto-electro-elastic nanoplates with immovable and movable edges. The present nonlocal continuum model and method of solution are validated by comparing the results with available results in the literature. It is found that the natural

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