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Vibration Analysis of Magnetostrictive Nano-Plate by Using Modified Couple Stress and Nonlocal Elasticity Theories

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Abstract : In the present study, the free vibration of magnetostrictive nano-plate (MsNP) resting on the Pasternak foundation is investigated. Firstly, the modified couple stress (MCS) and nonlocal elasticity theories are compared together and taken into account to consider the small scale effects; in this paper not only two theories are analyzed but also it improves the MCS theory is more accurate than nonlocal elasticity theory in such problems. A feedback control system is utilized to investigate the effects of a magnetic field. First-order shear deformation theory (FSDT), Hamilton’s principle and energy method are utilized in order to drive the equations of motion and these equations are solved by differential quadrature method (DQM) for simply supported boundary conditions. The MsNP undergoes in-plane forces in x and y directions. In this regard, the dimensionless frequency is plotted to study the effects of small scale parameter, magnetic field, aspect ratio, thickness ratio and compression and tension loads. Results indicate that these parameters play a key role on the natural frequency. According to the above results, MsNP can be used in the communications equipment, smart control vibration of nanostructure especially in sensor and actuators such as wireless linear micro motor and smart nano valves in injectors.

Keywords : feedback control system, magnetostrictive nano-plate, modified couple stress theory, nonlocal elasticity theory, vibration analysis
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