Eringen's nonlocal theory for nonlinear bending analysis of bi-directional functionally graded Timoshenko nanobeams

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Abstract

In this paper, the nonlinear static analysis of Timoshenko nanobeams consisting of bi-directional functionally graded material (BFGM) with immovable ends is investigated. The scratching in the FG nanobeam mid-plane, is the source of nonlinearity of the bending problems . The non-local theory is used to investigate the nonlinear static deflection of nanobeam. In order to simplify the formulation, the problem formulas is derived according to the physical middle surface. The Hamilton principle is employed to determine governing partial differential equations as well as boundary conditions. Moreover, the differential quadrature method (DQM) and direct iterative method are applied to solve governing equations. Present results for nonlinear static deflection were compared with previously published results in order to validate the present formulation. The impacts of the nonlocal factors, beam length and material property gradient on the nonlinear static deflection of BFG nanobeams are investigated. It is observed that these parameters are vital in the value of the nonlinear static deflection of the BFG nanobeam.

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