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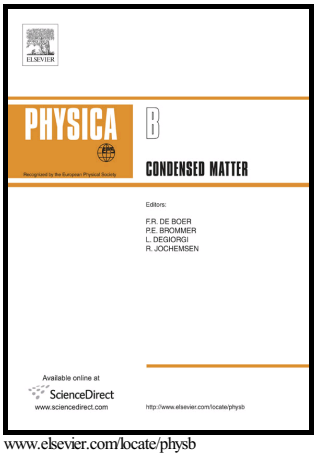

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Abstract

In this study, a model is developed based on strain gradient, considering surface stress effect. Then, higher-order nonlinear governing equations and corresponding boundary condition for a hydrostatically and electrostatically actuated rectangular nanoplate are obtained using principle of minimum potential energy. The derived nonlinear differential equations are linearized by step-by-step linearization method, and then the obtained linear equations are discretized by generalized differential quadrature (GDQ) method. The effects of three length scale parameters, boundary conditions, thickness of nanoplate, and surface material properties on pull-in instability behavior are investigated. The obtained results demonstrate that the effects of length scale parameter can influence pull-in instability, and for greater amounts of length scale parameter, higher amounts of voltage are concluded.

Keywords: nanoplate, strain gradient theory, surface stress effect, first shear deformation theory, pull-in instability

1. Introduction

Nano and micro electromechanical systems (NEMS and MEMS) are nano/micro structures such as nano/micro beams, tubes, and plates, being electrostatically actuated. These