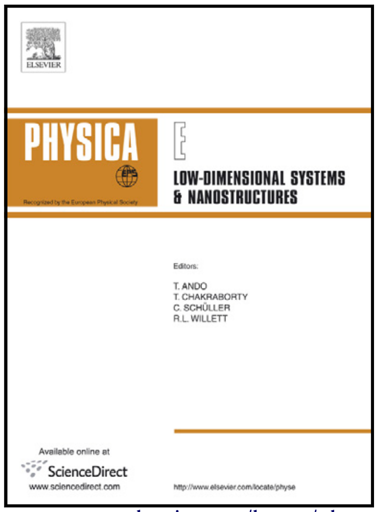
Author's Accepted Manuscript



www.elsevier.com/locate/physe

Free vibration of conducting nanoplates exposed to unidirectional in-plane magnetic fields using nonlocal shear deformable plate theories

Keivan Kiani

PII: S1386-9477(13)00363-9
DOI: http://dx.doi.org/10.1016/j.physe.2013.10.034
Reference: PHYSE11428

To appear in: *Physica E*

Received date: 21 February 2013
Revised date: 27 October 2013
Accepted date: 29 October 2013

Cite this article as: Keivan Kiani, Free vibration of conducting nanoplates exposed to unidirectional in-plane magnetic fields using nonlocal shear deformable plate theories, *Physica E,* http://dx.doi.org/10.1016/j.physe.2013.10.034

Free vibration of conducting nanoplates exposed to unidirectional in-plane magnetic fields using nonlocal shear deformable plate theories

Keivan Kiani[a,*]

[a]Department of Civil Engineering, Islamic Azad University, Chalous Branch, Chalous, Iran

Abstract

The alteration of the frequencies of nanostructures via an external field is of great importance in the design of nanomechanical devices whose vibrations should be appropriately controlled. Herein, free in-plane and out-of-plane vibration behaviors of conducting rectangular nanoplates subjected to unidirectional in-plane steady magnetic fields are of concern. To this end, the body forces exerted on the nanoplate based on the hypotheses of Kirchhoff, Mindlin, and higher-order plate theories are obtained. Subsequently, the nonlocal versions of the equations of motion of the conducting nanoplate for the suggested plate models are extracted. The presented formulations show that the small-scale parameter is incorporated into the exerted forces on the nanoplate due to the applied magnetic field. For the proposed models, the frequencies pertinent to the in-plane and out-of-plane vibrations of the nanoplates are evaluated. In the continuing, the roles of the length to thickness ratio, length to width ratio, small-scale parameter, and magnetic field strength on both in-plane and out-of-plane frequencies are addressed. The capabilities of the proposed models in predicting such frequencies are also explained and discussed.

Keywords: In-plane and out-of-plane vibrations; Conducting nanoplate; In-plane magnetic field; Nonlocal Kirchhoff plate; Nonlocal Mindlin plate; Nonlocal Reddy plate.

*Corresponding author. Tel: +98 191 2223796; Fax: +98 191 2220536.
Email address: k__kiani@iauc.ac.ir; keivankiani@yahoo.com (Keivan Kiani)