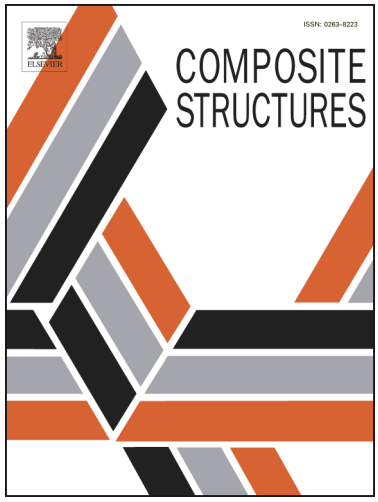
Accepted Manuscript



A novel mixed nonlocal elasticity theory for thermoelastic vibration of nanoplates

Ashraf M. Zenkour

PII: S0263-8223(17)33534-1
DOI: https://doi.org/10.1016/j.compstruct.2017.10.085
Reference: COST 9060

To appear in: *Composite Structures*

Received Date: 26 October 2017
Accepted Date: 31 October 2017

Please cite this article as: Zenkour, A.M., A novel mixed nonlocal elasticity theory for thermoelastic vibration of nanoplates, *Composite Structures* (2017), doi: https://doi.org/10.1016/j.compstruct.2017.10.085

This is a PDF file of an unedited manuscript that has been accepted for publication. As a service to our customers we are providing this early version of the manuscript. The manuscript will undergo copyediting, typesetting, and review of the resulting proof before it is published in its final form. Please note that during the production process errors may be discovered which could affect the content, and all legal disclaimers that apply to the journal pertain.

ACCEPTED MANUSCRIPT

A novel mixed nonlocal elasticity theory for thermoelastic vibration of nanoplates

Ashraf M. Zenkour[1,2,*]

[1]*Department of Mathematics, Faculty of Science, King Abdulaziz University, P.O. Box 80203, Jeddah 21589, Saudi Arabia*
[2]*Department of Mathematics, Faculty of Science, Kafrelsheikh University, Kafrelsheikh 33516, Egypt*

Abstract

This paper develops a nonlocal theory of elasticity for the thermoelastic vibration of nanoplates. A mixed variational formula based upon Hamilton's principle is extended to deal with nanoplates. The present nonlocal first-order shear deformation theory does not need any shear correction factors. Equations of motion and boundary conditions are obtained simultaneously through the mixed variational formula. Governing equations of a mixed nonlocal smart nanoplate are obtained and their solutions are given. The accuracy of the present results is investigated through many comparison examples in the literature. The influences of different factors such as nonlocal parameter, aspect ratio, side-to-thickness ratio, and mode numbers on the natural vibration characteristics of nanoplates are studied.

Keywords: Mixed nonlocal elasticity theory, nanoplate; natural vibration frequencies; temperature change.

1. Introduction

Microstructures have been presented in many micro- and nano-scale components and appliances. Among the different nanostructures, we can introduce nanoplates that refer to small-scale fields. Because of rapid development of the technology, particularly in the micro and nano domains, nanoplates are used in micro or nanoelectromechanical systems for their superior mechanical, thermal and electrical properties. The classical (local) elasticity theory is not able to predict such size effects due to the absence of a nonlocal parameter of the material length scale. To overcome this deficiency, several unconventional (nonlocal) elasticity theories incorporating nonlocal parameters dependent on microstructure have been used to improve such unconventional plate models.

The modified couple stress theory has been developed previously by Yang et al. [1]. According to this model, Ma et al. [2] have improved a non-classical Mindlin's plate theory via the modified couple stress analysis and the variational Hamilton's principle to present the vibration of nanoplates. After two years, the same authors (Gao et al. [3]) have extended this work to treat the same problem with a non-classical higher-order shear deformation theory. Tsiatas and Yiotis [4] have presented the size effect on Kirchhoff-type skew microplates in the context of the modified couple stress theory.

The recent use of Eringen's nonlocal elasticity theory [5-7] in nanostructural analysis has attracted great interest. Pradhan and Phadikar [8] have formulated the classical and first-order shear deformation theories of plates by employing Eringen's nonlocal differential constitutive relations.

* **Corresponding author: E-mail:** zenkour@gmail.com, zenkour@kau.edu.sa (A. M. Zenkour)

Download English Version:

https://daneshyari.com/en/article/6704812

Download Persian Version:

https://daneshyari.com/article/6704812

Daneshyari.com